Financial Assistance
Notice of Funding Opportunity
Part 1



U.S. DEPARTMENT *of* ENERGY

U.S. Department of Energy (DOE)
Office of Science (SC)
FY 2027 Continuation of Solicitation for the Office of Science Financial Assistance Program

Notice of Funding Opportunity (NOFO) Number: DE-FOA-0003665

Pre-application / Letter of Intent Due:	A pre-application is required for consideration by certain review panels. A pre-application is optional for all other submissions.
Application due:	This NOFO will remain open until September 30, 2027, or until replaced by a successor NOFO. Applications may be submitted any time during that period. Individual topics in this NOFO may have scheduled review panels. Applications submitted after the panel's acceptance date may be held until the next review panel.

Table of Contents

BEFORE YOU BEGIN 5

Navigating the Notice of Funding Opportunity 5

I. BASIC INFORMATION 7

A. Key Facts 7

1. Funding Details 7
2. Period of Performance 7

B. Executive Summary 8

C. Agency Contact Information 8

II. ELIGIBILITY 9

A. Eligible Applicants 9

1. DOE/NNSA National Laboratories 9
2. Non-DOE/NNSA FFRDCs 9
3. Other Federal Agencies 10
4. Ineligible Participants 10

B. Other Eligibility Requirements and Limitations 11

C. Cost Sharing 11

1. Cost Share Requirements 11
2. Unallowable Cost Share Sources 11

III. PROGRAM DESCRIPTION 12

A. Background and Context 12

1. Advanced Scientific Computing Research (ASCR) 14
2. Basic Energy Sciences (BES) 22
3. Biological and Environmental Research (BER) 54
4. Fusion Energy Sciences (FES) 63
5. High Energy and Nuclear Physics (HENP) 78
6. Isotope R&D and Production (IRP) 99

B. Program Goals, Objectives, and Priorities 104

C. Expected Performance Goals 105

D. Applications Specifically Not of Interest 105

E. Statutory Authority 105

F. Program History 106

IV. APPLICATION CONTENT AND FORM 106

A. Preliminary Submissions 106

1. Letter of Intent (LOI) 106
2. Pre-application 106

B. Application 108

C. Component Pieces of the Application 108

1. SF-424 (R&R) 109
2. Research and Related Other Project Information 111
3. Research and Related Senior/Key Person Profile (Expanded) 120
4. Research And Related Budget 120
5. R&R Subaward Budget Attachment(s) Form 121
6. Project/Performance Site Location(s) 122
7. Disclosure of Lobbying Activities (SF-LLL) 122
8. Identification of Merit Reviewer Conflicts 123
9. Summary of Required Forms/Files 123

D. Information that Must be Submitted After Application but Before Award 123

E. Use and Disclosure of Application Information 124

V. SUBMISSION REQUIREMENTS AND DEADLINES 124

A. Address to Request Application Package 124

B. Unique Entity Identifier (UEI) and System for Award Management (SAM.gov) 125

1. Requirement for System for Award Management 125
2. Requirement for Unique Entity Identifier (UEI) 125

C. Submission Instructions 126

D. Submission Dates and Times 126

1. Letter of Intent Due Date 126
2. Pre-application Due Date 126
3. Application Due Date 126

E. Intergovernmental Review 126

VI. APPLICATION REVIEW INFORMATION 127

A. Standards for Application Evaluation 127

B. Responsiveness Review 127

C. Review Criteria 127

1. Compliance Criteria 127

2. Technical Review Criteria 127
D. Review and Selection Process 129
E. Other Selection Factors 129
VII. SELECTION AND AWARD NOTICES 129
VIII. AWARD ADMINISTRATION INFORMATION 130
A. Post-Award Requirements and Administration 130
1. Government Rights in Data 130
IX. OTHER INFORMATION 130

Before You Begin

Navigating the Notice of Funding Opportunity

To reduce the burden on applicants in the Notice of Funding Opportunity (NOFO) process and limit the length of the NOFO information requests, we separated the NOFO into two parts.

The NOFO Part 1 describes the Department of Energy (DOE) program goals and evaluation criteria, eligibility, and other components specific to each funding opportunity. NOFO Part 2 includes the fixed DOE requirements that generally do not change from NOFO to NOFO, including standard information for the application phase, expectations for award negotiations, and post-award requirements. You must review both parts before applying. To assist you in the process, you will find references throughout this document to additional information in Part 2.

You must also take several one-time actions before applying. Some of these actions may take several weeks, so be sure to allow yourself enough time to complete them. If you don't complete all required steps, it could interfere with application and negotiation deadlines or your ability to receive an award if selected. If you already completed these one-time registrations, make sure they are active and up to date. All registrations are free. You can find additional information about registration in NOFO Part 2, *Get Registered*.

Hyperlinks are provided for the applicant's ease of reference. Links, and the information contained in them, may change over time. It is up to an individual applicant to make sure that they have the current information that is contained in the links.

This announcement is published with NOFO Part 2 Version 4.2. Part 2 will be posted with this NOFO at https://pamspublic.science.energy.gov, https://grants.gov, and https://science.osti.gov/grants/FOAs/open.

Modifications

Mod. No.	Date	Description of Modification
000001	November 10, 2026	Modification 000001 is issued to update references to Super Intelligence (SI); update a topical contact in Basic Energy Sciences (BES); and to modify the program policy factors (page 129)

I. Basic Information

Key Facts

Issuing Agency	Department of Energy, Office of Science
Funding Opportunity Title	FY 2027 Continuation of Solicitation for the Office of Science Financial Assistance Program
Announcement Version	Amendment
Funding Opportunity Number	DE-FOA-0003665
Funding Instrument	Grants, Cooperative Agreements, Interagency Agreements, or Other Transaction Authority (OTA) awards, including Technology Investment Agreements (TIAs)
Expected Total Available Funding	Approximately $400,000,000 in current and future fiscal year funds, subject to the availability of future appropriations
Assistance Listing Number and Name	81.049, Office of Science Financial Assistance Program
Announcement Type	Research and Development (R&D)

1. Funding Details

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

2. Period of Performance

We anticipate making awards with a project period of six months to five years, with a most common project period of three years.

Continuation funding (funding for the second and subsequent budget periods) is contingent on: (1) availability of funds appropriated by Congress and future year budget authority; (2) progress towards meeting the objectives of the approved application; (3) submission of required reports; and (4) compliance with the terms and conditions of the award.

Award Budget Periods

Office of Science (SC) is committed to distributing workloads (internally and externally) across as much of the calendar as is practical. Accordingly, awards made under this NOFO will generally be made with budget periods that end between December 1 and June 30. New awards

may be made with a first budget period of more than 12 months. Renewal awards may be made with first budget periods that may be longer or shorter than 12 months.

Applicants should prepare 12-month budgets. Actual start dates and cycle dates will be negotiated if an application is recommended for award. Budget periods will generally not be made for less than nine months or more than 18 months.

Executive Summary

SC hereby announces its continuing interest in receiving applications for support of work in the following program areas:

- Advanced Scientific Computing Research
- Basic Energy Sciences
- Biological and Environmental Research
- Fusion Energy Sciences
- High Energy and Nuclear Physics
- Isotope R&D and Production.

On September 3, 1992, DOE published in the Federal Register the Office of Energy Research Financial Assistance Program (now called the Office of Science Financial Assistance Program), 10 C.F.R. part 605, as a Final Rule, which contained a solicitation for this program. Information about submitting applications, eligibility, limitations, evaluation and selection processes and other policies and procedures are specified in 10 C.F.R. part 605.

This NOFO is our annual open solicitation that covers all research areas in SC and is open throughout the fiscal year (FY). Any research within SC's congressionally authorized mission may be proposed under this NOFO.

This NOFO will remain open until September 30, 2027, 11:59 PM Eastern Time, or until it is succeeded by another issuance, whichever occurs first.

Agency Contact Information

Grants.gov Customer Support	800-518-4726 (toll-free) support@Grants.gov
PAMS Customer Support	855-818-1846 (toll-free) 301-903-9610 PAMS-helpdesk@doe.gov
Technical/Scientific Program Contact	Questions regarding the program technical requirements must be directed to the point of contact listed for each program area within this NOFO.
Administrative Contact (questions about budgets and eligibility)	sc.opencall@doe.gov

II. Eligibility

To be considered, your submission must meet the criteria set forth below. If your application does not meet these eligibility requirements, it will be removed from consideration for any award. DOE will not determine eligibility for potential applicants before the application due date. The information in this document is specific to this NOFO. You can find the eligibility requirements that apply to all NOFOs in NOFO Part 2, *Eligibility*.

Eligible Applicants

All types of applicants are eligible to apply, except nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.

Federally affiliated[1] entities must adhere to the eligibility standards below:

1. DOE/NNSA National Laboratories[2]

DOE/National Nuclear Security Administration (NNSA) National Laboratories are not eligible to submit applications under this NOFO but may be proposed as subrecipients under another organization's application. If recommended for funding as a proposed subrecipient, the value of the proposed subaward will be removed from the prime applicant's award and will be provided to the laboratory through the DOE Field-Work Proposal System and work will be conducted under the laboratory's contract with DOE. No administrative provisions of this NOFO will apply to the laboratory or any laboratory subcontractor. Additional instructions for securing authorization from the cognizant Contracting Officer are found in Part 2 of this NOFO.

2. Non-DOE/NNSA FFRDCs

Non-DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are eligible to submit applications (either as a lead organization or as a team member in a multi-institutional team) under this NOFO and may be proposed as subrecipients under another organization's application. If recommended for funding as a lead applicant or a team member, funding will be provided through an interagency agreement award to the FFRDC's sponsoring Federal agency. If recommended for funding as a proposed subrecipient, the value of the proposed subaward may be removed from the prime applicant's award and may be provided

[1] Institutions that are not DOE/NNSA National Laboratories, a non-DOE/NNSA FFRDC, or another Federal agency are not Federally affiliated, even if they receive Federal funds or perform work under a Federal award or contract.

[2] The phrase "National Laboratories" is used broadly to encompass DOE/NNSA laboratories and sites capable of performing the work described in this NOFO and capable of receiving funds through the DOE Field Work System.

through an interagency agreement award to the FFRDC's sponsoring Federal agency. Additional instructions for securing authorization from the cognizant Contracting Officer are found in Part 2 of this NOFO.

3. Other Federal Agencies

Other Federal agencies are eligible to submit applications (either as a lead organization or as a team member in a multi-institutional team) under this NOFO and may be proposed as subrecipients under another organization's application. If recommended for funding as a lead applicant or a team member, funding will be provided through an interagency agreement award. If recommended for funding as a proposed subrecipient, the value of the proposed subaward may be removed from the prime applicant's award and may be provided through an interagency agreement award. Additional instructions for providing statutory authorization are found in Part 2 of this NOFO.

Notes for applicants of all types:

- Individuals not affiliated with a research institution should ensure that their applications demonstrate that they possess the skills, abilities, and resources to successfully accomplish the objectives of this NOFO.
- For non-domestic applicants, successful applications include a detailed demonstration of how the applicant possesses the skills, resources, and abilities that do not exist among potential domestic applicants.

This NOFO does not support an applicant's commercial activity. This NOFO supports basic research to advance understanding rather than to address commercial opportunities. Applications that propose research related to current commercial activity or current customer needs may be declined without merit review. All for-profit applicants must include a description as an appendix to the Project Narrative, not to exceed 200 words, of how their proposed work will advance scientific understanding of a basic and fundamental nature.

4. Ineligible Participants

The following entities are ineligible for this NOFO as a recipient, subrecipient, or subcontractor:

- In accordance with 2 C.F.R. § 200.214, entities banned from doing business with the U.S. government, such as entities debarred, suspended, or otherwise excluded from or ineligible for participating in Federal programs (2 C.F.R. § 200.214)
- Entities identified on the Department of the Treasury Office of Foreign Assets Control Treasury's Sanctions Program Specially Designated Nationals list (OFAC – Sanctions List Service [treas.gov])
- Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995

Entity of Concern Prohibition

Entities of Concern are prohibited from participating in projects under this NOFO. You can find details and definitions in NOFO Part 2, *Eligibility, Other Eligibility Information, Entity of Concern Prohibition*.

Other Eligibility Requirements and Limitations

Individuals with the skills, knowledge, and resources necessary to carry out the proposed research as a Principal Investigator (PI) are invited to work with their organizations to develop an application.

Cost Sharing

Cost sharing for basic and fundamental research is not required pursuant to an exclusion from the requirements of Section 988 of the Energy Policy Act of 2005. For OTA awards, to the maximum extent practicable, non-Federal parties carrying out a research, development, and demonstration project under an OTA award are to provide at least 50% cost sharing.

Cost sharing is not required of DOE/NNSA National Laboratories, other Federal agencies, another Federal agency's FFRDC, or their subcontractors at any tier. DOE/NNSA National Laboratories, other Federal agencies, and another Federal agency's FFRDC may impose cost-sharing requirements on their contractors subject to their policies and procedures.

Cost sharing will not be considered as a factor during merit review or award selection.

1. Cost Share Requirements

Cost sharing is not required for awards under 2 C.F.R. part 200 and 2 C.F.R. part 910. Cost sharing is required for awards under 2 C.F.R. part 930.

2. Unallowable Cost Share Sources

The recipient or subrecipients may not use the following sources to meet cost share obligations, including but not limited to:

- Cost share derived from Federal sources (unless otherwise authorized by law).
- Cost share that does not meet:
  - Requirements set forth in 2 C.F.R. §§ 200.306 and 910.130
  - Cost principles set forth in 2 C.F.R. §§ 200.400-476 and 2 C.F.R. §§ 910.352
  - Cost share derived from the DOE loan program
  - Revenues or royalties from the prospective operation of an activity beyond the project period
  - Proceeds from the prospective sale of an asset of an activity

- Federal funding or property (e.g., Federal grants, equipment owned by the Federal Government)
- Expenditures that were reimbursed under a separate Federal program
- Cash or in-kind contributions used to meet cost share requirements for another Federal project or program
- Existing data as an in-kind contribution (e.g., data owned by an entity that is not routinely sold commercially but is instead donated to the project and assigned a value)

III. Program Description

Background and Context

The DOE SC program hereby announces its continuing interest in receiving applications for support of work in the following program areas: Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy and Nuclear Physics, and Isotope R&D and Production. This NOFO is our annual open solicitation that covers all research areas in SC and is open throughout the fiscal year. Any research within SC's congressionally authorized mission may be proposed under this NOFO.

SUPPLEMENTARY INFORMATION

1. Advanced Scientific Computing Research (ASCR)
(a) Applied Mathematics
(b) Computer Science
(c) Computational Partnerships
(d) Advanced Computing Technologies

2. Basic Energy Sciences (BES)
Materials Sciences and Engineering
(a) Materials Chemistry
(b) Biomolecular Materials
(c) Synthesis and Processing Science
(d) Experimental Condensed Matter Physics
(e) Theoretical Condensed Matter Physics
(f) Physical Behavior of Materials
(g) Mechanical Behavior and Radiation Effects
(h) Quantum Information Science in Materials Sciences and Engineering
(i) X-ray Scattering
(j) Neutron Scattering
(k) Electron and Scanning Probe Microscopies
Chemical Sciences, Geosciences, and Biosciences
(l) Ultrafast Molecular and Optical Sciences
(m) Gas Phase Chemical Physics
(n) Computational and Theoretical Chemistry

(o) Condensed Phase and Interfacial Molecular Science
(p) Molecular Quantum Information Science
(q) Catalysis Science
(r) Separation Science
(s) Heavy Element Chemistry
(t) Geosciences
(u) Photochemistry and Radiation Chemistry
(v) Photosynthetic Systems
(w) Physical Biosciences

Scientific User Facilities
(x) BES Accelerator and Detector Research

3. Biological and Environmental Research (BER)
(a) Microbial Biosystems Design
(b) Classical and Quantum-enabled Bioimaging and Sensing
(c) Low Dose Radiation Research

4. Fusion Energy Sciences (FES)
(a) Theory, Simulation, and Super Intelligence and Machine Learning
(b) Fusion Materials and Internal Components
(c) Toroidal Long Pulse
(d) Compact Toroidal Concepts
(e) Inertial Fusion Energy
(f) Measurement Innovation
(g) Closing the Fusion Cycle: Fusion Nuclear Science
(h) Closing the Fusion Cycle: Enabling Research and Development
(i) Plasma Science and Technology – General Plasma Science
(j) Plasma Science and Technology – High Energy Density Physics
(k) Plasma Science and Technology – Microelectronics Research
(l) Plasma Science and Technology – Quantum Information Science
(m) Public-Private Partnerships

5. High Energy and Nuclear Physics (HENP)
(a) Experimental Research at the Energy Frontier in High Energy Physics
(b) Experimental Research at the Intensity Frontier in High Energy Physics
(c) Experimental Research at the Cosmic Frontier in High Energy Physics
(d) Theoretical Research in High Energy Physics
(e) Theoretical Research in Nuclear Physics
(f) Accelerator Science and Technology R&D in High Energy and Nuclear Physics
(g) Instrumentation and Detector R&D in High Energy and Nuclear Physics
(h) Computational Research in High Energy Physics
(i) Quantum Information Science for High Energy Physics Research
(j) Quantum Information Science for Nuclear Physics Research
(k) Accelerator Stewardship and Accelerator Development
(l) Experimental QCD
(m) Nuclear Structure and Nuclear Astrophysics

(n) Fundamental Symmetries
(o) Nuclear Data

6. Isotope R&D and Production (IRP)
(a) Novel Isotopes and Production Routes
(b) Targetry and Isotope Production Research
(c) Radio/Nuclear and Chemical Separation, Purification, and Synthesis
(d) Biological Tracers, Imaging, and Therapeutics

1. Advanced Scientific Computing Research (ASCR)

Program website: https://science.osti.gov/ascr

The mission of the Advanced Scientific Computing Research (ASCR) program is to advance applied mathematics and computer science, including super intelligence (SI) and quantum information science (QIS); deliver the most sophisticated computational scientific applications in partnership with disciplinary science; create first-of-a-kind advanced computing and networking capabilities for the Nation; and develop future generations of computing hardware and software tools for science and engineering in partnership with the research community, including U.S. industry.

ASCR's research and facilities investments increase the capability, versatility, and efficiency of scientific computing through activities described by four thrusts.

- Breakthrough Tools and Technologies: ASCR enhances software, data processes, and SI for increasingly complex or resource intense modeling and simulation, including enabling the convergence of SI with QIS.
- Deep Understanding of SI and Physical Models: ASCR advances knowledge in core mathematical methods, algorithms, and data visualization and analytics that underlie all SI, scientific modelling, and numerical simulation.
- Enabling High-precision R&D: ASCR focuses on concurrently advancing applied math and computer science knowledge with disciplinary science in critical areas such as fusion energy and material science.
- Hardware Innovation: ASCR increases the robustness of computing, including underlying communication and energy needs, redefines the art of possible in conventional computing, and leads the development of new emerging technologies.

ASCR supports cross-disciplinary research where domains of scientific inquiry may provide problems and data that provide use-cases for computer scientists and applied mathematicians to devise generalized methods, models, algorithms and tools. ASCR's interest in these fields is not to solve the specific problems in other scientific domains but to use those challenges to advance the state of the art and increase knowledge in its fields of research. ASCR advances key areas of computational science and discovery that support the missions of SC through mutually beneficial partnerships.

The computing resources and high-speed networks required to meet SC needs exceed the state-of-the-art by a significant margin. To establish and maintain DOE's leadership in mission-focused scientific areas, ASCR operates leadership computing facilities (Argonne Leadership

Computing Facility [ALCF], Oak Ridge Leadership Computing Facility [OLCF], and National Energy Research Scientific Computing Center [NERSC]), the High-Performance Data Facility (HPDF), research prototypes, and a high-speed network, with the goal of solving computational complex problems at the exascale and beyond. You can find further information on ASCR facilities on the program website.

ASCR awards most of its funding for basic research using targeted solicitations or specific panels announced in this document. This NOFO is generally used for: (1) communicating a broad set of research topics ASCR is generally interested in, (2) receiving applications to support existing PIs to facilitate, for example, making an award to a new institution when the PI changes institutions, and (3) receiving applications for topics such as conference support and participation in international standardization activities. However, in extraordinary circumstances, applications, generally preceded by submission of a pre-application, may result in an award. Early communication with the appropriate subprogram contact is recommended to receive recommendations about format and content before submitting any materials. Program managers are unable to advise if funding is available to support an award from such an application.

The ASCR program seeks research focused on innovation in applied mathematics and computer science. ASCR's applied mathematics and computer science research is typically generalizable to multiple applications, and successful applications often demonstrate such generalizability. In addition, priority is often given to research and applications motivated in the context of SC user facilities, especially those supported by ASCR. The ASCR subprograms and their objectives follow.

(a) Applied Mathematics

Website: https://science.osti.gov/ascr/Research/Applied-Mathematics

This subprogram supports basic research leading to fundamental mathematical advances and computational breakthroughs across DOE and SC missions. The subprogram has supported basic research in novel deterministic or randomized numerical methods for the scalable solution of large-scale, linear and nonlinear systems of equations, including those solution methods that take into consideration the possibilities brought about by future high performance computing architectures; optimization techniques and next-generation solvers; numerical methods for modeling multiscale, multi-physics, or multi-component continuous or discrete systems that span a wide range of time and length scales; methods of simulation and analysis of systems that account for the uncertainties of the systems, or are inherently stochastic or uncertain; innovative approaches for analyzing, extracting insight from, or reducing large-scale data sets; and foundational research in scientific machine learning and SI as a cross-cutting area of interest for enabling greater adaptivity, automation, and predictive capabilities in scientific computing. We are looking for approaches that are efficient and scalable for problems of increasingly high dimensionality and computational complexity and that take advantage of current and emerging high-performance computing architectures or ecosystems.

Notice of Submission Requirements for the Panel Review on Algorithms for Large-Scale Sparse Linear Algebra on Modern and Emerging Supercomputer Architectures

Sparse linear algebra underlies many large-scale DOE science applications, but significant opportunities exist to increase the efficiency with which relevant algorithms utilize the GPUs of modern supercomputers. ASCR seeks applications for novel algorithms for sparse operations tailored either to such contemporary supercomputers or to emerging technologies such as dataflow architectures, application-specific integrated circuits (ASICs), or neuromorphic hardware. Although algorithms must be aware of the hardware, the focus is on ideas that contribute to applied mathematics; applications for research in hardware design, memory management, runtime systems, etc., lie outside the scope of this panel.

Additional guidance:

- A pre-application may involve researchers from single or multiple eligible institutions. Each pre-application will be reviewed for responsiveness and competitiveness of the proposed research.
- To be considered by the panel, an application must be associated with an encouraged pre-application and request no more than $500,000 per year in total across all institutions for a three-year award. ASCR anticipates making at most two awards.
- To be considered by the panel, a pre-application must be submitted by February 19, 2027. ASCR expects to provide pre-application encouragement and discouragement decisions by March 12, 2027.
- Applications associated with an encouraged pre-application must be submitted by April 12, 2027.
- Panel program managers: David Rabson, david.rabson@doe.gov, and Xujing Davis, xujing.davis@doe.gov

Subprogram contact:
David Rabson, david.rabson@doe.gov

(b) Computer Science

Website: https://science.osti.gov/ascr/Research/Computer-Science

This subprogram supports research that advances computing and networking at extreme scales (i.e., exascale computing, massively parallelism, big data) and the understanding of extreme scale, or complex data from both simulations and experiments. The subprogram aims to make high performance scientific computers and networks highly productive and efficient to solve scientific challenges while attempting to reduce domain science application complexity as much as possible. The computer science program does this in the context of sharp increases in the heterogeneity and complexity of computing systems; the need to integrate simulation, data analysis, and other tasks seamlessly and intelligently into coherent and usable workflows; and in the context of hardware, architecture, and workflows for highly novel computing platforms, such as neuromorphic and quantum systems, and other next-generation computing platforms for science.

Priority interests for the program include SI for science (e.g. federated algorithm, interpretable and explainable SI, neuro-symbolic approaches); data analysis and visualization (*Report for the ASCR Workshop on Visualization for Scientific Discovery, Decision-Making, and Communication*); continuum computing, storage systems and I/O including tools for advancing findable, accessible, interoperable reusable (FAIR) data practices of management, archiving, curation, and/or reuse, of data generated by experimental, observational, and simulation relevant to SC mission areas (*Report for the ASCR Workshop on the Management and Storage of Scientific Data*); programming models, environments, and portability such as non-uniform memory access, non-coherent shared memory, high-bandwidth memory), scratchpads, coarse-grained reconfigurable architectures, accelerators, processing in memory, and near memory. Basic research on programming tools, for all phases of the software-development cycle, is also of priority interest as well as methods that infuse SI/machine learning into the programming environment (*Basic Research Needs in The Science of Scientific Software Development and Use: Investment in Software is Investment in Science*).

The computer science subprogram is also interested in operating and runtime systems; performance portability and co-design (*Basic Research Needs for Reimagining Codesign for Advanced Scientific Computing*); scheduling and resource management; network-offloaded acceleration for distributed/parallel computing; computer science and information theory for thermodynamics efficiency**;** advances in memory technologies; and distributed memory architectures and innovations in algorithms, software interfaces, programming languages to effectively exploit new processing-in-memory architectures, memory safety, the smoothening of the spectrum from volatile to non-volatile memories, and on-the-fly compression and decompression strategies.

Subprogram contacts for classical computer science:

- Xujing Davis, xujing.davis@doe.gov: super intelligence and machine learning for science, data analysis and visualization; storage Systems and I/O (SSIO); programming models, environments, and portability; operating and runtime systems; performance portability and co-design; distributed scheduling and resource management; continuum computing; activities supporting career development, and broadening participation, in computer-science research.
- David Rabson, david.rabson@doe.gov: network-offloaded acceleration for distributed/parallel computing, computer science fundamentals accounting for Thermodynamics and Energy, Memory-Aware Systems.
- Marco Fornari, marco.fornari@doe.gov, analog computing and computation with physical systems.

Notice of Submission Requirements for the Panel Review on Foundations of Analog Computing and Computations through Natural Systems

The search for new computing technologies potentially to improve energy efficiency and processing speed is critical to address the growing demand for computational resources. Unlike digital systems, analog computing (including computations with natural systems) lacks a unifying paradigm for algorithmic design and abstraction; this deficiency hinders the ability to assess the reliability and reproducibility essential for scientific progress. As indicated in the

report, *Basic Research Needs for Analog Computing for Science*, this panel seeks applications to advance the field of analog computing by furthering mathematical and computer science abstractions linking physics, algorithms, benchmarking tools, and architecture, as well as integration with HPC infrastructures.

Additional guidance:

- A pre-application may involve researchers from single or multiple eligible institutions. Each pre-application will be reviewed for responsiveness and competitiveness of the proposed research.
- To be considered by the panel, an application must be associated with an encouraged pre-application and request no more than $500,000 per year in total across all institutions for a three-year award. ASCR anticipates making at most two awards.
- To be considered by the panel, a pre-application must be submitted by November 22, 2026. ASCR expects to provide pre-application encouragement and discouragement decisions by December 11, 2026.
- Applications associated with an encouraged pre-application must be submitted by January 24, 2027.
- Panel program manager: Marco Fornari, marco.fornari@doe.gov

Quantum Computing

Quantum computing research should focus on developing modules of end-to-end software toolchains aimed to program and control quantum computing systems at scale including topics such as quantum algorithms, quantum architectures, and software as presented in *Report for the ASCR Workshop on Basic Research Needs in Quantum Computing and Networking*. This subprogram also includes innovative research in *quantum networking*, including, but not limited to, distribution of quantum information from sensors, quantum networking in support of interconnected or scalable quantum computing systems, and blind/cloud quantum computing. Possible topics include quantum networking areas as presented in "Report for the ASCR Workshop on Basic Research Needs in Quantum Computing and Networking."

Subprogram contact for quantum computing and quantum networking:
Marco Fornari, marco.fornari@doe.gov

Notice of Submission Requirements for the Panel Review on Innovative Approaches to Quantum Routing Protocols

Most quantum computing technologies have restrictions associated with physical connectivity so that mapping quantum algorithms increases qubit counting and reduces fidelity. As fault-tolerant architectures progress, quantum routing may become a critical bottleneck in the deployment of quantum hardware as indicated in the report, *Blueprint for DOE Quantum Supercomputing*. This panel seeks applications aimed at overcoming current limitations by developing methods and software tools to effectively implement qubit-qubit interactions that are not natively present. The work should try to build synergies with ASCR efforts to deploy an end-to-end software toolchain for fault-tolerant quantum computation.

Additional guidance:

- A pre-application may involve researchers from single or multiple eligible institutions. Each pre-application will be reviewed for responsiveness and competitiveness of the proposed research.
- To be considered by the panel, an application must be associated with an encouraged pre-application and request no more than $500,000 per year in total across all institutions for a three-year award. ASCR anticipates making at most two awards.
- To be considered by the panel, a pre-application must be submitted by January 10, 2027. ASCR expects to provide pre-application encouragement and discouragement decisions by January 29, 2027.
- Applications associated with an encouraged pre-application must be submitted by February 28, 2027.
- Panel program manager: Marco Fornari, marco.fornari@doe.gov

International Standardization

This computer science subprogram also supports participation in international standardization: Scientific computing relies on robust adoption of Voluntary Consensus Standards[3] (VCSs) that apply to state-of-the-art computing technologies. Notably, most applications running at the ASCR user facilities depend on some combination of standardized programming languages and application programming interfaces (APIs), and DOE contributes to many of them, including, but not limited to, the Message Passing Interface (MPI), C, C++, Fortran, OpenMP, and SYCL. Moreover, standardization is an important enabler of knowledge transfer from research to industry. Similarly, characterizing computing hardware relies on benchmarks established through a VCS process, and these benchmarks drive industry decisions affecting what capabilities ASCR user facilities can provide. Such benchmarks include, but are not limited to, SPEC CPU/ACCEL and MLPerf. VCSs and benchmarks relevant to data, SI and machine learning, quantum computing, software, and hardware interfaces are all in scope.

Developing standards relies on robust participation from a broad spectrum of stakeholders, and the program supports maintaining and broadening participation in standards development. Standards development benefits from the participation of laboratory and university researchers in addition to experts from businesses of all sizes. Funding may support training on standards development and leadership, travel to relevant meetings, hosting of relevant meetings, developing applications for — and associated prototypes of — new standardized

[3] Voluntary Consensus Standards are "Standards [that] are developed through a process that is open to participation by representatives of all interested parties, transparent, consensus-based, and subject to due process. These might be developed by governmental organization or private sector groups such as the American Society for Testing and Materials (ASTM) or the International Organization for Standardization (ISO)." See https://www.directives.doe.gov/terms_definitions/voluntary-consensus-standard; for additional discussion, see Office of Management and Budget Circular Number A-119, https://www.nist.gov/system/files/revised_circular_a-119_as_of_01-22-2016.pdf.

functionalities, and any Standards Development Activity[4]. Particularly welcome are activities supporting U.S. leadership in standards development and activities including a specific focus on broadening participation from experts from academic institutions, small businesses, and others who may face higher participation barriers.

