

**Program Announcement  
To DOE National Laboratories**

**LAB 12-597**

**Office of Science  
Office of High Energy Physics**

*Second Generation Dark Matter Experiments*

**GENERAL INQUIRIES ABOUT THIS PROGRAM ANNOUNCEMENT TO DOE  
NATIONAL LABORATORIES SHOULD BE DIRECTED TO:**

**Technical/Scientific Program Contact:**

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**SUMMARY:**

The Office of High Energy Physics (OHEP) at the U. S. Department of Energy's Office of Science, hereby announce their interest in receiving new proposals for support of experiments dedicated to the direct detection of dark matter. Only those experiments qualifying as "second-generation" experiments will be considered, i.e., those with the capability to improve by at least an order of magnitude our current knowledge of physical dark matter parameters. Proposals selected in response to this Program Announcement will be funded in FY13 for one year of research and development (R&D) and pre-conceptual design.

A companion Funding Opportunity Announcement, DE-FOA-0000597, will also be posted on the Office of Science Grants and Contracts web site at: <http://www.science.doe.gov/grants>.

**Letter of Intent:**  
**(Requested/Not Required)**

A **Letter of Intent (LoI)** that provides an abstract and lists the collaboration members and their institutional affiliations is requested, although not required. The LoI should be submitted electronically by E-mail to [Michael.Salamon@science.doe.gov](mailto:Michael.Salamon@science.doe.gov) and [Kathy.Turner@science.doe.gov](mailto:Kathy.Turner@science.doe.gov). By identifying collaboration members these LoI's will help DOE select a review panel that has no conflicts of interest. Submission of LoI's by May 4, 2012 is requested.

**PROPOSAL DUE DATE:**

Formal proposals submitted in response to this Program Announcement must be submitted from the DOE National Laboratory to the site office through Searchable FWP by **Friday, July 6, 2012, 11:59 p.m. Eastern Time**, to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2013. **Each proposal should be in a single PDF file. The first few pages of the PDF should be the Field Work Proposal (FWP) followed in the same PDF by the full technical proposal.** You are encouraged to transmit your proposal well before the deadline. **PROPOSALS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

**SUBMISSION INSTRUCTIONS:**

LAB administrators should submit the entire LAB proposal and FWP via searchable FWP (<https://www.osti.gov/fwp>). Questions regarding the appropriate LAB administrator or other questions regarding submission procedures can be addressed to the Searchable FWP Support Center. All submission and inquiries about this Program Announcement must reference Program Announcement LAB 12-597.

**SUPPLEMENTARY INFORMATION:**

**Background:** Astrophysical and cosmological observations have established that atomic matter constitutes only ~5% of the mass-energy in our Universe. In the Standard Model of cosmology the remaining 95% is composed of two mysterious components: dark matter (23%) and dark energy (72%). The Standard Model of particle physics does not include a particle species with properties that can account for dark matter. One non-Standard Model candidate for dark matter is a weakly-interacting massive particle (WIMP) whose cosmic abundance today is a relic of the Big Bang. Other dark matter candidates include the axion, originally hypothesized as a solution to the strong-CP problem.

Searches for WIMPs, axions and other dark matter particle candidates directly address the HEP mission of understanding the origin and unification of particles and forces and the mysterious forms of unseen energy and matter. These studies fall within HEP's Cosmic Frontier program, whose focus is on non-accelerator-based measurements of naturally occurring phenomena to learn about the nature of dark matter, dark energy, and other fundamental properties of matter and energy.

**Investigation Requirements:** There are three complementary methods for searching for dark matter: (1) accelerator searches for dark matter particle production, (2) indirect detection of dark matter annihilation within the Galaxy, and (3) the direct detection of Galactic dark matter particles that pass through terrestrial detectors. This Announcement solicits proposals for support of future second-generation experiments of the third type only, those that conduct direct-detection searches for dark matter particles.

For the purposes of this Announcement, a second-generation experiment is one that, in the absence of detection, improves our current knowledge of a relevant dark matter particle parameter by roughly one order of magnitude or more. For WIMPs, this parameter could be (but is not restricted to) the WIMP-nucleon cross section limit. In the case of axions, the parameter could be (but is not restricted to) a limit on the photon-axion coupling constant.

Proposals are not limited to searches for WIMPs or axions; any viable dark matter species may be the object of an investigation. The strength of theoretical arguments for the existence of a given species will be a factor in the selection process.

