

Physics Colloquium

Monday November 15th, 2004. 4:15 PM

428 Pupin Hall

Professor David Grier, New York University

“The Guiding Light: Transforming Mesoscopic Matter with Holographic Optical Traps”

Optical trapping is an increasingly important technique for controlling and probing matter at length scales ranging from nanometers to millimeters. This talk describes how to use computer-generated holograms to project hundreds of optical traps in arbitrary three-dimensional configurations and to translate and transform them independently under computer control. In addition to forming conventional optical tweezers, these holographic methods also can sculpt the light's wavefronts to create exotic optical traps based on novel modes of light. These include torque-exerting optical vortices, axial line traps, optical bottles, and optical rotators. The resulting ability to establish arbitrary potential energy landscapes for mesoscopic systems presents exciting new opportunities for fundamental research and commercial applications. As particular applications, we will focus on the anomalous transport properties of nano- and microparticles in large optical tweezer arrays, and on the self-organization of micro- and nanofluidic pumps in holographic arrays of optical vortices. Substantial questions remain to be answered regarding even the simplest of these model systems. Nevertheless, substantial real-world applications already have emerged from their exploitation.



Host: Aron Pinczuk