IEM SEMINAR SERIES

TUESDAY
NOVEMBER 3rd, 2015

Computation Models of Magnetic Nanoparticle Hyperthermia

Institute for Engineering in Medicine

UNIVERSITY OF MINNESOTA
Driven to Discover℠

DR. ROY CHANTRELL
Professor
Department of Physics
University of York
United Kingdom

FREE event, no registration required.

Pizza and drinks will be provided.

12:00PM - 1:00PM
Nils Hasselmo Hall
Room 4-101

For additional information on Dr. Chantrell's presentation, please contact:
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The Institute for Engineering in Medicine (IEM) is pleased to announce the upcoming IEM Seminar by Dr. Roy Chantrell, "Computational Models of Magnetic Nanoparticle Hyperthermia."

Magnetic nanoparticle hyperthermia is a non-invasive cancer therapy without the side effects of conventional therapies. It is based on the heat produced by subjecting a system of magnetic nanoparticles to an alternating magnetic field, which can result in reduction or destruction of a tumour with minimal effects on surrounding tissue. While the therapy is in use in Europe, the physics of the heating mechanism is not fully understood. Proposed models include Brownian motion of the particles driven by the coupling of the magnetic moment to the applied field and Néel relaxation, where the magnetic moment rotates with respect to the particle axes leading to hysteresis heating. In the latter case, alternative models exist; a linear response theory valid for nanoparticles with small energy barriers and small fields and a second assuming fully hysteretic behaviour. I will present a numerical model based on a kinetic Monte Carlo approach, which is shown to encompass both regimes. Calculations show that interactions affect the hysteresis in a complex way depending on the detailed microstructure of the nanoparticle array. Detailed knowledge of the nanoparticle array within the tumor is shown to be important in understanding and optimization of MNH as a practical therapy.

Prof. Chantrell has made outstanding contributions to the theory of magnetism and of the effects of thermal fluctuations on magnetisation reversal. His career has been primarily as an academic, and during some 30 years he has developed a group carrying out research into magnetic materials which is internationally recognized.

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