**Award Description:** This Announcement solicits proposals for one year of support for R&D leading to second-generation dark matter experiments. Those investigations selected will be provided with funding that shall be used for R&D, including pre-conceptual experiment design and work that reduces scientific, technical or cost risks associated with the experiment. Funding is expected to commence early in FY2013. The total amount of DOE funds is anticipated to be approximately \$6M, subject to availability of funds, to be divided among the successful investigations selected under this Announcement and the companion DOE FOA noted above. No experiments will enter project phase during this year of funding. This funding shall not be used for fabrication of the experiment **except as noted below**.

Funding for the project phase of second-generation dark matter experiments is not supported under this Announcement. A future selection process (“down-selection”), described in “Future Project Awards” below, will select a subset of the investigations for project funding during the period FY2014 to FY2016. The intent of this Announcement is to provide support for R&D, including pre-conceptual design and risk reduction prior to the future competition for entry into project phase and subsequent fabrication and commissioning of the experiment.

Near the end of the one-year funding period, each Principal Investigator (PI) is to submit a report to DOE that documents the work done under the award, including any improvements in the experiment concept and any reductions of scientific, technical or cost risks associated with the experiment.

Experiments whose costs fall below the two thresholds given below are not subject to the DOE requirements that are placed on projects and major items of equipment. For such experiments, funding provided under this Announcement may be used for equipment and fabrication costs in addition to R&D, pre-conceptual design and risk reduction costs. The two cost thresholds are:

- 1) \$2,000,000 for the total capital equipment cost to DOE. Contributions from other agencies are not included in this total.

- 2) \$5,000,000 for the total experiment cost to DOE. “Experiment cost” is defined to include the cost of design, engineering, equipment, fabrication, technical support, and management; but does not include operations or the costs of scientific personnel. Contributions from other agencies are not included in this total.

Final determination of which proposed experiments fall below the DOE budget and project threshold(s) will be made by DOE program managers.

**Future Project Awards:** This section briefly describes the anticipated process by which second-generation dark matter experiments will be selected to enter into project status and does not affect the award process for this Announcement. The actual process used to down-select and implement experiments may differ from that described here.

Each future second-generation dark matter project will be managed by a DOE Laboratory. The PI, with DOE coordination, will choose a DOE Laboratory to fulfill project-phase management responsibilities. The chosen DOE Laboratory may also join the scientific collaboration subject to the membership rules of the collaboration. Near the end of the R&D awards made under the companion FOA, the PI and the affiliated DOE Laboratory will be invited to prepare a Field Work Proposal (FWP) for submission through the Laboratory to DOE for the design, fabrication, and commissioning of the proposed project.

Following review of the FWP’s, a down-selection will be made by the DOE Selection Official (the Associate Director of the Office of High Energy Physics) in which a subset of the investigations selected by this Announcement will be chosen to become new DOE projects within the Second-Generation Dark Matter Experiment Program. **Only investigations that have been selected under this Announcement will be eligible for continued funding into project phase.** Those investigations not chosen to continue as projects will not receive additional funding beyond the one year of support provided by this Announcement. Contingent upon availability of funds, those investigations selected to become projects are expected to receive project funding over the three-year period of FY2014 to FY2016. The amount of DOE funds for all experiments during the FY2014-2016 period is anticipated to total up to \$29M.

DOE Laboratory management or collaboration will not be required for experiments whose total DOE costs fall below the thresholds specified in “Award Description.” For such an experiment, rather than submitting an FWP, the PI will submit a grant renewal proposal to the *Continuation of Solicitation for the Office of Science Financial Assistance Program* for continued funding if desired. Proposals received under this solicitation will be reviewed following standard merit review criteria.

## **PROPOSAL REQUIREMENTS:**

Selections will be based in part on the scientific merit of the proposed experiment itself. Therefore in addition to requiring a description of the research activities to be conducted during the R&D funding period, a substantial fraction of the proposal’s science section should be devoted to a description of the experiment, including its science goals, design, technology, and estimated cost and schedule.

The following elements are to be included in the body of the proposal:

- a. A statement of the science goals and the theoretical context for the chosen experiment, along with justification for qualifying this experiment as a second-generation dark matter experiment.
- b. Description of and advocacy for the chosen experimental method, including the experiment performance requirements needed to achieve the science goals.
- c. A technical description of the experiment that documents how it will meet its performance requirements.
- d. An estimate (not a budget), including basis of estimate, of the total costs of the experiment up to but not including operations or data analysis, broken into each of the following categories:
  - o Design, engineering and technical support costs
  - o Equipment costs
  - o Fabrication costs
  - o Management costs
  - o (Support for science personnel is not to be included)
- e. A schedule estimate of the experiment development.
- f. A list of current technical risks, should any exist, along with a plan for their minimization. Less mature detection methods are expected to have larger numbers of technical risks than more mature methods.
- g. A detailed description of the proposed research and concept development work, including scientific, technical and cost risk reduction, which will be conducted during the year of support provided under this Announcement. A formal budget for this period is required, along with a budget explanation.

