Eugene Wigner Colloquium

event of SFB 910

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Universität Potsdam

"Light Responsive Micro-Objects"

We report on how long range repulsive interactions between colloidal particles trapped at a solid-liquid interface can be introduced and be tuned on demand just by optical stimuli. Quasi-two dimensional systems of colloidal ensembles are important in order to rationalize a plethora of phenomena, from understanding phase behaviour of dense colloidal systems to the collective action of cells and mixtures of active and passive Brownian particles in the non-equilibrium case. For a given system, however, the mutual interactions between colloids can usually not be adjusted easily over a broad range, rather a cumbersome change of environment or modification of particle surfaces is required if one thinks of the usual framework of DLVO forces comprising electrostatic/double-layer, Van-der-Waals and steric interactions. Here we show that in a given fixed system of colloids the strength of long range repulsive forces can be tuned on demand by applying external optical stimuli. In this way, the nature of the given system can be changed drastically. For instance, we report on colloidal ensembles that can be separated to defined distance and then clustered in a reversible way many times using just two different illumination wavelength. The physical mechanism we exploit relies on the light driven diffusioosmotic generation of local fluid flows in the vicinity of each colloidal particle. We realize light driven diffusioosmosis with colloids immersed in an aqueous solution of photosensitive surfactants. The repulsive strength is notable over more than 10 particle diameters and can be regulated with illumination intensity. The possibilities we introduce may give a whole new perspective of how colloidal ensembles can be studied.

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