FACILITY FOR
RARE ISOTOPE BEAMS

June 2026

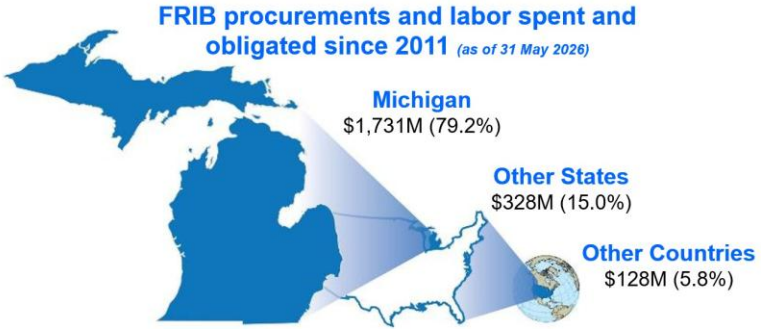
Addressing State, National Priorities

Michigan State University (MSU) operates the Facility for Rare Isotope Beams (FRIB) as a user facility for the U.S. Department of Energy Office of Science (DOE-SC), with financial support from and furthering the mission of the DOE-SC Office of Nuclear Physics. User facility operation is supported by the DOE-SC Office of Nuclear Physics as one of 28 DOE-SC user facilities.

FRIB provides state-of-the-art capabilities to advance nuclear science, with additional benefits to medicine, materials science, and industry, strengthening U.S. competitiveness and national security, and accelerating translation of discovery into real-world impact.

Economic Impact in Michigan

FRIB is a DOE-SC user facility for nuclear science with benefits to medicine, materials science, national security, and industry. FRIB has spent and obligated over $2 billion in procurements and labor since January 2011, with $1.7 billion (79%) in Michigan, and 94 percent in the United States. FRIB uses a best-value procurement approach as required by federal regulations. Michigan has proven to be a great resource, and a strong regional skilled workforce supported civil construction.



FRIB Adds Value to Nation

Artificial intelligence (AI) as an Enabling Capability, Aligned with DOE's Genesis Mission

As a DOE Office of Science user facility based at a university, FRIB advances the goals of the DOE Genesis Mission (genesis.energy.gov) by harnessing artificial intelligence to accelerate discovery in nuclear science and develop the workforce.

Integrating advanced AI systems into the research infrastructure, FRIB strengthens U.S. leadership in nuclear science while transforming how science is done: applying machine learning (ML) approaches to shorten discovery timelines and driving new advances across experimental nuclear science, theoretical nuclear science, and accelerator science.

Learn more at frib.msu.edu

Enabling World-Leading Discoveries

FRIB designed, built, and now operates the most powerful heavy-ion accelerator, providing researchers intense beams of rare isotopes (short-lived nuclei not normally found on Earth).

FRIB enables scientists to make discoveries about rare isotopes, nuclear astrophysics, fundamental interactions, and applications for society, including in medicine, homeland security, and industry.

FRIB's scientific program is forged with input from the FRIB Program Advisory Committee (PAC), a group of international world-leading scientists who review non-proprietary beam-time requests submitted to FRIB for merit and make recommendations to the FRIB Laboratory director. FRIB is open to all interested researchers, subject to applicable laws and regulations.

FRIB is oversubscribed by a factor of 3 and can only accommodate around 30% of requested beam-time. Published results are available at frib.msu.edu/publications.

Approximately 1,800 scientific users are engaged in FRIB science and instrumentation. They organized themselves in an independent FRIB Users Organization (fribusers.org).

Nuclear Science Leadership

Discoveries at FRIB will transform our understanding of nature. FRIB addresses science's most important questions related to the stability, composition, reactions, and applications of atomic nuclei.

FRIB provides researchers with more than 1,000 new rare isotopes never before produced on Earth.

This enables researchers to answer key scientific questions, ranging from the origins of stars and the universe to how to diagnose and cure diseases, optimize nuclear reactors, and destroy nuclear waste. FRIB has the potential to enable major discoveries.

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Experimental nuclear science: AI-enabled particle identification and real-time event selection allow researchers to process complex experimental data more rapidly.

Theoretical nuclear science: ML algorithms and intelligent systems to simulate nuclear structure, reactions, and dynamics, expanding computational capabilities to solve the hardest scientific challenges in many-body physics.

Accelerator science: AI-guided beam tuning and diagnostics improve operational performance and efficiency

Forward-Looking Integration with Quantum Science

Quantum science offers new ways to address the most difficult challenges in nuclear science.

FRIB researchers integrate quantum science to advance nuclear physics. FRIB experimentalists use new techniques to enhance quantum measurements and probe the entanglement of nuclear systems. FRIB theorists develop quantum algorithms to probe nuclear many-body systems on quantum computers.

Chip Testing Capability Addresses Critical National Need

Leveraging FRIB's accelerator expertise, FRIB's heavy-ion chip-testing facilities–FRIB Single Event Effects Facility (FSEE) and K500 Chip Testing Facility (KSEE)–address the national shortage of testing capacity for advanced microelectronics used in industries like spaceflight, wireless technology, and autonomous vehicles (frib.msu.edu/see). FRIB's chip-testing capability is enabled by the DOE-SC investment but is a self-supporting program. FRIB's facilities provide high-energy heavy-ion beams that allow testers to estimate, within minutes, the likelihood of malfunctions or failures caused by decades of cosmic ray exposure on electronic components. MSU Space Electronics Initiative (space-electronics.msu.edu) positions MSU as a national leader in chip design and testing by developing the nation's workforce in these fields.

Isotope Harvesting Benefits Society

FRIB's isotope harvesting infrastructure enables the production of high-purity radionuclides for research applications, including nuclear physics, astrophysics, materials science, biology, and nuclear medicine. During routine operation—without interfering with FRIB's primary users—extra, unused isotopes can be "harvested." DOE Isotope Program provided funding to establish the capability and now supports operations and research.

Innovation and Economic Engine

FRIB supports multidisciplinary collaboration, generates intellectual property, and stimulates external investment, enabling research and development for industry and the national interest. Past nuclear science discoveries led to MRI and PET machines, smoke detectors, and cell phone technology. FRIB leads in accelerator technology and systems for operating the most powerful superconducting heavy-ion accelerator, including low-beta superconducting radiofrequency particle acceleration and large-scale, high-efficiency helium liquefaction. It provides economic benefits as a research destination, improves quality of life for Michigan residents through medical and industrial discoveries, attracts private-sector development, and works with local economic developers to promote awareness of its potential.

Attracting and Training Next Generation

FRIB, located on the campus of a research-intensive university, attracts the best students to study nuclear science, accelerator science, cryogenic engineering, and radiochemistry, areas in which workforce development is in short supply and critical to U.S. economic competitiveness, energy security, nuclear security, and nonproliferation efforts. The university setting enables hands-on training in a world-class facility.

Between 2018–2024, MSU awarded 17% of U.S. nuclear physics PhDs. Median time to degree is 5.33 years (U.S. median is 6 years) and 81% PhD completion rate (U.S. average is 60%).

FRIB employs 131 graduate students and 74 undergraduate students.

Research and Student Training Supports National Security

FRIB offers students hands-on experience, engaging in cutting-edge research supported by the DOE-SC and the National Nuclear Security Administration.

Students explore pathways in nuclear science that directly contribute to national security and prepare them for future success in the Nuclear Security Enterprise.

For More Information

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