Facility for Rare
Isotope Beams

FRIB Fact Sheet – March 2011

THE PROJECT:

FRIB will be the world's **most powerful research facility** for research with rare isotopes. Preliminary design is now under way. Construction of FRIB is anticipated to begin in late 2013 and be completed by 2020 with an early completion goal in 2018. FRIB will cost about $615 million (including a $94 million cost share from Michigan State University) and will take approximately a decade to design and establish.

On September 1, 2010, **Critical Decision 1** (CD-1) was approved for the project, establishing the **preferred alternative** and associated cost/schedule range for the project. The DOE Office of Science has approved a budget of $55 million for preliminary design for FY 2011-12, subject to congressional budget authorization.

A **Finding of No Significant Impact** (FONSI) was also approved in September following an environmental assessment conducted in accordance with the **National Environmental Policy Act** (NEPA).

The heart of FRIB is a high-power **superconducting linear accelerator** that supports all cutting-edge methods of producing **rare isotopes.** FRIB will enable scientific research supporting a community of more than **1,000 scientists** from around the world and is expected to be a major economic driver.

THE SCIENCE:

The establishment of FRIB will support the mission of the Office of Nuclear Physics to **discover, explore, and understand** all forms of nuclear matter. **Particle accelerators**, including the superconducting linear accelerator at the core of FRIB, enable the production and study of isotopes not commonly found in nature that have a host of basic science and applied uses.

Rare isotopes are needed to improve our models of nuclei and how they interact, understand the history of the universe and why stars evolve and explode, and to provide tests of Nature's fundamental laws.

An **isotope** is like a flavor of an element. Most **elements** are **stable and naturally occurring**, like oxygen, carbon or copper. When neutrons are removed or added the element becomes more **unstable** and thus, **rare**. We are not sure how many new elements remain to be discovered, but it is certain that a majority of possible isotopes have **not been discovered**. Many isotopes exist for only fractions of seconds before they transform into a more stable form. **Rare isotopes are not normally found in nature. Instead, they** are forged in some of the most spectacular processes in the **cosmos**, including **exploding stars known as supernovae**.

HOW IT WORKS:

A beam of **stable nuclei** is **accelerated to half the speed of light** and directed at a thin target material. When the beam smashes into the target, the resulting collision creates a number of reaction products. Among those products are the **sought-after rare isotopes,** This mixture continues to speed down the beam line, where a series of magnets separate out the desired isotopes for study.

Why it's Important:

Science

With FRIB we will for the first time have the capability to produce most of the same rare isotopes that are created in the thermonuclear explosions of supernovae, which then decay into the elements found on Earth. This will help us better understand the origins of the elements. The same isotopes are needed to develop a comprehensive model of atomic nuclei and how they interact, and to provide the opportunity to test nature's fundamental laws. Because of this, expert review panels have identified FRIB as a core piece of the U.S. research infrastructure and a top priority for funding.

Researchers using FRIB will be able to improve their understanding of how nuclear particles may be used to model, diagnose and cure diseases. The improved nuclear models and precision data will allow optimization of the next generation of nuclear reactors and evaluation of techniques to destroy nuclear waste. They will probe advanced materials to examine the processes involved on the nano- and micro-scale – providing insights into how materials are affected by radiation and other forces. Modeling atomic nuclei and their interactions – a challenging problem in science – can also help lead to breakthroughs in security, the environment, high-energy physics, nanoscience and more.

Education

Education of the **next generation of scientists** is a top priority. FRIB will build on the tradition to routinely involve **undergraduate and graduate students in research.** FRIB will expand those opportunities. MSU's nuclear physics graduate program is ranked No. 1 in the nation, according to *U.S. News and World Report's* rankings of graduate schools for 2010. Alone, each year about 10 percent of the nation's nuclear science PhD holders are educated at MSU. In the future, perhaps a quarter to a third will use FRIB.

Economy

FRIB will be **a talent magnet**. It will attract an abundance of **top scientists, researchers, and students** ready to use the most powerful tool in the world for their specific research needs.

FRIB Resources

Official FRIB Project Website:

www.frib.msu.edu

FRIB Project Communication Manager:

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More online information:

FRIB Users Organization - www.fribusers.org

FRIB on Facebook - www.facebook.com/MSU.FRIB

NSCL on YouTube - www.youtube.com/nsclmedia

A Rare Isotope Rap - www.youtube.com/watch?v=677ZmPEFIXE