PLASMA SCIENCE AND FUSION CENTER

The timely development of practical fusion energy in the 21st century is arguably one of the most important challenges facing the scientific and engineering community worldwide. The Plasma Science and Fusion Center (PSFC) (*https://www.psfc.mit.edu*) provides a focus for experimental and theoretical studies in plasma science, magnetic and inertial fusion research, and the development of related enabling technologies. The center fosters independent creativity and provides the intellectual environment for the educational training of students, research scientists, and engineers. Research activities at the Plasma Science and Fusion Center focus on four areas.

Magnetic Fusion Energy (*https://www.psfc.mit.edu/research/magnetic-fusion-energy*). PSFC researchers study the use of strong magnetic fields to confine plasma at the high temperatures and pressures required to achieve fusion energy. Magnet research is conducted using on-site experimental facilities, theory and simulation, and collaboration with researchers at other facilities. PSFC scientists, students, and engineers perform experiments and develop technologies to confine and heat the plasma and to manage the interactions between the plasma and reactor materials.

Plasma Science (*https://www.psfc.mit.edu/research/plasma-science*). Plasma exhibits complex and rich physics phenomena, including waves, turbulence, and interactions with materials. Studying plasmas is critical to advance technology development for practical purposes like developing functional fusion reactors and to understand the fusion processes present in stars, planets, and interstellar space. PSFC scientists and students advance plasma physics using cutting-edge facilities and large-scale computation to obtain a comprehensive predictive understanding of plasmas in a variety of situations.

Technology and Engineering (*https://www.psfc.mit.edu/research/technology-engineering*). The study of plasmas, fusion, and magnetic resonance requires a core set of technology and engineering tools. Additionally, the understanding of plasmas can be used to develop new technologies with far-reaching applications. High-field magnets, high-power radio frequency sources, sensitive detectors, and various particle accelerators are used throughout the PSFC, while environmental technologies to reduce diesel emissions, process garbage and drill through rock to access geothermal resources have matured from PSFC research.

Magnetic Resonance (*https://www.psfc.mit.edu/research/magnetic-resonance*). Nuclear magnetic resonance (NMR) spectroscopy is a powerful tool to probe the structure of compounds important for biology, chemistry, physics, medicine, and energy. The techniques rely upon high-field magnets and microwaves of various frequencies to probe the magnetic fields at the nucleus, revealing the details of the configuration of the sample. The PSFC's Francis Bitter Magnet Laboratory (*http://web.mit.edu/fbml/index.shtml*) is a collaborative research facility whose research covers all aspects of magnetic resonance that are important for structural biology and many areas of magnetic resonance imaging.

The PSFC is one of the largest producers of plasma physics PhDs in the world. However, the center is not a degree-granting body and instead draws students from MIT's academic departments, including Physics, Nuclear Science and Engineering, Electrical Engineering and Computer Science, Materials Science and Engineering, Mechanical Engineering, Chemical Engineering, and Aeronautics and Astronautics. The center's programs and laboratories provide excellent forums for training students and professional researchers and offer world-class research facilities to faculty members from many departments. Approximately 70 graduate students are currently involved at all levels of thesis work.

Graduate and undergraduate students may find more information on the education page of the PSFC website (*https://www.psfc.mit.edu/education*). Undergraduates are encouraged to participate through the Undergraduate Research Opportunities Program (UROP) (*https://urop.mit.edu*) or Fusion Undergraduate Scholars (*https://www.psfc.mit.edu/fusars*) program. Contact Fusion Education Program Administrator Rachel Shulman (*rshulman@mit.edu*) for specific guidance.

Professor Nuno F. G. Loureiro directs the PSFC. For further information, email the PSFC (*info@psfc.mit.edu*).