

Physics Seminar

Thursday, 12th January 2012 at 14h00

(coffee at 13h45)

Campus Belval
Room F011

Talk by **Dr. Tobias Kraus**

Leibniz Institute for New Materials

Particle films, clusters and supercrystals: the science and the process engineering of nanoparticle self-assembly

Particles with sub-micron diameters and atoms share some traits. If the particles' sizes are narrowly distributed and their interactions are attractive, they exhibit phase transitions from dispersed states to agglomerates. Just like atoms, particles crystallize into regular arrangements ("superlattices") to minimize their free energy. Mixtures of different particles arrange into structures that remind of ionic crystals. Confined particles form clusters that resemble noble gas clusters.

Upon closer inspection, however, striking differences between such "particle self-assembly" and atomic crystallization become apparent. I will present surprising temperature dependencies of the self-assembly process to show that the contact mechanics between nanoparticles often governs their agglomeration and prevents crystalline assembly. I will also discuss the role of capillary interactions and convective flows during the evaporation of particle dispersions and show that even small particles can be assembled into regular arrangements regardless of particle-particle interactions.

Particle agglomeration and assembly is a fundamentally interesting problem with applications: Nanoscale particles are components in many commercial materials. They lend their properties to particle-polymer hybrids, form dense networks in sol-gel coatings and sinter into flexible functional layers at moderate temperatures. We are therefore interested in controlling the particles' shapes and arrangement both to improve material properties and to introduce new functionalities. Our goal is to derive robust techniques for material synthesis from an understanding of particle agglomeration. I will present attempts to combine particle assembly with standard techniques such as dip-coating, printing, emulsion processing and polymer formulation.

Next Physics Seminars

- Friday, 20th January 2012
Belval, hour to be precised
Dr. Alain Lafond
X-rays Crystallographic Investigations of Photovoltaic Chalcogenide Compounds