University of Iowa News Release

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UI-led consortium receives $6.25 million nanotechnology grant

University of Iowa researchers have received a $6.25 million grant from the U.S. Department of Defense as part of a multi-university research initiative to design and develop nano-magnetic materials and devices that may lead to more efficient computers and cell phones.

The consortium will develop a fundamental understanding of materials and establish the engineering expertise needed to exploit hybrid structures of magnetic metals, semiconductors, and plastics, according to team leader Michael Flatté, professor in the College of Liberal Arts and Sciences (CLAS) Department of Physics and Astronomy.

"Consortium advances may lead to considerably more compact devices that operate for far longer between battery recharges," he said. "Applications of these devices range from laptop computers to cell phones to unmanned sensors. As the processing costs for these materials are much less than those of traditional semiconductor chips, these new devices should also be inexpensive to produce."

Flatté, who also serves as professor in the UI College of Engineering Department of Electrical and Computer Engineering, will work to explore magnetic coupling between several different types of materials including metals, plastic semiconductors and oxide semiconductors. His UI colleague on the research team is Markus Wohlgenannt, assistant professor in the CLAS Department of Physics and Astronomy. The consortium also includes professors Andy Kent of New York University, Yuri Suzuki of the University of California, Berkeley, Giovanni Vignale of the University of Missouri at Columbia, and Jeremy Levy of the University of Pittsburgh. John Prater of the Army Research Office will monitor the program.

"A key goal of the team is to understand how magnetism can be manipulated and modified by constructing hybrid structures of different materials and changing their properties with electric fields and optical illumination," Flatté said. "The magnetic coupling between these materials may occur via magnetic fields, or through the exchange or flow of electron 'spin,' the fundamental property of electrons that gives rise to magnetism in materials."

He added that magnetic coupling through electron spin is expected to be extremely strong when the constituent materials are a few nanometers thick or thinner. New magnetic device concepts will be explored and developed based on these advances in the fundamental understanding of magnetic coupling in materials.

Flatté said that the targeted device concepts include seamless integration of memory and logic, high-speed magneto-optical modulators for optical communications and switching, reconfigurable logic devices and new sensing capabilities. The use of electron-spin-mediated coupling is expected to permit the design of devices that operate at much higher speeds than current electronic devices, and at the same time use considerably less power.

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