

## **Control of colloidal crystal growth by external fields**

E. von Rhein, O. Gudi, and S. Greulich-Weber,

Universitaet Paderborn, Department Physik, Warburger Str. 100, Paderborn, Germany.

Since the introduction of the concept of a photonic crystal much effort has been targeted at producing 3D photonic crystals working in the visible wavelength range. The most promising way is by self-assembly of monodisperse sub-micron spheres made of silica or organic materials resulting in fcc and hcp colloidal crystals. However, the large scale fabrication and thus their application in photonics suffer from the reproducibility of defect-free extended bulk crystals. Commonly used 'natural' sedimentation is unacceptably slow and often results in low crystal quality showing cracks and stacking faults or reveals a disordered bulk below an apparently ordered surface. In literature there are several examples, where additional external fields such as electric or acoustic fields were applied, which to a certain extent enhanced the crystal quality. However, the reproducibility of such experiments depends on many parameters like the chemical composition of the spheres, the solvent, the density ratio of spheres and solvent, and many more. To have control of all these parameters during crystal growth is one of our current projects. We will present details of our computer controlled crystal growth experiments using specific external fields. In classical crystal growth methods (e.g. Czochralski-growth), one avails of temperature gradients. In analogy, we use acoustic noise gradients instead of temperature gradients for optimizing crystal growth. The crystal growth and evaporation of the suspension is monitored by CCD-cameras and thus computer-controlled.