Niobium study

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Spartan Engineers will use $1.1 million grant to study a nucleus's journey through MSU's FRIB

Researchers from Michigan State University’s College of Engineering will use a $1.1 million grant to try to make a nucleus’s journey through the Facility for Rare Isotope Beams (FRIB) a little more fast and efficient.

The grant is from the U.S. Department of Energy’s Office of High Energy Physics. It will be used to study the element niobium, which is used to make the tunnels, or cavities, through which rare isotope ions fly at about half the speed of light. The same material also is used to make cavities that accelerate sub-atomic particles, such as electrons and positrons, to nearly the speed of light.

MSU is establishing FRIB as a scientific user facility for the Office of Nuclear Physics in the U.S. Department of Energy Office of Science.

Under construction on campus, FRIB will enable scientists to make discoveries about the properties of rare isotopes in order to better understand the physics of nuclei, nuclear astrophysics, fundamental interactions and applications for society, including in medicine, homeland security and emerging industrial applications.

When the particles are accelerated through the underground tunnels of an accelerator such as FRIB, they go through a series of twists and turns to control the beam before reaching the final destination. Any defect in the niobium can interfere with the superconducting process and slow things down.

“What we are studying is how to get niobium in the right condition to give the best performance in an accelerator,” said Thomas Bieler, a professor of materials science who is leading the project. “We’d like to develop a predictive model
that would allow a designer to build a cavity with a particular design that maximizes its efficiency and performance.”

He said the number of atomic-scale defects in the niobium affects how much heat is generated, and how fast it can flow out to the liquid helium coolant. The ability to get the heat out quickly and efficiently is crucial because it affects the cost and performance of the accelerator, Bieler said.

“FRIB has been, and will continue to be, a transformational project on the campus of Michigan State University,” said Leo Kempel, dean of the MSU College of Engineering. “This new project reaffirms the close collaboration between material science and FRIB in making the devices used by high-energy physicists at MSU, and from around the world, the best system possible.”

“Partnering with the MSU College of Engineering has been instrumental in developing our superconducting radio frequency cavities, which are core components of FRIB’s linear accelerator,” said Thomas Glasmacher, FRIB laboratory director. “We are extremely fortunate to be able to collaborate with MSU experts to build what will be the world’s most-powerful rare isotope accelerator, and we look forward to future collaborations.”

Other MSU members of the research team are Neil Wright, associate professor of mechanical engineering; Philip Eisenlohr, associate professor materials science; and Chris Compton, FRIB staff engineer. This project also involves collaboration with researchers at Ohio State University, Arizona State University and Florida State University.

To honor the College of Engineering’s contributions, FRIB recently hosted a recognition event and presented Bieler a special award.

Related Website: Story courtesy of MSUToday
MSU Facility for Rare Isotope Beams
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