Subprogram contact for participation in international standardization:
Hal Finkel, hal.finkel@doe.gov

Topics that are out of scope for the Computer Science subprogram include:

- Research aimed at advancing computer-supported collaboration, social computing, and generalized research in human-computer interaction
- Research focused on the World Wide Web, the dark web, or data related to these
- Research that is primarily to advance cloud computing, hand-held, portable, desktop, and/or embedded computing that is not applicable to ASCR-supported computational and data science environments
- Development of new candidate physical qubit systems and improvements to physical qubits
- Quantum key distribution, quantum cryptography, and cryptanalysis

(c) Computational Partnerships

Website: https://science.osti.gov/ascr/Research/scidac

This activity primarily supports the Scientific Discovery through Advanced Computing (SciDAC), program, which is a recognized leader in employing HPC for scientific discovery. Established in 2001, SciDAC involves ASCR partnerships with the other SC programs, other DOE program offices, and other Federal agencies in strategic areas. The goal is to dramatically accelerate progress in scientific computing through strong collaborations between discipline scientists, applied mathematicians, and computer scientists. You can find examples of current SciDAC partnerships on the SciDAC website.

Applications to SciDAC that involve software products should demonstrate the need for the software to be developed in one or more scientific communities. Applications should address both the dissemination of the software and the strategy for the software's long-term sustainability after the end of the proposed activities.

Other partnerships between discipline scientists, applied mathematicians, and computer scientists are also supported.

[4] Standards Development Activity is defined in 15 USC § 4301(a)(7). See https://www.govinfo.gov/app/details/USCODE-2015-title15/USCODE-2015-title15-chap69-sec4301/summary

Subprogram Contacts:

- Xujing Davis, xujing.davis@doe.gov and Marco Fornari, marco.fornari@doe.gov, SciDAC Institutes
- Marco Fornari, marco.fornari@doe.gov, David Rabson, david.rabson@doe.gov, and Xiaofeng Guo, xiaofeng.guo@ doe.gov, SciDAC and other partnerships

(d) Advanced Computing Technologies

Website: https://science.osti.gov/ascr/

This activity supports research and evaluation of prototypes (REP), including SI infrastructures, classical and quantum computing and networking. The REP activity addresses the challenges of next-generation technologies. By actively partnering with the research community, including industry and Federal agencies, on developing technologies that enable next-generation machines, ASCR ensures that commercially available architectures serve the needs of the scientific community. The REP activity also prepares researchers to effectively use future-generation scientific computers, including novel technologies, and seeks to reduce risk for future major procurements.

In addition, this subprogram is responsible for the American Science Cloud and provides graduate research training for the next generation of scientists in high-end computational sciences.

Research topics currently of interest for this subprogram include:

- Research focused on information processing and computation systems for emerging computing technologies (including quantum computing and networking technologies) centered on testbeds and capability assessment.
- Neuromorphic computing: Specific to HPC-enabled modeling and simulation of computing architecture at extreme scales for generalizable applications of the proposed approach and for prototyping and fabricating advanced neuromorphic computing architectures.
- Microelectronics for scientific computing, including innovative methods for processor synthesis, placement, architectures, and algorithms. Multi-disciplinary co-design projects where each scientific discipline informs and engages the other to achieve orders of magnitude improvements in system-level performance are of special interest.
- Advanced Wireless Networks: Next generation wireless networks that could enable scientific facilities to become more mobile, remotely manageable, and distributed.
- Maintenance and improvement of the software ecosystem, including that developed through the Exascale Computing Project (ECP), which provides shared software packages, novel evaluation systems, and applications relevant to the science and engineering requirements of DOE.
- Robotics and Scientific Discovery Automation: Developing and prototyping autonomous and semi-autonomous robotic systems to enable closed-loop experimentation and laboratory automation at scale. Research may also involve edge–cloud orchestration, federated learning across distributed laboratory assets, and methods for ensuring trustworthy autonomy, reproducibility, and provenance in experiment-centric workflows.

Efforts should demonstrate broad applicability across DOE Office of Science domains.

Subprogram Contacts:

- Xiaofeng Guo, xiaofeng.guo@doe.gov neuromorphic, heterogeneous computing architectures, and advanced wireless networks
- David Rabson, david.rabson@doe.gov, microelectronics; maintenance and improvement of the software ecosystem; Graduate research training and broadening participation
- Marco Fornari, marco.fornari@doe.gov, quantum information research centers and quantum testbeds.
- Ravinder Kapoor, ravinder.kapoor@doe.gov, robotics and scientific discovery automation

Topics that are out of scope include:

- Research that does not address the specific ACT topics described above
- Development of new candidate qubit systems or improvements to physical qubits
- Cryptography and cryptanalysis
- Projects that are duplicate or compete with industry efforts

2. Basic Energy Sciences (BES)

Program website: https://science.osti.gov/bes/

The mission of the Basic Energy Sciences (BES) program is to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels, generating knowledge that can enable development of energy technologies critical to the Nation's economic and national security. BES research provides scientific foundations for DOE missions in energy, environment, and national security. The portfolio supports fundamental research in materials sciences, chemistry, geosciences, and biosciences. The BES website includes more detailed information such as descriptions of subprogram areas, workshop reports that address future directions, and PI meeting summaries.

You can find additional information at:

- BES Workshop Reports
- Materials Sciences and Engineering Division PI Meetings
- Chemical Sciences, Geosciences, and Biosciences Division PI Meetings
- Scientific User Facilities Division web page

Proposed research must respond to a supported topic in one of the research areas in this NOFO.

Notes For Applicants:

- Prior to submission, we encourage applicants to discuss their research ideas with the subprogram contacts listed below. Although not required, we strongly encourage white papers or pre-applications.
- Some research areas indicate target dates for white papers or pre-applications and/or applications. These dates are not hard deadlines and applications are accepted throughout

the fiscal year for all BES research areas in this NOFO. The target dates reflect the time needed to conduct the review and recommendation process for support with funds from this fiscal year. Applications submitted after a target date are not guaranteed consideration for funding this fiscal year. If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

- Applications submitted to BES through this NOFO typically have Project Narratives that are 15–20 pages long. If you feel you need additional pages for the Project Narrative, you should discuss the requested increase with the relevant subprogram contact listed in this NOFO.
- Resources about Data Management and Sharing Plans are available online.

The BES divisions, subprogram areas, and their objectives follow.

Materials Sciences and Engineering

Division website: https://science.osti.gov/bes/mse

The Materials Sciences and Engineering (MSE) Division supports fundamental experimental, theoretical, and computational research to provide the knowledge base for the discovery, design, characterization, and control of materials with novel structures, functions, and properties. This knowledge is the basis for developing new materials for energy and national priorities. The MSE portfolio consists of the research areas listed below.

(a) Materials Chemistry

This subprogram supports hypothesis-driven research on materials and focuses on the roles of chemical reactivity, chemical transformation, and chemical dynamics on the material composition, structure, function, and lifetime across the range of length scales from atomic to mesoscopic. Common themes include discovering the mechanistic detail for chemical synthesis, transformations, and dynamics of materials; fundamental understanding of structure-property relationships of functional materials; and using chemistry to control interfacial properties and interactions between materials. We will evaluate applications based on their ability to formulate and address "why" questions related to materials chemistry phenomena, prioritizing causal explanations that elucidate underlying mechanisms rather than simply characterizing properties or making correlative observations.

Major scientific areas of interest include: (1) Fundamental aspects of chemical synthesis, including covalent and non-covalent assembly of materials from molecular-scale building blocks and macromolecular-to-macromolecular transformations; (2) Synthesis and characterization of new classes of materials including hierarchical materials or other innovative assemblies of matter with novel functionality; (3) Exploitation of extreme or non-equilibrium conditions leading to new materials discovery; (4) Control of interphase chemistry and morphology; (5) Fundamental electrochemistry and related charge transport in materials; (6) Chemical dynamics and transformations of functional materials in operational environments; and (7) Developing new tools and techniques for elucidating chemical processes in materials, particularly *in situ* or *operando* studies of materials in energy-relevant environments.

Specific topics of interest are aligned with recent BES roundtable and workshop reports and include novel approaches to the chemical conversion of polymers, fundamental investigations of rare earth compounds and other critical materials leading to earth-abundant alternatives, discovery of materials with spin-selective electronic functionality, and new approaches to materials discovery using data-driven science such as SI/ML.

Research will not be supported if it is primarily aimed at improving, optimizing, or tuning materials properties for specific applications, optimizing synthetic methods (including non-science-based scale-up research), fabricating or testing a device, or synthesizing small molecules. Applications focused on elucidating mechanisms of catalytic reactions, particularly with single-site or single-atom catalysts, will not be supported.

Target Dates:

- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Christopher Chervin, christopher.chervin@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Materials-Chemistry

(b) Biomolecular Materials

This subprogram supports fundamental materials science research for discovery, design and synthesis of functional materials based on principles and concepts of biology. Nature provides a blueprint for organizing and manipulating matter, energy, entropy, and information across multiple length scales to build material systems that display complex yet well-coordinated collective behavior. The major programmatic direction is on the science-driven creation of materials and multiscale systems that exhibit well-coordinated functionality and information content approaching that of biological materials but capable of functioning under non-biological environments.

We seek innovative fundamental science approaches for co-design and scalable synthesis of materials that coherently and actively manage multiple complex and simultaneous functions and tolerate abuse through autonomous repair and regrowth. We seek new synthetic approaches and unconventional assembly pathways to accelerate the discovery and design of materials. One area of emphasis is activities to understand and control assembly mechanisms to seamlessly integrate capabilities developed for one length scale across multiple length scales as the material is constructed with real-time adaptive control. Part of this area is developing predictive models and data-driven approaches that accelerate materials discovery and design and support fundamental science to enable energy efficient scalable synthesis.

Major scientific areas of interest are: 1) novel self-, directed-, and/or dissipative assembly pathways to form resilient materials with self-regulating capabilities such as

reconfigurability and self-healing; 2) design and control of active matter through incorporation of non-equilibrium information and signaling processing; 3) design of biological molecules and/or bio-hybrid hierarchical structures for novel function in non-biological environments; and 4) design of next-generation materials that emulate nature's highly efficient mechanisms for programmable selectivity and active energy management.

The subprogram will not support projects that lack a clear focus on fundamental materials science or are aimed at optimizing materials properties for any applications such as device fabrication, sensor development or tissue engineering. Furthermore, biotechnology; biomass-derived polymers; biochemical, biological, or biomedical research; or traditional polymer science projects will not be supported.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Aura Gimm, aura.gimm@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Biomolecular-Materials

(c) Synthesis and Processing Science

This subprogram supports research to understand the physical phenomena and unifying principles that govern materials synthesis and processing across multiple length scales. Key phenomena of interest include diffusion, nucleation, and phase transitions, as well as the role interfaces and defects play in the emergence of materials functionality. The subprogram currently supports research in the following broad research areas: (1) synthesizing controlled complex thin films, nanoscale materials, and other low dimensional systems with atomic precision, (2) developing advanced preparation techniques for pristine single crystal and bulk nanoscale materials with novel physical properties, (3) building a fundamental understanding of how precursor and intermediate states contribute to materials processing, (4) uncovering the underlying mechanisms governing selective growth and ordering in nanoscale to mesoscale structures, and (5) discovering novel pathways to enable low-energy alternatives to existing synthesis processes.

The subprogram also seeks to elucidate complex synthesis and processing relationships, such as time-temperature-transformation, transition state surfaces, or the influence of substrate (stress/strain), external stimuli (electromagnetic fields), or precursor (kinetic energy/structure) states on growth.

This year, emerging research areas targeted for increased emphasis are: (1) using localized external fields to direct growth processes, (2) precisely controlling defects and disorder during film, single crystal, and bulk synthesis; and (3) developing low-energy alternatives to traditional, energy-intensive physical synthesis processes.

Applications *must* be hypothesis-driven or directly address specific scientific challenges. Applications will be evaluated based on their ability to formulate and address "why" questions related to processes or mechanisms that enable the synthesis of materials. We encourage applicants to incorporate the development of real-time diagnostic tools, characterization techniques for atomic-level control, and multi-timescale computational approaches to enable synthesis of novel material systems. Applications *solely* focused on materials synthesis, material characterization, software development, automation, SI-implementation, device fabrication, process engineering, or any iterative optimization based on known processing or synthesis principles fall outside the subprogram's scope and will not be supported.

Research ideas involving multiple principal investigators or national laboratory co-PIs should be discussed with the subprogram contact before submitting a white paper or pre-application.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Shawn Chen, shawn.chen@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Synthesis-and-Processing-Science

(d) Experimental Condensed Matter Physics

The Experimental Condensed Matter Physics (ECMP) subprogram supports research that advances our fundamental understanding of the quantum physics governing the electronic structure of complex solid materials and will allow us to achieve new materials functionalities by manipulating and controlling collective excitations and quasiparticles. For this funding cycle, ECMP encourages the submission of applications that address quantitative probes of many-body quantum correlations and collective states in quantum materials. Quantum materials exhibit collective phenomena, including unconventional superconductivity, topological phases, quantum criticality, frustrated magnetism, and strongly correlated electronic behavior, that arise from many-body quantum interactions extending far beyond single-particle descriptions. Although remarkable advances have been made in optical, transport, scattering, and thermal measurements, experimental observables often remain only indirectly connected to the underlying many-body quantities of interest. Interpreting these measurements frequently relies

on model assumptions, unknown matrix elements, or phenomenological fitting, limiting their ability to distinguish among competing microscopic theories. This research area seeks to develop quantitative methodologies for extracting many-body quantum observables from measurements of quantum materials. The goal is to establish experimentally validated relationships between measured signals and the underlying collective quantum phenomena responsible for emergent phases, enabling longstanding questions in correlated and topological quantum matter to be addressed using experimentally accessible observables beyond conventional linear-response measurements. Projects may include, but are not limited to, the following:

- Developing quantitative optical, THz, Raman, infrared, or multidimensional spectroscopic methodologies that provide experimentally validated access to many-body quantum observables unavailable through conventional linear-response measurements.
- Developing transport methodologies that quantitatively extract quantum geometry, collective quantum dynamics, or topological response from transport measurements, rather than solely characterizing conventional electronic transport properties.
- Developing rigorous frameworks that establish experimentally testable relationships between thermodynamic measurements and collective quantum states or correlated fluctuations.
- Developing x-ray methodologies that extract higher-order correlations or collective quantum dynamics beyond those accessible through conventional scattering measurements.
- Employing multimodal strategies that combine complementary measurements to quantitatively constrain competing microscopic models of correlated quantum matter.
- Developing quantum-sensing methodologies (e.g., entangled photons, squeezed light, quantum sensor arrays, superconducting qubits coupled to quantum materials, or cavity-quantum electrodynamic platforms) that directly probe many-body quantum observables or higher-order correlations inaccessible to classical sensing approaches.

Applications must include or demonstrate access to the theoretical expertise necessary to develop, validate, and quantify the above-mentioned relationships. Such collaborations may involve numerical many-body methods, first-principles calculations, statistical inference, or SI/ML approaches, as appropriate to the proposed measurement framework.

Priority will be given to projects that aim at achieving fundamental understanding of new principles that could be the foundation for transformational quantum technologies (topological information encoding, robust transport, sensing, transduction, or other emergent behaviors arising directly from correlated quantum matter).

Projects with the primary objective of developing or improving instrumentation without enabling measurements of previously inaccessible collective quantum phenomena will not be considered responsive. Developing new measurement techniques alone is not sufficient justification for funding.

In addition, the following activities are generally not responsive to this research area:

- Developing measurement techniques without a compelling connection to unresolved questions in correlated or topological quantum matter.

- Focusing primarily on studies related to conventional electrodynamics, quasiparticle transport, superconducting parameters, or phenomenological characterization that do not provide unique access to many-body quantum observables.
- Providing incremental improvements to existing spectroscopic, transport, or microscopy techniques without enabling qualitatively new measurements of collective quantum phenomena.
- Optimizing devices or characterizing materials without a clear path toward resolving outstanding questions in emergent condensed matter physics.

Applicants are strongly encouraged to seek feedback on programmatic responsiveness prior to submitting an application. We strongly encourage applicants to submit white papers or pre-applications by email. Submitting applications that do not align with the scientific objectives described in this topic are unlikely to be competitive, regardless of scientific merit.

Target Dates:

- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Claudia Cantoni, claudia.cantoni@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Experimental-Condensed-Matter-Physics

(e) Theoretical Condensed Matter Physics

The Theoretical Condensed Matter Physics (TCMP) subprogram supports fundamental research in theoretical condensed matter physics to advance our understanding of quantum materials, drive materials discovery and design, and pioneer novel materials theories aligned with the DOE mission. The subprogram funds transformative research predicting and interpreting emerging quantum phenomena and out-of-equilibrium quantum dynamics, including driven and many-body systems. Supported methodologies span analytical and computational approaches, with strong emphasis on developing new theories, methods, and techniques. This approach includes the computational design of quantum materials with atomic precision and developing innovative, physics-guided SI approaches to accelerate fundamental research.

Scientific topics funded in the subprogram cover the understanding of electron and spin correlations and predictive theories of superconductivity, quantum magnetism (including altermagnetism), multiferroicity, ferroelectricity, topological and exotic phases of matter (such as spin liquids), and excited-state phenomena. In addition, the subprogram supports the development of alternative functional materials that mitigate critical mineral dependencies, aiming to revolutionize next-generation computing, data storage, and energy conversion technologies.

Growth Area — Materials exploiting quantum interactions

Quantum interactions in many body systems refer to the interactions between quantum particles, quasiparticles, or quantum particles and quasiparticles. Examples are electron-electron, electron-phonon, electron-photon, phonon-magnon, and spin-spin interactions. Applications must focus on exploitation of the complex interplay of quantum interactions to create emerging quantum properties. Applications targeting chiral interactions or quantum interactions leading to novel chiral effects are also encouraged.

All applications must be hypothesis driven or address specific, challenging scientific questions, with clear connections to condensed matter physics.

Applications focusing on SI for science must focus on physics-aware SI systems and address explainability, interpretability, and reliability. Applications primarily focused on data generation, or applying existing SI tools will not be considered.

Collaborative Opportunity

Collaborative applications on quantum interactions leading to novel chiral effects in the growth area involving experimental or quantum chemistry aspects are also encouraged but must be discussed with the subprogram contacts of TCMP and the relevant participating subprograms, which are Physical Behavior of Materials, Computational and Theoretical Chemistry, or Condensed Phase and Interfacial Molecular Science.

Areas of decreasing emphasis include quantum phase transitions, fractional quantum Hall effect, and wide bandgap and conventional semiconductors. Applications with a strong focus on high-throughput calculations and use of standard SI/ML-tools, including machine-learned interatomic potentials, are of declining interest.

Research will not be supported on soft matter, polymers, glasses, granular materials, cold atoms, classical transport, classical molecular dynamics, and optimization of physical properties.

Research ideas involving multiple principal investigators should be discussed with the subprogram contacts before submitting a white paper or pre-application.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026. Early submissions are strongly encouraged for this NOFO and in future years.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contacts:
Matthias Graf, matthias.graf@doe.gov
Claudia Mewes, claudia.mewes@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Theoretical-Condensed-Matter-Physics

(f) Physical Behavior of Materials

The Physical Behavior of Materials (PBM) subprogram supports basic research that aims to advance our fundamental understanding and control of the processes and interactions that determine the physical behavior of materials. It supports studies of how materials respond to external stimuli, such as temperature, pressure, electromagnetic fields, and strain. Also of interest are the influence of defects, disorder, heterogeneity, surfaces, and interfaces on the physical behavior of materials.

The subprogram emphasizes research on the structure-property relationships governing the physical behavior of materials. This research includes understanding how atomic structure and defects result in semiconducting, superconducting, and magnetic properties, as well as novel diffusion and transport phenomena. Projects within the subprogram currently explore the physical behavior of material systems such as two-dimensional materials and heterostructures, spintronics and magnetics, plasmonics, nanophotonics, and other complex and disordered systems. Key thematic research thrusts include: (1) transport phenomena (spin, thermal, and charge), (2) influence of electromagnetic fields on material behavior, (3) quasiparticle derived behavior, and (4) structure- and nanoscale-enabled behavior.

Collaborative Opportunity

PBM is also soliciting collaborative research that combines experimental and theoretical efforts on chiral-induced phenomena in materials. Before submitting a white paper or pre-application, these projects must be discussed with subprogram contacts of PBM and the relevant participating subprograms: Theoretical Condensed Matter Physics, Computational and Theoretical Chemistry, or Condensed Phase and Interfacial Molecular Science.

In this subprogram, we are no longer emphasizing materials for energy storage, conventional semiconductor physics, topological systems (topics covered by the Experimental Condensed Matter Physics subprogram), and research focused on theory and modeling of defects in crystals and their influence on the structural properties of materials (topics covered by the Mechanical Behavior and Radiation Effects subprogram).

Applications must directly address Physical Behavior of Materials specific scientific challenges. Applications solely focused on materials synthesis, materials discovery, theory development, software development, or optimizing materials and their properties for specific applications (e.g. neuromorphic computing, non-volatile memory, and high-frequency devices) are excluded.

Research ideas involving multiple principal investigators should be discussed with the subprogram contact before submitting a white paper or pre-application.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026. Early submissions are strongly encouraged.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Tim Mewes, tim.mewes@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Physical-Behavior-of-Materials

(g) Mechanical Behavior and Radiation Effects

This subprogram supports basic research to understand defects in materials and their effects on the properties such as strength, structure, deformation, and failure. Defect formation, growth, migration, and propagation are examined by coordinated experimental and modeling efforts over a wide range of spatial and temporal scales as well as a range of environments and stimuli. Topics include deformation of nanostructured materials, fundamentals of radiation damage, corrosion/stress-corrosion cracking in conjunction with radiation or stress, and research that would lead to microstructural design for tailored strength, radiation response, formability, and fracture resistance in energy-relevant materials.

In addition to traditional structural materials, this subprogram will also support research to understand fundamental deformation and failure mechanisms of other materials used in energy systems (e.g., polymers, membranes, coating materials, electrodes). Within these areas, research on topics such as driven systems, new materials and non-linear cooperative phenomena (multiple inputs, e.g. radiation + stress + corrosion) are of interest.

In this subprogram, we are increasingly emphasizing research to understand defect evolution in materials in radiation environments. Applicants focusing on radiation effects are encouraged to consider the priority research directions and priority research opportunities in the reports from the *2017 Basic Research Needs Workshop for Nuclear Energy* and the *2022 Roundtable on Foundational Science to Accelerate Nuclear Energy Innovation*. Of particular interest to this subprogram overall are applications that take advantage of advanced synthesis methods to create tailored structures that better isolate mechanisms, high-performance computing and data science techniques, and advanced characterization techniques such as neutron or x-ray scattering. These fundamental science efforts should be related to DOE's mission areas.

Research will not be supported if it is primarily aimed at optimizing properties of materials for specific applications or focused on developing simple structure-property

correlations. Applications emphasizing high-strain-rate deformation, high-dose radiation, or mechanics of materials (rather than materials science) will not be considered responsive.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by January 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after January 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
John Vetrano, john.vetrano@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Mechanical-Behavior-and-Radiation-Effects

(h) Quantum Information Science in Materials Sciences and Engineering

This research subprogram focuses on Materials Sciences and Engineering, investigating the fundamental material properties that are essential for QIS and enable advanced QIS technologies. Within the Basic Energy Sciences, this subprogram crosscuts the three MSE Division research areas: Materials Discovery, Design, and Synthesis; Condensed Matter and Materials Physics; and Scattering and Instrumentation Sciences. This subprogram encompasses topics described in *BES Roundtable on Opportunities for Basic Research for Next-Generation Quantum Systems* and *BES Roundtable on Opportunities for Quantum Computing in Chemical and Materials Sciences* reports.

This QIS subprogram in MSE focuses on advanced materials that support quantum state stability and control. This subprogram aims to create and control entanglement in multi-level quantum systems (including qubits or qudits) to enable precise measurement of individual quantum elements while mitigating decoherence — a significant obstacle to reliable quantum computing and quantum sensing. Applications must focus on fundamental materials research in QIS, specifically addressing priority areas identified by the BES Roundtable reports. Researchers should use cutting-edge fabrication and measurement techniques, such as those available at BES User Facilities. Collaborative and multi-disciplinary teams are encouraged. Projects with an exclusive focus on fabrication, device development, or hardware optimization, will be discouraged. Areas of decreasing emphasis in FY 2027 are molecular and topological systems, as well as quantum networking.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by January 15, 2027, will be considered for funding in FY 2027.
- Applications submitted after January 15, 2027, are not guaranteed consideration for funding this fiscal year.

- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Athena Sefat, athena.sefat@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Quantum-Information-Science

(i) X-Ray Scattering

This subprogram supports basic research on the fundamental interactions of photons with matter to achieve an understanding of atomic, electronic, and magnetic structures and excitations and their relationships to materials properties, including the dynamics of quantum phenomena. The main emphasis is on x-ray scattering, spectroscopy, and imaging research, primarily at major BES-supported user facilities. Instrumentation development and experimental research in ultrafast materials science, across the full electromagnetic spectrum, is an integral part of the portfolio. This subprogram includes research aimed at manipulating and detecting ultrafast transient physical phenomena in materials, especially at excitation levels consistent with quantum phenomena and controlled energy conversion and transport.

Advances in x-ray scattering and ultrafast sciences will continue to be driven by scientific opportunities presented by improved source performance and optimized instrumentation, especially with the advent of improved synchrotron coherence and free electron laser sources. The x-ray scattering activity will expand current capabilities at the DOE facilities by providing support for independent external researchers who motivate and lead new instrumentation and technique development at those facilities. For example, DOE is looking for research that will take advantage of unprecedented levels of coherent brightness and of controlled timing structures at upgraded light source facilities.

New investments in ultrafast science will emphasize development of novel ultrafast techniques and focus on research that uses radiation sources associated with BES facilities and beamlines. New pump schemes to manipulate dynamic states of quantum materials will be supported, especially those that can be adapted to x-ray free-electron laser and ultrafast electron diffraction probe environments. Additionally, new approaches to improve the collection, processing and analysis of large data sets obtained with high repetition-rate pulsed sources or with fast multi-mega-pixel detector arrays are encouraged under the cross-cutting emerging domain of Data Sciences.

DOE is looking for novel X-ray techniques that enable detailed investigations of the fundamental dynamic mechanisms of energy conversion systems and their active material components. This research involves interaction of complexity at atomic to mesoscopic length scales and requires development of multimodal experimental techniques that examine the same active sample positions, in place and under operational boundary conditions. Of particular emphasis for new energy-saving quantum computation is the in-place study of the evolution of quantum properties and phase transitions at the shortest relevant time scales.

The subprogram will not support research considered mature use of existing x-ray or ultrafast techniques. Typically, the emphasis on new techniques enables new access to inhomogeneous and dynamic systems and, therefore, the subprogram will de-emphasize steady-state research of bulk and equilibrium systems.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Helen Kerch, helen.kerch@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/X-Ray-Scattering

(j) Neutron Scattering

This subprogram supports hypothesis-driven research to understand atomic, molecular, electronics, and magnetic structures and excitations, and their relationships to macroscopic properties, including mechanical, thermal, electronic, magnetic, and topological. Neutron scattering, spectroscopy, and imaging research performed primarily at DOE neutron facilities should be central to this research.

The scientific research should use advances in neutron scattering driven by improved source performance, instrumentation, and advanced data acquisition and analysis approaches. The neutron scattering activity will expand current capabilities at DOE neutron facilities by providing support for research that motivates and leads new instrumentation and technique developments. We are looking for research to identify fundamental mechanisms governing the response of materials to out-of-equilibrium (including operando) conditions as achieved through correlation of neutron detection with driven changes of sample environment, and concepts to analyze such measurements. New approaches to improve collection and analysis of large data sets in raw form obtained with high repetition-rate pulsed sources or pulsed sample environment or fast multi-mega-pixel detector arrays are encouraged. Scientific research supported by this activity should enable growth of the neutron scattering community, such as through engagement of postdocs and students and efforts to make data widely accessible.

The subprogram will not support research considered mature or routine use of neutron scattering techniques. Typically, the emphasis on new techniques enables new access to inhomogeneous and dynamic systems and, therefore, the subprogram will de-emphasize research of bulk systems in quiescent conditions or research resulting in incremental advances of understanding of materials.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Helen Kerch, helen.kerch@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Neutron-Scattering

(k) Electron and Scanning Probe Microscopies

This subprogram supports basic research in materials sciences using advanced electron and scanning probe microscopy and related spectroscopy techniques to understand the atomic, electronic, and magnetic structures and properties of materials. This activity also supports the development of new instrumentation concepts and quantitative techniques to advance materials characterizations. Supported advancements include ultrafast electron diffraction and imaging techniques. The goal is to develop a fundamental understanding of materials, including quantum phenomena, through advanced microscopy, spectroscopy, and the associated theoretical tools.

This activity emphasizes innovative research using electron and scanning probe microscopy techniques for groundbreaking science. Key areas of focus include developing innovative techniques and probes that harness quantum behavior, alongside using imaging and spectroscopic techniques to understand the interplay among the quantum observables that produce unique properties. These areas include understanding and controlling quantum systems, nano- or meso-scale inhomogeneity; and the interplay between charge, orbital, spin and lattice degrees of freedom. Research opportunities also include functionality imaging and spectroscopy of nanostructures; integrating multiple probes or multimodal imaging for functional studies of quantum materials and behaviors; and using advanced computational methods, including super intelligence and machine learning, for integrating complex datasets from multimodal imaging and faster and more accurate data reconstruction and analysis.

The subprogram will not support research considered to be mature use of microscopy techniques or device development. Electron and scanning probe efforts, including technique development, proposed without associated scientific goals or are motivated primarily by support of other funded research will not be considered.

Target Dates:

- We strongly encourage white papers or pre-applications. There is no target date for white papers or pre-applications.
- Applications submitted by December 1, 2026, will be considered for funding in FY 2027.
- Applications submitted after December 1, 2026, are not guaranteed consideration for funding this fiscal year.

- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Jane Zhu, jane.zhu@doe.gov
Website: https://science.osti.gov/bes/mse/Research-Areas/Electron-and-Scanning-Probe-Microscopies

Chemical Sciences, Geosciences, and Biosciences

Division website: https://science.osti.gov/bes/csgb/

The Chemical Sciences, Geosciences, and Biosciences (CSGB) Division supports experimental, theoretical, and computational research to provide fundamental understanding of chemical transformations and energy flow in systems relevant to DOE missions. This knowledge serves as a basis for developing new processes for energy and national priorities. The CSGB research portfolio consists of the subprograms listed in this section.

In addition to applications that directly respond to a CSGB research area, CSGB may consider applications from single PIs and small two- or three-PI teams for research addressing the following topics, which cross multiple research areas.

- Applications for combined experimental and theoretical studies probing how chirality impacts spin-dependent chemistry
- Applications in systems chemistry examining the molecular mechanistic basis of emergent reactive behavior during maintenance of non-equilibrium regimes or of the emergence and control of far-from-equilibrium structures that give rise to novel chemical functionality
- Applications that discover and characterize fundamental chemical or biochemical mechanisms that could enable biohybrid or bioinspired approaches for critical mineral and material discovery, recovery, separations, and/or transformation (the recent workshop brochure provides additional information)
- Experimentally grounded applications aimed at investigating how quantum phenomena affect or control the mechanisms of multiscale chemical, biochemical, or geochemical processes and the functions they enable, such as energy transformation, rather than merely modulating their behavior. Projects may combine experiment and theory but the primary component must be experimental studies.

