UC SANTA BARBARA

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A Magnetic Moment

Already magnetic resonance imaging saves lives. Yet the world's most advanced form of spectroscopy has yet to reach its full potential in nonmedical scientific advances.

A recent breakthrough in high magnetic field science now provides new possibilities for the advancement of magnetic resonance via high-field superconducting magnets that can tolerate much stronger magnetic fields. This high critical temperature superconductive product requires much less power and less space than conventional electromagnets, for the first time making science at very high magnetic fields possible outside huge facilities such as the National High Magnetic Field Laboratory (NHMFL) in Tallahassee, Florida.

It may soon be possible at UC Santa Barbara, too.

May 17 to 19, the campus will host "Big Mag @ UCSB," a workshop intended to identify the transformational science that would be enabled by coupling a 32 Tesla superconducting magnet — about 1 million times stronger than the Earth's magnetic field — to UC Santa Barbara's terahertz free-electron laser (FEL), the only facility of its kind in the U.S. The summit will convene scientists from around the world whose research would benefit from the creation of the proposed Magnetic Resonance eXploration (MRX) facility, where potential uses range from studying conformational changes in proteins to creating and probing new phases of quantum matter.

“We want to figure out the most exciting questions in condensed matter physics, chemistry, biology and materials science and what would be needed from a magnet to address those questions,” explained conference chair Mark Sherwin, director of the Institute for Terahertz Science and Technology and a professor in the Department of Physics. “This workshop is an opportunity to brainstorm new use cases for the instrument, interface with partners from industry and the NHMFL, forge new collaborations and shape the future of the proposed MRX facility.”

In a 2013 report to the National Academies of Sciences, Engineering and Medicine, the National Research Council recommended that if a superconducting magnet capable of generating fields in excess of 30 Tesla could be produced — which it was late last year at NHMFL — such a magnet should be deployed at a FEL facility with access to the terahertz radiation band. Enter UC Santa Barbara.

“Bringing a very high-field superconducting magnet to UCSB to create the MRX facility would provide a unique opportunity to fulfill a national need and enable many experiments that cannot be done at the NHMFL,” said chemistry professor Songi Han , a member of the “Big Mag @ UCSB” program committee who has been working with Sherwin for more than a decade on filming proteins in action. “Accessing high-power pulsed magnetic resonance at magnetic fields up to 32 Tesla coupled with frequencies up to 4.5 terahertz will create a new frontier in high magnetic field science.”

During the three-day conference, participants will hear presentations and panel discussions that consider the technology and science drivers for MRX, how the facility would best serve a variety of scientific disciplines and perhaps most importantly shaping the next step for magnetic resonance to reach its full potential.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.