Department of Physics and Materials Science

SEMINAR

Superparamagnetic Microparticle Trapping and Transport Using Patterned Magnetic Structures: Applications and Simulation

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Abstract: Magnetic microspheres are commercially-available, fluid-borne particles made of iron oxide encapsulated in polystyrene. These microspheres are designed for bioseparation of cells, proteins, DNA, and RNA, whereas they can be specifically bound to these targets allowing for field gradients to separate the particles from a mixture. We study the transport of these particles about grids of permalloy disks, driven by varying, weak (<100 Oe) magnetic fields. Recent work has been done in the development of surface-based transport schemes and methods of applying tunable magnetic forces, showing promise for use in on-chip devices. I will discuss some of the applications of this chip-based technique as well as phenomena that arise during transport, for example variation in particle speed with external fields and transition from ordered to disordered transport at varying field turnover frequencies. We compare results from these experiments to computer models which simulate particle transport for the purpose of understanding magnetic characteristics of both the microparticles as well as the disk landscapes.

Bio: Prof. Vieira is an assistant professor in the Department of Physics at Rhodes College. He received his bachelors in physics in 2006 from the University of Maryland College Park and his PhD in 2012 from The Ohio State University. He teaches throughout the undergraduate physics curriculum at Rhodes and in 2022 served as President of the Tennessee Academy of Science.

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