Such applications must be aligned with programmatic priorities listed for at least two CSGB research areas described in the following subprograms. Potential applicants should submit a preapplication and discuss their ideas with the subprogram contacts for the areas of interest to determine programmatic before submitting an application. The funding range is anticipated at $600,000 to $1,200,000 total for three years.

(l) Ultrafast Molecular and Optical Sciences

The Ultrafast Molecular and Optical Sciences (UMOS) subprogram supports fundamental experimental and theoretical research in ultrafast chemical sciences. The

subprogram's primary mission is to establish the foundational knowledge required to control chemical transformations by developing accurate quantum chemical descriptions of excited-state physical and chemical processes and by advancing novel optical tools to guide reactants towards desired products.

The UMOS subprogram supports research that advances the understanding of electronic and nuclear dynamics on attosecond, femtosecond, and picosecond timescales. This research includes efforts to:

- Probe electron dynamics by taking advantage of unique capabilities at BES user facilities, including X-ray Free Electron Lasers (XFELs). Within this theme, the subprogram supports research to elucidate the connections between attosecond physics and subsequent photo-induced chemical reaction dynamics.
- Control vibrational wavepackets on excited-state potential energy surfaces. This theme includes developing novel X-ray and optical approaches to track and steer molecular systems as they evolve through conical intersection seams.
- Track photophysical processes and photochemical product formation. Research in this area connects photoexcitation and early time dynamics to efforts aimed at controlling reaction branching ratios and final product formation.

In addition to the above central themes, the UMOS subprogram strongly encourages applications that push the boundaries of the field. These areas include research that investigates chemical dynamics at the space-time limit by achieving joint femtosecond (or faster) temporal resolution and nanometer (or finer) spatial resolution. Additionally, the subprogram seeks applications that use principles from quantum metrology and nanophotonics to enhance classical approaches to probing and controlling ultrafast chemistry, with the ultimate aim of achieving chemical control at the space-time limit.

The UMOS subprogram is not accepting applications in the areas of plasma physics or the physics of atomic systems. To be considered responsive, applications focused on theoretical, computational, or instrument development must include a well-integrated scientific research component that directly addresses important scientific questions aligned with the above-outlined subprogram goals.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by December 31, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Patrick El Khoury, patrick.el-khoury@doe.gov
Website: https://science.osti.gov/bes/csgb/research-areas/atomic-molecular-and-optical-science/

(m) Gas Phase Chemical Physics

Research in the Gas Phase Chemical Physics (GPCP) subprogram is pursued through three primary thrust areas. These areas represent distinct yet complementary approaches to understanding and controlling gas-phase chemical phenomena. The thrusts are: Fundamental Chemical Reactivity, which focuses on elementary processes; Emergent Complexity and Systems Chemistry, which addresses collective behaviors in large molecular systems and ensembles; and Gas-Surface Chemical Physics, which targets surface-mediated reactions. Applicants are encouraged to propose research that aligns with the core focus of one or more of these thrusts.

Fundamental Chemical Reactivity

This area supports research aimed at establishing the fundamental principles of gas-phase reactivity relevant to the BES energy mission. Experimental and theoretical investigations where the primary objective is to yield generalizable insights holds the highest priority in this area. This emphasis includes studies of chemical kinetics, reaction mechanisms, chemical dynamics, and collisional energy transfer specifically designed to target prototypical molecular interactions or critical processes governing reactivity. Similarly, the construction and calculation of molecular potential energy surfaces must be explicitly coupled to modeling these dynamic and reactive processes. This area encompasses electron-driven chemistry and encourages the development and application of innovative tools, only when used to reveal transferable physical principles of energy flow and chemical transformation in the gas phase.

Emergent Complexity and Systems Chemistry

This area focuses on understanding how complex, collective behaviors arise from underlying elementary gas-phase reactions. Research in this area must aim to establish the mechanistic pathways that connect elementary processes to the observed behavior of large reaction networks and molecular ensembles. The goal is to understand why and predict when emergent phenomena, such as significant changes in reaction rates, branching ratios, or product distributions, will manifest. This research includes the study of gas-particle interconversion, with a specific focus on elucidating the molecular mechanisms of particle formation, growth, and transformation. In this context, the subprogram supports research that uses SI/ML methods as a tool to analyze and discover the fundamental principles governing the behavior of these increasingly complex gas-phase systems.

Gas-Surface Chemical Physics

This area emphasizes molecular-scale investigations where the surface is used as a well-characterized boundary to influence gas-phase phenomena. The goal is to develop a fundamental understanding of the cooperative effects that arise from coupling of gas-phase chemistry with an interface. To be responsive, research must answer fundamental questions about how gas-phase reactivity, kinetics, or energy transfer are altered by proximity to the surface. Therefore, the central scientific questions must be rooted in the gas-phase, not the intrinsic catalytic properties of the condensed-phase material itself.

The GPCP subprogram does not support research centered on continuum-level or applied engineering topics. This exclusion includes fluid dynamics (transport phenomena, computational fluid dynamics, and reacting turbulent flow) as well as spray dynamics and developing, characterizing, or optimizing end-use combustion devices. Furthermore, the subprogram does not support research that is primarily directed toward other government agency missions, including collisional kinetics for hypersonic flow research, or that is aimed at static characterization, such as spectroscopic investigations of molecular structure. Finally, developing general-purpose data-sharing software also falls outside the subprogram's scope.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by December 31, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contacts:
Patrick El-Khoury, patrick.el-khoury@doe.gov
Tom Settersten, thomas.settersten@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/Gas-Phase-Chemical-Physics

(n) Computational and Theoretical Chemistry

This subprogram supports fundamental research for the sustained development, innovation, and integration[5] of theoretical and computational approaches for the accurate and efficient prediction of chemical processes and mechanisms relevant to the DOE mission. Part of the focus is on simulating dynamical processes that are so complex that efficient computational implementation must be accomplished along with developing new theories and algorithms. Efforts must be tightly integrated with the research and goals of BES and provide theories and computational approaches to advance the fundamental science of chemical transformations and energy and information transduction processes across multiple scales in complex environments and systems. Applications may include the development or improvement of modular computational tools that enhance interpretation and analysis of advanced experimental measurements, including those acquired at DOE user facilities, or efforts aimed at enhancing the accuracy, precision, applicability, and scalability of quantum-mechanical simulation methods. Also included are development of spatial and temporal multiscale methodologies that allow for time-dependent simulations of relativistic, coherent, entangled, and dissipative processes as well as rare events. Development of novel theories and simulation capabilities for theory-guided

[5] A Perspective on Sustainable Computational Chemistry Software Development and Integration, R. Di Felice et al., J. Chem. Theory Comput. 2023, 19, 7056. https://DOI.org/10.1021/acs.jctc.3c00419.

control of externally driven electronic and spin-dependent processes in real environments is encouraged.

The Computational and Theoretical Chemistry (CTC) focus for FY 2027 is on innovative predictive mechanistic theories and practical, systematically improvable and hierarchical methods for describing and simulating dynamical processes occurring in complex molecular ensembles and environments. Topics of interest within this focus include developing and integrating quantum chemical approaches for the accurate simulation and prescriptive design of (i) systems-level behaviors and other emergent functionalities and phenomena for manipulating information and energy transduction, with specific emphasis on dynamical chemical systems that exploit coordinated effects of chirality, topology, and magnetoelectric interactions to achieve novel functionalities, (ii) non-biological cooperative reaction networks and mechanisms, leading to programmable matter, chemical super intelligence, or molecular cybernetic functionalities, or (iii) chemical transformation and energy transfer and transduction processes in field-driven complex open quantum systems, with specific interest in chemical systems exhibiting nonlinear dynamical behaviors that require explicit algorithmic consideration of correlated local stability/activity and entropy production, or many-body non-Hermitian criticalities and effects, to describe.

Collaborative Opportunity

Collaborative research that involves experimental or theoretical condensed matter physics aspects to address the specific emphasis described in the first CTC topic of interest above is encouraged. Before submission, multiple investigator collaborative research ideas should be discussed with the subprogram contacts of CTC and the relevant participating subprograms: Condensed Phase and Interfacial Molecular Science, Physical Behavior of Materials, or Theoretical Condensed Matter Physics.

CTC does not support projects based on (i) the mature use of presently available implementations of computational and theoretical chemistry methods and/or approaches, (ii) developing phenomenological models and empirical parameterization of models, (iii) methods for, or applications to, systems that do not explicitly consider rearrangements of quantum-mechanical degrees of freedom, or (iv) developing density functional theory approximations or machine-learned potentials. SI/ML focused efforts in CTC must develop run-time compute intensive algorithms and methods — such as those that require reasoning and/or inference modelling to be performed during their execution — to advance the current state-of-the-art in exascale, quantum hardware-based, or other novel compute paradigm-based simulations of chemical systems and processes for fundamental knowledge discovery.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by February 15, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 15, 2027, are not guaranteed consideration for funding this fiscal year.

- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Aaron Holder, aaron.holder@doe.gov
Website: https://science.osti.gov/bes/csgb/research-areas/computational-and-theoretical-chemistry/

(o) Condensed Phase and Interfacial Molecular Science

The Condensed Phase and Interfacial Molecular Science (CPIMS) subprogram emphasizes basic research at the boundary of chemistry and physics, pursuing a molecular-level understanding of chemical and physical processes in liquids and/or at interfaces. With its foundation in chemical physics, the impact of this crosscutting subprogram is far reaching, providing scientific foundations underpinning a variety of areas of importance to the DOE, including energy, chemical synthesis and manufacturing, microelectronics, nuclear power generation, and quantum information science. The CPIMS subprogram also supports a significant number of efforts that develop and use SI/ML to form the basis for new approaches for understanding science questions of interest to the CPIMS subprogram.

Experimental and theoretical investigations in the gas phase, condensed phase, and at interfaces aim at understanding the molecular-scale chemical and physical properties and interactions that govern chemical reactivity, solute/solvent structure, and transport. Studies of reaction dynamics at well-characterized surfaces and clusters lead to the development of theories on the molecular origins of surface-mediated catalysis and heterogeneous chemistry. Studies of model condensed-phase systems target first-principles understanding of molecular reactivity and dynamical processes in solution and at interfaces. Fundamental studies of reactive processes driven by radiolysis in condensed phases and at interfaces provide improved understanding of radiation-driven chemistry. Radiation chemistry research is managed jointly by the CPIMS subprogram and Photochemistry and Radiation Chemistry subprogram (see section (u) below); applicants may wish to discuss their radiation chemistry research plans with the contacts for each subprogram.

The transition from molecular-scale chemistry to the emergence of collective phenomena in complex systems allows knowledge gained at the molecular level to be exploited through the dynamics and kinetics of collective interactions. The desired evolution is toward predictive capabilities that span the microscopic to nanoscale domains. This subprogram is looking for a molecular level understanding of complex molecular systems, capturing the essence of chemical behavior, uncovering the knowledge of the main molecular-level driving forces behind the behavior, revealing the information that can be discarded while achieving reasonable descriptions, and discovering the universal principles that can be applied more widely.

The CPIMS subprogram will continue to emphasize Systems Chemistry to understand how interacting molecular networks can lead to emergent reactive behavior during maintenance of nonequilibrium conditions. Examples include reaction-diffusion systems, positional information, compartmentalized reaction networks, substrate-induced reactive systems, chemical

replication, directionality in chemical flux and assembly growth, and the dynamics of nonequilibrium catalysis.

The CPIMS subprogram will increase emphasis on chemistry at the boundaries of condensed matter physics, including where unexpected emergent behavior has been identified. The subprogram will increase a portfolio that includes studies of how chemical reactions might be supported at the surface of topological materials, the impact of Moiré effects on electrochemistry, the use of the theories of topological physics to change the way chemical reactions are understood and manipulated, and how light-matter coupling can affect chemical reactions. Another topic of interest is the impact of chirality on spin-dependent interfacial chemistry.

Collaborative Opportunity

CPIMS is also soliciting collaborative applications for combined experimental and theoretical studies of the impacts of chirality on spin-dependent interfacial chemistry. Before submission, multiple investigator collaborative research ideas should be discussed with the subprogram contacts of CPIMS and the relevant participating subprograms: Computational and Theoretical Chemistry, Theoretical Condensed Matter Physics, and Physical Behavior of Materials.

The CPIMS subprogram does not fund research in mechanics or dynamics of bulk fluids. Applications based on technological applications or device development will not be considered.

Target Dates:

- We strongly encourage white papers or pre-applications, which have no target date.

Subprogram Contact:
Patrick El-Khoury, Patrick.el-khoury@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/Condensed-Phase-and-Interfacial-Molecular-Sciences

(p) Molecular Quantum Information Science

The Molecular Quantum Information Science (mQIS) subprogram supports theoretical, computational, and experimental research that advances the quantum information science of complex chemical systems. Efforts in this area develop a fundamental understanding of the structure, dynamics, and control of quantum information processes at the molecular scale, building the scientific foundations for the next generation of molecular quantum technologies in computing, communication, and sensing.

The subprogram adopts an integrated approach that combines quantum information foundations in chemical systems, pathways to molecular quantum information functionality, and new approaches to quantum computing and learning.

Within these research areas, responsive applications must address one or more of the following topics:

Quantum Information Foundations in Chemical Systems:

- Develop theoretical frameworks that treat quantum information as a fundamental description of chemical complexity. Applicants should draw on operator algebras, quantum geometry, noncommutative methods, and related tools to reveal structural and conceptual features difficult to capture with existing methods, including multipartite correlation structure and information-theoretic formulations of fundamental chemical concepts.
- Establish fundamental principles and limits governing the transformation and operational characterization of quantum information at the molecular scale. Approaches may include quantum resource theories, game-theoretic and diagrammatic reasoning, and related methods for characterizing entanglement, magic, contextuality, and related quantum resources in realistic chemical environments, with experimentally accessible witnesses, control objectives, or information-processing roles.
- Determine how quantum functionality is affected as the length scales and complexity of chemical systems increase. This research should include changes in the organization, transformation, and characterization of quantum information; entanglement growth, decoherence, and thermalization; and the interplay with energy, work, and dissipation at experimentally relevant scales.

Molecular Quantum Information Functionality:

- Harness diverse molecular quantum modalities, beyond spin degrees of freedom, for high-dimensional quantum information encoding using qudits or continuous-variable modes, with credible pathways to initialization, coherent control, entanglement generation, and state readout under realistic conditions.
- Develop molecular principles governing coherent quantum-state transfer and transduction among different quantum degrees of freedom in complex, variable architectures. Of interest are the effects of disorder, molecular motion, and environmental interactions on information preservation and stable communication between molecular subsystems via near-field coupling, host-mediated interactions, or photonic pathways.
- Establish molecular systems as physical substrates for quantum learning and information-processing primitives by exploiting native molecular dynamics and interactions. Research may include quantum reservoir computing, kernel and feature-map methods, and related strategies for data representation, feature extraction, inference, and decision tasks under realistic chemical and resource constraints.

Quantum computing and learning:

- Develop problem-specific and adaptive models of computation for the dynamical evolution of chemical processes that account for their structure, statistics, and symmetries and adapt to changing informational signatures, model mismatch, and measurement and experimental feedback, including SI-assisted adaptation and control. Model design may encompass qudit and continuous-variable representations, fermionic and bosonic encodings, native analog primitives, and computational paradigms such as measurement-based computing and quantum cellular automata.

- Advance quantum surrogate models as abstract, controllable representations of chemical systems that reveal hidden structure and yield fundamental physical insight. Their construction may combine algebraic and control-theoretic analysis of experimentally available operations, information-theoretic characterization, and learning from driven evolution and measurement data. This approach may open pathways toward self-computing chemical systems in which surrogate-guided control and measurement protocols steer the system's intrinsic quantum dynamics toward desired information-processing outcomes.
- Design interpretable quantum machine learning approaches to uncover physically meaningful structure within molecular quantum systems by extracting patterns, transferable representations, and resource features from trained models, identifying underlying mechanisms and control principles, and refining theoretical frameworks.

To be considered responsive, applications must pursue high-impact foundational research that incorporates one or more of the research topics listed above and clearly articulates its importance to the molecular systems relevant to the CSGB domain sciences.

Applications will be deemed non-responsive if they are principally centered on:

- Materials science, engineering, synthesis, device optimization, or designing or building quantum computing hardware
- Experimental studies or platform-development efforts focused principally on isolated performance metrics, such as coherence times, that neither advance foundational understanding of quantum information processes nor establish a credible path to realizable molecular quantum functionality
- Algorithmic translation of established quantum chemistry methods to quantum computers
- Computational simulation, including SI/ML-based simulation approaches, without contributing to the understanding or advancement of foundational QIS principles

Target Dates:

- We strongly encourage white papers or pre-applications, which have no target date.

Subprogram Contact:
Marat Valiev, marat.valiev@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/Quantum-Information-Sciences

(q) Catalysis Science

This subprogram supports basic research pursuing novel catalyst design and molecular-level control of chemical transformations relevant to the conversion of energy resources. Emphasis is on the understanding reaction mechanisms and enabling precise identification and manipulation of catalytic active sites, their environments, and reaction conditions for optimized efficiency and selectivity. Understanding *catalytic reaction mechanisms in varied chemical environments* and *the structure-reactivity relationships of solid and molecular catalysts* is a central component of the subprogram. The subprogram encourages applications from single PIs and small two- or three-PI teams and anticipates a funding range of $550,000 to $1,000,000 total for three years.

A long-term objective is to promote convergence of heterogeneous, homogeneous, electro-, and bio-catalysis as a means to discover novel inorganic, organic, and hybrid catalysts that are atom and energy efficient for selective fuel and chemical production. Specific focus areas include:

- New mechanisms and catalytic transformations mediated by earth-abundant metals
- Reducing dependence on catalysts containing platinum group or other critical elements by advancing novel concepts to increase active site efficiency
- Approaches that explore catalysts and mechanisms associated with energy-relevant transformations in multicomponent mixtures, multiple reactions, and integrated processes
- Advanced concepts for catalyst design, including topics related to atomically precise synthesis that enable, for instance, multi-functionality, confinement within porous materials, site cooperativity, nano- and single-atom stabilized structures, and manipulation of weak interactions
- Substituting or coupling thermal energy sources with less-energy intensive ones, such as electrical, mechanochemical, or electromagnetic sources leading to efficient and resilient chemical processes
- Examining the dynamics of catalyst and electronic structures occurring during catalytic cycles and deactivation via the development of novel spectroscopic techniques and structural probes for *in situ/operando* characterization of catalytic processes. This area also includes strategies to induce changes in catalytic structure and activity via response to stimuli.
- Integrated theory-experiment and predictive theoretical catalysis supported by data-intensive and SI/ML approaches for mechanism identification, catalyst discovery and development, and benchmarking catalytic properties

This subprogram does not support: (1) the study of transformations for pharmaceutical applications; (2) non-catalytic stoichiometric reactions; (3) whole cell or organismal catalysis; (4) studies where the primary focus is photochemistry or photophysics; (5) studies primarily focused on process or reactor design and optimization; (6) studies primarily focused on battery chemistry; and (7) studies primarily focused on catalytic materials synthesis and materials characterization.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by October 30, 2026.
- Applications submitted by December 14, 2026, will be considered for funding in FY 2027.
- Applications submitted after December 14, 2026, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contacts:
Viviane Schwartz, viviane.schwartz@doe.gov and
Chris Bradley, chris.bradley@doe.gov

Website: https://science.osti.gov/bes/csgb/research-areas/catalysis-science/

(r) Separation Science

This subprogram provides mechanistic and molecular insight into chemical separation processes or phenomena by supporting fundamental, testable hypothesis-based experimental and computational research questions. Research projects seek to develop foundational knowledge that enable prediction and control of chemical and physical mass transport and phase de-mixing. This research includes understanding the kinetics, thermodynamics, and interfacial dynamics of these transitions across multiple length and time scales, from quantum interactions to macroscopic phenomena. Although parameters such as selectivity, capacity, throughput, durability, and energy input are important performance benchmarks, projects must not focus on optimization. Instead, projects must focus on molecular-level insight and mechanistic understanding into chemical separation processes or phenomena. The subprogram encourages nascent stage separation science projects for energy-relevant streams (e.g., critical minerals and materials, industrial gases or liquids such as methane) as well as projects that use SI to provide fundamental insight in separation mechanisms.

Scientific research topics that align with current subprogram priorities are:

- *Kinetics and Chemical Conversions.* Elucidating the temporal molecular mechanisms governing separation system changes, including activation, degradation, or solvation.
- *Interfacial Dynamics.* Understanding how dynamics and molecular criteria limit phase and mass transfer at interfaces or interfacial regions during separation processes.
- *Overcoming Thermodynamics via Cooperative Chemical Interactions.* Discovering and predicting mechanistic paradigms for selective isolation and release of dilute constituents from complex mixtures using cooperative chemical phenomena.
- *Under-Explored Physical Driving Forces.* Exploring highly efficient, alternative separation mechanisms, such as bio-inspired pathways, chirality, magnetic or magneto-reactive forces, or other non-thermal inputs.

White papers or pre-applications and applications must explicitly define a research question, identify a fundamental testable hypothesis, and describe the separation science knowledge gap that will be addressed. These submissions should clearly detail how the proposed project addresses one of the bulleted programmatic scientific priorities described above. Scientific research questions that use experimental, computational, or SI approaches are encouraged. Applicants must make a strong case for the relevance of the work to energy and to the fundamental chemical separation science nature of the proposed research (as opposed to an applied technology or another BES subprogram).

The subprogram does not support goals that primarily focus on: (a) Engineering (design, narrowly defined processes or devices, process scale up, technoeconomic analyses, microfluidics, established water desalination, optimization, technology advancement), (b) Materials/Ligand Optimization (routine synthesis, material screening, structural characterization, ligand optimization, etc. that lack a primary focus on separation mechanism), (c) Tool Development (sensor development, objectives related to database creation, or generating new computational or characterization methodologies without direct integration into fundamental

mechanistic separation studies), and (d) Optimization by SI (objectives using SI solely for high-throughput phase space exploration or parameter optimization).

The following research topics are generally considered beyond subprogram scope and should be directed to the BES subprograms in parentheses: chemical aspects of structure-property relationships of materials (Materials Chemistry); nucleation, prenucleation phenomena, and phase transitions (Synthesis and Processing); subsurface transport (Geosciences); molecular-level understanding of chemical and physical processes at interfaces unrelated to separations (Condensed Phase and Interfacial Molecular Science); or the unique properties of heavy elements (Heavy Element Chemistry). Furthermore, projects focused on isotope separations or technology development are beyond subprogram scope.

Target Dates:

- We strongly encourage white papers or pre-applications for both new and renewal projects, which should be submitted by October 30, 2026.
- Applications submitted by December 11, 2026, will be considered for funding in FY 2027.
- Applications submitted after December 11, 2026, are not guaranteed consideration for funding this fiscal year.
- If not considered this fiscal year, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Amanda Haes, amanda.haes@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/separation-science

(s) Heavy Element Chemistry

This subprogram supports actinide and transactinide fundamental chemical research that underpins the DOE missions in energy, environment, and national security with an emphasis on the chemical and physical properties of the transuranic elements. The unique molecular bonding of these elements is explored using experiment and theory to elucidate electronic and molecular structure, reaction thermodynamics, as well as quantum phenomena.

The emphasis in this subprogram is placed on the chemical and physical properties of the transuranic elements to determine their bonding and reactivity, the fundamental transactinide chemical properties, and the overarching goal of resolving the *f*-electron challenge. The *f*-electron challenge refers to the inadequacy of current electronic structure methods to accurately describe the behavior of *f*-electrons, in particular strong correlation, spin-orbit coupling, multiplet complexity, and associated relativistic effects. We will consider theoretical applications that integrate with experimental research or otherwise demonstrate impact outside the theory community. Transactinide element research is highly encouraged; these investigations, where relativistic chemical effects dominate and the half-lives are short, are a challenging test of theoretical and chemical techniques.

The role of 5*f* electrons in bond formation remains the fundamental topic in actinide chemistry and is an overarching emphasis for this subprogram. Theory and experiment show that 5*f* orbitals participate significantly in molecular actinide compounds. Resolving the role of the *f*-electrons is one of the three grand challenges identified in the *Basic Research Needs for Advanced Nuclear Energy Systems (ANES)* report of the Basic Energy Sciences Workshop (2006) and echoed in the report from the Basic Energy Sciences Advisory Committee, *Science for Energy Technology: Strengthening the Link between Basic Research and Industry* (2010). Applicants should also look at the priority research directions and opportunities discussed in the reports from the 2017 *Basic Research Needs for Future Nuclear Energy* workshop and the July 2022 *Foundational Science to Accelerate Nuclear Energy Innovation* roundtable.

Applications that include methods using super intelligence are particularly desirable. This subprogram does not fund research on the following areas, which are more appropriately supported through other DOE programs: processes affecting the transport of subsurface contaminants; form and mobility of contaminants, including wasteforms; projects focused on using heavy-element surrogates; projects aimed at optimizing materials properties, including radiation damage, high-pressure research on neptunium or plutonium, device fabrication, data science efforts without chemical experimentation, or biological research.

Catalytic reactivity involving actinides, if not better aligned with the BES Catalysis Science subprogram described in section (q), is of interest to this subprogram if the project yields insight into *f*-electron behavior. Exotic catalytic and redox behavior exhibited by actinides in extreme environments, such as the legacy nuclear waste tanks or molten salts, is also of particular interest to this subprogram.

The following areas are generally better aligned with the subprogram identified in parentheses: research that is focused primarily on separations that does not address the unique properties of the heavy elements (Separation Science); developing or improving computational tools (Computational and Theoretical Chemistry); research focused primarily on radiation chemistry — chemistry initiated from excited states (Condensed Phase and Interfacial Molecular Science and Photochemistry and Radiation Chemistry). Applications should be hypothesis-based. Hypotheses should be testable and falsifiable. Applications must reference aligned research supported by this subprogram.

For Renewal Applications

The Renewal Proposal Products list generated in PAMS should ***only*** include publications from the project period immediately preceding the application that explicitly acknowledge support of the grant and must include DOIs.

Target Dates:

- We strongly encourage white papers or pre-applications, which have no target date.
- Applications submitted by November 20, 2026, will be considered for funding in FY 2027.
- Applications submitted after November 20, 2026, are not guaranteed consideration for funding this FY.

- If not considered this FY, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Philip Wilk, philip.wilk@doe.gov
Website: https://science.osti.gov/bes/csgb/research-areas/heavy-element-chemistry/

(t) Geosciences

This subprogram supports basic experimental, theoretical, and computational research in geochemistry and geophysics that have clear connections to energy production or recovering critical elements. Geochemical research emphasizes fundamental understanding of the reaction mechanisms and rates associated with geochemical processes, focusing on molecular-mesoscale aspects of minerals and interfaces and on the molecular origins of critical element distributions and their influence on migration, separation, or fractionation pathways in the earth. Geophysical research focuses on new approaches to understanding subsurface processes that characterize the evolution of fractures in the upper crust, particularly when associated with enhanced geothermal systems and hydrocarbon prospection and recovery.

Applicants should look at the geosciences-aligned priority research directions and opportunities discussed in the BES workshop and roundtable reports. The reports that contain particularly topical geosciences topics include, *Basic Research Needs for Geosciences: Facilitating 21st Century Energy Systems* (2007) and *Controlling Subsurface Fractures and Fluid Flow: A Basic Research Agenda* (2015).

Including super intelligence or quantum computing methods is particularly desirable. Although the work should have a well-defined connection to energy production or critical elements, priority in BES Geosciences funding is given to research that has strong potential for breakthrough science. Applicants must make a strong case for the relevance of the work to energy production or critical elements and the fundamental science nature of the work (i.e., why the work belongs in BES and not a more applied program). Applications that do not make a strong case for both may be declined without review.

Research that is focused primarily on separation science and does not address subsurface science, would be better aligned with the Separation Science subprogram, which is described in section (r). Modeling-focused applications that do not clearly indicate direct engagement with novel and compelling data sets are discouraged. Applications that do not describe subsurface science (e.g. oceanography) are discouraged. Applications should be hypothesis-based. Hypotheses should be testable and falsifiable. Applications must reference aligned research supported by this subprogram.

The Geosciences subprogram does not fund research areas more appropriately supported through other programs such as wellbore integrity, advanced drilling methods, hydraulic fracturing technologies, remediation tools, stimulation methods, CO_2 sequestration, optimizing processes for industry, code development, engineering design or scale-up, development of

narrowly defined processes or devices, mapping & surveys, biological research, device fabrication, microfluidics, or sensors.

For Renewal Applications

The Renewal Proposal Products list generated in PAMS should ***only*** include publications from the project period immediately preceding the application that explicitly acknowledge support of the grant and must include DOIs.

Target Dates:

- We strongly encourage white papers or pre-applications, which have no target date.
- Applications submitted by November 20, 2026, will be considered for funding in FY 2027.
- Applications submitted after November 20, 2026, are not guaranteed consideration for funding this FY.
- If not considered this FY, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Philip Wilk, philip.wilk@doe.gov
Website: https://science.osti.gov/bes/csgb/research-areas/geosciences/

(u) Photochemistry and Radiation Chemistry

This subprogram supports fundamental, molecular-level research on photochemistry and radiation chemistry in the condensed phase and at interfaces.

Photochemical processes initiated by absorbing visible or near-infrared light may ultimately form the basis of reliable, secure energy technologies that generate energy-rich chemicals or electricity. Advances in these areas will require a thorough understanding of elementary processes such as light absorption, charge separation, and charge transport within a number of chemical systems, including those with significant nanostructured composition.

Supported research areas include organic and inorganic photochemistry, light-driven electron and energy transfer in condensed phase and interfacial molecular systems, photocatalysis of reactions relevant to fuels or commodity chemicals, semiconductor photoelectrochemistry, light-driven generation or manipulation of quantum phenomena in molecular systems, and artificial assemblies that mimic natural photosynthetic systems. An enhanced theory and modeling effort is needed to improve current understanding of many photochemical phenomena. Research that leverages super intelligence tools to accelerate experimental and/or computational progress is particularly desirable.

Photochemical topics of high programmatic interest include mission-relevant research on:

- Processes that use chirality-induced spin selectivity to influence photochemical outcomes
- Novel photoredox strategies for driving energy-relevant transformations
- Light-driven accumulation of multiple redox equivalents at reactive centers

- New approaches to enhance photoelectrochemical durability, especially for light-driven water oxidation

Another area of interest is the chemistry initiated by creating excited states with ionizing radiation — produced through electron pulse radiolysis — to investigate reaction dynamics, structure, and energetics of short-lived transient intermediates in the condensed phase, solutions, and interfaces. Basic research on radiation chemistry is needed to enable continued advances in nuclear energy production and environmental waste management. Supported topics include fundamental research to understand the radiation-induced speciation and redox chemistry of coolants and solvents being considered for next-generation nuclear energy systems, the degradation mechanisms and mitigation strategies of molecular reagents employed for separations processes in the nuclear cycle, and the radiation chemistry of solid-liquid interfaces encountered in nuclear waste processing and storage. Radiation chemistry research is managed jointly by the Photochemistry and Radiation Chemistry subprogram and the CPIMS subprogram (see section (o) above); applicants may wish to discuss their radiation chemistry research plans with the contacts for each subprogram.

