The Vienna Doctoral Programme on Complex Quantum Systems
invites you to a

Seminar Talk

by

Kishan Dholakia

St. Andrews University, UK

Let Nothing slow you down: new directions in optical manipulation

In science fiction, one is quite familiar with the idea of moving objects using laser beams, evoking concepts such as a "tractor beam". In the laboratory science fiction turns into science fact: a powerful technique known as "optical tweezers" (OT) shows that micrometre-sized particles (and even biological material and atoms) can be grabbed, moved and generally manipulated without any physical contact using optical forces. This is a powerful demonstration of the optical dipole or gradient force in action. Such "optical tweezers", based primarily on Newton's laws and fundamental optics have enabled unprecedented insight about biological molecules such as DNA and molecular motors. In the microscopic world of optical tweezers, researchers are now harnessing these systems to study a host of science: this includes advanced colloidal interactions, dynamics of particles in various potentials (with strong analogues to atomic systems), insights into superconductivity, optically bound matter, studies of the optical angular momentum of light, thermodynamics, microfluidics and motor protein transport. The list is ever growing and now includes potential studies in quantum physics.

This talk will give a perspective of emergent studies in manipulation using materials science particularly for studies at the classical-quantum interface. This can include the rotation of particles in liquid and vacuum using vaterite [1] and nanovaterite particles [2]. These particles exhibit a birefringence that allows them to spin when using circularly polarised trapping beams. Such studies can lead to very high rotation rates and exhibit new features that link to optomechanical cooling of the particle motion and potential future studies of quantum friction. This work may be extended to study the rotation of two particles in vacuum in co- and counter-rotating geometries [3]. The use of these latter types of particles can lead to new studies in optomechanics [4].

Monday, 6 November 2017,
16:30h get-together with coffee and snacks!

Lise Meitner Hörsaal, Strudlhofgasse 4, 1st floor, Vienna

The seminar talk will be preceded by a CoQuS Student talk at 17:00h
by

Daniel Hartley

University of Vienna
"Simulating Gravitational Waves"

Hosted by: Markus Arndt and James Millen

[1] Y. Arita, M. Mazilu, and K. Dholakia, Nat Commun 4, 2374 (2013)
[2] J. Yoshihiko Arita, Joseph M. Richards, Michael Mazilu, Gabriel C. Spalding, Susan E. Skelton Spesyvtseva, Derek Craig, and Kishan Dholakia, ACS Nano, 2016, 10 (12), 11505 (2016)
[3] Yoshihiko Arita, Michael Mazilu, Tom Vettenburg, Ewan M. Wright, and Kishan Dholakia, Optics Letters 40(20), 4751-4754 (2015).
[4] Susan E. Skelton Spesyvtseva and Kishan Dholakia, ACS Photonics 3(5), 719-736 (2016)