复旦大学物理系物质科学报告

Physics Department Colloquium

Some Theoretical Studies on Optical Micromanipulation and Their Realization

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As small particles will migrate to the high laser intensity region to minimize the free energy, one can trap and manipulate small particles at will with a focused laser. This optical manipulation technique has applications range from the trapping and cooling of atoms, to large molecules, and to microscopic particles and biological objects. I will briefly introduce our progresses on the theory and modeling of optical micromanipulation – the manipulation of micron-sized objects. I intend to cover all or some of the following topics, where, in addition to the theoretical predictions, their experimental implementation will also be briefly discussed.

1. While it is anticipated that the scattering of light always pushes a particle forward, we demonstrate that the scattering force can sometimes pull a particle backward, in a manner similar to an "optical tractor beam" in scientific novel.

2. A way to sort high-Q micro-cavities with state-of-the-art accuracy is proposed. The bonding and anti-bonding forces associated with the hybridized whispering gallery modes of a pair of such micro-cavities are discussed.

3. Huge resonant electromagnetic compressive or expansive pressures in metallic cavity were demonstrated. In infrared cavity, the large electronic kinetic energy is responsible for the compression, while in the microwave cavity the E-field leakage at the edge is responsible for the expansion.

4. Some experimental and theoretical progress in optical binding (the use of light to bind particles into a single entity) will be reported.

5. A type of unexpected counter rotation, where positive angular momentum flux can induce a negative torque on a particle, was demonstrated.

Time：2:00 pm, Tuesday, 2013.11.26

Location：Physics Building, Room 221B

(Cookies and coffee are served from 1:30 pm)