The Photochemistry and Radiation Chemistry subprogram does support systems-level investigations, but it does not fund applied research on device development or optimization.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by October 30, 2026.
- Applications submitted by December 11, 2026, will be considered for funding in FY 2027.
- Applications submitted after December 11, 2026, are not guaranteed consideration for funding this FY.
- If not considered this FY, applications will be held for consideration in a future selection cycle.

Subprogram Contacts:
Christopher Fecko, christopher.fecko@doe.gov
Jennifer Roizen, jennifer.roizen@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/Solar-Photochemistry

(v) Photosynthetic Systems

This subprogram supports basic research on the capture and conversion of solar energy to chemical energy in the photosynthetic systems of plants, algae, and photosynthetic microbes. Topics of study include, but are not limited to, light harvesting, proton and electron transport, reduction of carbon dioxide to form organic compounds, and the self-assembly and self-repair of photosynthetic proteins, complexes and membranes. Examples of specific topics under these headings include capture of carbon dioxide by carboxylase enzymes and bicarbonate transporters, assembly of subunit proteins into large photosynthetic complexes, control of excitation energy transfers through light harvesting proteins, and extraction of electrons from water for generation of useful organic compounds. The broad goal of the subprogram is to foster

greater knowledge of the varied photosynthetic systems found in nature. These systems offer a natural library of self-assembling biochemical systems that conduct unusually efficient transfers and energy conversions from one form to another. Understanding of these systems can guide the development of new energy technologies.

All submitted applications must clearly state how the knowledge gained from the proposed research is relevant to greater mechanistic understanding of capture and conversion of solar energy to chemical energy in the photosynthetic systems of plants, algae, and photosynthetic bacteria. Photosynthetic Systems does not fund: 1) development or optimization of energy devices or processes; 2) development or optimization of microbial strains or plant varieties for biofuel or biomass production; 3) phenotype analyses that do not test specific hypotheses relevant to the subprogram; 4) genomic, transcriptomic, or proteomic data acquisition that does not test specific hypotheses relevant to the subprogram; and 5) projects that are primarily computational in nature.

Target Dates:

- We strongly encourage white papers or pre-applications, which have no target date.
- Applications submitted by November 20, 2026, will be considered for funding in FY 2027.
- Applications submitted after November 20, 2026, are not guaranteed consideration for funding this FY.
- If not considered this FY, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Kate Brown, katherine.brown@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/Photosynthetic-Systems

(w) Physical Biosciences

This subprogram supports basic research into the biochemistry, biophysics, and molecular biology that underpins natural energy capture, conversion, and storage systems. Primary focus areas of this subprogram include:

- Structure/function, mechanism, and energetic properties of complex multielectron enzyme reactions, cofactor redox tuning, chemical environments that control redox potential, electron flow and catalytic bias, pathways and mechanisms that control complex metallocofactor and active site biosynthesis, proton coupled electron transfer, tunneling, and quantum phenomena in non-photosynthetic natural systems
- Factors that direct and regulate electron flow across spatial and temporal scales (e.g. protein-protein interactions, conformational changes, and allostery)
- Biochemistry of energy-rich biological compound or material biosynthesis and structure (e.g., plant cell walls, lipids, terpenes, etc.)

Funded projects typically combine biochemistry, biophysics, molecular biology, computational chemistry, and other approaches to understand the structure, function, and mechanism of enzymes, enzyme systems, and energy-relevant biological reactions that control

energy flow in natural systems. Combined approaches that support a broad interdisciplinary understanding of these processes and identify distinctive principles that can provide foundational knowledge for critical materials and new energy technologies are encouraged. These processes and unique structure-function relationships can provide a basis for the design and synthesis of highly selective and efficient bioinspired catalysts and allow control of the electron flow in biological systems to achieve desired metabolic outcomes.

All submitted applications must clearly state how the knowledge gained from the proposed research will further the fundamental understanding of how plants, algae, and non-medical microbes capture, convert, or store energy. Projects must be hypothesis-driven. Physical Biosciences does not fund research in: 1) animal systems; 2) microbes related to human or animal health or disease; 3) development or optimization of energy devices or processes; 4) development or optimization of microbial strains or plant varieties for biofuel or biomass production; 5) cell wall breakdown or deconstruction; 6) transcriptional or translational regulatory mechanisms or processes; 7) environmental remediation or identification of environmental hazards; 8) genomic or other "omic" data acquisition that does not test specific hypotheses relevant to the subprogram; and 9) computational projects that do not contain complementary experimental components (by PI or collaborator).

Target Dates:

- We strongly encourage white papers or pre-applications, which have no target date.
- Applications submitted by November 20, 2026, will be considered for funding in FY 2027.
- Applications submitted after November 20, 2026, are not guaranteed consideration for funding this FY.
- If not considered this FY, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Kate Brown, katherine.brown@doe.gov
Website: https://science.osti.gov/bes/csgb/Research-Areas/Physical-Biosciences

Scientific User Facilities

Division website: https://science.osti.gov/bes/suf/

The Scientific User Facilities Division supports research and development, planning, construction, and operation of scientific user facilities for a vast range of science using x-ray, neutron, and electron beam scattering as fundamental probes of matter. This division supports research to improve today's facilities and lay the foundation for next-generation facilities.

(x) BES Accelerator and Detector Research

This subprogram supports research that advances the instruments, techniques, and capabilities of the existing and/or future scientific user facilities. Of interest is research that aims at developing techniques that will enable and/or strongly benefit the next generation of

accelerator-based particle sources. Research includes studies of creating, manipulating, and transporting ultrahigh brightness beams and modeling of beam dynamics.

Specific topics of interest are aligned with the recent *BES Basic Research Needs Workshop on Accelerator-based Instrumentation* brochure (full report to be available on the BES Community Resources – Reports website) and include:

- R&D in support of novel acceleration schemes to deliver GeV/m gradients for electron beams
- Research to understand the fundamentals of beam generation and parameters' behavior near or at their theoretical limits
- Research to explore scientific mechanisms that limit system performance and utilization;
- Mechanisms to tailor and control beams with unprecedented precision and speed to probe complexity in matter
- Detectors concepts with higher computational capabilities per pixel, improved readout rates, radiation hardness, and better energy and temporal resolution
- High atomic weight sensors to expand the range of experiments possible at synchrotrons and allow operando probes of diverse materials
- Optics and detector co-design approaches to unlock the full potential of next-generation X-ray sources
- Ultrafast beam techniques and instrumentation capable of accurate measurement of femto- and atto-second bunch lengths
- Tight control of beam losses in high-intensity H– currents and proton beams

Research emphasizing device fabrication will be discouraged. Research focused on incremental improvements will not be supported.

Target Dates:

- We strongly encourage white papers or pre-applications, which should be submitted by November 30, 2026.
- Applications submitted by February 1, 2027, will be considered for funding in FY 2027.
- Applications submitted after February 1, 2027, are not guaranteed consideration for funding this FY.
- If not considered this FY, applications will be held for consideration in a future selection cycle.

Subprogram Contact:
Mikhail Zhernenkov, mikhail.zhernenkov@doe.gov
Website: https://science.osti.gov/bes/suf/accelerator-and-detector-research/

3. Biological and Environmental Research (BER)

Program website: https://science.osti.gov/ber

The mission of the Biological and Environmental Research (BER) program is to support transformative science and scientific user facilities to achieve a predictive understanding of

complex biological, Earth, and environmental systems, in support of DOE's vision to advance innovative solutions for the Nation's energy expansion and national security challenges.

BER research seeks to uncover nature's mysteries involving the processes and interdependencies among plant and microbial systems from molecular to cellular to ecosystem and Earth system scales. BER supports fundamental synthetic and systems biology research in plants and microbes, as well as energy-relevant atmospheric, terrestrial, cryospheric, and human system processes. The program integrates multi-omics data, biogeochemistry, atmospheric observations, and ecosystem studies with laboratory experiments, computational modeling, super intelligence, and user facility capabilities to advance DOE's mission to deliver transformative science for energy expansion and national security.

Applications may be submitted at any time for research within BER's above-described mission space if it is not within the subprogram topics listed below. Those applications will be evaluated and considered using the generally-applicable criteria in this NOFO.

Applications Submitted to Panel Reviews

BER holds panels annually to review applications focused on priority subprogram topics supported by the program. In FY 2027, BER anticipates holding merit review panels to evaluate applications in each of three subprogram topics focused on: Microbial Biosystems Design, Classical and Quantum-enabled Bioimaging and Sensing, and Low Dose Radiation Research. Each panel is expected to meet in the Spring of 2027. To be considered by the panel, a pre-application must be submitted by December 22, 2026. Each pre-application will be reviewed for responsiveness of the proposed research to the topics described below. BER may evaluate all or some pre-applications to determine their competitiveness within a scientific topic. If a competitiveness review is conducted, it will be based on:

- Responsiveness to the objectives of the NOFO and the BER subprogram topic areas
- Scientific and technical merit
- Appropriateness of the proposed research approaches
- Likelihood of scientific impact

The decision to encourage or discourage an application may also be based on:

- Relevance of the proposed activity to the BER program priorities
- Ensuring an appropriate balance of activities within the selected program area

BER expects to provide pre-application encouragement and discouragement decisions by January 26, 2027. To be reviewed by the panel, applications associated with encouraged pre-applications must be submitted by March 16, 2027. Applications submitted after this deadline may be considered for funding in a future selection cycle.

Additional pre-application instructions

In addition to the instructions provided in Section IV, the title page of the pre-application should include the following additional information:

- Subprogram topic to which you are submitting the pre-application. If the subprogram topic lists focus areas, state the focus area(s), as well.
- BLUF (Bottom Line Up Front) Summary: In fewer than 100 words, describe the main ideas and approach expressed in the pre-application.

Applicants are encouraged to structure pre-applications as follows:

1. Objectives/Goals – Describe the research objectives and goals and at least one proposed testable hypothesis or research question that motivates the proposed effort.
2. Background/Justification – Describe the background related to the proposed research topic, knowledge gaps, and justification for the scientific need.
3. Methods/Approach – Describe the proposed technical and methodological approaches at a high level to address the proposed hypothesis or research questions. If the subtopic requires specific observations, models, or approaches, discuss their use in the proposed research.
4. NOFO and subtopic relevance – Explain how the proposed research addresses the scientific research needs highlighted by the BER subprogram topic (and, if applicable, focus area).

Additional application instructions

Applications with research narratives longer than 15 pages may pose an undue burden on merit reviewers and may be declined without review. If you feel you need additional pages for the narrative, before submission, discuss the requested increase with the relevant contact listed in this NOFO.

Applications may be from a single institution or from a multi-institutional team. If submitting an application for a multi-institutional team to BER, a prime and subaward model with one application submitted by the lead institution is strongly encouraged for applications. Multi-institutional teams must follow the instructions in Section IV for a Title Page Supplement for Multi-Institutional Teams, including the required table.

Applications for conference or workshop grants may be submitted to this NOFO, but applicants are strongly encouraged to contact program staff before submission to ensure the conference scope aligns with programmatic goals and funds will be available.

Previously declined applications that have not been substantially revised to address merit reviewer comments may be declined without additional merit review.

BER subprogram topic areas for panel review follow:

(a) Microbial Biosystems Design

BER's Microbial Biosystems Design seeks to gain a fundamental understanding of genome-encoded functions in microbes and microbiomes and to design and engineer new biological processes for energy and the economy, providing the basic science to strengthen U.S. leadership in biotechnology innovation. Microbial Biosystems Design is advancing towards a

robust and secure U.S. bioeconomy by supporting the development of the next generation of genome engineering technologies and unlocking the potential of microorganisms to safely and efficiently produce valuable chemicals, and new-to-nature materials from plant biomass, petroleum-derived polymers, and/or light.

Iterative application and testing of those engineering technologies to design living organisms with new functional properties will also lead to a deeper understanding of the fundamental principles governing those organisms. Therefore, this "design, build, test, learn" (DBTL) cycle not only results in improved biosystems design but also in a more comprehensive knowledge of relevant biological systems. The advent of SI-assisted automation used to control self-driving laboratories that require minimal human intervention to develop engineered organisms can accelerate the DBTL cycle. Moreover, incorporating innovative agentic SI approaches will not only facilitate the discovery of new molecular mechanisms and their use for biological engineering but will also enable accurate prediction of the behavior of engineered organisms. To develop the next generation of biological engineering and synthetic biology technologies and to achieve predictive understanding of fundamental biological principles that can be harnessed to advance new biotechnology strategies, applications are solicited for highly innovative, fundamental multi-omics and systems biology research and technology development to advance Microbial Biosystems Design.

Applications should pursue multidisciplinary approaches to develop genome-wide design and editing, and *in vivo* or cell-free engineering technologies for eukaryotic microbes, prokaryotic microbes, or microbiomes to produce bioproducts and biomaterials from lignocellulosic biomass, petroleum-derived synthetic polymers, or as a byproduct of photosynthesis. Applications are expected to propose development of highly innovative, high-throughput platforms for biological design and testing, supported by advanced modeling, computational tools, and SI.

A focus on new or emerging model systems to expand the breadth of platform microorganism for engineering is encouraged. Research areas of interest include but are not limited to: *i*) *in vivo*, cell-free, artificial cell-like systems, or intercellular systems to confer new functionalities such as biosensors, tunable genetic circuits, and subcellular compartmentalization that enable the synthesis of desirable products; *ii*) orthogonal metabolic, macromolecular synthesis, and signaling pathways that equip cells to biologically carry out processes of industrial relevance or not found in nature; *iii*) design of recoded, minimal, and/or synthetic genomes with novel properties; *iv*) engineering microorganisms or microbiomes that can break down petroleum-derived synthetic polymers and/or convert them into valuable products; *v*) design and engineering microorganisms or microbiomes for the production of biominerals, inorganic-organic composites, and composites of inorganic materials and living cells (living materials) with wholly new properties not found in known organisms; *vi*) design and engineering microorganisms or microbiomes capable of capturing, accumulating, and/or separating critical minerals and materials; *vii*) understand and manipulate horizontal gene transfer to develop new nucleic acid delivery systems such as engineered viruses, synthetic vesicles, and interkingdom conjugation for microbiome genome engineering; and *viii*) SI-assisted generation and integration of multimodal data and models (*e.g.*, genome-scale modeling, fluid dynamics, cellular reaction dynamics, physicochemical measurements, *etc*.) to understand the fundamental science

underpinning scale-up challenges in bioproduction, and to engineer strains with predictable behavior under a broad range of cultivation volumes and conditions.

Scope of Microbial Biosystems Design Research

All applications must include strategies to address biocontainment for proposed activities, minimizing risks of potential release of engineered organisms into the environment or other unintended outcomes.

BER encourages submission of innovative high-risk or high-reward research applications that address critical knowledge gaps and have the potential for high impact. The probability of success and the risk-reward balance will be considered when making funding decisions.

The following areas are NOT within the scope of the Microbial Biosystems Design subprogram topic area: starch-, waste-, natural gas- or coal-derived biofuels, bioproducts or biomaterials; microbial fuel cells; electrosynthesis; wastewater; municipal solid waste; bioremediation; bioprospecting; biomimetics/biohybrids; production of ethanol, biogas, hydrogen, pharmaceuticals, nutraceuticals, cosmetics, or food products; environmental microbiology; microbial ecology; and plant-microbe interactions are not within scope. Projects focused on titer/yield improvement or scale-up production in established microbial systems are out of scope. Research that would result in only incremental knowledge or technological advances, or applications focused solely on technology development will not be considered.

References

Further information on BER's vision for Biosystems Design research as well as relevant reports and previously funded projects can be found in BER's Biosystems Design and Documents and Reports websites. Recent relevant BER reports include *Microbial Design for a Developing Bioeconomy* and *Engineering Microbial Communities*. You can find information on previous Genomic Science Program awards and a description of the program's goals and overall organization on the program website.

DOE User Facilities and Other Resources

Awarded projects will receive priority for using the DOE Joint Genome Institute (JGI) capabilities through the Biological and Environmental Research Support Science user program. To determine the feasibility of the planned work to be done by JGI, applicants should contact JGI before submitting their application.

Applicants are encouraged to also consider using other DOE resources, including the Systems Biology Knowledgebase, National Microbiome Data Collaborative, Environmental Molecular Sciences Laboratory, National Energy Research Scientific Computing Center, and Structural Biology and Imaging Resources.

Specific Instructions for Microbial Biosystems Design

- Beginning in the first year of funding, one or more project participants must attend an annual PI meeting, generally held in the Washington, D.C., area (virtual attendance may be an option in some of the project periods); reasonable travel expenses may be included as part of the project budget.
- For this topic, BER considers a budget between $300,000 and $3,000,000 per year and award durations of three years to be appropriate.
- The total funding for DOE/NNSA National Laboratories proposed as subawards within an application may not be more than 30% of the total project budget.

Subprogram Contact:
Pablo Rabinowicz, pablo.rabinowicz@doe.gov
Websites: https://science.osti.gov/ber; https://www.genomicscience.energy.gov/biosystems-design/.

(b) Classical and Quantum-Enabled Bioimaging and Sensing

BER's Bioimaging Science supports integrative approaches to detect, visualize, and measure biological processes in situ to gain a predictive understanding of cellular function. To support advanced genomics research and the foundations of biotechnology development, the Bioimaging program encourages developing new imaging instrumentation and technologies for studying cellular and molecular systems and networks critical to research on DOE-relevant plants, microbes, and microbial communities. This includes quantum-enabled approaches to surpass limitations of classical optical methods and research towards new quantum science-enabled probes and sensors. Priority research areas include technologies for probing biological systems to understand dynamic spatial and temporal relationships by characterizing structures of molecular and cellular components, chemical exchanges that facilitate the flow of information and materials across membranes and between intracellular partitions and measuring signaling processes between cells or organelles and plant-microbe and microbe-microbe interactions.

BER is interested in innovative applications to advance fundamental research or use-inspired technologies of new classical and quantum-enabled bioimaging and/or sensing approaches for biological systems research. Fundamental research to enhance spatial and temporal resolution, measurement speed, long-term sample stability, selectivity, sensitivity, or chemical specificity of bioimaging technologies are desirable. Proposed research should demonstrate a comparative advantage over state-of-the-art techniques or identify biological characteristics that cannot currently be measured. All applications are expected to describe how, if realized, they would advance biological knowledge of plant and microbial systems relevant to bioenergy or environmental research in fields of study supported by BER.

Applications can focus on either novel research concepts proceeding through technical validation that are not required to evaluate new biological hypotheses or innovative experimental prototype research proceeding through hypothesis-driven biological experimentation. Novel research concepts can include fundamental imaging or sensing research from concept to validation that could have a significant impact if successful. This stage may be too early to

investigate new biological questions until proven accurate and reproducible. These high-risk or high reward applications should evaluate untested concepts, and theoretical models, develop novel experimental prototypes, and must validate measurement accuracy against known technical or biological validation standards. Innovative experimental prototype applications should focus on research and development on instruments and methods that include demonstration of feasibility leading to hypothesis-driven biological experimentation towards value to the user community. Applicants are encouraged to coordinate with biological collaborators if domain expertise is not in-house. In addition to technical research and testing, projects must include research to evaluate an untested biological question or hypothesis. Large-scale imaging data could be analyzed in the context of integration with genomic, transcriptomic, proteomic, metabolomic, and phenotypic data to explain biological function. SI/ML approaches could classify and characterize image data in reproducible formats that facilitate multi-omics data integration that will lead to new mechanistic and predictive knowledge.

Applicants are encouraged to consider the use of DOE resources, including the Systems Biology Knowledgebase, Joint Genome Institute, Environmental Molecular Sciences Laboratory, and Structural Biology and Imaging User Resources.

References

You can find BER's Bioimaging science overview, relevant reports, and previously funded projects on the program website.

Notes About Scope

Using current or newly acquired resources, capabilities, or equipment is not in scope; rather the intent of this funding opportunity is to explore new or innovative bioimaging and sensing technologies with applications to BER research. Applications proposing the use of commercially available imaging systems (except for validation of new technologies against known standards), will not be given consideration, and are excluded. Field ready or demonstration prototypes that have passed the research stage and include engineering development are not eligible for consideration. This opportunity does not solicit late-stage optimization after initial prototype research, or engineering development of resources, or equipment. Imaging approaches intended for biomedical research would not be eligible without a clear intention to employ them for research on plant and microbiological systems of relevance to bioenergy. Applications to develop novel materials or fundamental chemical processes are more appropriate for the SC Basic Energy Sciences program.

Specific Instructions for Bioimaging Topic Area

- One or more project team members must attend the annual PI meeting held in the Washington, D.C., area; reasonable travel expenses to attend the PI meeting may be included in the budget.
- For this topic, BER considers a budget between $250,000 and $750,000 per year and award durations of three years to be appropriate.

- The total funding for DOE/NNSA National Laboratories, if proposed as subawards, may not request more than 30% of the total funding.

Subprogram Contact:
Resham Kulkarni, resham.kulkarni@doe.gov
Website: https://www.genomicscience.energy.gov/bioimaging-science-program/

(c) Low Dose Radiation Research

The U.S. population is continuously exposed to low-dose and low-dose-rate ionizing radiation (IR) from several different sources, including natural background sources, medical applications, and occupational exposures. BER's Low Dose Radiation Research seeks to take advantage of advanced model systems, high throughput genomics and other multi-omics approaches, and computational SI/ML tools and technologies to advance a more mechanistic understanding of low dose and low dose rate radiation effects on cellular metabolism. Over the long-term, this approach seeks to provide a basis for identifying biomarkers and/or patterns of altered cellular functions that may be indicate or be associated with an adverse health outcome.

Epidemiological studies of populations exposed to IR have generally focused on cancer, however, increasing evidence shows that non-cancer health outcomes such as cardiovascular disease, neurological disorders, and immune dysfunction are also possible. Integrated biological and computational approaches may provide new insights into reducing the uncertainties of health effects in epidemiological studies following low dose (≤100 mGy) and low dose rate (≤5 mGy/hr) exposures and provide a basis to explore links to IR-induced health effects.

BER is interested in applications for integrated biological and computational low dose radiation research to gain further mechanistic understanding of the effects of low dose radiation exposure on cellular functions. The long-term goal is to build on the understanding of IR effects on cellular function and establish comprehensive datasets we can incorporate into increasingly capable SI/ML models to identify both transient and persistent changes in cellular metabolism and tissue states that may be linked to adverse health outcomes. This funding opportunity calls for biological research applications conducted with well-characterized exposures confirmed by physical dosimetry methods to low energy transfer (LET) IR sources (high energy electrons, protons, X- and gamma rays) and high LET sources (alpha particles, neutrons) across a range of low dose exposures (<100 mGy encompassing 10 mGy) and dose rate ranges encompassing 5 mGy/hr within a combination of the four focus areas below.

Development of experimental laboratory model systems representative of human systems for combined experimental and computational analyses

Model systems that better represent human systems impacted by low dose/dose-rate IR are needed. New or improved model systems that can be used for systematic hypothesis-based investigations in the laboratory under controlled conditions will be crucial to understanding mechanisms of cellular response to radiation exposure and for extrapolating to potential adverse outcomes in humans. This program is also interested in model systems of sufficient genetic

diversity that can address impacts due to genetic sensitivity under a range of differing conditions that reflect confounding inter-individual variation observed in epidemiological studies.

Combined Experimental and Computational Approaches for Low Dose Radiation Research

This focus area includes hypothesis-based experimental approaches to evaluate genomic and multi-omic (transcriptomic, proteomic, metabolomic) changes in cellular metabolism within appropriate model cell, tissue, multi-cellular, or organoid systems exposed to a range of doses and dose rates from well-characterized low energy transfer (LET) IR sources (high energy electrons, protons, X- and gamma rays) and high LET IR sources (alpha particles, neutrons) confirmed by physical dosimetry methods are of interest. The goal is to generate high-quality datasets using relevant laboratory model systems that can be related back to human systems that capture, to the fullest extent possible, changes in cellular metabolism as a result of exposure to a range of radiation doses extending from < 100 mGy and encompassing 10 mGy and dose rate ranges encompassing 5 mGy/hr. Datasets resulting from these activities should be assembled in machine-readable format suitable for including in SI/ML computational systems for analysis, modeling, and sharing with the larger community.

Assembly and Analysis of Harmonized Datasets to Support Biological Research

There is a need to assemble more coherent datasets from within the literature, data archives, and legacy tissue archives that could benefit our understanding of low dose IR impacts. Assembling relevant datasets, including analysis of archived tissue samples from existing legacy datasets, could still provide a wealth of information relevant to low dose radiation research. This topic seeks to support efforts to assemble, re-analyze, and harmonize datasets relevant to low dose radiation research where the sample quality is robust and radiation doses or dose rates are known.

Computational Tools Supporting Low Dose Radiation Research

Computational approaches that can model potential genomic or multi-omic changes leading to transient and persistent alterations in cellular metabolism may lead to identifying potential biomarkers and/or patterns of low dose IR effects. Computational efforts that take advantage of new SI/ML approaches are of interest to explore in silico effects that could lead to new hypotheses of radiation effects and, by extrapolation, resulting adverse health outcomes. Web-based collaboration platforms or portals for data collection, reproducible analyses and research report sharing will also be needed.

For this funding opportunity, applications are expected to build on DOE and BER capabilities and complement research supported by other agencies, where possible. Advancement in this research area will rely on training programs and workforce development, and these aspects should be an integral part of the application.

Applicants are encouraged to consider the use of DOE resources, including the Systems Biology Knowledgebase, Joint Genome Institute, Environmental Molecular Sciences Laboratory, and Structural Biology and Imaging User Resources. Other resources available to the broader

research community (e.g., exposure facilities) could also be considered for collaborative activities.

Notes About Scope

Assembly of epidemiological and/or phenomenological data sets are not in scope. Studies involving human subjects are not applicable. The focus of this effort is on laboratory-based, experimental systems and datasets that take advantage of the latest developments in genomics/multi-omics technologies and statistical and SI/ML-based computational tools to gain a systems level understanding of the effects of low dose radiation on cellular function.

Specific Instructions for Low Dose Radiation Research Topic Area

- One or more project team members must attend the annual PI meeting held in the Washington, D.C., area; reasonable travel expenses to attend the PI meeting may be included in the budget.
- For this topic, BER considers a budget between $250,000 and $500,000 per year and award durations of three years to be appropriate.
- The total funding for DOE/NNSA National Laboratories, if proposed as subawards, may not request more than 30% of the total funding.

Subprogram Contact:
Resham Kulkarni, resham.kulkarni@doe.gov
Website: https://www.genomicscience.energy.gov/lowdose/

4. Fusion Energy Sciences (FES)

Program website: https://science.osti.gov/fes/

The mission of the Fusion Energy Sciences (FES) program is to drive the scientific and technological foundation for a fusion energy source and support developing a competitive U.S. fusion energy industry, a scope expanded by the Energy Act of 2020 (42 U.S.C. § 18645). To achieve its mission, FES issued a comprehensive national strategy to accelerate the development and commercialization of fusion energy by the mid-2030s, as described in the *Fusion Science & Technology (S&T) Roadmap*. The Roadmap identifies critical science and technology gaps that must be addressed to bring commercial fusion energy to the grid. Developed with broad input from over 800 researchers, engineers, and industry stakeholders, the Roadmap establishes DOE's strategy to advance foundational research, support breakthrough innovations, and build a competitive U.S. fusion sector.

In service of this goal, this solicitation recognizes that cutting-edge research is enabled by robust and accessible research capabilities. Therefore, applications submitted to any topic area may include activities and associated costs for developing, fabricating, enhancing, or providing access to the underlying research capabilities required to execute the proposed work. In addition, in alignment with the Roadmap and the national vision outlined in the *Science: A New Golden Age* report, FES invites innovative applications with the potential to fundamentally accelerate the fusion energy development timeline. Applications enabling bridges between foundational

science and early-stage technology development, including the needs of the fusion private sector, are encouraged.

FES may sponsor conferences, workshops, summer schools, and seminars. If you are interested in FES support, contact the designated subprogram contact for the program area that most closely aligns with your event. Applicants should communicate interest at least six months prior to the scheduled event.

Submission of preliminary research descriptions (e.g., pre-applications or white papers) is strongly encouraged to ensure alignment with program goals. Prior to submission, applicants are highly encouraged to contact the relevant subprogram contact for format, content, and submission guidelines.

Specific information for each FES subprogram is provided in the following sections.

(a) Theory, Simulation, and Super Intelligence and Machine Learning

The Theory, Simulation, and SI/ML subprogram supports efforts to close critical scientific and technology gaps in advancing fusion energy as described in the Roadmap through foundational theory, first-principles, high-performance computing, and data-driven methodologies.

Supported activities span the full range of other FES fusion-relevant subprogram areas, including developing fusion data resources, advanced simulations, SI models, and scientific software frameworks. This subprogram is dedicated to supporting the Roadmap Infrastructure Streams, including but not limited to the following topics:

- Blanket: Research that models breeding blanket concepts, including
  - Plasma-blanket Interactions
  - Neutronics
- Fuel Cycle: Research that models and simulate the tritium fuel cycle, including
  - Tritium storage, processing, permeation
  - Advanced component manufacturing
- Exhaust: Research that addresses scientific gaps in the plasma edge, including
  - Divertor Design and Optimization
  - Pedestal Prediction
  - Core-Edge Integration
- Nuclear Effects in Materials: Research that focuses on the critical gaps in fusion materials science including
  - Multiphysics, Multiscale Modeling
  - Materials Discovery and Manufacturing
  - Materials Lifecycle
- Plasma Confinement: Research that addresses critical gaps in plasma physics that apply to Fusion Pilot Plant concepts, including
  - Plant/Plasma State Optimization
  - High-Fidelity Plant Design

  - Scenario Planning
  - Plasma Stability
  - Turbulence and Transport
- Actuators: Data-driven connections to experiments, including
  - Real-time Control and Feedback Response
  - Diagnostic Monitoring and Fault Detection
  - Synthetic Diagnostics
- Balance of Plant: Efforts that encompass experimental facilities, including
  - Remote Maintenance
  - Whole Facility Modeling

The Roadmap identifies the SI-Fusion Digital Convergence Platform (DCP) as a critical component of its national strategy to accelerate the commercialization of fusion energy. DCP is one of the ten primary Key Actions outlined in the Roadmap, falling under the *Build* pillar of the Build-Innovate-Grow strategy. The DCP seeks to:

- Expand the development of surrogate and reduced-order models with data from High Performance Computing (HPC) codes
- Engage with the American Science Cloud for data-driven activities including workflows, pipelines, and metadata standards
- Explore using SI/ML methods to optimize the design of facilities and experiments
- Explore the acceleration of HPC numerical algorithms with SI/ML methods
  - Develop SI-enabled digital twins that integrate physical device data with modular, integrated simulation tools

Applicants should articulate how their projects will be integrated into the DCP ecosystem, whether that effort includes informing SI models through foundational science or providing synthetic datasets. Proposed computational projects should integrate the capabilities of the Genesis Mission or provide data to Genesis Mission activities when relevant.

