Soft Matter World Newsletter

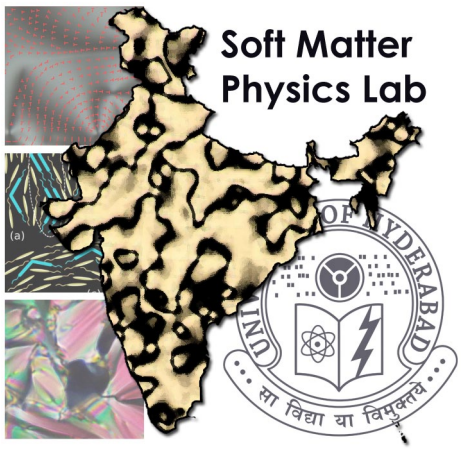
March | 2012 | Issue 39

Dear Soft Matter Colleagues,

Welcome to our March newsletter. This month we are featuring Dr. Dhara's group from Hyderabad, India, and studies on how the behavior of foams, ponytails, and spider webs can be modeled. Have a pleasant March and a great read.

Soft Matter Physics Group at the University of Hyderabad

Dr. Surajit Dhara's group in the Department of Physics at the University of Hyderabad, Hyderabad, India investigates the molecular dynamics of liquid crystals using field cycled nuclear magnetic resonance and Monte Carlo simulation. The group consists of Dr. Dhara and five researchers. Their three research interests are:



• *Structures and Properties of Liquid Crystalline Phases of Unconventional Mesogens*

The phase transitions and visco elastic properties are investigated in liquid crystals composed of bent, T-shaped, or hockey-stick shaped molecules. The physical properties and the electro optical responses in unconventional liquid crystals are drastically different from those of conventional thermotropic liquid crystals.

• *Liquid Crystal-Nanoparticle Composites*

The curvature elasticity, rotational viscosity, and the rheological properties of liquid crystal nanocomposites is experimentally investigated. Dilute nanosuspensions seem to behave in a similar way to a pure liquid crystal, their unique electro-optical and magneto-optical properties have attracted much recent attention for display applications.

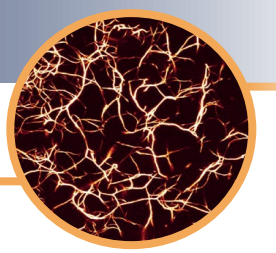
• *Rheology of Complex Fluids*

An overarching theme in the group's research, rheology, structures, and dynamics of complex liquid crystals, liquid crystal-nanoparticle composites, and polymers are investigated.

Dr. Dhara's lab setup optimally enables precise liquid crystal sample preparation and observation.

Dr. Dhara's group specializes in synthesizing liquid crystals and measuring their behavior on irregular substrates with a lab setup designed to enable precise liquid crystal sample preparation and observation. Images of liquid crystal phase transitions from the lab have been featured in the kaleidoscope image gallery of European Physical Journal E, in particular, one of these images documents the discontinuous anchoring transition of a nematic liquid crystal on an amorphous perfluoropolymer surface. In 2010, Dr. Dhara was awarded the Michi Nakata Prize by the International Liquid Crystal Society for Early Career Achievement for the discovery of this transition. Dr. Dhara has received another award from the Indian Physics Association. He is also visiting scientist of the Jozef Stefan Institute in Ljubljana, Slovenia and of the Department of Organic and Polymeric Materials in Tokyo Institute of Technology in Tokyo, Japan.

To read more, visit Dr. Dhara's website.

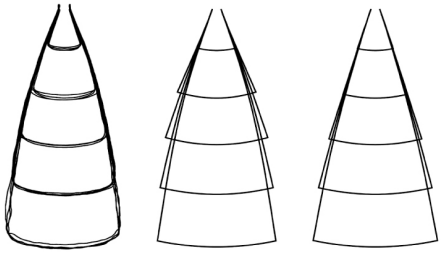


Shape of a Ponytail and the Statistical Physics of Hair Fiber Bundles

Raymond E. Goldstein, Patrick B. Warren, and Robin C. Ball. Physical Review Letters, 2012, Vol. 108, Issue 7, DOI: 10.1103/PhysRevLett.108.078101

In his notebooks, Leonardo da Vinci remarked that human hair resembles fluid streamlines. British researchers have reduced the many-body problem of a ponytail envelope into a one- body problem of swelling pressure, characterized by an "equation of state" (EOS).

