

UNIVERSITY OF TEXAS AT DALLAS - DEPARTMENT OF PHYSICS

PHYSICS COLLOQUIUM

<http://www.utdallas.edu/physics/lectures/info/>

Wednesday, February 7, 2007; 4:00-5:00 PM
Kusch Auditorium, FN 2.102

Biomedical Applications of Magnetic Nanomaterials

Professor Diandra L. Leslie-Pelecky

*Department of Physics & Astronomy, Nebraska Center for Materials and Nanoscience
University of Nebraska – Lincoln*

Nanoscale materials offer unprecedented opportunities to investigate and interact with biological systems. Magnetic nanomaterials are especially interesting due to the potential for locating materials inside the body using an external magnetic field. Magnetically targeting chemotherapy drugs, for example, could decrease the systemic effects that make cancer treatment so debilitating. Biomedical applications, however, impose constraints. Magnetic targeting requires large magnetic moments, but also that materials be biocompatible, and stable in air and aqueous environments. Size and surface characteristics (e.g. charge, chemical functionality) must be controlled to regulate how the nanomaterials circulate within the body and interact with different types of cells.

After a general overview of the challenges and opportunities for physical scientists interested in applying their expertise to biomedical challenges, I will describe our work developing multifunctional magnetic nanoparticle fluids. These materials are capable of delivering multiple hydrophobic anti-cancer drugs to specific locations, as well as enhancing magnetic resonance imaging of the affected area. In this formulation, the drugs partition in the hydrophobic portion of a double-layer surfactant, which improves drug loading and release, while the outer layer of the surfactant improves the circulation time in the body. I will then describe our use of inert-gas condensation into liquids to produce increased magnetic moment nanoparticles that will improve the magnetic targeting capability, and our efforts to understand the mechanisms by which surfactants change magnetic properties.

About the speaker: Diandra Leslie-Pelecky earned the Ph.D. in condensed matter physics from Michigan State University in 1991 for work in two- and three-dimensional multi-layered spin glasses. Following postdoctoral work in the glass transition and chemically synthesized magnetic nanoparticles, she became an Assistant Professor in the Department of Physics & Astronomy and the Center for Materials Research and Analysis at the University of Nebraska – Lincoln in 1996 and an Associate Professor in 2002. Her research is funded by the Nebraska Research Initiative, the National Institutes of Health, the Department of Energy and the National Science Foundation. Her current research in nanostructured magnetism focuses on understanding the fundamental properties of disordered magnetic rare-earth alloys. In collaboration with Vinod Labsetwar at the University of Nebraska Medical Center, she is developing magnetic nanoparticles for MRI and drug delivery. Their development of a magnetic carrier carrying multiple anti-cancer drugs that can be targeted to tumors using magnetic fields has been featured by the National Cancer Institute's Alliance for Nanotechnology News. In addition to research, she directs Project Fulcrum, a NSF-funded GK-12 program that teams math, science and engineering graduate students with elementary and middle-school teachers to improve student achievement in math and science.