Subprogram Contact:
Michael Halfmoon, michael.halfmoon@doe.gov
Website: https://science.osti.gov/fes/Research

(b) Fusion Materials and Internal Components

Developing materials suitable for a power-producing fusion device is prerequisite for the eventual success of fusion power. Every component, from the innermost chamber walls to the outer framework, demands materials that can endure and perform in demanding conditions, including extremes of heat, particle exposure, and neutron fluxes. The Fusion Materials and Internal Components (FM&IC) subprogram is devoted to advancing materials, developing physical and numerical material models, and realizing essential material tools necessary to achieve fusion power. Priority research in this subprogram focuses on:

- Suitable materials for solid plasma-facing components in a fusion power plant (FPP)
- Suitable materials for solid structural components in an FPP

- Adequate modeling support for component and structural design of an FPP that accurately represents material behavior in the fusion environment
- Effective use or development of new research facilities aimed at fulfilling the above
- Adequate materials codes that can be used to assess the suitability of various materials and components in an FPP
- Suitable functional materials (e.g. diagnostics, shielding, magnets, etc.) for an FPP (via collaboration with the relevant research communities)

Therefore, this subprogram supports applications in the following areas. Please note, some research topics are considered cross-cutting and are coupled to the fusion nuclear science subprogram. Please indicate in your application if the topic is cross-cutting or contact the subprogram contact for more information.

Plasma Material Interactions and Plasma Facing Components

The innermost wall of a fusion device, known as the plasma-facing component, is exposed to high-energy plasma and a high neutron flux. Plasma-material interactions can cause erosion, sputtering, and material migration. Research in this area aims to advance solid materials that can withstand and perform within the extreme heat, particle fluxes, irradiation effects, and erosion conditions that these components are subject to.

Structural Materials for Fusion

Structural materials refer to those materials used in the overall construction of the fusion device, such as the vacuum vessel, blanket structure, and other supporting components. These materials must be able to withstand the structural loads, radiation, and heat while maintaining their desired material properties. Advanced alloys and composite materials are areas of interest for research.

Fundamental Modeling and Materials Behavior

Advances in materials modeling play a crucial role in predicting how materials will behave under fusion reactor conditions. Computational tools allow researchers to simulate material responses to high temperatures, radiation, and stress, aiding in material selection and design optimization.

Functional Materials

These materials impact the functionality of various fusion components beyond their structural integrity. For instance, materials used for sensors and heat transfer enhancement fall under this category. This category usually has cross-program application to the Fusion Nuclear Science subprogram in FES and is typically submitted to that other subprogram.

- FY 2027 FM&IC Comparative Review: The deadline was September 5, 2026.
- FY 2028 FM&IC Comparative Review: Applicants must submit pre-applications for the FY 2028 comparative review by July 9, 2027. Encourage/discourage decisions are expected to be returned on these pre-applications by July 30, 2027. Applications from encouraged pre-applications are due by September 5, 2027. Applications submitted without an encouraged pre-application will not be considered by the review panels. FY 2028 comparative review applications are also subject to the following additional guidance:
    - Narrative Length: Applications requesting $1,000,000 or less with research narratives longer than ten pages may present an undue burden on reviewers. Applications requesting more than $1,000,000 with research narratives longer than 20 pages may present an undue burden on reviewers.
    - Project start date: Applicants may wish to request a project start date in spring/summer of 2028, though actual start dates will be negotiated later.
    - Project duration: A three-year project period is standard. Any proposed deviations from a three-year project period must be described in the pre-application.
    - Timetable of Activities: For applications, applicants are encouraged to provide a timeline for all major activities.

Subprogram Contact:
John Echols, john.echols@doe.gov
Website: https://science.osti.gov/fes/Research

(c) Toroidal Long Pulse

The Toroidal Long Pulse (TLP) area addresses gaps in the physics and technology basis for the conventional tokamak and stellarator approaches to magnetic confinement fusion. The TLP Tokamak Research area includes research on the DIII-D National Fusion Facility in San Diego, CA, small-scale tokamak research conducted on university-scale devices, and research on international tokamak facilities accessible to U.S. staff under international bilateral agreements and multi-lateral frameworks. The TLP Stellarator Research area includes research on the Helically Symmetric Experiment (HSX) in Madison, Wisconsin, and the Wendelstein 7-X stellarator in Greisfwald, Germany.

This subprogram supports foundational science, early-stage technology development, and capability development in the following priority areas:

- Sustaining Burning Plasmas, which includes managing plasma transport and instabilities from energetic particles, enhancing plasma confinement, accessing and maintaining burning plasma conditions, and optimizing plasma heating and current drive strategies.
- Exhaust Handling, which includes understanding the physics of tokamak divertors, managing plasma exhaust, controlling particle inventories, and integrating plasma core and edge scenarios.

- Plasma Material Interactions, which includes controlling the plasma edge, testing the survivability of materials, effects from impurities on materials and plasma performance, and wall conditioning for long pulse operation.
- Control of Damaging Transients and Instabilities, which includes mitigating tokamak disruptions, avoiding and preventing off-normal events, and controlling instabilities (e.g., edge localized modes, resistive wall modes, tearing modes, etc.).
- Theory and Model Validation, which includes scope in SI and ML, simulation support for experimental efforts, integrated control modeling and pulse design, and model validation, including uncertainty quantification.
- Other activities essential for operating and exploiting conventional tokamak and stellarator facilities not covered in the areas above.

Applicants are encouraged to propose research with the following characteristics:

- R&D that addresses common challenges for both tokamaks and stellarators
- Research with the potential for transformative impact on steady-state operation of magnetic confinement configurations

Subprogram Contact:
Matthew Lanctot, matthew.lanctot@doe.gov
Website: https://science.osti.gov/fes/Research

(d) Compact Toroidal Concepts

The Compact Toroidal Concepts subprogram supports research needed to develop a compact toroidal configuration. Two promising concepts are the spherical tokamak (ST), such as the National Spherical Torus Experimental-Upgrade (NSTX-U), and conventional aspect ratio tokamaks operated at high toroidal magnetic fields, exemplified by the SPARC tokamak.

These devices offer complementary strategies for improving confinement and achieving compactness: STs use enhanced plasma physics properties while high-field conventional tokamaks rely on high-field magnets. Regardless of the approach, enabling technologies are essential for delivering these compact designs, including high-temperature superconducting magnets and liquid metal plasma-facing components. With several private sector stakeholders pushing the frontiers, the subprogram naturally incorporates the fusion energy industry and fosters strong connections to foundational S&T research.

The primary scientific research topics for STs directly address the Roadmap Core Challenge C1 S&T gap and corresponding metrics by using enhanced plasma physics properties at a low aspect ratio. These topics include but are not limited to:

- Confinement: This research area encompasses both thermal and energetic particle-driven transport. Studies evaluating collisionality dependencies are of particular interest. This area also includes gyrokinetic model validation of ST confinement against turbulent fluctuation measurements.
- High Beta: This research area includes studies on both high normalized plasma pressure and pedestals. Magnetohydrodynamics (MHD) and plasma stability, including both disruptive and edge transients, are considered within this topic. In addition, plasma

scenario and control development to maximize normalized pressures in STs are addressed.
- High Bootstrap Current: This research area involves all non-inductive scenario development efforts aimed at maximizing self-driven plasma currents and minimizing auxiliary current drive.

The primary scientific research topics for high-field tokamaks are associated with initial fusion gain studies, which directly address the quantitative metrics of the Roadmap Core Challenge C4 S&T gap. These topics include but are not limited to:
- Fusion Gain: This research area involves accessing and sustaining Q > 1 and burning plasma conditions. Achieving this goal requires integrated efforts spanning thermal transport and confinement, energetic particle stability, heating, exhaust, fueling, impurity, and transient control.
- Emergent Discoveries: This research area covers other activities arising from inevitable discoveries resulting from the study of high fusion power plasmas for the first time.

The subprogram also considers common technical challenges for any compact fusion core. These areas span both ST and high-field tokamak topics and include science and technology efforts related to extreme divertor heat fluxes and developing innovative power and particle handling techniques to optimize plasma exhaust in high-performance scenarios. Finally, diagnostic measurements for deployment on major CTC research facilities will be considered.

Subprogram Contact:
Josh King, joshua.king@doe.gov
Website: https://science.osti.gov/fes/Research

(e) Inertial Fusion Energy

The Inertial Fusion Energy (IFE) subprogram is dedicated to advancing the foundational science and technology essential for developing IFE as a viable energy source. Key research areas of interest are outlined in the *IFE Basic Research Needs Workshop Report*. In addition, the FES program has established IFE Science and Technology hubs, which focus on both scientific advancement and the stewardship of the IFE ecosystem. We encourage applications that use this ecosystem. Areas of interest include but are not limited to:

- Target Physics: Improving energy transfer with broad laser bandwidth, advancing theoretical and computational models of laser-plasma instabilities, and investigating the physical processes that restrict fuel compression in implosions
- Driver Technologies: Developing conceptual designs for IFE driver system-level architecture, reducing the cost of diode pumps in diode-pumped solid-state laser technologies, and improving the reliability of high-power switching and capacitor energy storage systems
- Target Injection and Engagement: Developing an IFE target injector capable of reaching necessary velocities without compromising the target or its fuel layer and demonstrating accurate, real-time engagement of IFE targets with a driver beam.

Applicants are strongly encouraged to contact the subprogram contact before submitting an application.

Subprogram Contact:
Kramer Akli, kramer.akli@doe.gov
Website: https://science.osti.gov/fes/Research

(f) Measurement Innovation

The *Innovate* part of the *Build-Innovate-Grow* strategy in the Roadmap includes support of Measurement Innovation (MI) to enable verification and validation of design modelling codes for components and materials under extreme prototypical fusion environmental conditions. The MI subprogram supports the development of world-leading transformative and innovative diagnostic techniques and their application to support both fusion science and technology objectives. Applications to develop diagnostics with the high spatial, spectral, and temporal resolution necessary to validate plasma physics models used to predict the behavior of plasmas in all FES subprograms, including burning plasmas and eventual fusion pilot plants, are encouraged.

Subprogram Contact:
Josh King, josh.king@doe.gov
Website: https://science.osti.gov/fes/Research

(g) Closing the Fusion Cycle: Fusion Nuclear Science

Applications for the Fusion Nuclear Science (FNS) research activities in the four subprogram areas below may be submitted to this NOFO. The FNS program will conduct yearly comparative merit reviews for both new and renewal applications. We strongly encourage pre-applications to ensure alignment with program goals. Before submission, we highly encourage you to contact the subprogram contact for format and content.

Applications in response to this NOFO may also propose activities that support FNS research, which include but are not limited to supplemental support for research activities, conferences, or exploratory (seed) research. Emerging fusion technologies and innovative feasibility studies that contribute to the fusion technology ecosystem and accelerate commercialization of fusion energy are in scope. These applications are not part of the comparative review process and may receive lower programmatic priority unless exceptions are warranted based on program needs.

Additional Application Instructions

- The deadline for the FY 2027 FNS Comparative Review was September 5, 2026.
- For FY 2028, FNS expects to convene merit review panels in November 2027. Applicants must submit pre-applications by July 15, 2027. Encourage/discourage decisions are expected to be returned by August 5, 2027. Applications from encouraged pre-applications are due by September 7, 2027. Applications submitted without an

encouraged pre-application will not be considered. FY 2028 comparative review applications are also subject to the following additional guidance:

- Narrative Page Limits: Applications requesting less than $1,500,000 with research narratives longer than 15 pages may present an undue burden on reviewers; applications requesting more than $1,500,000 with research narratives longer than 20 pages may present an undue burden on reviewers.
- Project start date: Applicants should request a project start date in summer of 2028 with actual start dates subject to negotiation.
- Project duration: A three-year project period is standard. However, we recognize that some research activities benefit from shorter or longer periods. Any proposed deviations from a three-year project period must be described in the pre-application.
- Teaming Arrangements: Applicants must explicitly justify the benefits of multi-institutional teams in their pre-application.

Additional information about the FNS research areas is described below. All applicants should pay particular attention to the following when preparing applications to be submitted to this NOFO:

- External peer reviewers will be requested to evaluate the applicant's proposed work in relation to the priorities established in the Roadmap.
- FES recognizes the ever-increasing integrated nature of fusion energy technology research. Research that is considered cross-cutting with another program area but primarily sits within one of the research areas listed below must indicate that it is cross-cutting research and identify the other program areas the research crosses into.

In addition, this subprogram provides graduate research training for the next generation of researchers as well as activities supporting career development in foundational engineering science and technology.

Fusion Nuclear Science (FNS) Subprogram Areas

The FNS subprogram focuses on understanding and addressing the challenges associated with the nuclear aspects of fusion energy systems. This focus includes studying the behavior of blanket functional materials under high neutron fluxes, developing tritium breeding technologies, and advancing fusion nuclear components such as blankets and first-wall structures. FNS aims to bridge the gap between plasma physics and the engineering requirements of fusion energy systems, ensuring that the nuclear components of future fusion systems are safe, reliable, and efficient. Foundational science within the FNS portfolio focuses on understanding fundamental processes and developing new technologies that are not yet ready for commercial application but are essential for overcoming long-term challenges in fusion energy. High priority areas of interest include:

Blanket Systems

- *Functional Materials:* Develop materials that optimize tritium breeding, heat transfer, and compatibility with breeding environments.
- *Coolant Interaction Studies:* Investigate the interactions between breeding materials and coolants to ensure efficient heat removal and minimal corrosion or degradation.

Fuel Cycle Systems

- *Tritium Permeation and Retention:* Research on materials and technologies to control tritium permeation and retention within fuel cycle systems.
- *Isotope Separation Technologies:* Develop advanced materials and processes for efficient isotope separation and recycling within the fusion fuel cycle.
- *Tritium Breeding and Handling:* Research on tritium management, including breeding and safe handling, while ensuring minimal permeation and environmental impact.

Foundational Crosscutting Research

- *Thermal Management Strategies:* Develop materials and technologies to manage heat loads expected in a fusion energy system, including innovative cooling solutions.
- *Activation Studies:* Understand material activation under neutron exposure and develop strategies to minimize radiological waste. *(Nuclear Data and Fusion Materials)*
- *Radiation Transport:* Develop advanced radiation transport models to predict neutron behavior and their effects on materials within fusion reactors. *(Nuclear Data and Fusion Materials)*
- *Fusion Waste Reduction Technologies:* Research into deactivation techniques and materials recycling processes.
- *Safety Analysis:* Foundational research into the safety of nuclear components, including failure modes and accident scenarios, to ensure the safe operation of fusion power plants.

Areas that are considered out of scope include research focused on structural materials, plasma-facing components, or technologies already demonstrated in public or commercial facilities (Technology Readiness Level [TRL] 5+). The program prioritizes early-stage, high-impact research that advances foundational knowledge and addresses long-term challenges, rather than applied engineering solutions, or iterative improvements to existing models and data.

Subprogram Contact:
Jeff Stehr, jeff.stehr@doe.gov
Website: https://science.osti.gov/fes/Research

(h) Closing the Fusion Cycle: Enabling Research and Development

The Enabling Research and Development subprogram establishes the scientific and technological foundation necessary for developing essential components across a wide range of concepts that will eventually be integrated into a fusion energy system. This subprogram addresses many cross-cutting challenges as part of the *Innovate* portion of the Roadmap's *Build-Innovate-Grow* strategy. Enabling R&D supports early-stage, high-impact research. High-priority topics are as follows:

- *Fusion Subsystems:* This area includes key components such as superconducting magnets, optics, and radiation-hardened electronics. Studies of the material properties of these components, particularly those interacting with harsh fusion environments, will be considered.

- *Auxiliary Heating and Current Drive:* This area includes the technological development of auxiliary systems to heat and drive currents inside fusion plasmas (e.g. neutral beam injectors). These technologies may include plasma injector guns or similar technology.
- *Liquid Metal Plasma-Facing Components*: Research on using liquid metals for plasma-facing components, focusing on materials that can withstand high thermal and particle fluxes while maintaining plasma compatibility is of interest. In addition, engineering challenges such as corrosion, material replenishment, thermal management, system integration, fusion exhaust, and efficient hydrogenic species extraction are within scope.

Research on structural materials, solid plasma-facing components, or technologies already demonstrated in public or commercial facilities (TRL 5+) is out of scope.

Subprogram Contact:
Josh King, joshua.king@doe.gov
Website: https://science.osti.gov/fes/Research

(i) Plasma Science and Technology — General Plasma Science

The General Plasma Science (GPS) subprogram supports research at the frontiers of foundational plasma science. GPS supports hypothesis-driven, frontier-level research to significantly increase our understanding of the plasma processes spanning magnetic reconnection, turbulence, and dusty plasma. Applicants are strongly encouraged to develop integrated research projects in frontier plasma science, using existing laboratory-based, GPS collaborative research facilities, and high-performance computing. High-priority areas of interest for General Plasma Science include: (i) multi-island or plasmoid-mediated magnetic reconnection (three-dimensional, rate, onset, particle heating and acceleration, fast release of magnetic energy, cross-scale coupling in large systems, multi-scale research from laboratory to large system such as magnetospheric or solar plasma); (ii) Waves and turbulence (energy cascade, relaxation, dissipation, heating, acceleration, and coherent structures); and (iii) dusty plasma (dust grain formation in strong magnetic field, nucleation, agglomeration, charging rate, growth, breakup, and transport).

For more information, see GPS science drivers (e.g., Understanding Plasma Universe) in the *Community Planning Process Report: A Community Plan for Fusion Energy and Discover Plasma Sciences, 2019-2020*. Research relevant to Inertial Fusion Energy or High Energy Density Physics (HEDP) is out of scope and should be submitted to the appropriate FES subprograms.

Additional Application Instructions

FES anticipates holding a merit review to evaluate applications in this area. Applications should be for ambitious projects with the potential to make significant advances in the understanding of the above-mentioned plasma processes.

- To be considered, a pre-application must be submitted by November 24, 2026.
- FES expects to provide pre-application encouragement and discouragement decisions by December 18, 2026.

- Applications associated with encouraged pre-applications must be submitted by January 26, 2027.
- Applications submitted after this deadline will be considered for funding in a future selection cycle.

Applicants in this topic are advised that:

- FES considers an appropriate budget to be up to $300,000 per year, regardless of the number of participating institutions.
- FES considers award durations of three years to be appropriate for this topic.
- If a multi-institutional team is submitting collaborative applications, only the lead institution should submit a pre-application, which should include all institutions, institutional Co-Principal Investigators, and all other personnel and relevant information.
- The first page of the pre-application should specify at least one scientific hypothesis whose investigation motivates the proposed work. This information must be followed by a clear and concise description of the objectives and technical approach of the proposed research.
- Pre-applications with a sufficiently identical scope of work from a previously reviewed application will be discouraged without review. Applicants must highlight changes or revisions to previously reviewed applications.

Applicants are strongly encouraged to contact the subprogram contact before submitting a pre-application.

Subprogram Contact:
Nirmol Podder, nirmol.podder@doe.gov
Website: https://science.osti.gov/fes/Research

(j) Plasma Science and Technology — High Energy Density Physics

The HEDP subprogram seeks to understand how matter behaves under extreme conditions of temperature and pressure. In this domain, energy density is typically defined as being above 1 Mbar (100 GPa or approximately 1 million atmospheres), which is comparable to the energy density of a chemical bond, such as in a water molecule. HEDP conditions are crucial for studying processes such as the formation and destruction of stars and for controlling fusion in laboratory settings. Topics of interest for this NOFO include but are not limited to the following areas.

Relativistic HED Plasmas and Intense Beam Physics

This area includes relativistic laser and beam propagation, relativistic laser-solid interactions, ultrahigh energy density plasmas at the quantum electrodynamic (QED) limit, relativistic thermal plasmas, and relativistic shocks. Key questions include: How do plasmas dominated by relativistic effects behave? What new collective behaviors and fundamental physics can we uncover at the relativistic limits of high-energy density physics? Additionally, how can we generate ultra-bright vacuum ultraviolet (VUV) and X-ray sources that surpass the capabilities of current light sources?

Nonlinear Optics of Plasmas and Laser-Plasma Interactions

This area investigates the interplay between coherent radiation and nonlinear states in high-energy-density (HED) plasmas, nonlinear wave-particle interactions, multiple coexisting instabilities, broadband radiation in plasma, and quantum phenomena. Important questions include: How does coherent radiation drive self-organized states in plasmas? How can we control and tailor nonlinear optical processes in high-energy-density laboratory plasmas? Additionally, how do multiple nonlinear processes co-evolve, and how do overlapping laser pulses interact through common plasma modes? Finally, how can we create a self-consistent wave-kinetic model for laser-matter interactions that bridges classical, quantum, and relativistic regimes?

HED Hydrodynamics

This area focuses on topics such as turbulent mixing, probing the properties of HED matter through hydrodynamics, new hydrodynamic instabilities, and hydrodynamic scaling. Key questions include: How do hydrodynamic flows change due to the added physical complexity and multiscale nature of HED plasmas? How can we understand and control the hydrodynamic instabilities that may limit the achievable pressures and densities in laboratory environments?

Applicants are strongly encouraged to contact the subprogram contact before submitting an application.

Subprogram Contact:
Kramer Akli, kramer.akli@doe.gov
Website: https://science.osti.gov/fes/Research

(k) Plasma Science and Technology — Microelectronics Research

Plasmas are essential to manufacturing devices in the semiconductor industry, from creating extreme ultraviolet photons used in the most advanced lithography to thin film etching, deposition, and surface modifications. An estimated 40–45% of all process steps needed to manufacture semiconductor devices use low temperature plasmas (LTPs) in one form or another.

LTPs have been an enabling technology in the multi-decade progression of shrinking device dimensions, often referred to as Moore's Law. New challenges in circuit and device design, novel materials, and increasing demands to achieve environmentally benign processing technologies are pushing the boundaries of what is possible today in plasma technology. Microelectronics research areas are focused on plasma science for microelectronics and plasma-enabled nanofabrication. These include but are not limited to: (i) Plasma assisted processes enabling sustainable device manufacturing at extreme scales; (ii) Optimization and control of plasma-surface interactions down to the atomic scale to enable materials and device structures; (iii) Development of integrated modeling and validation capability to enable next generation semiconductor plasma processing; and, (iv) Generation and control of radiation, radiation transport, and materials interactions in semiconductor processing systems for lithography,

plasma etching and deposition applications. You can find more information in the report of the recent FES sponsored microelectronics workshop titled, *Plasma Science for Microelectronics Nanofabrication*.

Applicants are strongly encouraged to contact the subprogram contact before submitting a pre-application.

Target Dates:

- To be considered for funding in FY 2027, a pre-application must be submitted by November 20, 2026.
- FES expects to provide pre-application encouragement and discouragement decisions by December 18, 2026.
- Applications associated with encouraged pre-applications must be submitted by February 1, 2027.
- Applications that are not associated with an encouraged pre-application will not be considered for funding in FY 2027.

Subprogram Contact:
Riq Parra, enrique.parra@doe.gov
Website: https://science.osti.gov/fes/Research

(l) Plasma Science and Technology — Quantum Information Science

The QIS subprogram supports basic research in QIS that could transform FES mission areas and research that takes advantage of unique FES-enabled plasma capabilities to advance QIS development. Areas of focus include developing quantum computing concepts to address inherently nonlinear plasma dynamics and fusion challenges; implementing plasma-relevant quantum algorithms on current and emerging quantum hardware platforms; identifying quantum sensing techniques to enhance diagnostic capabilities in plasma science and fusion applications; and applying plasma-based methods, including high-energy-density plasmas and LTPs, to develop and control novel quantum materials for QIS applications. You can find additional background and priority research opportunities in the *2018 Fusion Energy Sciences Roundtable on Quantum Information Science*.

Applicants are strongly encouraged to contact the subprogram contact before submitting a pre-application.

Target Dates:

- To be considered for funding in FY 2027, a pre-application must be submitted by November 20, 2026.
- FES expects to provide pre-application encouragement and discouragement decisions by December 18, 2026.
- Applications associated with encouraged pre-applications must be submitted by February 1, 2027.
- Applications that are not associated with an encouraged pre-application will not be considered for funding in FY 2027.

Subprogram Contact:
Riq Parra, enrique.parra@doe.gov
Website: https://science.osti.gov/fes/Research

(m) Public-Private Partnerships

Public-private partnerships (PPPs) enable greater resources to be applied to help achieve technical goals and accelerate commercialization timelines. The rapidly growing private fusion sector is informed and enabled by decades of publicly supported research in fusion. Through PPPs, research can be pursued in a way that is relevant to the private sector and amenable to commercialization. Within the PPP space, multiple avenues exist for the public and private sector to cooperate on research of mutual interest.

Applicants must contact the relevant subprogram contact listed below before applying under the PPP program.

Innovation Network for Fusion Energy (INFUSE)

The Innovation Network for Fusion Energy (INFUSE) supports research partnerships with the emerging fusion private sector, with the goal of accelerating the development of fusion energy in the U.S. This program seeks to advance our scientific understanding of fusion-related phenomena by fostering collaborations involving the expertise and unique resources available at DOE National Laboratories and U.S. universities. Applications to this subtopic are reserved for university or research institution-based scientists, seeking to collaborate with industrial partners in the INFUSE program.

Partnership awards made under the INFUSE program follow a unique application process. You can find more information on the INFUSE website.

Subprogram Contact:
Colleen Nehl, colleen.nehl@doe.gov
Website: https://science.osti.gov/fes/Research

Milestone-Based Fusion Development Program

The Milestone program aims to accelerate progress toward the development of commercial fusion energy by establishing partnerships with the private sector. Key goals of this program in the near term include achieving preliminary designs and technology roadmaps for a fusion pilot plant and enabling significant performance improvements of fusion pilot plant concepts. DOE may award OTAs via TIAs under this topic. TIAs are assistance instruments used to increase the involvement of commercial entities in DOE's research, development, and demonstration programs. DOE has greater flexibility in tailoring the terms and conditions of a TIA.

Subprogram Contact:
Colleen Nehl, colleen.nehl@doe.gov
Website: https://science.osti.gov/fes/Research

Private Facilities Research

As private fusion facilities begin operation, opportunities exist for publicly funded researchers to conduct scientific studies on privately constructed facilities for the mutual benefit of all parties. Uniquely, the Private Facilities Research activity aims to advance fusion and plasma science and technology by openly disseminating results using data acquired from world-leading private experimental facilities.

Subprogram Contact:
Josh King, joshua.king@doe.gov
Website: https://science.osti.gov/fes/Research

5. High Energy and Nuclear Physics (HENP)

Program website: https://science.osti.gov/hep and https://science.osti.gov/np/

The mission of the High Energy and Nuclear Physics (HENP) program is to understand how the universe works at its most fundamental level by discovering and investigating the elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time. HENP is the major sponsor of high energy physics and nuclear physics research in the U.S., providing approximately 90% of the funding allocated by the Federal government.

The scientific objectives and priorities for HENP recommended by the scientific community are detailed in two recent long-range strategic plans, *Pathways to Innovation and Discovery in Particle Physics: Report of the 2023 Particle Physics Project Prioritization Panel* and *A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science*.

Research in high energy physics is divided into four core areas covering three experimental scientific frontiers and theory:

- *The Energy Frontier*, where powerful accelerators are used to create new particles, reveal their interactions, and investigate fundamental forces using highly sensitive collider-based experimental detectors
- *The Intensity Frontier*, where intense particle beams and highly sensitive detectors are used to pursue alternate pathways to investigate fundamental forces and particle interactions by studying events that occur rarely in nature, and to provide precision measurements of these phenomena
- *The Cosmic Frontier*, where data from the universe are used to probe fundamental physics questions and offer new insight about the nature of dark matter, cosmic acceleration in the forms of dark energy and inflation in the early universe, neutrino properties, and other phenomena

- *Theoretical Particle Physics*, where the vision and mathematical framework for understanding and extending the knowledge of particles, forces, space-time, and the universe are developed

Together, these interrelated and complementary discovery research areas offer the opportunity to answer some of the most basic questions about the world around us. Also integral to high energy physics research are the following four technology research areas that enable new scientific opportunities by developing the necessary tools and methods for discoveries:

- *Accelerator Science and Technology R&D*, where the technologies and basic science needed to design, build, and operate the accelerator facilities essential for making new discoveries are developed
- *Instrumentation and Detector R&D,* where the basic science and technologies needed to design and build the HENP instrumentation essential for making new discoveries are developed
- *SI and Computational High Energy Physics,* where computational tools, data management and analytics, and simulation techniques are developed for high energy physics research; this program also supports research that uses SI to advance the HENP mission, use of high energy physics datasets and theory to learn about fundamental SI techniques, and development of the high energy physics SI ecosystem to broaden participation in high energy physics SI research
- *Quantum Information Science for High Energy Physics Research,* an interdisciplinary research area where innovative solutions for scientific discovery techniques leveraging the unique capabilities of quantum information science and technology (e.g., in sensing, computing, and theoretical advances) are developed through partnerships with the wider quantum information science community to advance the high energy physics science drivers, as identified by P5, the program mission of HENP, and the SC quantum information science initiative

For nuclear physics research, priorities include:

- Developing experiments, methods, and techniques to accurately describe and predict the interactions between neutrons and protons that drive nuclear structure and nuclear reactions.
- Determining how quarks and gluons make up protons, neutrons, and atomic nuclei.
- Using atomic nuclei to uncover physics beyond the Standard Model.
- Connecting multi-messenger and nuclear physics observables to characterize the nuclear processes that drive the birth, life, and death of stars.
- Conceiving, constructing, and operating national scientific user facilities and developing novel detector and accelerator instrumentation and technologies to support these facilities

Within each of these priority areas, unique nuclear physics opportunities using SI, ML, and new developments in microelectronics will be considered. Applicants are encouraged to contact the relevant subprogram contact.

To carry out its mission and target priority areas, the nuclear physics program addresses three broad, tightly interrelated, scientific thrusts: Quantum Chromodynamics (QCD); Nuclei

and Nuclear Astrophysics; and Fundamental Symmetries. Nuclear physics research is supported in six subprogram areas: Experimental QCD, Nuclear Structure and Nuclear Astrophysics, Fundamental Symmetries, Theoretical Research in Nuclear Physics, and Nuclear Data. In addition, HENP supports Accelerator Research and Development for Nuclear Physics-focused Facilities and Quantum Information Science for Nuclear Physics Research. Contact the relevant subprogram contacts for guidance if the proposed scope of work includes multiple subprograms.

Applications for supporting research activities in any of the research areas identified above may be submitted to this NOFO. HENP expects to convene comparative merit review panels on a yearly basis, as described below, for both new and renewal applications devoted to these research activities.

The FY 2027 comparative review panels for high energy physics topics required application submission to the previous open call, and the FY 2027 comparative review panels for nuclear physics subprograms applications are due November 16, 2026.

All FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by September 2, 2027, for merit reviews by those panels.

