

# Fusion Energy Sciences

The following program descriptions are offered to provide more in-depth information on scientific and technical areas of interest to the Fusion Energy Sciences (FES) program:

Program Website: <https://science.osti.gov/fes>

The mission of the Fusion Energy Sciences (FES) program is to expand the fundamental understanding of matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. This is accomplished through the study of plasma, the fourth state of matter, and how it interacts with its surroundings.

To accomplish its mission, the FES program is organized into four subprograms:

- **The Burning Plasma Science: Foundations** subprogram supports foundational experimental and theoretical research aimed at resolving magnetic-confinement plasma science issues for the next generations of machines.
- **The Burning Plasma Science: Long Pulse** subprogram supports experimental research in new scientific regimes achievable with long-duration superconducting international machines and research in the development of materials to withstand the harsh conditions in a burning plasma environment.
- **The Burning Plasma Science: High Power** subprogram supports the U.S. Contributions to the ITER Project; and
- **The Discovery Plasma Science** subprogram supports investigations into fundamental plasma properties and processes, including research at the frontiers of basic and low temperature plasma science and high-energy-density laboratory plasmas, and the development of innovative diagnostic techniques.

Embedded in these areas are also investments in transformational technologies such as artificial intelligence and machine learning (AI/ML) and quantum information science (QIS), that have the potential to accelerate progress in several FES mission areas.

The FES scientific objectives and priorities are guided by the priorities in the “[Fusion Energy Sciences, a Ten-Year Perspective \(2015-2025\)](#)” report to Congress, the research opportunities identified in a series of recently held basic research needs workshops (<https://science.osti.gov/fes/Community-Resources/Workshop-Reports>), and National Academies reports such as the 2018 report on a [Strategic Plan for U.S. Burning Plasma Research](#), the 2018 report on [Opportunities in Intense Ultrafast Lasers](#), and the [2020 Decadal Assessment of Plasma Science](#) report. FES is currently undertaking a long-range planning activity. Community input associated with this activity can be found in the recently published [report by the Community Planning Process](#) group under the auspices of the Division of Plasma Physics of the American Physical Society.

Of special interest and relevance to the ALCC program are the following workshop and program review reports:

- *Report on the Workshop on Integrated Simulations for Magnetic Fusion Energy Sciences, June, 2015*; [https://science.osti.gov/-/media/fes/pdf/workshop-reports/2016/ISFusionWorkshopReport\\_11-12-2015.pdf](https://science.osti.gov/-/media/fes/pdf/workshop-reports/2016/ISFusionWorkshopReport_11-12-2015.pdf)
- *FES Workshop on Plasma Materials Interactions (2015)*; [https://science.osti.gov/-/media/fes/pdf/workshop-reports/2016/PMI\\_fullreport\\_21Aug2015.pdf](https://science.osti.gov/-/media/fes/pdf/workshop-reports/2016/PMI_fullreport_21Aug2015.pdf)
- *Report on Scientific Challenges and Research Opportunities in Transient Research, FES Workshop on Transients in Tokamak Plasmas (2015)*; [https://science.osti.gov/-/media/fes/pdf/program-news/Transients\\_Report.pdf](https://science.osti.gov/-/media/fes/pdf/program-news/Transients_Report.pdf)
- *FES Exascale Requirements Review, January 2016*; <https://www.osti.gov/servlets/purl/1375639>
- *Transformative Enabling Capabilities for Efficient Advance Toward Fusion Energy, Fusion Energy Sciences Advisory Committee (FESAC) (2018)*; [https://science.osti.gov/-/media/fes/fesac/pdf/2018/TEC\\_Report\\_1Feb20181.pdf](https://science.osti.gov/-/media/fes/fesac/pdf/2018/TEC_Report_1Feb20181.pdf)
- *Report on the Workshop on Advancing Fusion with Machine Learning, April, 2019*; [https://science.osti.gov/-/media/fes/pdf/workshop-reports/FES\\_ASCR\\_Machine\\_Learning\\_Report.pdf](https://science.osti.gov/-/media/fes/pdf/workshop-reports/FES_ASCR_Machine_Learning_Report.pdf)

All ALCC applications should address the broad scientific objectives and mission of the FES program and its priorities. Applications should be submitted in one of the following areas:

- Magnetic Fusion Energy Sciences
- Materials and Fusion Nuclear Science
- General Plasma Science
- High Energy Density Laboratory Plasmas
- Other

Please note that applications in the Other category should still address the broad scientific objectives and mission of the FES program and its priorities.