Nanoparticle cooling for interferometry

Fri, 2017-06-23 13:15 - Manon Roeleveld [1] **At:** http://vds-physics.univie.ac.at/admission/
Deadline: 7 July, 2017

Location

University of Vienna Boltzmanngasse 5
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An overview of the open positions:

- Open position with Prof. Markus Arndt
  Nanoparticle cooling for interferometry
  We explore the optical cooling of nanoparticles in the mass range of 10^6-10^7 amu to a degree that they can be used for quantum coherence and interference experiments. This shall push the mass and complexity limits of matte-wave interferometry.
  We are looking for an enthusiastic experimentalist with a good background in optics and quantum physics.
- Open position with Prof. Christoph Dellago
  Non-equilibrium Fluctuations of Vacuum Laser Trapped Nanoparticles
  The objective of this project is to investigate, using computer simulations and theory, the dynamics of non-equilibrium systems. The specific example to be studied is a laser trapped nanoparticle, which is investigated experimentally by our project partners at the ETH Zurich. The levitated nanoparticle will be used to investigate non-equilibrium fluctuations, which will be analyzed in the framework of stochastic thermodynamics. Specifically, we will explore transitions between stationary non-equilibrium states, fluctuations in steady-states that violate the principle of detailed balance, the concept of conditional reversibility, and the coupling between internal and center-of-mass temperatures. The student to be involved in this project is expected to have knowledge of advanced statistical mechanics and be proficient in computer programming.
- Open position with Prof. Jani Kotakoski
  In-situ investigation of stacked heteronanostructures (ISIHNANO)
  A PhD position is available within the FWF-funded ISIHNANO project. The project aims at understanding and controlling the physical and structural properties of low-dimensional

nanostructures, their heterostructures and their defects under the influence of external perturbations. Carbon nanostructures (nanotubes, graphene, etc.), semiconductor nanostructures and two-dimensional transition metal dichalcogenides and their heterostructures are the main studied materials. Atomic-scale studies of the prepared structures and their defects will be performed by (scanning) transmission electron microscopy in situ under external perturbation. Successful candidate will be allowed take an independent role in designing the details of their PhD project.

- Open position with Prof. Christos Likos
  Self-assembly of quasi-two dimensional soft colloids
  We are looking for a Ph.D. student to work on our current activity of investigations of soft, patchy colloids under geometrical confinement. Previous investigations in the group have established that star-shaped block-copolymers in the bulk can act as self-organized patchy particles, whose patchiness can be tuned by molecular architecture and temperature, leading to the emergence of a variety of self-assembled structures. The current project will extend these investigations at the border between two and three dimensions, where the block copolymer stars have been found to build a variety of soft polygons, including squares, triangles and pentagons, which make them excellent candidates for the formation of two-dimensional quasicrystals. The focus will be on developing coarse-grained models for the investigation of the phase behavior in two dimensions. The successful candidate should have a solid background in Statistical Physics; experience with computer simulations and/or polymer or colloidal physics is a plus.
- (2) Open position(s) with Prof. Thomas Pichler
  1. Optical study of confined carbyne
  The PhD project deals with ultra-long carbon chains stabilized inside DWCNT. This material was elusive for more than 125 years and was for the first time produced in my laboratory (chains with more than 6000 carbon atoms length) [1]. Theoretically it is predicted as hardest material in the world, but it has to be stabilized. We have results on how to stabilize it via charge transfer and hybridization inside the nanotubes and how this can be theoretically understood and influences the optical properties [2]. Within the PhD a systematic study of the chain length dependent confinement in different nanotubes will be performed in order to challenge the application potential of these novel materials in nano-optics and as sensors.
  References:
  [1] DOI: 10.1038/NMAT4617, Nature Materials, 15, 634 (2016);
  DOI: doi.org/10.1103/PhysRevB.94.195422 [5], Phys. Rev. B, 94, 195422 (2016);
  [2] DOI: 10.1002/adfm.201505502, Advanced Functional Materials 26, 4874 (2016);
  arXiv:1705.02259.

  2. Development of in-situ spectroscopic cells to follow chemical reactions inside carbon nanotubes and graphene towards controlled functionalization.
  The control of functionalization of graphene and carbon nanotubes is crucial for accessing the application potential of these material class. This allows to achieve hybrid structures with tailored properties. The PhD deals with novel setups to spectroscopically control the functionalization degree by analysing their spectroscopic fingerprint. As an example we have recently developed a Raman cell and found the unique fingerprint of covalent sp3 defects in the Raman spectra of highly functionalized graphene [1]. Based on this study the PhD will work on setting up new in-situ functionalization cells, allowing unraveling different spectral fingerprints and to monitor and control and understand the properties in unprecedented details

  [1] DOI: 10.1038/ncomms15192; Nature Communications 8, 15192 (2017).

- Open position with Prof. Paul Winkler
  Nucleation and growth rate measurements from anthropogenic precursors in chamber and field experiments
  An open PhD position is currently available in the framework of a Marie Sklodowska-Curie Innovative Training Network called CLOUD-MOTION. The successful candidate will conduct experimental studies of nanoparticle formation using cutting-edge instrumentation for nanoparticle detection and sizing. This work will partly be performed at the CLOUD experiment at CERN, Switzerland. In addition, field experiments in Vienna are planned to

investigate urban nucleation.

- PhD [6]

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