Atomic and Laser Physics Seminar

Monday, 28 January

11.30

Audrey Wood Seminar Room

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Shape Matters: Optical Forces on Nanostructures

Optical trapping (OT) of nanostructures has raised much interest in the last few years. Manipulating nanoparticles with OT is generally difficult because radiation forces scale approximately with particle volume and thermal fluctuations can easily overwhelm trapping forces at the nanoscale. However, carbon nanotubes, graphene, polymer nanofibers, plasmonic nanoparticles, and semiconductor nanowires have now been stably trapped thanks either to their highly anisotropic geometry or to their intrinsic resonant behavior. In particular, OT has been used to build nano-assemblies, for ultra-sensitive chemical-physical analysis of trapped nanostructures, as well as to accurately measure forces with femtonewton resolution combining the outstanding force-sensing capabilities of OT with increased nanometric precision. In this context the role of shape is crucial for understanding the interplay between optical forces and hydrodynamic interactions that change dramatically with size, hence much affecting both force-sensing and spatial resolution in precision applications.

In this seminar, after a general introduction on OT of nanostructures, I show some results on optical force measurements and spectroscopy of linear nanostructures (carbon nanotubes, silicon nanowires) and graphene. Thus, I describe two novel concepts: i) intra-cavity optical trapping based on optical feedback-locking, where the optical feedback on a diode laser source is controlled by the light scattering from a trapped particle, and ii) laser cooling of hybrid nanostructures that exhibit Fano resonances.