UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

Mittwoch, 24.01.2018
13:00 Uhr
Hörsaal MC 122

Building molecule and solid analogues from colloidal particles

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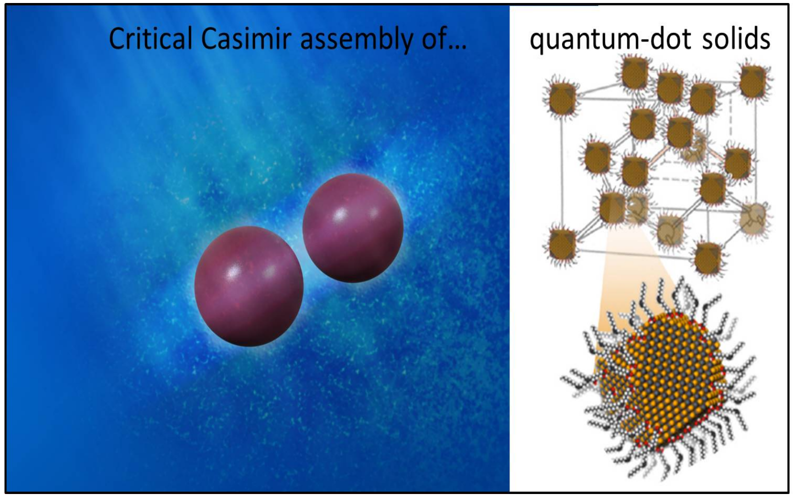

Control over the assembly of colloidal and nanoparticles has important applications in the design of new materials at micrometer and nanometer length scales. Recently, critical Casimir forces have emerged as new solvent-mediated forces offering unprecedented control over particle interactions via temperature-dependent solvent fluctuations: In analogy to the confinement of fluctuations of the electromagnetic field between two conducting plates (quantum mechanical Casimir effect), the confinement of fluctuations of a critical solvent in the gap between two surfaces leads to a universal attraction between these surfaces. This offers exquisite temperature control over the interactions of colloidal particles. We show that this dynamic control allows us to form equilibrium phases, as well as quench into well-defined non-equilibrium states. Fascinating opportunities arise for the assembly of “colloidal molecules”, analogues of molecules on the colloidal scale. Using patchy colloidal building blocks with well-defined symmetry, we can assemble new families of complex molecule-like structures. Another important application lies in the realm of new optoelectronic materials using quantum dots as building blocks. We assemble semiconductor nanocrystals into active films for next-generation opto-electronic devices such as solar cells. By coating with short conductive ligands, we achieve quantum-mechanical coupling between the assembled nanocrystals, resulting in solid-state-like transport that can be designed by the choice of building blocks and ligands. I will discuss the opportunities offered by critical Casimir forces in this exciting internationally rising field.