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Masters, PhD and postdoc positions in Applied physics/Nanoscience

My new research group at the Institute of Physical Chemistry, University of Zurich is interested in developing new ways to control and manipulate matter at the nanoscale, suspended in solution. At these length scales, gravity plays almost no role and the dynamics of an object in free solution are entirely dominated by random kicks from the surrounding thermal bath. Placing the object in a confined space however puts new forces in play, namely those between the object and the neighbouring walls. We have recently shown how these forces can be harnessed to manoeuvre a nanoscale object into a stable position and orientation in three dimensions (take a look at *Nature* 467, 692 (2010) & *Nature Nanotechnology* July 2012 for further details).

Our broad goal is to develop recipes toward "force-free" control of matter in solution - from proteins and biological macromolecules like viruses and DNA, to inorganic entities displaying interesting photonic properties. To this end, we will use micro- and nanofluidic systems as an experimental platform to explore a number of intermolecular interactions. We will also come up with ways to use light, electrical and flow fields to manipulate the dynamics both of single-objects as well as ensembles. This work will ultimately feed into the development of new technology, and could show up in practical devices such as sensors, photonic components, possibly even memories and displays, all based on the precise manipulation and control of nanoscale building blocks.

The research areas we are involved in span soft condensed matter physics, applied physics and photonics, physical chemistry of charged interfaces, and single molecule biochemistry. At the level of experimental techniques, we rely on a combination of advanced nanofabrication, optical imaging and detection, chemistry and biochemistry.

There are a wealth of exciting problems for Masters theses and PhD projects in this area that include:

- Trapping single biological macromolecular complexes and proteins in an electrostatic fluidic trap
- Sorting nanoscale matter in electrostatic landscapes on a fluidic chip
- Using interactions beyond classical electrostatics eg., depletion and dispersion, to manipulate objects in a "force-free" fashion on a chip.

Projects are generally highly interdisciplinary. Students broadly interested in applied physics and nanoscience, with a flair for quantitative work are strongly encouraged to apply. A strong experimental background in optics and/or micro- and nanofabrication is highly welcome.

Please send an email with your CV, a brief description of your academic background, skills and interests, preferably all in one file to:applications-krishnan@pci.uzh.ch

Prof. Dr. Madhavi Krishnan, Assistant Professor of Physical Chemistry