Dear Soft Matter Colleagues,

Welcome to our April newsletter. This month we are featuring Dr. Uri Raviv’s group from the Hebrew University of Jerusalem, an exploration into a new phase of actin, design ideas for responsive buckled surfaces, and a new book from Shigeyuki Komura and Takao Ohta. Have a pleasant read and a happy April.

Professor Uri Raviv's Biomolecular Structure and Interactions Lab

Hailing from the Hebrew University of Jerusalem Center for Nanoscience and Nanotechnology, Professor Uri Raviv’s group addresses dynamical aspects of self-assembly in supramolecular nanostructures of biomolecules through x-ray scattering and diffraction in solutions combined with electron microscopy. The group consists of six members, two Ph.D. students, three Masters students, and three undergraduates.

Combined with a world class X-ray scattering infrastructure, the lab uses its own software, X+, to analyze the data and minimize background noise. Complete with model fitting procedures, X+ is a leading analysis tool for X-ray scattering data that enables any electron density profile and polydispersity distribution profile to be analyzed. The software is free and available for download here.

Some of their extensive research includes:

- **Supramolecular assembly of cytoskeleton proteins:** Dr. Raviv’s lab focuses on microtubules using the nerve cell and its rich cytoskeleton as a model system. The interactions between Tau and microtubules are scrutinized to elucidate how the self-assembly of microtubules is influenced by Tau with the ultimate goal of connecting structure to function.

- **Using synthetic polypeptides to control the structure, assembly and functionality of proteins and biopolymers:** The self-assembly of certain protein, polypeptide or biopolymer aggregates that are associated with various diseases including Alzheimer’s, Huntington, and Kennedy diseases is studied for the purpose of disrupting their assembly. A clear knowledge of the design principles for such polypeptides would enable the rational manipulation of these polypeptides through knowledge gained from soft matter physics.

The group develops state-of-the-art measurements and analysis capabilities that allow observation of self-assembled biomolecules in solutions. Their work in model membranes, amyloids, viruses, and microtubules has allowed them to form a solid ground for addressing biologically relevant assemblies. In the future, Prof. Raviv plans to continue this dual mode. Studying relatively simple model systems, where fundamental physical chemistry questions can be addressed in great detail, is essential for understanding the more complex biological structures.

You can read a more detailed description of the group’s research projects in this month’s Supplementary Material.

Read more about the group on their website.
Counterion-Induced Formation of Regular Actin Bundle Networks

Researchers from the University of Leipzig report the self assembly of actin bundles into networks of aster-like and ladders to a nematic-like clusters with increasing cation concentration. By taking confocal images of droplets containing fluorescent actin and magnesium ions as the droplet evaporated, a reversible, progressive change from aster bundles to ladders to nematic configuration was mapped on a phase diagram relating actin and ion concentrations.

Distance from aster bundle centers is not related to filament length since radical filament shortening had no effect on average center spacing. It remains to be elucidated whether bundle growth kinetics (e.g. resembling colloidal aggregation dynamics) in conjunction with sterically hindered filament and bundle diffusion can already account for the observed bundle network’s regularity.

Read more in Soft Matter.

Designing Responsive Buckled Surfaces by Halftone Gel Lithography

Copolymer crosslinking is tuned to yield complex three dimensional shapes by photopatterning polymer sheets and controlling the irradiation dose. The method of halftone lithography permits fabrication of stimulus-responsive gel sheets with micrometer scale thicknesses and 2D patterned swelling. Researchers from the University of Massachusetts mathematically describe the relationship between photopattern dot size, polymer swelling, and temperature by modeling dot swelling as an Enneper’s minimal surface with n nodes.

Results of the model match experimental data. Beyond fabricating simple shapes with constant target Gaussian curvature, this approach opens the door to fabricating shapes of arbitrary complexity. The model represents a powerful method for fabricating stimuli-responsive gel micro-devices and studying fundamental questions about how 3D shapes are formed through differential growth in 2D.

Read more in Science.
CECAM Workshop: Emergent Dynamics in Driven Colloids

The workshop focuses on key barrier problems of understanding physical mechanisms underlying emergent dynamics and self-assembly in far-from-equilibrium colloidal systems. The task is to identify strategies and minimal reaquirements for coarse-grained models using inputs from experiment, computer simulation, and theory. This workshop also presents a discussion platform that is crucial to raise the level of awareness for this burgeoning research field. It is an opportunity for experimentalists and theoreticians to exchange ideas advancing our understanding of active soft matter.

In order to further encourage a coherent discussion in a very broad field, the conference program will focus the topics to periodically driven colloidal systems like colloids in alternating electrical and magnetic fields, acoustically driven suspensions, and colloids under alternating hydrodynamic forcing. The conference aims to bring together experimentalists and theoreticians working in the field and especially focus on bridging the gaps between the computational approaches on different levels of coarse graining. Register and read more on the website.

Gordon Research Conference: Polymer Physics

The 2012 Gordon Research Conference on Polymer Physics features outstanding lectures and discussions in this critical interdisciplinary field. Polymer Physics impacts every industrial sector from electronics to transportation to medicine to textiles to energy.

The conference will feature 22 invited lectures. The technical content of the 2012 meeting will comprise topics of strong current and enduring interest across polymer physics, with particular focus in areas including:

- Conducting polymers for energy applications
- Polymers at the interface with biological systems
- Polymeric surfactants for functional encapsulation
- Semi-crystalline polymers: science of materials design
- Self-assembly strategies from lab and nature
- Entangled rheology and shear banding (is rheology finished?)

This meeting will take place immediately following the first annual Polymer Physics Gordon Research Seminar. Register and read more on the website.

We hope you enjoy browsing softmatterworld.org and come back soon

Linda S. Hirst, Adam Ossowski and Dmitri Medvedko

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