Documentation of the investigators' experience in dark matter research or related areas is to be provided in the proposal along with the curriculum vitae of the investigators.

**SELECTION CRITERIA:**

Proposals will be competitively peer-reviewed and evaluated in part using the standard selection criteria of the DOE Office of Science, these being:

1. Scientific and/or technical merit of the project;
2. Appropriateness of the proposed method of research;

3. Competency of applicant's personnel and adequacy of proposed resources;
4. Reasonableness and appropriateness of the proposed budget.

The second-generation dark matter experiment must be described in sufficient detail so as to enable an evaluation of proposals using the following additional selection criteria:

- a. Importance of the investigation's experiment within the context of current national and international dark matter research efforts.
- b. Completeness of flow-down from science goals to experiment performance requirements.
- c. Capability of the experiment to meet its performance requirements along with the potential scientific power of the experimental method.
- d. Completeness of the identification of current technical risks; feasibility of the plan for technical risk reduction. The increased risk associated with methods incorporating less mature technologies may be offset by the promise of potentially superior science capabilities.

An external, competitive, anonymous peer review will be held in which all compliant proposals will be evaluated according to the above criteria. Selection(s) will be made by the DOE Selection Official based on these evaluations, coordination with the NSF, and other programmatic factors.

#### **PROGRAM FUNDING:**

It is anticipated that up to \$6,000,000 total will be available for multiple awards to be made in FY2013, contingent on the availability of appropriated funds. Submitted budgets may request one year of support. The year of support (FY2013) is limited to research and experiment concept development work only, not to fabrication of the experiment. The budget explanation page for the year of support must reflect this restriction.

DOE is under no obligation to pay for any costs associated with the preparation or submission of a proposal. DOE reserves the right to fund, in whole or in part, any, all, or none of the proposals submitted in response to this Program Announcement.

**The instructions and format described below should be followed. You must reference Program Announcement LAB 12-597 on all submissions and inquiries about this program.**

## **OFFICE OF SCIENCE GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS**

## **TO BE SUBMITTED BY NATIONAL LABORATORIES**

Proposals from DOE National Laboratories submitted to the Office of Science (SC) as a result of this Program Announcement will follow the Department of Energy Field Work Proposal (FWP) process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

### **1. Evaluation Criteria**

Proposals will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance. Included within each criterion are specific questions that the merit reviewers will be asked to consider:

- a) Scientific and/or Technical Merit of the Project
- b) Appropriateness of the Proposed Method or Approach
- c) Competency of Applicant's Personnel and Adequacy of Proposed Resources; and
- d) Reasonableness and Appropriateness of the Proposed Budget.

The evaluation process will include program policy factors such as the relevance of the proposed research to the terms of the Announcement and the agency's programmatic needs. Note that external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of a proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

### **2. Summary of Proposal Contents**

- Field Work Proposal (FWP) Format (Reference DOE Order 412.1A) (DOE ONLY)
- Proposal Cover Page
- Table of Contents
- Budget (DOE Form 4620.1) and Budget Explanation
- Abstract (one page)
- Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel – 20-page limit)
- Literature Cited
- Biographical Sketch(es)
- Description of Facilities and Resources
- Other Support of Investigator(s)
- Appendix (optional)

#### **2.1 Submission Instructions**

LAB administrators should submit the entire LAB proposal and FWP via searchable FWP (<https://www.osti.gov/fwp>). Questions regarding the appropriate LAB administrator or other questions regarding submission procedures can be addressed to the Searchable FWP Support Center. All submission and inquiries about this Program Announcement must reference Program Announcement LAB 12-597. Full proposals submitted in response to this Program Announcement must be submitted to the searchable FWP database no later than 11:59 pm, Eastern Time, **July 6, 2012**. It is important that the entire peer reviewable proposal be submitted to the searchable FWP system as a single PDF file attachment.

### **3. Detailed Contents of the Proposal**

Adherence to type size and line spacing requirements is necessary for several reasons. No researcher should have the advantage, or by using small type, of providing more text in his or her proposal. Small type may also make it difficult for reviewers to read the proposal. Proposals must have 1-inch margins at the top, bottom, and on each side. Type sizes must be at least 11 point. Line spacing is at the discretion of the researcher but there must be no more than 6 lines per vertical inch of text. Pages should be standard 8 1/2" x 11" (or metric A4, i.e., 210 mm x 297 mm).

