SYRACUSE UNIVERSITY

# DEPARTMENT OF BIOMEDICAL AND CHEMICAL ENGINEERING

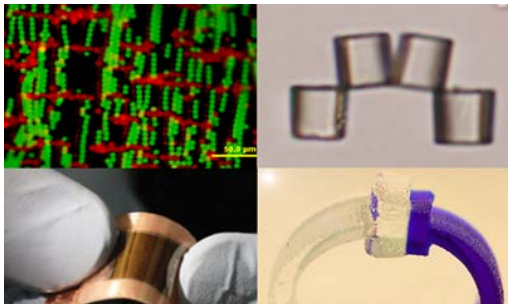
GRADUATE STUDENT SEMINAR SERIES FALL 2015

## "Soft Matter Manipulated by External Fields: Dynamic Assemblies, Biomimetic Circuits and Soft Robotics"

**Friday, Sept. 4**
**1-2 pm**
**105 Link Hall**

**Orlin Velev, PhD**
**Department of Chemical & Biomolecular Engineering**
**North Carolina State University**
**Raleigh, North Carolina**

I will present strategies for electric and magnetic field driven manipulation of novel functional structures from "soft matter" - asymmetric particles or gels in water environment. Their complex structure and dynamics arise as a result of two effects - counterionic mobility and anisotropic polarizability. In the first part of the talk I will discuss how external AC fields can assemble asymmetric particles into programmable and reconfigurable structures. Metallo-dielectric particles, such as Janus/patchy spheres, and selectively coated microcubes, acquire complex polarization pattern in electrical fields, which can lead to programmed multidirectional interactions. In addition, such particles exhibit a variety of AC electrokinetic motility effects. The combination of dielectrophoresis and AC electrokinetics, controlled through the field frequency, strength and direction, opens a rich field of possibilities for engineered assembly and manipulation. Permanent, yet reconfigurable, structures can also be assembled by using magnetic fields and asymmetric particles with residual polarization. I will present a few such dynamic microscale structures with potential applications in emerging fields such as microrobotics. In the second part of the talk I will discuss briefly the complementary case of ionic effects in water-based gels doped with polyelectrolytes. The counterionic mobility around their molecular backbones can be used in a broad range of biomimetic devices. I will demonstrate that ion-doped conductive hydrogels can form the core of novel diodes, memristors and photovoltaic cells. Finally, such hydrogels can be ionically patterned and reconfigured by electrical or chemical means to form new types of actuators and soft robotic components.



**FOR MORE INFORMATION, CONTACT PROFESSOR Shikha Nangia at snangia@syr.edu**
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