Eligible applications not subject to this comparative review process will be sent for peer review but will likely be assigned a lower programmatic priority than those that are, and any exceptions will be considered on a case-by-case basis to address program priorities. Before submitting to this NOFO, applicants are strongly encouraged to contact the relevant subprogram contact listed below to develop applications that properly address program goals.

Applications in response to this NOFO may also propose activities *in support of* HENP research, which include, but are not limited to supplemental support for research activities, conferences, experimental operations, conceptual R&D, or design or fabrication *directed towards a specific (pre)project* within the HENP scientific program, but such applications will *not* be considered by comparative merit review panels.

Nuclear Physics applications submitted for the FY 2027 comparative review process

- Applications are due Monday, November 16, 2026, for full consideration.
- Applications with research narratives longer than 20 pages (with an additional five pages per major research thrust or separate task) may pose an undue burden on merit reviewers and may be declined without review.
- For all applications, the end of the project narrative must include a bullet list of annual objectives that mark anticipated research achievements, phase of completed work, or a key decision point in the proposed timeline. Each objective needs a clear, specific, measurable metric that signifies progress.
- For renewal applications, the project narrative must describe the progress made under the previous award.
- For all applications, a table in the budget justification section should specify the funding request by subprogram and, if relevant, SI and microelectronics. An example follows for

a total request of $1,710,000, of which $50,000 is related to microelectronics and $230,000 is for SI activities.

Example Table

Subprogram	FY 2026	FY 2027	FY 2028
Experimental QCD	$510,000	$400,000	$500,000
Fundamental Symmetries	$90,000	$100,000	$110,000
Microelectronics	$15,000	$25,000	$10,000
SI	$60,000	$80,000	$90,000

- For all applications, a student tracking table is required. This table must be included at the end of the project narrative and will not count against the narrative page limit.

Example Table

Student	Date Entered Grad. School	Date Joined Group	Degree Program	Date Degree Awarded/Expected	Advisor
L. Meitner	Aug. 2023	Jan. 2024	Ph.D.	(May 2028)	M. Curie

- For renewal applications, when PIs receive an automated email from PAMS requesting Renewal Proposal Products, that list should *only* include publications from the project period immediately preceding this application.
- For renewal applications, PIs should list their contributions to publications from the project period immediately preceding this application. This list must be included at the end of the project narrative and will not count against the narrative page limit.
- For all new and renewal applications, the narrative reference list must not exceed three pages.

Applicants may email subprogram contacts regarding the technical requirements for the application. Administrative questions should be directed to sc.opencall@doe.gov.

Applications submitted for the FY 2028 HENP comparative review process

HENP expects to convene merit review panels in November 2027 for research areas (a) through (o) below. Research applications that are aligned with one or more of those research areas and are received by Thursday, September 2, 2027, will be considered for merit review by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Additional information about the high energy physics and nuclear research areas described above, and in areas (a) through (o) below, may be found at https://science.osti.gov/hep/research/ and https://science.osti.gov/np/. All applicants should pay particular attention to the following when preparing applications to be submitted to this NOFO:

- External peer reviewers will be explicitly requested to evaluate the applicant's proposed work in relation to HENP priorities.
- Applications for support of *generic particle detector R&D* efforts should be directed to the Instrumentation and Detector R&D in High Energy and Nuclear Physics research area described below. However, applicants proposing physics studies and pre-conceptual R&D efforts *directed toward a specific experiment* should submit their application to the relevant HENP scientific frontier research subprogram specified below.
- Applications which pose an undue burden on merit reviewers may be declined without review:
    - Applications in HENP from a single institution must not contain project narratives longer than nine pages per senior/key person. This limit includes multi-institutional teams with applications structured as a single primary applicant with subawards.
    - Collaborative applications in HENP from multi-institutional teams must not contain project narratives longer than nine pages per senior/key person or a total of 20 pages, whichever is less.
- In addition to the points listed in Section IV, HENP also offers these suggestions on the Project Narrative:
    - *Research using Super Intelligence SI or ML, if applicable:* HENP will prioritize support for SI research activities through the Genesis Mission and dedicated funding opportunities. You should briefly and clearly describe significant SI components of your proposed research activities so reviewers understand the full scope of your proposed program. Support for SI research aligned with the Genesis Mission through Comparative Review may be considered as a reduced priority.
    - *Proposed Resources:* Identify the resources needed to meet the objectives of the proposed project and accomplish the research goals. Requests for support of any resources in the budgets submitted with the application should be consistent with the scope of research efforts identified in the narrative. Reviewers will be asked to consider if the proposed budgets are reasonable and appropriate to carry out the proposed work and adequately estimated and justified.
    - *Timetable of Activities:* Timeline for all major activities including aims and objectives.
- Previously declined applications that have not been substantially revised considering merit reviewer comments may be declined without additional merit review and will not be considered for funding.

Additional requirements for multi-task or multi-institution applications follow below. Investigators who are proposing a single-task, single-institution research effort may skip to the High Energy Physics and Nuclear Physics Research Subprograms descriptions below.

Multi-Task Applications

HENP allows applications from single institutions that span multiple research areas described in this NOFO, including applications that span multiple subprograms or research areas. These separate research areas are called "tasks" within the application and should be separately

delineated. Specifically, applications in response to this NOFO may propose multiple research tasks, addressing two or more HENP research subprograms (e.g., the Energy Frontier and Theoretical Particle Physics) or different research areas (specific experiments, experimental or technology R&D campaigns, or other significant collaborations) within a particular HENP research subprogram (e.g., LSST and LZ/LUX in the Cosmic Frontier).

Each task should be a distinct, non-overlapping subsection of the application narrative. Each task should also be associated with one or more of the listed senior/key personnel. Reviewers will be requested to comment on each of the proposed activities and their impact.

If proposing a multi-task application:

- Ensure the application describes an overall integrated and synergistic research effort. Do not propose unconnected discrete research efforts.
- Organize the narrative portion of the application by task.
- Provide a common narrative**:** any narrative material that is common to all research tasks or areas should be included in a single separate section within the narrative. This section should address the integration and the synergies of the different research activities (as appropriate) and describe the management of the overall research effort. Reviewers will have access to the complete application and will be asked to comment on the adequacies of such synergies and institutional support or infrastructure as appropriate to the application.
- Provide both a summary budget and a budget for each task, using the Research and Related Subaward Budget Attachment Form to provide multiple task budgets by identifying the task budget type as “project.”
- Provide a supplementary page to the DOE title page, including:
  - List all research tasks by name with each Co-Investigator (Co-I) for the respective research on the same line.
  - Indicate the Lead PI who will serve as the point of contact and coordinator for the combined application.
  - Include a table modeled on the following chart providing summary budget information for each research task. Provide the total costs (Direct and Indirect) in the budget request in each funding year for each subprogram or thrust as well as the totals for all rows and columns.
  - If necessary, appropriately add rows for additional Co-I(s) and research tasks.
  - Modify the table below for the correct number of years corresponding to the budget request in the application.

Example Summary Budget Table (for Applications with Multiple HENP Tasks)

Name and Yearly Budget for Applications with Multiple Research Tasks						
	Name	**Research Task**	**Year 1 Budget ($)**	**Year 2 Budget ($)**	**Year 3 Budget ($)**	**Total Budget ($)**
Lead PI Co-I #1 Co-I #2						
Co-I #1 Co-I #2 Co-I #3 Co-I #4						
TOTAL	—	—	***Total Year 1***	***Total Year 2***	***Total Year 3***	***Total Y1-Y3***

- If any senior/key person requests support from two or more HENP research tasks (including two or more tasks in the same research subprogram), provide information on the estimated distribution of research effort (FTE) for them in a table (example below) in the subprogram/task budget justification. Applicants should appropriately modify the table for their proposed efforts.

Example Effort Table (for Applications with Multiple HENP Tasks)

Yearly FTE Estimates for Senior/Key Personnel with Multiple HENP Tasks						
Name	**Application Project Period**					
	Budget Period 1		**Budget Period 2**		**Budget Period 3**	
	Name of Task 1	Name of Task 2	Name of Task 1	Name of Task 2	Name of Task 1	Name of Task 2
	FTE	**FTE**	**FTE**	**FTE**	**FTE**	**FTE**
Senior/Key Person A	0	100%	25%	75%	50%	50%
Senior/Key Person B	50%	50%	25%	75%	0%	100%

Multi-Institutional Teams

Applications in response to this NOFO may consist of teams of investigators from multiple institutions to submit applications in accordance with the mechanisms described in the "Multi-Institutional Teams" section. Such teams may be appropriate when the involvement of multiple institutions permits the formation of larger teams that can address a greater scope of scientific inquiry or significant research area. However, unless specifically encouraged in the research area descriptions below, such applications are likely to be assigned a lower programmatic priority and excluded from the merit review panels.

Multi-institutional team applications should provide a supplementary page to the DOE title page, including:

- List all institutions by name and each Co-Investigator (Co-I) at that institution.
- Indicate the Lead PI who will serve as the point of contact and coordinator for the combined application.
- Include a table modeled on the following chart providing summary budget information for each institution. Provide the total costs (Direct and Indirect) in the budget request in each funding year for each institution as well as the totals for all rows and columns.
- If necessary, appropriately add rows for additional Co-I(s).
- Modify the table below for the correct number of years corresponding to the budget request in their application.

Example Summary Budget Table (for Applications with Multiple Institutions)

Name and Yearly Budget for Applications with Multiple Institutions						
	Name	**Institution**	**Year 1 Budget ($)**	**Year 2 Budget ($)**	**Year 3 Budget ($)**	**Total Budget ($)**
Lead PI Co-I #1 Co-I #2						
Co-I #1 Co-I #2 Co-I #3 Co-I #4						
TOTAL	—	—	***Total Year 1***	***Total Year 2***	***Total Year 3***	***Total Y1-Y3***

Applications from multi-institutional teams should not be part of a multi-task application from the lead institution.

(a) Experimental Research at the Energy Frontier in High Energy Physics

This research subprogram seeks to support studies of fundamental particles and their interactions using particle beam collisions at the highest possible energies and/or luminosities. This research is accomplished through direct detection of new phenomena or through sensitive measurements of processes that probe the Standard Model and new physics beyond it. In particular, HENP is looking for applications for physics research utilizing data being collected at the Large Hadron Collider (LHC) by the ATLAS (A Toroidal LHC Apparatus) and CMS (Compact Muon Solenoid) experiments. This research area also provides graduate, undergraduate, and postdoctoral research training for the next generation of scientists, and equipment and computational support for LHC physics research activities.

Applications addressing physics studies and pre-conceptual R&D directed towards specific future proposed Energy Frontier collider experiments are also accepted through this NOFO but will not be considered under the annual HENP comparative review process. Instead, applicants are strongly encouraged to work with the nationally coordinated consortia or organizations that were recently formed in the U.S. to seek support for such future collider

physics studies and pre-conceptual R&D efforts. Support for heavy-ion physics research is not provided under this research area.

Subprogram Contact:
Abid Patwa, abid.patwa@doe.gov
Website: https://science.osti.gov/hep/research

(b) Experimental Research at the Intensity Frontier in High Energy Physics

This research area seeks to support precision studies that are sensitive to new physical processes at very high-energy scales, beyond what can be directly probed with energy frontier colliders, and often require intense particle beams. This research area includes studies of the fundamental properties of neutrinos produced by a variety of sources, including accelerators and nuclear reactors; studies of rare processes or precision measurements probing new physics processes, as described above, with either high intensity stored beams or beams incident on fixed targets; and studies of high intensity electron-positron collisions. In addition, this research area includes searches for proton decay.

Graduate and postdoctoral research training for the next generation of scientists, and equipment and computational support for physics research activities are also provided. Applications addressing physics studies and pre-conceptual R&D directed towards specific future Intensity Frontier experiments are also accepted but will be assigned a lower priority for support than those that are considered in support of existing experiments and approved projects. Support for the Large Hadron Collider beauty experiment (LHCb) research or studies of neutrinoless double beta decay is not provided under this research area.

Subprogram Contact:
Brian Beckford, brian.beckford@doe.gov
Website: https://science.osti.gov/hep/research

(c) Experimental Research at the Cosmic Frontier in High Energy Physics

This research area seeks to support precision studies using observations of the cosmos and naturally occurring cosmic particles to understand the properties of fundamental particles and fields. Priorities include the study of cosmic acceleration by studying the nature of dark energy, planning the next-generation ground-based cosmic microwave background experiment to explore the inflationary epoch, and using direct-detection experiments to search for dark matter particles. Many of the experiments in the program also place constraints on neutrino masses. Measurements using high-energy cosmic rays, gamma rays and other phenomena are included, but at a lower priority.

HENP is looking for applications for physics research efforts supporting current experiments in the Cosmic Frontier, as well as physics studies and pre-conceptual planning directed towards specific future experiments being considered for the program. This research area also provides undergraduate, graduate, and postdoctoral research training for the next generation of scientists and equipment and computational support for physics research activities.

Research efforts aimed at developing techniques or understanding experimental data within the context of theoretical models that are expressly for or part of an experimental research collaboration are included in this area. General theoretical or computational research applications not specifically carried out as part of a particular Cosmic Frontier experimental collaboration should be directed to the Theoretical Research in High Energy Physics subprogram. Studies of gravitational physics (other than for cosmic acceleration), classical astrophysics phenomena, fundamental symmetries, or planning for future cosmic ray or gamma ray experiments are not included in this research area.

Subprogram Contacts:
Bryan J. Field (Research), bryan.field@doe.gov
Kathleen (Kathy) Turner, kathy.turner@doe.gov
Website: https://science.osti.gov/hep/research

(d) Theoretical Research in High Energy Physics

This research area seeks to support theoretical activities that provide the vision and the mathematical framework for understanding and extending our knowledge of particles, forces, space-time, and the universe. Theoretical research is essential to support current experiments at the Energy, Intensity, and Cosmic Frontiers to identify new directions for high energy physics and to provide a deeper understanding of nature. Topics studied in theoretical high energy physics research include but are not limited to: phenomenological studies that seek to interpret experimental data, suggest searches for new physics at existing facilities and develop a research program for future facilities; precision calculations of experimental observables to test our current theories at the level of quantum corrections; the development of new models of physical interactions to describe unexplained phenomena or to unify seemingly distinct concepts; progress in quantum field theory, quantum gravity and other possible frameworks to develop a deeper understanding of nature; quantum information science to extend the reach of high energy physics theory; and the development of analytical and numerical computational techniques to facilitate studies in these areas.

This research area also provides undergraduate, graduate and postdoctoral research training for the next generation of scientists and the computational resources needed for theoretical calculations. Activities that rely on experimental data, performed expressly for or with an experimental research collaboration, are not included in this research area.

Subprogram Contact:
William (Bill) Kilgore, william.kilgore@doe.gov and Bryan Field, byan.field@doe.gov
Website: https://science.osti.gov/hep/research

(e) Theoretical Research in Nuclear Physics

The nuclear theory subprogram focuses on theory as a fundamental pillar of modern science and nuclear physics. It explains how fundamental building blocks of matter, such as quarks and gluons, combine to form atomic nuclei. It describes how nuclei decay and reacts to

release energy, produce various isotopes, and forge chemical elements within stars and stellar explosions. By revealing how nuclear properties unveil fundamental particles and forces, supported nuclear theory research delivers the core concepts, methods, and predictive tools needed to bridge subatomic and astrophysical scales. Beyond driving pure discovery, these theoretical frameworks generate the precise modeling data vital to energy, medicine, and national security. This interdisciplinary subprogram actively connects with astronomy, particle physics, condensed matter physics, chemistry, and applied mathematics, while increasingly using high-performance computing, SI, and QIS. The nuclear theory subprogram addresses all of the field's scientific areas described in *A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science*, as well as the specific questions listed for all of the nuclear physics experimental subprograms. This subprogram also funds nuclear theory research using large-scale supercomputing and advanced computational methods.

To advance our understanding of quantum chromodynamics across systems spanning from single protons to dense neutron stars, the following topical areas are supported:

- Nuclear structure and nuclear reactions
- Nuclear astrophysics and nucleosynthesis
- Nuclear theory BSM physics
- Experimental QCD
- Lattice, SI, and QIS methods, computations, and techniques

Of particular interest is developing research software and advanced computing algorithms broadly applicable across the nuclear theory computing ecosystem. This area includes developing SI techniques and novel applications unique to NP research. The scope and estimated budget of SI-related work should follow the guidance outlined in the NP introduction section of this NOFO.

Because this subprogram focuses primarily on research, applications for community activities, such as visitor programs and workshops, must be submitted as standalone requests to be considered for merit review.

For FY 2027, a comparative review panel is expected in early 2027. Applications submitted by Monday, November 16, 2026, will be evaluated by the panel. Applications submitted after this deadline will be considered for funding in FY 2028.

FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by Thursday, September 2, 2027, for merit reviews by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Subprogram Contact:
Astrid Morreale, astrid.morreale@doe.gov
Website: https://science.osti.gov/np/research/

(f) Accelerator Science and Technology R&D in High Energy and Nuclear Physics

The Accelerator Science and Technology R&D subprogram develops the next generation of particle accelerators and related technologies that are essential for discoveries in high energy physics. This research area supports world-leading research in the physics of charged particle beams, and long-range, early-stage exploratory research aimed at developing new acceleration concepts. In addition, this subprogram also provides graduate and postdoctoral research training, equipment for experiments, test facilities and related computational efforts.

Accelerator R&D supporting nuclear physics-focused facilities should significantly advance the state-of-the-art capabilities relevance to next-generation machines for nuclear physics or to improve the performance of existing nuclear physics facilities. A review of applications is not anticipated for FY 2027 but are invited for consideration in FY 2028. Particularly, applications in the following areas are encouraged for FY 2028:

- Transformative accelerator R&D in superconducting radiofrequency (SRF) technology for restoring cryomodule performance at SRF-based accelerator facilities. One example is R&D to establish practical and reproduceable in situ plasma processing techniques.
- High performance polarized electron photocathodes and polarized light ion sources.
- Transformative accelerator R&D in next generation ion and electron sources.

Topics studied in the Accelerator Science and Technology R&D subprogram include but are not limited to accelerator and beam physics, including the development of analytic and computational techniques for modeling particle beams and simulation of accelerator systems; novel acceleration concepts; the science of high gradients in accelerating cavities and structures; high-power radio-frequency sources; high-power targets; high-brightness beam sources; and beam instrumentation and controls. Also of interest are superconducting materials and conductor development for high-field magnets; innovative magnet design and development of high-field superconducting magnets; as well as associated testing and cryogenic systems. R&D applications which are focused on accelerator uses outside of high-energy physics continue to be coordinated through the Accelerator Stewardship subprogram, see section (k) below.

Subprogram Contacts:
Derun Li, derun.li@doe.gov
Website: https://science.osti.gov/hep/research

Manouchehr Farkhondeh, manouchehr.farkhondeh@doe.gov
Website: https://science.osti.gov/np/research/

(g) Instrumentation and Detector R&D in High Energy and Nuclear Physics

The Detector R&D subprogram develops the next generation of instrumentation for high energy and nuclear physics. It supports research leading to fundamental advances in the science of particle and radiation detection, and the development of new experimental techniques. This research is typically long-term, "generic" R&D that is high-risk but has the potential for wide applicability or high impact.

Applications should broadly align with the priority research directions identified in the 2020 *DOE Basic Research Needs Study on High Energy Physics Detector Research and Development* report. Moreover, applications for blue-sky scientific research on innovative technologies not already in contention for implementation in future high energy physics will likely be assigned a higher programmatic priority.

Topics studied in the Detector R&D research area include but are not limited to low-mass, high channel density charged particle vertexing and tracking detectors; high resolution, fast-readout calorimeters and particle identification detectors; techniques for improving the radiation tolerance and fast-timing capabilities of particle detectors; detectors for photons from ultraviolet to infrared wavelengths; detectors for cosmic, micro-, and mm-wave background radiation; detectors and experimental techniques for low-mass dark matter and ultralow-background experiments, including those enabled by advances in QIS; and advanced front-end electronics and data acquisition systems, including those enabled by advances in 3D heterogeneous integration and real-time, edge SI.

Support for undergraduate, graduate, and postdoctoral research training, engineering and other technical efforts, and equipment and computational efforts required for experimental detector R&D is included in this research area.

Multi-institutional team applications to the FY 2028 HENP Comparative Review described above are not encouraged for this topic.

Subprogram Contacts:
Helmut Marsiske, helmut.marsiske@doe.gov
Website: https://science.osti.gov/hep/research

Michelle Shinn, michelle.shinn@doe.gov
Website: https://science.osti.gov/np/research

(h) Computational Research in High Energy Physics

This research area supports advanced computing research and development targeting challenges that can or could be broadly applied to the increasingly complex high energy physics computing ecosystem. These challenges may include hardware-software co-design, development of collaborative software infrastructure, and research into high-performance software and algorithms. This subprogram facilitates the effective use of DOE computing resources including, high-performance computing and the Genesis Mission American Science and Security Platform. The subprogram will prioritize SI research that contributes to broader activities developing SI computing ecosystems, preparing and curating SI-ready data, or developing new transformative SI models and capabilities for high energy physics specific challenges.

This program seeks applications in forward-looking blue-sky seed research and development of successful seed research into mature software products for the broader high

energy physics community through bridge applications. This subprogram does not support computing research and/or activities specific to individual projects or experiments in the other research and technology R&D subprograms described in this NOFO. Support for specific operation efforts and/or hardware requests are also outside the scope of this area.

Subprogram Contact:
Jeremy Love, jeremy.love@doe.gov
Website: https://science.osti.gov/hep/research

(i) Quantum Information Science for High Energy Physics Research

QIS is the study of how the unique behaviors of the microscopic world described by quantum mechanics — such as entanglement, superposition, and interference — can be used to solve scientific problems and build new technologies, such as quantum sensors and computers. This program pursues the potential for QIS to solve previously intractable problems, measure previously undetectable signals, and bring new theoretical tools to bear on our understanding of the universe through our Quantum Information Science Enabled Discovery (QuantISED) program. This research area is aligned to the SC and U.S. national initiatives in QIS, particularly those that focus on interdisciplinary partnerships between high energy physics and the wider QIS communities. This subprogram supports efforts that advance the high energy physics science drivers, as identified by P5, as well as the program mission of HENP in the context of broader benefits to QIS.

This subprogram does not support general (i.e., not related to the HENP mission) quantum computing research, algorithms, or hardware or quantum networking R&D. Applications to this subprogram without a clear connection to the HENP mission will be declined without review.

Topics of interest for the QuantISED comparative review process include, but are not limited to application of quantum information theory to fundamental physics problems; quantum computational study to understand, apply, and implement quantum computing devices to high energy physics problems and experiments; theory and experiment to develop, characterize, and make practical sensors that apply unique features of quantum mechanics (such as entanglement and back-action evasion) to surpass the standard quantum limit to precision in high energy physics experiments; and integration of QIS tools and techniques into new or ongoing high energy physics projects. Applications should highlight their novelty and innovation in both high energy physics and QIS, making a case for the value of the proposed scope of work to both fields and providing evidence that their team possesses sufficient expertise in both subfields to accomplish the proposed research goals.

Subprogram Contact:
Zachary Goff-Eldredge, zachary.goff-eldredge@doe.gov
Website: https://science.osti.gov/hep/research

(j) Quantum Information Science for Nuclear Physics Research

This pioneering effort has a primary objective of advancing discovery science at the intersection of nuclear physics and QIS. By identifying and coordinating emerging research and applied challenges in both fields, and by using the interdisciplinary nature of quantum computing and QIS, this program creates new opportunities to address complex problems, expanding the frontiers of HENP-supported research and fostering innovation vital for scientific advancement.

Successful applications should address at least one of the following topics.

Collaborative Experimental Research at the Nuclear Physics/QIS Interface

This research aims to unlock new scientific frontiers through robust collaboration between the Nuclear Physics and QIS communities. Applications must clearly demonstrate how merging expertise from academic institutions, National Laboratories, and industrial partners will drive innovation and provide a clear path for either:

- Revolutionizing Nuclear Science through Quantum Innovation — using cutting-edge QIS technologies to achieve breakthroughs in nuclear science. This area involves developing quantum-enabled detectors and instruments that exploit distinct quantum phenomena such as superposition, entanglement, and squeezing, thereby providing unprecedented capabilities for sensing, information acquisition, and data processing relevant to nuclear physics.

- Enhancing QIS via Nuclear Science Expertise — using nuclear science knowledge and its specialized infrastructure to significantly advance the foundational components of QIS. Some examples include design, fabrication, and characterization of novel nuclear-spin-based qubits, and the development of radiation-tolerant quantum device engineering crucial for the resilience and performance of quantum computing and sensing platforms in diverse environments.

Theoretical and Algorithmic Research at the Nuclear Physics/QIS Interface

This area supports theoretical and computational research dedicated to using the transformative capabilities of emerging quantum computing technologies — including digital quantum computers, hybrid systems, quantum annealers, and quantum simulators — to address critical challenges in nuclear physics. Applications must rigorously delineate how integrating QIS principles, through development of novel quantum algorithms and theoretical frameworks, will enable a more profound and otherwise unattainable understanding of complex nuclear phenomena. An equally critical objective is advancing classical algorithms in nuclear physics robust enough to model, challenge, or surpass specific claims of quantum supremacy.

Grand Challenges

This area supports larger, multidisciplinary teams engaged in sustained, ambitious endeavors aimed at driving paradigm-shifting experimental advancements. Ambitious

undertakings could include developing high-precision nuclear clocks or creating fundamentally novel types of nuclear qubits. Applicants should contact the subprogram contact to present their ideas and how the team will be organized.

Additional Application Instructions

Applications must adhere to the following guidelines:

- *Team Structure:* Applications can originate from a single institution or a multi-institutional team. For multi-institutional collaborations, a prime and subaward model, with the lead institution submitting a single consolidated application, is a better fit for applications to this subtopic.
- *Interdisciplinary Requirement:* Applications with experimental scope must involve researchers from both nuclear physics and QIS disciplines. Applications must clearly articulate how the proposed research will generate significant impact in both fields.
- *National Laboratory Alignment:* Applications that include subawards to Department of Energy (DOE) or National Nuclear Security Administration (NNSA) National Laboratories must explicitly detail how the proposed research aligns with the existing and ongoing scientific activities at the respective laboratories.
- *SI Integration:* If the application includes SI components, the scope of this work and its estimated budget must conform to the specific guidance provided in the HENP introduction section of this NOFO.
- *Relevance to Objectives:* Applications that do not clearly articulate the relevance of the proposed research to the nuclear physics and QIS objectives within the application narrative will not be considered.

For FY 2027, a comparative review panel is expected in early 2027. Applications submitted by Monday, November 16, 2026, will be evaluated by the panel. Applications submitted after this deadline will be considered for funding in FY 2028.

FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by Thursday, September 2, 2027, for merit reviews by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Applicants are strongly encouraged to review recent QIS awards from NP. You can find those awards on the program website. You can find more information about SC endeavors in the QIS Centers website and the SC Program Offices QIS website.

Subprogram Contact:
Gulshan Rai, gulshan.rai@doe.gov
Website: https://science.osti.gov/np/Research/Quantum-Information-Science

(k) Accelerator Stewardship and Accelerator Development

Program website: https://science.osti.gov/ardap

The Accelerator Stewardship and Accelerator Development subprograms (collectively referred to as Accelerator Stewardship and formerly known as ARDAP) share a mission to:

- Coordinate accelerator R&D within the SC
- Advance accelerator science and technology relevant to the DOE, other Federal agencies, and U.S. industry
- Foster public-private partnerships and other collaborative R&D activities to develop, demonstrate, and enable the commercial deployment of accelerator technology
- Support the development of a skilled accelerator workforce
- Provide access to accelerator design and engineering resources through BeamNetUS

Applicants addressing cross-cutting accelerator research or technology development activities in one or more of the following five research areas are strongly encouraged to submit applications to the annual Research Opportunities in Accelerator Stewardship and Accelerator Development NOFO, available through Grants.gov.

Accelerator Stewardship applications for supplements to current awards may be submitted to this NOFO, but new applications will likely be assigned a lower programmatic priority than those submitted to the dedicated Accelerator Stewardship NOFO. Before submitting to this NOFO, applicants are strongly encouraged to contact the subprogram contact listed below.

Subprogram Contact:
Eric R. Colby, eric.colby@doe.gov
Website: https://science.osti.gov/ardap

(l) Experimental QCD

The Experimental QCD subprogram is dedicated to: a) unraveling the fundamental nature of matter, specifically focusing on hadrons and, b) focusing on studies of emerging phenomena in the bulk, condensed quark-gluon matter created at extremely high densities and temperatures characteristic of the infant Universe.

The study of the hadron structure was previously covered by the *Medium Energy (ME)* subprogram. This research primarily seeks to understand the internal structure of hadrons, the dynamics of quarks within them, and to rigorously test Quantum Chromodynamics (QCD), the theory describing the strong interaction. QCD posits that all observed nuclear particles, collectively known as hadrons (such as the familiar protons and neutrons in atomic nuclei), are formed from the profound interaction of quarks, antiquarks, and gluons. Although computationally complex, QCD predicts the existence, interaction, and decay of these particles.

Key questions guiding research in hadron structure include:

- What is the intricate internal arrangement of protons and neutrons (nucleons)?
- How does experimental data affect QCD-Theory's predictions for the properties of strongly interacting matter?
- What mechanisms govern transformation of quarks and gluons into hadrons?
- What is the precise role of gluons and their self-interactions within nucleons and nuclei?

To address these questions, this part of the program aims to develop a comprehensive understanding of the spatial, momentum, and angular momentum substructure of the nucleon. It also strives to understand the mysteries of quark confinement, hadron excitations, and the origin of mass while deepening our knowledge of the strong interaction within nuclei.

Experimental efforts employ various approaches to map the distribution of *up, down,* and *strange* quarks; their antiquarks; and gluons inside protons and neutrons. These experiments also clarify the critical role of gluons in confining quarks and antiquarks within hadrons, often using polarized electron and proton beams to probe the effects of quark and gluon spins and nuclear environmental influences. The subprogram further supports experimental searches for predicted *excited states* and exotic hadrons, alongside studies of their production and decay.

The hadron part of the program primarily supports experimental research at its cornerstone facility, the Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility (TJNAF). Data analysis support also extends to other significant facilities, such as the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL), the High Intensity Gamma Source (HIGS) at the Triangle Universities Nuclear Laboratory (TUNL), and the future Electron-Ion Collider (EIC).

The studies of bulk, hot, or dense nuclear matter was formerly covered by the *Heavy Ion* nuclear physics subprogram. The primary facilities in the world currently capable of exploring the properties nuclear matter in these conditions have been the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) and the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN). The goal is to explore and understand unique manifestations of QCD in this many-body environment and their influence on the Universe's evolution. Important avenues of investigation are directed at resolving properties of the quark-gluon plasma at different length scales and learning more about its physical characteristics including its temperature, the energy loss mechanism for quarks and gluons traversing the quark-gluon plasma, determining the speed of sound in the quark-gluon plasma, measuring the effect of the chiral magnetic force, understanding how quarks fragment and recombine to form hadronic matter (hadronization), and locating a possible critical point for the transition between the quark-gluon plasma and normal matter. The high baryon-density region of the phase diagram for nuclear matter continues to be explored. Experimental research is carried out primarily using the data collected at the (now decommissioned) RHIC facility and the LHC.