#### **3.1 Field Work Proposal Format (Reference DOE Order 412.1A) (DOE ONLY)**

The FWP is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

#### **3.2 Proposal Cover Page**

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project:  
SC Program Announcement title and number: **Second Generation Dark Matter Experiment Program - LAB 12 – 597**  
Name of laboratory:  
Name of principal investigator (PI):  
Position title of PI:  
Mailing address of PI:  
Telephone of PI:  
Fax number of PI:  
Electronic mail address of PI:  
Name of official signing for laboratory\*:  
Title of official:  
Fax number of official:  
Telephone of official:  
Electronic mail address of official:  
Requested funding for each year; total request:

Use of human subjects in proposed project:

If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.

Use of vertebrate animals in proposed project:

If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.

Signature of PI, date of signature:

Signature of official, date of signature\*:

\* The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

### **3.3 Table of Contents**

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages, and do not use suffices, such as 5a, 5b.

### **3.4 Budget and Budget Explanation**

A detailed budget is required for the entire project period and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information\*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

\* Form 4620.1 is available at web site: <http://www.science.doe.gov/grants/budgetform.pdf>

### **3.5 Abstract**

Summarize the proposal in one page. Give the project objectives (in broad scientific terms), the approach to be used, and what the research is intended to accomplish. State the hypotheses to be tested (if any). At the top of the abstract give the lead DOE National Laboratory, project title, names of all the investigators and their institutions, and contact information for the principal investigator, including e-mail address.

**3.6 Narrative** (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel).

The narrative comprises the research plan for the project and is limited to a **maximum of 30 pages**. It should contain enough background material in the Introduction, including review of the relevant literature, 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. It is important that the 30-page technical information section provide a complete description of the proposed work, because reviewers are not obliged to read the Appendices. Proposals exceeding these page limits may be rejected without review or the first 30 pages may be reviewed without regard to the remainder.

The page count of 30 does not include the Cover Page and Budget Pages, the Title Page, the biographical material and publication information, or any Appendices. Letters of endorsement from unfunded collaborators should also be included, if applicable. Please do not submit general letters of support as these are not used in making funding decisions and can interfere with the selection of peer reviewers.

#### Background and Recent Accomplishments

- Background – explanation of the importance and relevance of the proposed work.

#### Proposed Research and Tasks

- In addition to the technical description of the proposed work and tasks, include a discussion of schedule, milestones, and deliverables.

### **3.7 Literature Cited**

Give full bibliographic entries for each publication cited in the narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Principal investigators should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal.

### **3.8 Biographical Sketches**

This information is required for senior personnel at the institution submitting the proposal and at all subcontracting institutions (if any). The biographical sketch is limited to a maximum of two pages for each investigator and must include:

*Education and Training.* Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

*Research and Professional Experience.* Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

*Publications.* Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

*Synergistic Activities.* List no more than five professional and scholarly activities related to the effort proposed.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information must also be provided in each biographical sketch.

*Collaborators and Co-editors:* A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been, collaborators or co-authors with the investigator on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of the proposal. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the Principal Investigator interacted on a regular basis while the research was being done. Also, include those individuals who are currently or have been co-editors of a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of the proposal. Finally, list any individuals who are not listed in the previous categories with whom you are discussing future collaborations. If there are no collaborators or co-editors to report, this should be so indicated.

*Graduate and Postdoctoral Advisors and Advisees:* A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations. A list of the names of the individual's graduate students and postdoctoral associates during the past five years, and their current organizational affiliations.

### **3.9 Description of Facilities and Resources**

Facilities to be used for the conduct of the proposed research should be briefly described. Indicate the pertinent capabilities of the institution, including support facilities (such as machine shops), that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution (if any).

### **3.10 Other Support of Investigators**

Other support is defined as all financial resources, whether Federal, non-Federal, commercial, or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at

collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort (months per year or percentage of the year) devoted to the project.

### **3.11 Appendix**

Information not easily accessible to a reviewer may be included in an appendix, but **do not use the appendix to circumvent the page limitations of the proposal**. Reviewers are not required to consider information in an appendix, and reviewers may not have time to read extensive appendix materials with the same care they would use with the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts accepted for publication, abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

## **4. Detailed Instructions for the Budget** (DOE Form 4620.1 "Budget Page" may be used).

### **4.1 Salaries and Wages**

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

### **4.2 Equipment**

DOE Financial Management Handbook references equipment as an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$50,000 or more. Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

### **4.3 Domestic Travel**

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance

the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

#### **4.4 Foreign Travel**

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

#### **4.5 Other Direct Costs**

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

##### **a. Materials and Supplies**

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

##### **b. Publication Costs/Page Charges**

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

##### **c. Consultant Services**

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

##### **d. Computer Services**

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

##### **e. Subcontracts**

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

## **4.6 Indirect Costs**

Explain the basis for each overhead and indirect cost. Include the current rates.