# CPP 16: Colloids and Nanoparticles III

Time: Tuesday 17:00–18:30 Location: H47

CPP 16.1 Tue 17:00 H47

**Direct measurement of the critical Casimir force in a binary liquid** — •Christopher Hertlein, Laurent Helden, and Clemens Bechinger — 2. Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart

A colloidal particle suspended in a binary liquid at the critical composition close to a substrate experiences a critical Casimir force upon approaching the critical temperature of decomposition $T_c$. We have measured interaction potentials for a single polystyrene particle suspended in a mixture of water and 2,6 -lutidine approaching $T_c$ using Total Internal Reflection Microscopy (TIRM). TIRM is a technique for precise measurements of colloid - wall interaction potentials based on single particle evanescent wave light scattering. The measured interaction potentials display a clear contribution of the critical Casimir force which becomes stronger upon approaching $T_c$ and is either attractive or repulsive depending on the preference for water or lutidine of substrate and/or particle.

CPP 16.2 Tue 17:15 H47

**Influence of the preparation and processing on thermal and mechanical properties of metal/poly(methyl methacrylate) nanocomposites** — •Christian Hub[1], Shane Harton[2], Marcus Hunt[3], Rainer Fink[1], and Harald Ade[4] — [1]Universität Erlangen, Lehrstuhl für Physikalische Chemie II, Erlangen, Germany — [2]Columbia University, Department of Chemical Engineering, New York, USA — [3]North Carolina State University, Department of Fiber & Polymer Science, Raleigh, USA — [4]North Carolina State University, Department of Physics, Raleigh, USA

The inclusion of nanoparticles into polymeric materials is well-known to increase mechanical strength, provide tunable optical and electrical properties, or improve thermal resistance of the host polymer matrix. Because of the technologically relevant applications of nanocomposites, numerous investigations showing significant, and sometimes anomalous, changes in the observed properties have been done in recent years. In the current study the influence of the sample preparation and processing on thermal and mechanical properties of silica/PMMA nanocomposites were investigated. The changes in mechanical and impact strength of the obtained nanocomposites have been probed by dynamic mechanical analysis. Thermal properties have been investigated by differential scanning calorimetry. We will demonstrate that equilibrium inclusion of nanoparticles within polymer matrices can have a significant impact on mechanical properties of the host polymer, even though it may not be accompanied by changes in other properties such as the glass transition temperature (funded by DAAD).

CPP 16.3 Tue 17:30 H47

**High-resolution photoemission study of II-VI semiconductor nanoparticles** — •Tina Graber, Franziska Niederdraenk, Christian Kumpf, Achim Schöll, and Eberhard Umbach — Universität Würzburg, Experimentelle Physik II, Am Hubland, 97074 Würzburg

Semiconductor nanoparticles are of rapidly increasing interest due to their various actual and potential applications, such as, e.g., active components in LEDs or solar cells. Very small (1-5 nm) particles are also of particular interest in fundamental research since they represent a size scale which is in between the well-established descriptions of solid state and molecular physics.

We report on high resolution X-ray photoemission data of ZnO, CdSe and CdSe/ZnS core-shell nanoparticles in the range of 1-5 nm diameter. The particles were produced by a wet-chemical preparation method with organic stabilizers and drop-deposited on H-passivated silicon and polycrystalline Au substrates. A detailed analysis was performed to identify the various contributions from the core, shell, interface, and surface to the total signal in order to understand the influences of different synthesis routes on the particle composition. Influences of different solvents as well as beam damage and aging processes are discussed.

CPP 16.4 Tue 17:45 H47

**Raman intensity profiles of individual single-walled carbon nanotubes** — •Martin Fouquet[1], Hagen Telg[1], Janina Maultzsch[2], Christian Thomsen[1], James Hone[3], and Tony Heinz[2] — [1]Institut für Festkörperphysik, Technische Universität Berlin, Germany — [2]Departments of Physics and Electrical Engineering, Columbia University, USA — [3]Department of Mechanical Engineering, Columbia University, USA

We performed resonant Raman measurements on individual single-walled carbon nanotubes grown across a 100 micrometer wide slit. We collected intensity profiles of the radial breathing mode (RBM) and the high energy modes (HEM) by varying the excitation energy between 1.85 eV and 2.2 eV. In metallic nanotubes, the characteristic Fano-lineshape of the HEM is found, confirming that it is intrinsic to individual metallic tubes. We observe that the lineshape and peak positions depend on the resonance Raman condition, and their dependence on excitation energy is discussed.

CPP 16.5 Tue 18:00 H47

**Schwingungseigenschaften von (3,3) Kohlenstoffpicotubes** — •Nils Rosenkranz[1], María Machón[1], Rainer Herges[2] und Christian Thomsen[1] — [1]Institut für Festkörperphysik, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin, Germany — [2]Institut für Organische Chemie, Universität Kiel, Otto-Hahn-Platz 4, 24098 Kiel, Germany

Als Picotubes bezeichnet man hochsymmetrische Kohlenwasserstoffmoleküle, die strukturell eng verwandt mit den kleinsten Nanotubes sind. Als zentraler Ausgangspunkt einer gezielten Synthese von Nanotubes sind Picotubes von fundamentaler Bedeutung. Die hier vorgestellten Semitrimere ähneln einem Ausschnitt eines (3,3) Nanotubes. Wir stellen erstmalig die Schwingungseigenschaften dieses Moleküls vor. Mittels winkelabhängiger Ramanspektroskopie an Semitrimerkristallen konnten die Symmetrien der einzelnen Moden bestimmt werden. Unsere Ergebnisse zeigen Analogien zu den Schwingungseigenschaften von Nanotubes. Insbesondere konnten wir eine Mode identifizieren, die große Ähnlichkeit zu der für Nanotubes sehr charakteristischen Atmungsmode aufweist.

CPP 16.6 Tue 18:15 H47

**Photoactivation of Quantum Dots Controlled Embedded into Silica colloids** — •Christina Graf[1,2], Sofia Dembski[2], Anne Bock[2], Tim Krüger[3], and Eckart Rühl[1,2] — [1]Institut für Chemie und Biochemie, Freie Universität Berlin, Takustr. 3, 14195 Berlin — [2]Institut für Physikalische Chemie, Universität Würzburg, Am Hubland, 97074 Würzburg, — [3]Theodor-Boveri-Institut für Biowissenschaften, Universität Würzburg, Am Hubland, 97074 Würzburg

Quantum dots (QD) are nowadays widely used as markers in life science. However, after the transfer into biological systems their fluorescence quantum yield (QY) is often reduced. Photoactivation with UV or visible light is a powerful tool to increase the photoluminescene (PL) of QD. Here, we present a study on the influence of the local environment on the photoactivation of QD. CdSe/ZnS QD embedded in silica colloids were studied in various liquids. Under continuous photoactivation with UV or visible light the PL of the embedded QD can be stably up to ten times enhanced and strongly depends on the local environment. Hereby, the thickness-dependent permeability of the silica shell controls the influence of the outer media on the QD. If foreign ions are present the activation can be fully retained after termination of the activation, while in their absence the process is partially reversible. Considering the present results, a new model for the photoactivation of QD in various environments is developed. It comprises photopassivation and a subsequent oxidation processes. The embedded QD also retain their QY inside living cells. Moreover, they can be long-time photoactivated in living cells.