High Energy Physics

The following program descriptions are offered to provide more in-depth information on scientific and technical areas of interest to HEP:

Program Website: https://science.osti.gov/hep/.

The mission of the HEP program is to understand how the universe works at its most fundamental level, which is done by discovering the elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time.

The scientific objectives and priorities for the field recommended by the High Energy Physics Advisory Panel (HEPAP) are detailed in its recent long-range strategic Particle Physics Project Prioritization Plan (P5), available at: https://science.osti.gov/~/media/hep/hepap/pdf/May-2014/FINAL_P5_Report_Interactive_060214.pdf.

The HEP program focuses on three experimental scientific frontiers:

- The Energy Frontier - where powerful accelerators are used to create new particles, reveal their interactions, and investigate fundamental forces

- 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 non-accelerator-based experiments observe the cosmos and detect cosmic particles, making measurements of natural phenomena that can provide information about the nature of dark matter, dark energy, and other fundamental properties of the universe that affect our understanding of matter and energy.

Also integral to the mission of HEP are the crosscutting research areas that enable new scientific opportunities by developing the necessary tools and methods for discoveries:

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

- Computational High Energy Physics, where cross-cut computational tools, simulation techniques, and data management and analytics (including SC partnerships where relevant) are developed for advancing the HEP mission;

- Accelerator Science and Technology Research and Development, where the technologies and basic science needed to design, build, and operate the accelerator facilities essential for making new discoveries are developed; and

- Detector Research and Development, where the basic science and technologies needed to design and build the High Energy Physics detectors essential for making new discoveries are developed.

- Quantum Information Science (QIS) for High Energy Physics Research, where QIS enabled scientific discovery via partnerships with the QIS community is supported to advance the program mission of HEP, and the SC QIS initiative.

The three frontiers and the three crosscutting research areas are collectively the six research subprograms supported by HEP. All ALCC applications should address specific research goals in one or more of the eight research subprograms and explain how the proposed high performance computing effort supports the broad scientific objectives and mission of the HEP program and its priorities