Applications are invited for physics research supporting current and future experiments in either subarea, as well as for physics studies and early-stage planning for prospective experiments. Applications for novel instrumentation development for near-term experiments will also be considered. Applicants may also incorporate research components involving the

application of SI tools and methods, with specific guidance for scope and budget provided in the HENP introduction section of this NOFO.

For FY 2027, a comparative review panel is expected in early 2027. Applications submitted by Monday, November 16, 2026, will be evaluated by the panel. Applications submitted after this deadline will be considered for funding in FY 2028.

FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by Thursday, September 2, 2027, for merit reviews by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Subprogram Contact:
Spyridon (Spiros) Margetis, spyridon.margetis@doe.gov
Website: https://science.osti.gov/np/research/

(m) Nuclear Structure and Nuclear Astrophysics

The Nuclear Structure and Nuclear Astrophysics subprogram focuses on high-impact science with proton-rich and neutron-rich nuclei and searches for super-heavy elements and nuclear processes that inform our understanding of stellar nucleosynthesis, neutron stars, and Big Bang nucleosynthesis. Both frontiers are identified in *A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science*.

The subfield of nuclear structure addresses the underlying nature of atomic nuclei and the limits of their existence and describes dynamical processes such as nuclear reactions and fission. The goal is to develop a predictive understanding of nuclei and their interactions grounded in fundamental QCD and electroweak theory; furthermore, this understanding must be based on experimental data from a wide variety of nuclei.

Nuclear astrophysics addresses the role of nuclear physics in our universe. At the interface of astrophysics and nuclear physics, this field is concerned with the impact of nuclear processes on the evolution of the universe, the role of nuclear structure in influencing the evolution of the cosmos, and the cosmogenic origin of elements that are the building blocks of life. Nuclear astrophysics is a broad discipline that can identify new observational signatures probing our universe, can identify the conditions at the very core of stars, and provide a record of the violent history of the universe. To fully realize the discovery potential of this subfield, interdisciplinary collaborations must be formed and strongly encouraged that include nuclear experimentalists, theorists, and multi-messenger observers with a broad range of expertise.

Major goals of this subprogram are to develop a comprehensive description of nuclei across the entire nuclear chart, including as-yet undiscovered superheavy nuclei, to utilize rare isotope beams to reveal new nuclear phenomena and structures unlike those that are derived from studies using stable ion beams, and to measure the cross sections of nuclear reactions that power stars and spectacular stellar explosions and are responsible for the synthesis of the elements.

Experimental research is currently carried out primarily at the Argonne Tandem Linac Accelerator System (ATLAS), the Facility for Rare Isotope Beams (FRIB) at Michigan State University, the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory, the Texas A&M University Cyclotron Institute, and the Triangle Universities Nuclear Laboratory (TUNL) at Duke University.

Applicants may propose research components related to applying SI tools and methods. Scope of SI-related work and its estimated budget should follow the guidance outlined in the HENP introduction section of this NOFO.

For FY 2027, a comparative review panel is expected in early 2027. Applications submitted by Monday, November 16, 2026, will be evaluated by the panel. Applications submitted after this deadline will be considered for funding in FY 2028.

FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by Thursday, September 2, 2027, for merit reviews by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Subprogram Contact:
Keith Jankowski, keith.jankowski@doe.gov
Website: https://science.osti.gov/np/research/

(n) Fundamental Symmetries

https://www.osti.gov/servlets/purl/2280968/

This subprogram supports precision experiments to test the fundamental symmetries of nature and discover new particles and forces. These experiments address some of the most profound questions in physics today: What physical processes are responsible for the dominance of matter over antimatter in our universe? What is the fundamental nature of the neutrino, and is it its own antiparticle? What is the absolute mass of the neutrino? The research supported by this subprogram seeks to provide answers to these questions by using the nucleus and its decays as an observatory for new physics.

A major focus of this subprogram is the search for neutrinoless double beta decay (0vBB). The observation of this hypothetical decay would demonstrate that the neutrino is its own antiparticle (a Majorana fermion) and prove that lepton number conservation is violated. This discovery would provide a key mechanism for explaining the cosmic matter-antimatter asymmetry. The subprogram aligns with the priority within *A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science* to implement a ton-scale 0vBB experiment.

The subprogram also supports experiments searching for permanent electric dipole moments (EDMs) in neutrons and atoms. A non-zero EDM would, through a combination of charge (C) and parity (P) violation, demonstrate time-reversal (T) symmetry violation, signaling physics beyond the Standard Model. These low-energy, high-precision measurements provide constraints on new CP-violating phases that are complementary to direct searches at high-energy colliders.

Furthermore, this subprogram funds direct measurements of the neutrino mass scale to determine the absolute mass bounds. Although neutrino oscillations establish that neutrino mass eigenstates are non-zero, they only constrain the differences between the squares of those masses. Direct mass measurements via beta decay or electron capture kinematics provide a model-independent determination of the absolute neutrino mass scale.

Finally, the subprogram supports precision tests of weak interactions using beta decay in neutrons and nuclei. These experiments search for anomalous parity-violating signatures, scalar or tensor currents, and other deviations from Standard Model predictions.

Applicants may propose research components related to the application of SI, QIS, and/or microelectronics tools and methods. The scope of this highlighted work and its estimated budget must follow the guidance outlined in the HENP introduction section of this NOFO.

For FY 2027, a comparative review panel is expected in early 2027. Applications submitted by Monday, November 16, 2026, will be evaluated by the panel. Applications submitted after this deadline will be considered for funding in FY 2028.

FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by Thursday, September 2, 2027, for merit reviews by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Subprogram Contact:
Paul Sorensen, paul.sorensen@doe.gov
Website: https://science.osti.gov/np/research/

(o) Nuclear Data

The Nuclear Data subprogram is multi-disciplinary with applications to energy, defense, space, and medicine. Nuclear data underlies modeling and simulation software in nuclear applications, so it is key for ensuring results are accurate. Working groups have been established among researchers, as well as Federal programs, to help coordinate, prioritize, and fund research efforts to improve nuclear data in basic science and applied nuclear technologies.

In addition, the Nuclear Data subprogram collects, evaluates, and disseminates nuclear data with its support of the U.S. Nuclear Data Program (USNDP) and the National Nuclear Data Center (NNDC). This process combines historical and modern experiments, theory, and modeling to publish best values for nuclear properties such as cross sections and decay data. The extensive nuclear databases produced by this effort are an international resource consisting of carefully organized scientific information gathered over 50 years of nuclear physics research worldwide.

The Nuclear Data subprogram has two priorities in this NOFO:

- Integrating SI into USNDP library development, data management, and evaluation processes. Applicants to this priority area must either be part of, or partners with, the USNDP collaboration.
- Working on experimental nuclear data efforts to improve the nuclear reaction and decay uncertainties for nuclei relevant for power generation in nuclear fission and/or nuclear fusion applications. This priority includes nuclear data for power-generating reactions, structural materials, and decay heat. Applicants to this priority area must include an industry partner.

Applications that address nuclear data outside of these priorities are not of interest for FY 2027. The most recent needs have been discussed at the annual Workshop on Applied Nuclear Data Activities (WANDA).

All data generated under this topic must include sufficient uncertainty quantification and be shared with the USNDP collaboration so that improved data can get to end users as quickly as possible. For experiments using common techniques, detailed partial uncertainties for all known uncertainties should be provided to NNDC libraries (i.e., EXFOR), journals (at least as supplemental material), and nuclear data evaluators as best practice. For novel measurement techniques, a clear breakdown of known uncertainty sources should be provided to the same stakeholders.

FY 2028 comparative research review panels for HENP will meet in November 2027. Research applications for all programs are due by Thursday, September 2, 2027, for merit reviews by those panels. Applicants are strongly encouraged to submit pre-applications by July 29, 2027.

Subprogram Contact:
Keith Jankowski, keith.jankowski@doe.gov
Website: https://science.osti.gov/np/research/

6. Isotope R&D and Production (IRP)

Program website: https://science.osti.gov/Isotope-Research-Development-and-Production

The mission of the Isotope R&D and Production (IRP) program is to ensure a robust and secure domestic supply of isotopes vital for America's national security, scientific advancement, medical progress, and industrial competitiveness. As the Nation's sole domestic provider for approximately 300 isotopes, IRP is strategically reinforcing U.S. independence, fostering industry engagement, and fortifying infrastructure through dedicated research, robust operations, and strategic transition of technology to the private sector. Only the basic, fundamental, and use-inspired research portion of the IRP mission is supported by this NOFO.

IRP relies on expertise across numerous technical disciplines to accomplish its mission, including nuclear and radiochemistry, nuclear physics, accelerator and reactor science, materials science and engineering, separations science, nuclear data, and others. To promote a reliable domestic supply of stable and radioactive isotopes for research, Federal, and commercial entities, IRP uses specialized infrastructure across the National Laboratory complex and partner

universities. These facilities include particle accelerators, nuclear research reactors, isotope enrichment technologies, and radiochemical processing capabilities. Key production capabilities are located at Argonne, Brookhaven, Los Alamos, Oak Ridge, Pacific Northwest, and Savannah River National Laboratories, as well as university partners within the University Isotope Network, including Michigan State University, Texas A&M University, University of Alabama-Birmingham, University of Missouri, University of Washington, and University of Wisconsin-Madison.

IRP supports world-leading R&D associated with creating innovative and more efficient isotope production and processing techniques. Core research competencies associated with the IRP R&D portfolio include radio and nuclear chemistry, advanced targetry, SI and ML, robotics, automation, and advanced manufacturing concepts. Research, development, and fabrication of equipment directed toward any IRP mission-relevant topic may be proposed, but applications including extensive projects requiring detailed review of scope, budget, and schedule beyond the procedures for this announcement should first be socialized with the program office. In addition, applications should not attempt to bolster the case for facilities or major items of equipment not currently approved for funding or not expected to be available during the proposed work.

Although not an exhaustive list, three broad, basic, fundamental, and use-inspired research topics of interest to the IRP R&D portfolio are listed below. The topics seek basic research supporting development of advanced, cost-effective, and efficient technologies for producing, processing (including isotopic separations and the development of biological tracers), extracting, recycling, and distributing isotopes in short supply as well as aspects related to stable isotopes. Workforce development is viewed as an essential component of the Program's R&D portfolio.

You can find additional information about IRP on the program website.

(a) Novel Isotopes and Production Routes

Applications to this topic should be focused on basic research supporting novel or improved capabilities for inducing transmutation of atoms in targets to create radioisotopes that strongly align with the IRP mission space. This topic includes integrating AI and ML techniques to model and predict the purity and processing of radioisotopic products. Accelerator- and reactor-based isotope production have different considerations; applications to this topic can address either production modality. Robotics and advanced manufacturing techniques, as they apply to isotope production and processing, may also be proposed. Studies aimed at developing automated techniques to enhance the efficiency and safety of materials processing are also encouraged. Uses of SI or ML might include, but are not limited to, multi-physics modeling and advanced manufacturing. All applications should first be discussed with the subprogram contact listed below.

Subprogram Contact:
Ethan Balkin, ethan.balkin@doe.gov
Website: https://science.osti.gov/Isotope-Research-Development-and-Production

(b) Targetry and Isotope Production Research

Applications to this topic should be focused on basic research supporting novel or improved aspects of targetry and target fabrication in a variety of form factors and batch sizes (e.g., milligrams to kilograms), low-loss advanced manufacturing techniques, as well as the development of innovative approaches, including integration of SI and ML techniques to model and predict the purity and processing of stable isotope products as well as the behavior of targets undergoing irradiation to optimize yield and minimize target failures during routine isotope production. Accelerator- and reactor-based isotope production have different considerations; applications to this topic can address either production modality. Robotics and advanced manufacturing techniques, as they apply to isotope production and processing, may also be proposed. Studies aimed at developing automated techniques to enhance the efficiency and safety of materials processing are also encouraged. Uses of SI or ML might include, but are not limited to, multi-physics modeling and advanced manufacturing. All applications should first be discussed with the subprogram contacts listed below.

Subprogram Contacts:
Ethan Balkin, ethan.balkin@doe.gov
April Gillens, april.gillens@doe.gov
Website: https://science.osti.gov/Isotope-Research-Development-and-Production

(c) Radio/Nuclear and Chemical Separation, Purification, and Synthesis

Work in this topic broadly applies to basic research supporting the improvement and/or development of novel chemical and physical processes to recover and purify radioisotopes from activated targets or further refinement and purification of stable isotope feedstocks and final products. IRP also encourages applications proposing scopes of work dealing with isotopes resulting from activated targets along with those not necessarily resulting from direct transmutation of target material (e.g., the recovery and purification of radioisotopes from legacy materials, facility components, used nuclear fuel, or waste streams/effluents of other processing efforts).

In addition, basic research supporting the development or synthesis of chemical constructs or processes with physical or chemical properties that make them particularly useful in the isotope science landscape (e.g., the synthesis and development of novel chelating agents selective ion trapping ligands, chromatography resins, other novel separation technologies, or methods leading to increased chemical conversion efficiencies for stable isotope feedstocks and/or products) are programmatically very relevant.

Developing automated production and processing techniques to enhance the efficiency and safety of radioisotope production and processing (including uses of SI or ML and advanced manufacturing) are also encouraged.

Development of purification and separation techniques may, but do not have to, include the handling of radioactive materials or irradiation of targets (e.g., experiments based on surrogate material are acceptable). Scopes of work should be strongly aligned with the IRP

mission space. All applications should first be discussed with the subprogram contacts listed below.

Subprogram Contacts:
Ethan Balkin, ethan.balkin@doe.gov
April Gillens, april.gillens@doe.gov
Website: https://science.osti.gov/Isotope-Research-Development-and-Production

(d) Biological Tracers, Imaging, and Therapeutics

Work in this topic should be focused on basic research supporting the development of isotopes that might be useful as biological tracers, imaging, or therapeutic agents. Developing or modifying chemical constructs which have physical or chemical properties that make them particularly useful with isotopes in this category would also be considered responsive. This topic includes modifying existing agents and synthesizing and developing novel ligands, pharmacokinetic modifying linkers, or other hydrodynamic volume altering compounds. IRP funds only basic science R&D. Studies investigating the applications of isotopes will not be considered for funding. All applications should first be discussed with the subprogram contact listed below.

Subprogram Contact:
Ethan Balkin, ethan.balkin@doe.gov
Website: https://science.osti.gov/Isotope-Research-Development-and-Production

OTHER PROGRAMMATIC GUIDANCE

Multi-Institutional Teams

SC uses two different mechanisms to support teams of multiple institutions.

Collaborative Applications

Teams of multiple institutions may submit collaborative applications. Each submitted application in such a team must indicate that it is part of a collaborative project or group. Every partner institution must submit an application through its own sponsored research office. Each multi-institutional team can have only one lead institution. Each application within the multi-institutional team, including the title page, the narrative, and all required appendices and attachments, must be identical with the following exceptions. Each application must include a:

- Correct SF-424 (R&R)[6] cover page for the submitting institution only
- Unique budget corresponding to the expenditures for that application's submitting institution only
- Unique budget justification corresponding to the expenditures for that application's submitting institution only

[6] The Standard Form 424 (SF-424) family of forms is used to apply for Federal financial assistance through Grants.gov. The Research and Related (R&R) set of forms is used by the SC.

- Project/Performance Site Locations form for the submitting institution and its subawards
- List for the Identification of Merit Review Conflicts for the submitting institution's senior/key personnel and its subawards' senior/key personnel
- Research and Related Senior/Key Person Profile (Expanded) form with the biographical sketches and current and pending support from that institution's senior/key personnel
- Biographical sketches and current and pending support from each institution's senior/key personnel for the applicant leading the multi-institutional team only

Our intent is to create from the various applications associated with a multi-institutional team one document for merit review that consists of the common, identical materials combined with a set of detailed budgets from the partner institutions. Each team member's application must have the same project title. Team members may use Grants.gov Workspaces, webforms, and their system-to-system services in any combination.

Subawards[7]

Multi-institutional teams may submit one application from a designated lead institution with all other team members proposed as subrecipients.

DOE/National Nuclear Security Administration (NNSA) National Laboratories[8], other Federal agencies, and another Federal agency's FFRDCs,[9] if participating in a team led by another institution, may be proposed as subrecipients.

The value of any such proposed subaward may be removed from any such prime award: DOE may make separate awards to Federally affiliated institutions.

Distinguishing between Collaborative Applications and Subawards

Both collaborative applications and proposed subawards are ways multiple institutions can work together to reach the scientific objectives described in this NOFO. Choose the appropriate structure based on the nature of the scientific work being proposed. If multiple institutions will be functioning as a network of peer-level researchers, a collaborative structure would be more appropriate. If multiple institutions will be functioning with leadership and direction coming from one institution, a subaward arrangement would be more appropriate.

Collaborative applications are assembled from multiple identical applications submitted by the proposing institution. Such applications may be submitted under this NOFO in Grants.gov. The multiple applications will be assembled into one joint collaborative application,

---

[7] Subawards are made to subrecipients. Both terms are defined in 2 CFR 200.1 (https://www.ecfr.gov)

[8] The phrase "National Laboratories" is used broadly to encompass DOE/NNSA laboratories and sites capable of performing the work described in this NOFO and capable of receiving funds through the DOE Field Work System.

[9] You can find an authoritative list of all FFRDCs at https://www.nsf.gov/statistics/ffrdclist/.

which will be merit-reviewed as one document, with recommendations to fund or decline the application made at the level of each independent application.

Subawards exist when multiple institutions work together to submit one application with a designated prime recipient and multiple potential subrecipients. DOE/NNSA National Laboratories, other Federal agencies, and another Federal agency's FFRDCs may be proposed as subrecipients, but the value of any such proposed subaward may be removed from any such prime award: DOE will often make separate awards to Federally affiliated institutions.

A well-thought-out research plan and its associated budgets should leave no confusion about which institution will do which parts of the research.

Open Science

SC is dedicated to promoting the values of openness in Federally supported scientific research, including, but not limited to, ensuring that research can be reproduced and that the results of Federally supported research are made available to other researchers. These objectives can be met through any number of mechanisms, including but not limited to, data access plans, data-sharing agreements, archives and repositories, and various licensing schemes.

The phrase *open-source* does not refer to any particular licensing arrangement but is to be understood as encompassing any arrangement that furthers the objective of openness.

Export Control, Nonproliferation, Sanction, and Other Protocols

All entities submitting applications to this NOFO must recognize the moral and legal obligations to comply with export controls and policies that limit the transfer of technologies with potential dual use. Applicants are reminded that international activities must comply with nonproliferation, sanction, and other protocols described at https://www.trade.gov/export-solutions.

International activities related to special nuclear materials (SNM) are subject to additional requirements. Please see 10 C.F.R. part 810 for further information.

All work proposed under this NOFO must be for basic and fundamental research whose results may be published in scholarly literature. Do not submit applications containing restricted data or unclassified controlled nuclear information as defined in the Atomic Energy Act of 1954, as amended, 42 U.S.C. § 2011, et seq., 10 C.F.R. part 1017, 10 C.F.R. part 1045.

Program Goals, Objectives, and Priorities

SC's mission is to deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the U.S. SC is the Nation's largest Federal sponsor of basic research in the physical sciences and the lead Federal agency supporting fundamental scientific research for our Nation's energy future.

SC accomplishes its mission and advances national goals by supporting:

- The frontiers of science — exploring nature's mysteries from the study of fundamental subatomic particles, atoms, and molecules that are the building blocks of the materials of our universe and everything in it, to the DNA, proteins, and cells that are the building blocks of life. Each of the programs in SC supports research probing the most fundamental disciplinary questions.
- The 21st Century tools of science — providing the Nation's researchers with 28 state-of-the-art national scientific user facilities, the most advanced tools of modern science, propelling the U.S. to the forefront of science, technology development, and deployment through innovation.
- Science for energy and the environment — paving the knowledge foundation to spur discoveries and innovations for advancing DOE's mission in energy and environment. SC supports a wide range of funding modalities, from single principal investigators to large team-based activities, to engage in fundamental research on energy production, conversion, storage, transmission, and use and on our understanding of the earth systems.

SC is an established leader of the U.S. scientific discovery and innovation enterprise. Over the decades, SC investments and accomplishments in basic research and enabling research capabilities have provided the foundations for new technologies, businesses, and industries, making significant contributions to our Nation's economy, national security, and quality of life.

Awards resulting from this NOFO are intended to increase our understanding of scientific phenomena.

Expected Performance Goals

You will be expected to demonstrate progress toward increasing knowledge in periodic progress reports.

Applications Specifically Not of Interest

DOE will not review or consider the following types of applications as determined by DOE without appeal (also refer to the Responsiveness Review section below):

- Applications that fall outside the technical parameters specified in Background and Context
- Project concepts or approaches not based on established scientific principles (e.g., violates the laws of thermodynamics)

Statutory Authority

The programmatic authorizing statutes and governing regulations are:

- U.S. Department of Energy Organization Act, codified as amended at 42 U.S.C. § 7256 (2020)
- Act of Jul. 4, 2025, Pub. L. No. 119-21, § 50404, 139 Stat. 72 (2025)
- Energy Policy Act of 2005, Pub. L. No. 109-58, §§ 901, 911, 965, 119 Stat. 594 (2005)

- CHIPS and Science Act of 2022, Pub. L. No. 117-167, § 10731, 136 Stat. 1366 (2022)
- National Quantum Initiative Act, Pub. L. No. 115-368, § 401, 132 Stat. 5100, 5105 (2018)
- Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, codified at 2 C.F.R. part 200 (2024)
- U.S. Department of Energy Financial Assistance Rules, codified at 2 C.F.R. part 910 (2022)
- U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 C.F.R. part 605 (2014)
- U.S. Department of Energy Other Transaction Agreements Rule, codified at 2 C.F.R. part 930 (2025)

Program History

You can learn about SC's history, achievements, and awards at the following resources:

- History
- Achievements
- Awards

IV. Application Content and Form

This section includes application information specific to this NOFO. Refer to NOFO Part 2, *Application Content and Form*, for standard information that applies to all DOE NOFOs, such as formatting and content requirements and other requirements.

A. Preliminary Submissions

1. Letter of Intent (LOI)

Not applicable.

2. Pre-application

Pre-Application Due Date

Pre-applications may be submitted at any time while this NOFO is available. Some topics may have required or strongly encouraged submissions by specified dates if an application is to be considered by a review panel.

A pre-application (also called white paper) is recommended but optional for many topics. Before submitting a pre-application, read the information in Section III of this NOFO carefully to make sure your idea is responsive and to select the topical subprogram most relevant to your idea.

You must select a program manager when you submit your pre-application using the DOE SC PAMS website. Choose the subprogram contact for the topical area most relevant to your idea from those listed in Section III of this NOFO.

Feedback from DOE to the principal investigator is optional, but you are encouraged to use your submitted pre-application or white paper to initiate a discussion with the listed program manager about the appropriateness of the proposed research for this solicitation.

If a multi-institutional team is submitting collaborative applications, only the lead institution may submit a pre-application.

Pre-Application Format

The pre-application must begin with a title page that will not count toward the pre-application page limitation. Include, at the top of the first page, the following information:

Title of Pre-application
Principal Investigator Name, Job Title
[Lead] Institution
PI Phone Number, PI Email Address
NOFO Number: Include the NOFO Number indicated on the cover of this NOFO
Include a list of all senior/key personnel at the applicant and, if applicable, team member institutions

The title page must be followed by a clear and concise description of the objectives and technical approach of the proposed research. The pre-application may not exceed three pages, when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). The body text font must not be smaller than 11 point. Figures and references, if included, must fit within the three-page limit.

In addition, the pre-application must include a list of senior/key personnel and a listing of individuals who should not serve as merit reviewers of a subsequent application. Detailed instructions for how to craft the required listings are provided in Part 2 of this NOFO. **The list of individuals who should not serve as merit reviewers is rarely empty because the instructions contain mandatory inclusions requirements.** This listing will not count toward the pre-application's page limit. The list of individuals must be included as an "Additional Attachment" to your pre-application in PAMS.

The pre-application must be machine-readable. Do not submit a scanned image of a printed document.

The absence of an optional pre-application will not negatively affect an evaluation of a responsive application.

Pre-Application Submission

Pre-applications are created in the software system of your choice and must be submitted electronically through the DOE SC PAMS website. You cannot draft or edit a pre-application in PAMS. Do not submit a pre-application through FedConnect or Grants.gov.

Pre-applications may be submitted by a PI or by other users at the PI's institution with the "Submit to DOE" privilege in PAMS.

Applicants are strongly encouraged to inform their DOE Program Manager if teaming arrangements, proposed personnel, topics, or the anticipated title change between submitting the pre-application and when an application is submitted to ensure that their application is properly linked to their pre-application and that reviewers are properly assigned to the application.

Detailed instructions about how to submit a pre-application are in Part 2 of this NOFO.

B. Application

Applications in response to this NOFO must be submitted through Grants.gov. Detailed instructions for registering in and using Grants.gov are in Part 2 of this NOFO.

C. Component Pieces of the Application

Letters of Collaboration or Access

Letters from collaborators or from institutions providing access to data, models, software, equipment, or facilities may be appended to your Project Narrative and are not considered part of the Project Narrative's page limit. Please ensure that letters from collaborators or from institutions providing access to data, models, software, equipment, or facilities only describe the nature of the collaboration or the access to data, models, software, equipment, or facilities. Letters of recommendation are not allowed in applications under this NOFO.

Letters of collaboration or access should be placed in Appendix 7 (Other Attachments). Letters of collaboration or access must not be written as recommendation or endorsement letters, which are not allowed. Each letter of collaboration or access may contain two and only two sentences and must use the following format:

Dear <Principal Investigator Name>:

If your application entitled, "<Application Name>," is selected for funding under the FY 2027 Continuation of Solicitation for the Office of Science Financial Assistance Program, it is my intent to collaborate in this research by <Complete Sentence With a Very Short Description of What the Collaborator Offers to Do or Provide>.

Thank you for the opportunity to participate.

Sincerely,

<Collaborator's Name and Signature Block>

Scientific User Facilities

Documentation from any SC scientific user facility may be provided with other letters of collaboration or access in Appendix 7.

If the proposed research includes activities at the DIII-D National Fusion Facility, a U.S. DOE Office of Science user facility, then a Record of Discussion from the facility must be included in the submission. The Record of Discussion documents potential resources required by the facility to support the proposed research scope. Information on the Record of Discussion process at DIII-D is available online under the "Records of Discussion" header. A Record of Discussion form is available for download from that site.

1. SF-424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. The list of certifications and assurances referenced in Field 17 is available on the DOE Financial Assistance Forms website under Certifications and Assurances.[10] Applicants are bound by their representations and certifications in SAM.gov.

Type of Submission (Field 1)

Select the checkbox for "Application" for an initial submission. Select the checkbox for "Changed/Corrected Application" if submitting an updated version of an application. Do not submit pre-applications via Grants.gov: Do not select the checkbox for "Pre-application."

Identifying numbers (Field 4)

For renewals and supplemental funding, enter the DOE award number in Field 4a. Do not enter any other number in Field 4a. Do not enter anything in Field 4b. If submitting an updated version of an application, you may enter the previous Grants.gov Tracking ID in Field 4c, though this is not required.

UEI and EIN Numbers (Fields 5 and 6)

The Uniform Entity Identifier (UEI) and Employer Identification Number (EIN) fields on the SF-424 (R&R) form are used in PAMS to confirm the identity of the individual or organization submitting an application.

- Enter the UEI as a 12-digit alpha-numerical sequence.
- Enter the EIN as a nine-digit number.

[10] No separate form or submission is required for the Certifications and Assurances.

- Do not use hyphens or dashes.
- SC does not use the 12-digit EIN format required by some other agencies.
- Applications will not be rejected if an applicant's system-to-system service uses a 12-digit EIN format or inserts hyphens or dashes in an EIN.

Type of Application (Field 8)

A **new** application is one in which DOE support for the proposed research is being requested for the first time. A **renewal** application requests additional funding for a period of time following a current award. If the application requests a significant change in the scope of work, please consult with the subprogram contact identified in this NOFO to determine if the application should be considered new or a renewal.

SC does not use the Resubmission or Continuation options.

Applications for supplemental support of an existing award should be marked as "Revision."

Please answer "yes" to the question "Is this application being submitted to other agencies?" if substantially similar, identical, or closely related research objectives are being submitted to another Federal agency. Indicate the agency or agencies to which the similar objectives have been submitted.

Do not attach pre-applications to Field 20 of the SF-424(R&R) form or letters of intent to Field 21 of the SF-424(R&R) form.

DOE will accept new/renewal/supplemental applications under this NOFO. Information about how to distinguish between new and renewal applications is located in Part 2.

Applications for supplemental funding to existing SC awards compete for funding with all other applications submitted under this NOFO. Applications for supplemental funding may be made in two broad types:

1. **Supplemental funding**. These applications must indicate that they are requesting additional funding and must describe how the additional funds will be used. These applications must mark the box for "A. Increase Award" in Field 8 of the SF-424 (R&R) application form.
2. **Supplemental funding with additional time**. These applications must also indicate the need for additional time. These applications must mark the boxes for "A. Increase Award" and "C. Increase Duration" in Field 8 of the SF-424 (R&R) application form.

Regardless of whether or not an application for supplemental funding requests additional time, the application may propose a change in the scope of the award. If, in SC's determination, an application for supplemental funding proposes a change in scope, the application will be subject to merit review.

Applications for supplemental funding must include the existing award number in Field 4.a. of the SF-424 (R&R) application form and indicate that the type of application is a "Revision" in Field 8 of the SF-424 (R&R) application form.

Applicants intending to submit an application for supplemental funding are strongly encouraged to consult their DOE Program Manager before submitting the application.

Applications for supplemental funding to an existing SC award are typically intended to address extraordinary or unexpected circumstances and may include, but are not limited to, requests for:

- Support for additional personnel (e.g., graduate students, postdocs, research technicians or equivalent)
- Replacing or repairing equipment (items with a useful life of more than 12 months and a per-item acquisition cost of more than $10,000) required to conduct proposed research
- Previously unrequested travel for project personnel to attend one or more user facilities, scientific conferences, workshops, or professional society meetings relevant to the proposed research
- Support for temporary personnel to continue productivity of work while project personnel are on extended leave in accordance with the recipient institution's policies, whether for family, parental, military service, or other extended leave
    - If a PI or other senior/key personnel disengage for more than three months (or 25% of their approved effort), it requires agency prior approval separate from the request for supplemental funds.
- Purchase of new equipment, modification of existing equipment, or the provision of services to enable work to be carried out by project personnel with disabilities
- Support for increased costs for previously budgeted and approved materials, supplies, or equipment

All costs requested in a budget must conform to the applicable cost principles.

2. Research and Related Other Project Information

Complete questions in Fields 1 through 6 of the SF-424 Research and Related Other Project Information form.

Note regarding question 4.a. and 4.b.

