LABORATORY FOR NUCLEAR SCIENCE

Research in the Laboratory for Nuclear Science (LNS) (*http://web.mit.edu/lns*) seeks to understand the structures and interactions of the fundamental constituents of matter. Nuclear physics experiments are performed with electrons at the Thomas Jefferson National Accelerator Facility in Virginia, the ARIEL facility at TRIUMF in Canada, and the DESY accelerator facility in Germany; and heavy ions at the Large Hadron Collider (LHC) at CERN in Switzerland and Brookhaven National Laboratory in New York. Low energy nuclear physics uses precision laser spectroscopy of various atoms and radioactive molecules at the ISOLDE facility at CERN and the Facility for Rare Isotope Beams at Michigan State University, and in a development lab on the MIT campus. The high-energy particle physics program involves experiments with high-energy protons at the LHC; the search for antimatter and dark matter in space with the Alpha Magnetic Spectrometer on the International Space Station; and development of equipment to search for axions. Properties of neutrinos are being explored through experiments at various sites, including Fermi National Accelerator Laboratory in Illinois; Karlsruhe, Germany; Kamioka Observatory, Japan; the South Pole; through the development of a new technique to measure neutrino mass through Cyclotron Radiation Emission Spectroscopy; and through research and development to build a cyclotron-based high-intensity source of neutrinos. Searches for extremely rare, neutrino-less nuclear decays are taking place underground in Gran Sasso, Italy. A theoretical program investigates the properties of high-energy plasmas.

LNS supports research interests of faculty in the Department of Physics by supporting and administering facilities for studies of nuclear and particle physics, including the Center for Theoretical Physics, the MIT-Bates Research and Engineering Center, the Institute for Artificial Intelligence and Fundamental Interactions, the MIT-Bates High Performance Research Computing Facility, and the MIT Central Machine Shop. Students participate in the entire range of research programs in fulfilling their graduate and undergraduate degree requirements or as participants in the Undergraduate Research Opportunities Program (*https://catalog.mit.edu/mit/undergraduate-education/academic-research-options/undergraduate-research-opportunities-program*). For further information, contact the director, Professor B. Wyslouch, 617-253-7800.

The **Center for Theoretical Physics** is engaged in a broad range of fundamental research activities in theoretical nuclear and particle physics, including study of the fundamental constituents of matter and the theory that governs them, the structure and interactions of nuclei and hadrons, electroweak physics, lattice hadron physics, field theory, string theory and quantum gravity, many-body physics, mathematical physics, cosmology, and quantum computation. For further information, contact the director, Professor I. Stewart, 617-253-4848.

The **William H. Bates Research and Engineering Center** (Bates Lab) is operated by LNS as a research and engineering center with particular emphasis on accelerator science and technology. Current efforts include the design, construction, and testing of new detector, target, magnet, and vacuum systems for experiments at Jefferson Lab, Brookhaven, CERN and other laboratories; and development and testing of a thermal battery system to enable grid-scale energy storage from renewable sources. For further information, contact the director, Professor B. Wyslouch, 617-253-7800.

The **Institute for Artificial Intelligence and Fundamental Interactions** (IAIFI) advances physics knowledge from the smallest to largest scales using innovative AI techniques, and also galvanizes AI research innovation. IAIFI is a collaboration across multiple fields of study and several Boston-area institutions of higher learning. For further information, contact the director, Professor J. Thaler, 617-253-3713.