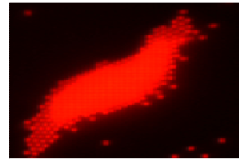


Tuesday, March 30, 2010
Room: Birck 1001, 3.00 p.m.
Birck Nanotechnology Center (Discovery Park)

**DYNAMIC MANIPULATION WITH LIGHT AND ELECTRIC
FIELDS: COLLOIDAL PARTICLES TO DROPLETS**

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Abstract: The realm of microfluidics deals with the study, control and manipulation of fluids that are geometrically constrained to small, typically sub-micrometer length scales. Many microfluidic applications require non-invasive manipulation of fluid or even particulates suspended in a fluid medium. Hybrid opto-electric techniques (HOTs) for non-invasive manipulation of matter over several length scales are developed. Rapid electrokinetic patterning (REP) is one such HOT for the non-invasive manipulation of micro and nano-particles on an electrode surface. The technique employed a simple parallel electrode setup, with an applied AC electric field, on which optical holograms at a suitable wavelength are shone. In a low AC frequency regime (<200 kHz), particles could be dynamically configured into various shapes by the use of holograms generated from spatial light modulator (SLM). REP is primarily an electrokinetic technique, where optically modulated electrokinetics serves to rapidly transport particles to the illuminated locations on the electrode surface leading to particle aggregation. It is shown that particle transport to the illuminated location is enabled by a toroidal electrothermal microvortex. While many different applications of REP can be conceived, two applications of this newly discovered technique are showcased – force measurement and sorting of particles.

Further development led to the creation of a universal hybrid opto-electric platform (u-HOP). u-HOP leverages a variety of different physical mechanisms to achieve dynamic manipulation of droplets and also achieve in-situ concentration of colloidal particles suspended in the droplets. Various physical mechanisms are leveraged through different modes of operation of the device. Each operational mode, which is activated through the proper combination of an applied AC bias and the illumination used, is characterized by the ability to manipulate objects at a certain length scale. It is also demonstrated that the device lends itself towards the ‘active control’ of microstructure patterns that emerge from a droplet evaporation process.

Bio: Aloke Kumar received his B.Tech and M.Tech degree in Manufacturing Science and Engineering and Industrial Engineering and Management respectively, from the Indian Institute of Technology, Kharagpur, India in 2005. He joined Purdue University, Indiana, USA in August 2005 for his PhD. During his study at Purdue University, Aloke received the Ross Doctoral Fellowship, the Adelberg Fellowship, Bilsland Dissertation Fellowship and the Josephine DeKármán Fellowship.