If any environmental impact, positive or negative, is anticipated, indicate "yes" in response to question 4.a., "potential impact – positive or negative - on the environment." Disclosure of the impact should be provided in response to question 4.b. First, indicate whether the impact is positive or negative and then identify the area of concern (e.g., air, water, exposure to radiation, impacts to endangered species or historic properties, etc.).

For actions that could have adverse impacts to the environment or have any possibility for adverse impacts to human health (e.g., use of human subjects, Biosafety Level 3-4 laboratory construction/operation, manufacture or use of certain nanoscale materials which are known to

impact human health, or any activities involving transuranic or high level radioactive waste, or use of or exposure to any radioactive materials beyond de minimis levels), applicants should indicate a "negative" impact on the environment.

Lastly, based on requirements and guidance in 10 C.F.R. § 1021.102 and DOE's NEPA Implementing Procedures, to find that a proposal is covered by a categorical exclusion (CX), DOE will determine if: (1) the proposal fits within one or more classes of actions for which CXs are permissible, (2) there are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal (DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the CX would apply), and (3) the proposal has not been segmented to meet the definition of a CX.

The bulk of your application will consist of files attached to the Research and Related Other Project Information form. The files must comply with the following instructions:

Project Summary/Abstract (Field 7 on the Form)

The project summary/abstract is a summary of the proposed activity suitable for distribution to the public and sufficient to permit potential reviewers to identify conflicts of interest. It must be a self-contained document. The project summary/abstract must include:

- The project title, the PI name and the PI's institutional affiliation, and any coinvestigators and their institutional affiliations. This information will not count toward the abstract's one-page limit.
- This information must be followed by a statement of the project's objectives, a description of the project, including methods to be employed, and the potential impact of the project (i.e., benefits, outcomes).
- The description of the proposed research may not exceed one page (excluding Project Title and list of investigators) when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). The body text font must not be smaller than 11 point. Figures and references, if included, must fit within the one-page limit.

A sample is provided below:

Project Title A. Smith, Lead Institution (Principal Investigator) A. Brown, Institution 2 (Co-Investigator) A. Jones, Institution 3 (Co-Investigator) Text of abstract (no more than one page, excluding Project Title and list of investigators)

If an application is recommended for award, the project summary will be used to prepare a public abstract about the award. Award abstracts and titles form a government document that

describes the project and justifies the expenditure of Federal funds in light of the DOE and SC mission statements.

- Do not include any proprietary or sensitive business information.
- DOE may use the abstract to prepare public reports about supported research.

DOE Title Page
(Part of Project Narrative attached to Field 8 on the form)

The application narrative must begin with a title page. The title page must include the following items:

- The project title
- Applicant/Institution
- Street address, city, state, ZIP
- Postal address
- Lead PI name, telephone number, email
- Administrative point of contact name, telephone number, email
- NOFO number printed on the cover of this NOFO
- DOE/SC program office
- DOE/SC program office technical contact
- DOE award number (if renewal application)
- PAMS pre-application tracking number (if applicable)
- Research area or areas as identified in Section III of this NOFO

Senior/Key Personnel

- Senior/Key Personnel Name, Institution
- Senior/Key Personnel Name, Institution
- Senior/Key Personnel Name, Institution
- …

Institution	Year 1 Budget	Year 2 Budget	Year … Budget	Total Budget

Important Instructions to the Sponsored Research Office of Submitting Institutions

SC requires you to create one single, machine-readable PDF file that contains the DOE Title Page, Project Narrative, all required appendices, and other attachments. This single PDF file may not be scanned from a printed document and must be attached in Field 8 on the Grants.gov form. This file must be a plain PDF file consisting of text, numbers, and images without editable fields, signatures, passwords, redactions, or other advanced features available in some PDF-compatible software. Do not use PDF portfolios or binders.

The Project Narrative will be read by SC staff using the full version of Adobe Acrobat. Please ensure the narrative is readable in Acrobat. If combining multiple files into one Project Narrative, ensure that a PDF portfolio or binder is not created. If creating PDF files using any software other than Adobe Acrobat, please use a "Print to PDF" or equivalent process to ensure that all content is visible in the Project Narrative. Once a Project Narrative has been assembled, please submit the combined Project Narrative file through a "Print to PDF" or equivalent process to ensure that all content is visible in one PDF file that can be viewed in Adobe Acrobat. Do not attach any of the appendices listed in this paragraph separately in any other field in Grants.gov. If you do, these additional attachments will not become part of the application in PAMS.

Title Page Supplement for Collaborative Applications (Part of Project Narrative attached to Field 8 on the Form)

If a multi-institutional team is submitting collaborative applications, provide the following information on a separate page as a supplement to the title page. This page will not count toward the Project Narrative page limitation.

- List all institutions by name with each institution's PI on the same line
- Indicate the lead PI who will be the point of contact and coordinator for the combined research activity
- Provide a statement explaining the leadership structure of the team
- Include a description of each institution's facilities, equipment, and resources that will be made available to the team
- If applicable, explain how students and early-stage researchers will be trained and mentored by senior researchers
- Include a table modeled on the following chart providing summary budget information from all institutions
- In that table, provide the total costs of the budget request in each year for each institution and totals for all rows and columns

Example budget table ($ in thousands)

	Names	**Institution**	**Year 1 Budget**	**Year 2 Budget**	**Year … Budget**	**Total Budget**
Lead PI						
Co-PI						
Co-PI						
Co-PI						

* Collaborative applications must be submitted separately.

Project Narrative (Field 8 on the form)

The Project Narrative consists of technical information, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). The body text font of all main text must not be smaller than 11 point.

Do not include any websites (URLs) that provide supplementary or additional information that constitutes a part of the application. Merit reviewers are not required to access websites; however, internet publications in a list of references will be treated identically to print publications. See Part 2 of this NOFO for instructions on how to mark proprietary application information. To attach a Project Narrative, click "Add Attachment."

The Project Narrative includes the research plan for the project. It should contain enough background material in the Introduction, including a brief review of the relevant literature and any prior research in this area, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project and should indicate which project personnel will be responsible for which activities. There should be no ambiguity about which personnel will perform particular parts of the project or the time when these activities will take place.

The following organization of the Project Narrative is suggested:

- **Background/Introduction**: explanation of the importance and relevance of the proposed work as well as a review of the relevant literature
- **Project Objectives:** a clear, concise statement of the specific objectives or aims of the proposed project
- **Progress Report (for renewal applications only):** a section that describes the results of the work accomplished during the current project period (since the last new or renewal award), analyzes how the results relate to the activities proposed to be undertaken during the renewal period, describes any changes that affected the overall direction of the research being performed, and includes an estimate of any remaining funds from the current project period at its anticipated end
- **Proposed Research and Methods**: the hypotheses to be tested (if any) and details of the methods to be used, including the integration of experiments with theoretical and computational research efforts.

The Project Narrative is considered the intellectual work of the proposed researchers. Concurrent submission of the same or substantially similar narratives attributed to different researchers may constitute academic dishonesty or research misconduct. Submitting a Project Narrative that is not the work of the proposed researchers, including machine-generated Project Narratives, may constitute academic dishonesty or research misconduct.

SC will apply a "fair-use" concept regarding use of generative super intelligence to support investigators' efforts in presenting their intellectual work in an application. Guided by the principles expressed by others (ACM.org and IEEE.org), applicants must disclose the use of any SI tools in applications, unless the tools were used solely for editing an original draft.

For Collaborative Applications Only

Each institution in a multi-institutional team submitting collaborative applications must submit an identical common narrative, including all appendices. Collaborative applications will necessarily be longer than single-institution applications. The common narrative must identify which tasks and activities will be performed by which of the institutions in every budget period of the proposed project. The budget and the budget justification — which are unique to each institution — may refer to parts of the common narrative to further identify each institution's activities in the joint project. There should be no ambiguity about each institution's role and participation in the team.

SC will use the multiple applications associated with a multi-institutional team to create one consolidated document for merit review that consists of the common, identical application materials, a set of detailed budgets from the partner institutions, and the senior/key personnel form (with attached biographical sketches and current and pending support statements). Every Project Narrative in the team *must* be identical (including the title).

Buy America Preference for Infrastructure Projects

Awards funded through this NOFO that are for, or contain, construction, alteration, maintenance, or repair of public infrastructure in the U.S. undertaken by applicable recipient types, require that:

- All iron, steel, and manufactured products used in the infrastructure project are produced in the U.S.; and
- All construction materials used in the infrastructure project are manufactured in the U.S.

Applicants should consult 2 C.F.R. part 184 and Part 2 of this NOFO to determine whether the Buy America Preference applies and if they should consider the application of the Buy America Preference in the proposed project's budget and/or schedule.

Within the first two (2) pages of the Project Narrative, include a short statement on whether the project will involve the construction, alteration, maintenance and/or repair of public infrastructure in the U.S. See Part 2 of this NOFO for applicable definitions and other information regarding Infrastructure Projects and the Buy America Preference.

Appendices

Do not attach any of the requested appendices described below as files for Fields 9, 10, 11, and 12 on the SF-424 Research and Related Other Project Information form in Grants.gov. Follow the below instructions to include the information as appendices in the single Project Narrative file.

Biographical sketches and current and pending support may no longer be provided as attachments to a Project Narrative. These documents must be attached to the Research and Related Senior/Key Person Profile (Expanded) form in an application.

Appendix 1: Bibliography & References Cited

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article title and journal name, book title, volume number, page numbers, and year of publication.

For research areas where there are routinely more than ten coauthors of archival publications, you may use an abbreviated style such as the *Physical Review Letters* (PRL) convention for citations (listing only the first author). For example, your paper may be listed as: "A Really Important New Result," A. Aardvark et. al. (MONGO Collaboration), PRL 999.

Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. Provide the Bibliography and References Cited information as an appendix to your Project Narrative.

Do not attach a bibliography to Field 9 of the Research and Related Other Project Information form.

Appendix 2: Facilities and Other Resources

This information is used to assess the capability of the organizational resources, including subrecipient resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. For proposed investigations requiring access to experimental user facilities maintained by institutions other than the applicant, provide a document from the facility manager confirming that researchers will have access to the facility. Such documents, provided they do not become letters of support or recommendation, may be printed on any letterhead. Provide the Facility and Other Resource information as an appendix to your Project Narrative.

Do not attach a facilities and other resources statement to Field 10 of the Research and Related Other Project Information form.

Appendix 3: Equipment

List major items of equipment already available for this project and, if appropriate, identify location and pertinent capabilities. Provide the Equipment information as an appendix to your Project Narrative.

Do not attach an equipment statement to Field 11 of the Research and Related Other Project Information form.

Appendix 4: Data Management and Sharing Plan

Provide a Data Management and Sharing Plan (DMSP) as an appendix to the Project Narrative. DMSPs are not required for applications that only request support for a conference, workshop, or scientific meeting. Subject to applicable cost principles, applications may request costs necessary for implementing the DMSP.

Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.

The standard requirements for a DMSP may be found in Part 2 of this NOFO. In addition, the DMSP should specifically address:

- How FAIR (Findable, Accessible, Interoperable, and Reusable)[11] principles will apply to the anticipated data sets, software,[12] and models[13] to be developed
- What developed software, data sets, and models will be made available using an "opensource" licensing arrangement, noting the Software Package Data Exchange (SPDX) identifiers when possible
  - Where deviation in this arrangement is expected from The Open Source Initiative's Open Source Definition, you must provide a specific justification.
- How best practices in scientific software development will be applied to any development activities
  - You can find more information on best practices, on the Better Scientific Software website.

Appendix 5: Synergistic Activities (Optional)

In addition to biographical sketches in the Common Format, each senior/key person may provide a one-page list of no more than five distinct examples of synergistic activities that demonstrate the individual's professional and scholarly activities that focus on the integration, transfer, and creation of knowledge as related to the application.

Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.

---

[11] Wilkinson, M. D. et al. The FAIR Guiding Principles for Scientific Data Management and Stewardship. Sci. Data 3:160018, 2016. https://doi.org/10.1038/sdata.2016.18

[12] Chue Hong, N. P., Katz, D. S., Barker, M., Lamprecht, A-L, Martinez, C., Psomopoulos, F. E., Harrow, J., Castro, L. J., Gruenpeter, M., Martinez, P. A., Honeyman, T., et al. (2022). FAIR Principles for Research Software version 1.0. (FAIR4RS Principles v1.0). Research Data Alliance. DOI: https://doi.org/10.15497/RDA00068

[13] Ravi, N., Chaturvedi, P., Huerta, E.A. et al. FAIR principles for AI models with a practical application for accelerated high energy diffraction microscopy. Sci Data 9, 657 (2022). https://doi.org/10.1038/s41597-022-01712-9

This appendix may not exceed a limit of the same number of pages as senior/key personnel when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). This appendix will not count in the Project Narrative page limitation.

Appendix 6: Transparency of Foreign Connections

As an appendix to your Project Narrative, applicants must provide the following information as it relates to the proposed recipient and subrecipients. Include a separate disclosure for the applicant and each proposed subrecipient.

Disclosure exceptions by entity type:

- U.S. National Laboratories and domestic government entities are not required to respond to the Transparency of Foreign Connections disclosure.
- Institutions of higher education and non-profit research organizations are only required to respond to items with an asterisk symbol (*).

Applicants, regardless of entity type, must provide complete responses for all proposed subrecipients that are not U.S. National Laboratories, domestic government entities, or institutions of higher education.

Disclosure Format

For the convenience of the entity providing the disclosure and certification a template is available at Transparency of Foreign Connections | Department of Energy, however, the entity is not required to use this specific format. If another format is used, the signatory must include the same substantive information, a signature, date, and the certification statement provided at Transparency of Foreign Connections | Department of Energy.

If you have questions, email your questions to rtesinfo@hq.doe.gov.

DOE reserves the right to request additional or clarifying information based on the information submitted.

Appendix 7: Other Attachment

If you need to elaborate on your responses to questions 1–6 on the "Other Project Information" document, please provide the Other Attachment information as an appendix to your Project Narrative. Information not easily accessible to a reviewer may be included in this appendix, but do not use this appendix to circumvent the page limitations of the application. Reviewers are not required to consider information in this appendix.

Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.

Reminders Regarding all Appendices

- Follow the above instructions to include the information as appendices to the Project Narrative file.
- Do not attach any appendices to Fields 9, 10, 11, or 12.

3. Research and Related Senior/Key Person Profile (Expanded)

Complete the Research and Related Senior/Key Person Profile (Expanded) form in accordance with the instructions on the form and the following instructions. Complete this form before the Budget form to populate data on the Budget form.

You must submit this information for the PI and all senior/key personnel who will be identified by name in Section A of the application's budget. List all other personnel who contribute in a substantive, meaningful way to the scientific development or execution of the project whether or not salaries are requested. Consultants should be included in the *Senior/Key Person Profile (Expanded)* form if they meet this definition. List individuals that meet the definition of senior/key regardless of what organization they work for. Senior/key personnel must be aware they are included in the application and must agree to perform the work if awarded. The form will pre-populate with the PI identified on the SF-424(R&R) form. For each senior/key person:

- Complete the required sections in their profile.
- In the "credential" field, enter the person's PAMS username, if known.
- Attach the person's biographical sketch, following the instructions in Part 2 of this NOFO for crafting a biographical sketch.
- Attach the person's current and pending support, following the instructions in Part 2 of this NOFO for crafting current and pending support.

The Senior/Key Person Profile (Expanded) form will support the PI and up to 99 additional senior/key personnel. On the addition of the 99th senior/key person, you will be presented with an option to upload an additional file with the required information for all other senior/key personnel.

4. Research And Related Budget

Complete the Research and Related Budget form in accordance with the instructions on the form (activate Help Mode to see instructions) and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all mandatory information on the form before the NEXT PERIOD button is activated. All fields with a red border are required, but you may enter a zero "0" in any field you are not requesting funds for. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this NOFO.

You can find additional information in Part 2 of this NOFO.

Budget Justification (Field L on the form)

Provide a justification that explains all costs proposed in the budget. The following items of advice are offered to assist you in developing a justification.

- Organize the justification by listing items in the same order as presented on the budget.
- Ensure the narrative matches the budget in dollar amounts and language.
- Explain the line items. If costs are estimated, provide a basis for the estimate. Explain if costs are based on prior experience of similar activities. If a cost is based on the product of two numbers (such as a number of items at a per-item price), ensure your math is correct.
- If including an inflationary factor for future budget periods, explain the basis for the inflationary factor.

Provide any other information you wish to submit to justify your budget request. Including items in the budget justification is not considered a form of cost sharing. Provide the details of all personnel (key or other) who will be working on the award, regardless of their sources of compensation. Explain their sources of compensation if it is not from this award. Include the indirect cost rate agreement as a part of the budget justification.

Attach a single budget justification file for the entire project period in Field L. The file automatically carries over to each budget year.

You can find additional information in Part 2 of this NOFO.

5. R&R Subaward Budget Attachments Form

Budgets for Subawards

You must provide a separate R&R budget and budget justification for each subrecipient. Download the *R&R Budget Attachment* from the *R&R Subaward Budget Attachments Form* and either email it to each subrecipient that is required to submit a separate budget or use the collaborative features of Workspace.

After the subrecipient has either emailed its completed budget back to you or completed it within Workspace, attach it to one of the blocks provided on the form. All fields with a red border are required, but you may enter a zero "0" in any field you are not requesting funds for. Use up to 10 letters of the subrecipient's name (plus.pdf) as the file name (e.g., ucla.pdf or energyres.pdf). Filenames must not exceed 50 characters.

If the project involves more subrecipients than there are places in the *Subaward Budget Attachments Form*, the additional subaward budgets may be saved as PDF files and appended to the Budget Justification attached to Field L.

Applicants should consult their local information technology (IT) support resources for any necessary assistance in converting the forms downloaded from Grants.gov into plain PDF files that can be combined into one non-Portfolio PDF file (the Budget Justification).

Ensure any files received from subrecipients are the PDF files extracted from the *Subaward Budget Attachments Form*. Errors will occur if a subrecipient sends a prime applicant a budget form that was not extracted from the application package.

In addition, the prime award budget request should include any subawards to a DOE/NNSA National Laboratory, a Federal agency, or another Federal agency's FFRDC, and subaward budgets and budget justifications should be included in the application. The details of such proposed budgets are essential for understanding and analyzing the proposed research. If recommended for an award, a revised budget will be requested where the value of such proposed subawards is deducted from any resulting award. SC will pay those classes of organizations directly.

If the budget for an application is comprised of discrete or separable projects or tasks, the *Subaward Budget Attachments Form* allows you to identify a budget as belonging to either a "project" or a "subaward."

The standard subaward budget form allows for a maximum of 10 subawards. If an application contains more than ten subawards, please present the budgets for the 11th and subsequent subawards in a tabular format, followed by the appropriate budget justification, as a part of the lead applicant's budget justification.

6. Project/Performance Site Locations

Indicate the primary site where the work will be performed. If a portion of the project will be performed at any other sites, identify the site locations in the blocks provided.

The Project/Performance Site congressional district is entered in the format of the 2-digit state code followed by a dash and a 3-digit congressional district code, for example VA-001. Hover over this field for additional instructions.

Use the *Next Site* button to expand the form to add additional Project/Performance Site Locations.

7. Disclosure of Lobbying Activities (SF-LLL)

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, *Disclosure Form to Report Lobbying*. Applicants that have never paid any person for influencing or attempting to influence an officer or employee of any agency, a

member of Congress, an officer or employee of Congress, or an employee of a member of Congress do not need to submit this form.

8. Identification of Merit Reviewer Conflicts

Provide a list of individuals who should not serve as merit reviewers of this application, following the instructions in Part 2 of this NOFO. Attach this information to Field 12 of the Research and Related Other Project Information Form.

9. Summary of Required Forms/Files

Your application must include the following items:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
Research and Related Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative, including required appendices	PDF	Field 8
Identification of Merit Review Conflicts	File	Field 12
Research and Related Senior/Key Person Profile (Expanded)	Form	N/A
Research and Related Budget	Form	N/A
Budget Justification	PDF	Field L
R&R Subaward Budget Attachments Form (if applicable)	Form	N/A
Subaward Budget Justification (if applicable)	PDF	Field L of the subaward budget
Project/Performance Site Locations	Form	N/A
SF-LLL Disclosure of Lobbying Activities, if applicable	Form	N/A

D. Information Submitted After Application but Before Award

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 C.F.R. § 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment letter from third parties contributing to cost sharing, if applicable

- Environmental information
- Information required to resolve concerns about conflicts of interest, conflicts of commitment, potential duplication of support

Applicants that do not already have an Indirect Cost Rate Agreement with their Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency should begin preparing an Indirect Cost Rate Proposal for submission, on request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

Use and Disclosure of Application Information

In addition to the information provided in NOFO Part 2, *Use and Disclosure of Application Information*, for compliance with *Presidential Memorandum Simplifying the Funding of Energy Infrastructure and Critical Mineral and Material Projects*, the Department of Energy may share and use within the Government any application information provided by or on behalf of the applicant. Accordingly, in accordance with applicable law and notwithstanding any other provisions herein, by submitting an application or agreeing to a financial assistance arrangement with the Department of Energy under this NOFO, the applicant is providing consent for any properly marked trade secret, confidential, proprietary, privileged or otherwise sensitive application information provided by or on behalf of the applicant to be disclosed to the Executive Office of the President and relevant Agencies offering loans, grants, equity, guarantees or other Federal funding, for the purposes of the *Presidential Memorandum on Simplifying the Funding of Energy Infrastructure and Critical Mineral and Material Projects*.

V. Submission Requirements and Deadlines

You **must** take several one-time actions before applying to this NOFO. Some of these tasks may take several weeks. These requirements are outlined in detail in the NOFO Part 2, *Get Registered and Required Registrations*.

A. Address to Request Application Package

Application forms and instructions are available at Grants.gov. To access these materials, go to Grants.gov, select "Search Grants," and then enter the Assistance Listings[14] number (81.049) and/or the NOFO number shown on the cover of this NOFO. Select the "Apply" button to access the application package.

Applications submitted through FedConnect will not be accepted. Applications may not be submitted through PAMS.

[14] The Assistance Listings were formerly known as the Catalog of Federal Domestic Assistance (CFDA).

Detailed instructions for registering in and using Grants.gov are in Part 2 of this NOFO.

B. Unique Entity Identifier (UEI) and System for Award Management (SAM.gov)

Applicants must complete a series of registrations and enrollments to submit applications in response to this NOFO. Applicants not currently registered with SAM.gov and Grants.gov should allow **at least four weeks** to complete these requirements. Applicants refers to the legal entity submitting an application. The applicant is usually a corporate entity, not an individual investigator.

You should start the process as soon as possible.

You may not be able to use your preferred Internet browser. Each system has its own requirements.

Applicants must register with SAM.gov and obtain a Unique Entity Identifier (UEI). You can find assistance with this process at the SAM Help Desk.

Applicants must provide a Taxpayer Identification Number (TIN) to complete their registration in SAM.gov. An applicant's TIN is an EIN assigned by the Internal Revenue Service (IRS). You may obtain an EIN online from the IRS if you don't already have one. Do not use a social security number in place of a TIN.

If entities have technical difficulties with the UEI validation or SAM registration process, use the Help feature on SAM.gov. SAM.gov will work entity service tickets in the order they receive them and asks that entities not create multiple service tickets for the same request or technical issue.

1. Requirements for System for Award Management

Unless exempt from this requirement under 2 C.F.R. § 25.110, the recipient must maintain a current and active registration in SAM.gov. The recipient's registration must always be current and active until the recipient submits all final reports required under this Federal award or receives the final payment, whichever is later. The recipient must review and update its information in SAM.gov at least annually from the date of its initial registration or any subsequent updates to ensure it is current, accurate, and complete. If applicable, this requirement includes identifying the recipient's immediate and highest-level owner and subsidiaries and providing information about the recipient's predecessors that have received a Federal award or contract within the last three years.

2. Requirement for Unique Entity Identifier (UEI)

If the recipient is authorized to make subawards under this Federal award, the recipient:

- Must notify potential subrecipients that no entity may receive a subaward until the entity has provided its UEI to the recipient.
- Must not make a subaward to an entity unless the entity has provided its UEI to the recipient.
  - Subrecipients are not required to complete full registration in SAM.gov to obtain a UEI.

C. Submission Instructions

Letters of Intent (LOIs) and pre-applications, if permitted under this NOFO, must be submitted in PAMS. Detailed instructions for LOIs are in Part 2 of this NOFO. Detailed instructions for pre-applications are in Part 2 of this NOFO.

Applications must be submitted in Grants.gov. Detailed instructions are in Part 2 of this NOFO.

D. Submission Dates and Times

1. Letter of Intent Due Date

Not applicable.

2. Pre-application Due Date

Optional pre-applications may be submitted at any time while this NOFO is available. Some topics may have required or strongly encouraged submissions by specified dates if an application is to be considered by a review panel.

3. Application Due Date

This NOFO will remain open until September 30, 2027, at 11:59 PM Eastern Time, or until it is succeeded by another issuance, whichever occurs first. This NOFO succeeds DE-FOA-0003600, which was published September 30, 2025.

Applications for conference or workshop support must be submitted at least six months before the meeting date and no later than April 1, 2027, to be considered for FY 2027 funding.

Renewal applications compete with all other applications and must be submitted through Grants.gov at least six months before the scheduled expiration of the current award's project period. Earlier submission is strongly encouraged to allow for timely processing.

Intergovernmental Review

This NOFO is not subject to Executive Order 12372, Intergovernmental Review of Federal Programs.

VI. Application Review Information

Standards for Application Evaluation

Applications that pass the initial review will be subjected to a formal merit review and will be evaluated based on the criteria codified at 10 C.F.R. § 605.10(d) in accordance with the guidance provided in the Office of Science Merit Review System for Financial Assistance.

Responsiveness Review

We will not review or consider the following concept papers and applications:

- Project concepts or approaches identified as NOT of interest (see the Applications Specifically Not of Interest section above)
- Applicants and applications that do NOT meet the Eligibility Criteria in NOFO Parts 1 and 2

Review Criteria

1. Compliance Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 C.F.R. § 605.10(b) to determine that: (1) the applicant is eligible for the award; (2) the information required by the NOFO, including LOIs or pre-applications, has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the NOFO; and (5) the proposed project does not duplicate programmatic work. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

2. Technical Review Criteria

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following criteria, listed in descending order of importance, as found in 10 C.F.R. § 605.10 (d), the Office of Science Financial Assistance Program Rule.

- Scientific and/or Technical Merit of the Project
- Appropriateness of the Proposed Method or Approach
- Competency of Applicant's Personnel and Adequacy of Proposed Resources
- Reasonableness and Appropriateness of the Proposed Budget
- Appropriateness of the Data Management and Sharing Plan

External peer reviewers are selected regarding both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and

submitting an application constitutes agreement that this is acceptable to the investigators and the submitting institution.

The questions below are provided to the merit reviewers to elaborate the criteria established by regulation:

1. Scientific and/or Technical Merit of the Project

- What is the scientific innovation of the proposed research?
- What is the likelihood of achieving valuable results?
- How might the results of the proposed work impact the direction, progress, and thinking in relevant scientific fields of research?
- How does the proposed work compare with other efforts in its field, both in terms of scientific and/or technical merit and originality?
- *For renewal applications only*: Is the proposed work an appropriate outgrowth of, continuation to, or successor of the currently supported research?

2. Appropriateness of the Proposed Method or Approach

- How logical and feasible are the research approaches?
- Does the proposed research employ innovative concepts or methods?
- Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to scientifically valid conclusions?
- Does the applicant recognize significant potential problems and consider alternative strategies?
- Is the proposed research aligned with the published priorities identified or incorporated by reference in Section III of this NOFO?

3. Competency of Applicant's Personnel and Adequacy of Proposed Resources

- How well qualified is the research team to carry out the proposed research?
- Are the research environment and facilities adequate for performing the research?
- Does the proposed work take advantage of unique facilities and capabilities?
- *For renewal applications only*: What is the past performance and potential of the research team?

4. Reasonableness and Appropriateness of the Proposed Budget

- Are the proposed budget and staffing levels adequate to carry out the proposed research?
- Is the budget reasonable and appropriate for the scope?

5. Appropriateness of the Data Management and Sharing Plan

- To what extent does the Data Management and Sharing Plan (DMSP) enable data generated during the research project to be publicly shared and preserved in a timely and fair manner that enables validation and replication of results?
- How well do the selected digital repositories enable appropriate sharing of scientific data?
- Does the DMSP adequately justify any limitations of data sharing?
- Are there any weaknesses in the DMSP that should be addressed prior to the start of the project?

Review and Selection Process

Applications submitted to this NOFO will be reviewed and considered for funding on a rolling basis. Applicants are cautioned that the Federal budget cycle may impact the availability of funds. Applications submitted in the latter half of the Federal FY (April 1 – September 30) may be considered for funding in the next FY.

Other Selection Factors

The Selection Official may consider any of the following program policy factors in making the selection, listed in no order of significance:

- Availability of funds
- Relevance of the proposed activity to SC priorities
- Relevance of the proposed activity to the President's policy priorities
- Ensuring an appropriate balance of activities within SC programs
- Performance under current awards
- Commitment to sharing the results and products of research
- Promoting principal investigators not previously supported by SC
- Promoting institutions not previously supported by SC
- Commitment to complying with administration policies, procedures, and guidance related to Gold Standard Science
- Institutional history of training and mentoring students, postdoctoral, and early-career researchers
- Participation with multi-institutional teams in accordance with program priorities identified and incorporated in Section III of this NOFO

VII. Selection and Award Notices

The NOFO Part 2, *Selection and Award Notices*, provides information on notifications for concept papers (if applicable), applications, award negotiations, and post-selection information requests.

VIII. Award Administration Information

Post-Award Requirements and Administration

DOE requires all award recipients to follow and accept requirements governed by laws and policies — both Federal and DOE. These post-award requirements include:

- National and administrative policy requirements
- National Assurance Policies
- Financial assistance general certifications and representations
- Build America, Buy America requirements
- Fraud, waste, and abuse requirements
- Safety, security, and regulatory requirements
- Environmental review with the National Environmental Policy Act requirements

Please review the Standard Award Terms and Conditions, the sample Federal Assistance Reporting Checklist, and standard Intellectual Property (IP) Provisions to better understand post-award requirements and administration.

Post-award requirements and administration that apply to awards funded under this NOFO are identified below. Detailed descriptions of standard requirements are provided in NOFO Part 2, *Post-Award Requirements and Administration*.

1. Government Rights in Data

The U.S. Government rights to data produced under an award or used in the performance of the award varies according to the following classifications.

Normally, the government has unlimited rights in technical data created under a DOE agreement, including the right to distribute to the public. Delivery or third-party licensing of proprietary software or data developed solely at private expense (Limited Rights Data) will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to ensure the commercialization of technology developed under a DOE agreement.

If software is specified for delivery to DOE, or if other special circumstances exist (e.g., DOE specifying "open-source" treatment of software), then the DOE Contracting Officer, after negotiation with the recipient, may include special provisions in the award requiring the recipient to obtain written approval of the DOE Contracting Officer prior to asserting copyright in the software, modifying the retained Government license, or otherwise altering the copyright provisions.

IX. Other Information

Please see NOFO Part 2, *Other Information*, for additional information, acronyms, and requirements that apply to all DOE NOFOs.