The EOS modifies the envelope shape from that of a single hair bent by gravity. It describes a force balance on a length element of the notionally equivalent single fiber as the sum of four dimensionless terms which are, respectively, an elastic restoring force, a "string tension" contribution, a weight term, and a radial swelling force corresponding to a pressure gradient per unit fiber density.



▲ Superimposed rotationally averaged outlines hair switches. The EOS equation predicts shape through calculating envelope pressure from unit fiber density

Read more in Physical Review Letters.

Simulations of two-dimensional foam rheology: Localization in Linear Couette Flow and the Interaction of Settling Discs

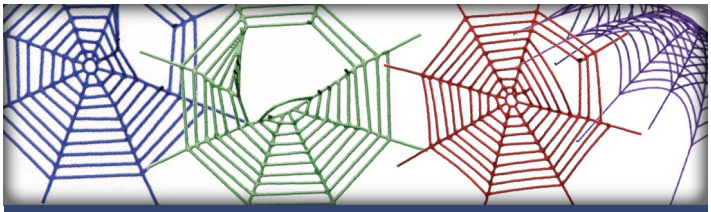
A. Wyn, I.T. Davies, and S.J. Cox. European Physics Journal E, 2008, Vol.26, Number 1-2, DOI: 10.1140/epje/i2007-10286-0

Changes in bubble topology that occur during plastic flow and the sedimentation of two circular discs under gravity are investigated through Surface Evolver simulations in an ideal two dimensional foam. Researchers from Aberystwyth University in Wales and Laboratoire Spectrometrie Physique in France investigate the challenge of determining localization from the initial structure of a foam through five parameters- the average of bubble coordinates, bubble area average, average foam disorder around bubbles, texture tensor, and the average of a line that spans a bubble. Results indicate localization in the linear Couette shear of a 2D foam is highly dependent on the polydispersity in bubble areas. When two discs, slightly larger than the bubbles, are placed close to or above one another, small discs move faster in the wake of the other. For sufficiently close pairs of discs, one is attracted into the wake of the other.

Read more in the European Physical Journal E.

Nonlinear Material Behaviour Of Spider Silk Yields Robust Webs

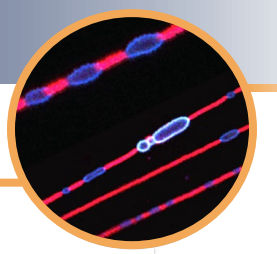
Steven W. Crandford, Anna Tarakanova, Nicola M. Pugno, and Markus J.Buehler. Nature, Vol. 482, DOI: 10.1038/nature10739



▲ (from left to right) A comparison of linear elastic, elastic–perfectly plastic behaviours, and derived dragline silk. Web behaviour under distributed (global) wind loading.

The properties of spider silk have been thoroughly investigated down to the primary amino acid sequence. However, the many elastic properties of a spider web are due to geometry as well as the silk itself. Researchers from MIT and Cornell have investigated how a spider web responds to stress in light of its geometry and materials composition through computer modeling and experiment. Results indicate spider silk softens and stiffens in a nonlinear manner with entropic unfolding, stiffening, and stick slip regimes progressing with increasing stress after an initial yield point. A spider web distributes stress by sacrificing threads, allowing the spider to repair rather than rebuild if failure occurs. This use of sacrificial elements may see application in engineering.

Read more in Nature.



Warwick Polymers 2012

Warwick 2012 will be held July 9-12th, 2012 at the Warwick conference center in Warwick, UK. Submit abstracts no later than April 30, 2012. Over the course of three days, there will be twelve plenary lectures and eighty invited lecturers, a poster session, and evening events. A very saturated conference, Warwick Polymers has a high rating among soft mater professionals internationally.

Register and read the program on the site.

24th International Liquid Crystal Conference

This biannual conference brings together a broad scientific community linked together by the interest in various aspects of soft matter and working in the interdisciplinary field of liquid crystals, or more broadly, mesophases. This community includes spanning classical synthetic chemistry, theoretical physics, structural biology, and engineering. Liquid Crystals are almost omnipresent in many very different fields. This conference provides a common platform for demonstrating and discussing new developments.

ILCC 2012 will be held in the Convention Center Rheingoldhalle in Mainz, Germany August 19th - 24th 2012 and will consist of talks, seminars, social events, and a poster session. All abstracts must be submitted not later than March 9, 2012.

Look through all twenty conference topics, register, and read more on the website.

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Linda S. Hirst, Adam Ossowski and Dmitri Medvedko

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