UNL Materials Research Science and Engineering Center: 
Quantum and Spin Phenomena in Nanomagnetic Structures

The Materials Research Science and Engineering Center: Quantum and Spin Phenomena in Nanomagnetic Structures at the University of Nebraska–Lincoln has received a $8.1 million competitive renewal grant from the National Science Foundation to support its research through 2014. Established in 2002 with a $5.4 million NSF grant and nicknamed Q-SPINS, Q-SPINS aims to become the leading interdisciplinary center for integrated research and education in nanomagnetism.

The center's 20 UNL faculty from the departments of physics and astronomy, chemistry, chemical and biomolecular engineering, electrical engineering and mechanical engineering and a physicist from the University of Nebraska at Omaha collaborate to study new magnetic structures and materials at the nanoscale – as small as a billionth of a meter. Research focuses on the properties and performance of nanomagnets. This work has potential applications in advanced computing, data storage, energy production, handheld electronic devices, sensors and medical technologies. The center also has a strong education and outreach program and collaborations with industry, national laboratories and scientists internationally.

Title of Grant: Materials Research Science and Engineering Center: Quantum and Spin Phenomena in Nanomagnetic Structures

Award: $8,121,899 over six years (funding through 2014)
Original award in 2002 for $5.4 million over six years

Funding Agency: National Science Foundation, Division of Materials Research

Center Leadership: Evgeny Tsymbal, professor of physics, director; Roger Kirby, professor of physics, associate director

Research groups: The center's research is conducted through two integrated research groups. Their research focuses and leaders are:

- Nanoscale Magnetism: Structures, Materials and Phenomena, David Sellmyer, professor of physics, leader. This team studies properties of nanomagnets – magnetic elements the size of a few nanometers. A nanomagnet's properties and structure differ from conventional magnets and have a variety of useful properties. They are important in developing advanced electronics and computing systems with vastly more storage capacity.

- Magnetolectric Interfaces and Spin Transport, Christian Binek, assistant professor of physics, leader. This group is exploring the functional properties of nanoscale magnetic materials. The team focuses on the interfaces between two different materials where electrical fields may be used to change magnetic properties. Researchers also want to understand how electric currents across such interfaces can be controlled to build new functional devices for advanced information technology applications.
Affiliated Faculty and Departments:
Chemistry: Rebecca Lai, Jody Redepenning, Xiao-Cheng Zeng
Chemical and biomolecular engineering: Ravi Saraf
Electrical engineering: Eva Franke-Schubert, Mathias Schubert
Mechanical engineering: Jeffrey Shield
Physics: Shireen Adenwalla, Kirill Belashchenko, Christian Binek, Stephan Ducharme, Axel Enders, Alexei Gruverman, Roger Kirby, Sy-Hwang Liou, David Sellmyer, Ralph Skomski, Andrei Sokolov, Evgeny Tsymbal
Physics/chemistry: Peter Dowben
UNO physics: Renat Sabirianov

External Advisory Board:
The MRSEC external advisory board consists of six internationally recognized scientists representing, industry, the national laboratories and academia. Board members are: William Gallagher, IBM; Yves Idzerda, Montana State University; Oleg Mryasov, Seagate Technology; Amanda Petford-Long, Argonne National Laboratory; Ramamoorthy Ramesh, University of California, Berkeley; and Carlos Rinaldi, University of Puerto Rico.