

Soft Matter World Newsletter

January | 2012 | Issue 37

Dear Soft Matter Colleagues,

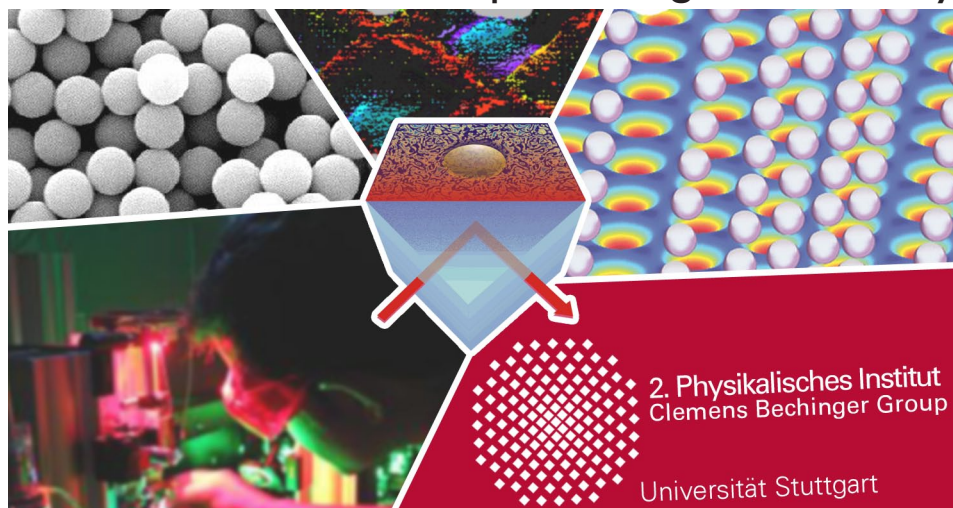
Welcome to our January newsletter. We at Soft Matter World are celebrating our third year with a special feature highlighting those who make Soft Matter World possible: our subscribers. An overview of our newsletter coverage since 2009 is presented on page two. We would like to follow-up last month's featured article on smectic liquid crystal shells by highlighting a second article on the subject, published in the same June 2011 issue of *Physical Review Letters*. Also, we are proud to feature the prolific colloidal research group of Dr. Clemens Bechinger of Stuttgart University and a study on granular flows in avalanches.

Have a fresh new year and a pleasant read.

Dr. Clemens Bechinger's research group at Stuttgart University has seen great success with December publications in *Nature Materials* and *Nature Physics* journals. The group uses colloidal systems; mesoscopic particles with diameters of 10 – 1000 nm which are suspended in a liquid, as model systems for studying problems in the fields of solid state physics, statistical physics and stochastic thermodynamics. The group has expertise in a diverse array of experimental techniques, including optical tweezers, total internal reflection microscopy, acousto-optic deflectors and interference patterns and with over 20 areas of research and thirty-one group members, mostly PhD students. Dr. Bechinger's group collaborates with researchers in Germany, Italy, Israel and America.

Nature Physics journal recently published Valentin Blickle and Dr. Bechinger's article titled "Realization of a Micrometer-Sized Stochastic Heat Engine". In the study, a single colloidal particle subject to a time-dependent laser trap acts as a microscopic Stirling heat engine that extracts energy by cyclically working between two heat baths in a regime where fluctua-

Colloidal Research Group at Stuttgart University



▲ Micron-sized colloidal particles undergo Brownian motion and thus exhibit many properties also found in atomic systems. Owing to their length and time scales, their trajectories can be directly observed with microscopes which distinguishes colloids as versatile model systems to study e.g. phase transitions at surfaces, fluctuation-induced phenomena, interfacial forces and much more.

tions dominate (Read the full paper in *Nature Physics*). The article published in *Nature Materials* is titled "Observations of Kinks and Antikinks in Colloidal Monolayers Driven Across Ordered Surfaces". Thomas Bohlein, Jules Mikhael and Dr. Bechinger report the direct observation of kinks and antikinks in a two-dimensional colloidal crystal that is driven across different types of ordered substrate. These topological excitations are thought to dominate friction on atomic length-

scales. (Read the full paper in *Nature Materials*).

2011 was a press intensive year for the group with eleven publications in prestigious journals such as *Soft Matter*, *PNAS* and *Physical Review Letters*. The studies range from pattern formation in colloidal explosions to micro-swimmers in patterned environments and tuning Brownian motion with light.

[Visit the site to read more.](#)



SPECIAL FEATURE

3 Year Anniversary of the Soft Matter World Newsletter and Global Network

This month brings the 3 year anniversary of the Soft Matter World Newsletter. We have come a long way since the first text based newsletters in January of 2009. In these past three years we have seen the development of many features and changes to the website and like the Global Network Map and the Noticeboard and Conference Listing Bulletins.

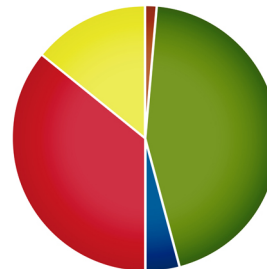
Of course this has only been made possible by community of research groups and users who have been reading and contributing to the newsletter.

This year we would like to see the website grow even more by expanding to countries and universities where we have less readers and by networking within the ones which we have already have registered users.

where are they from?

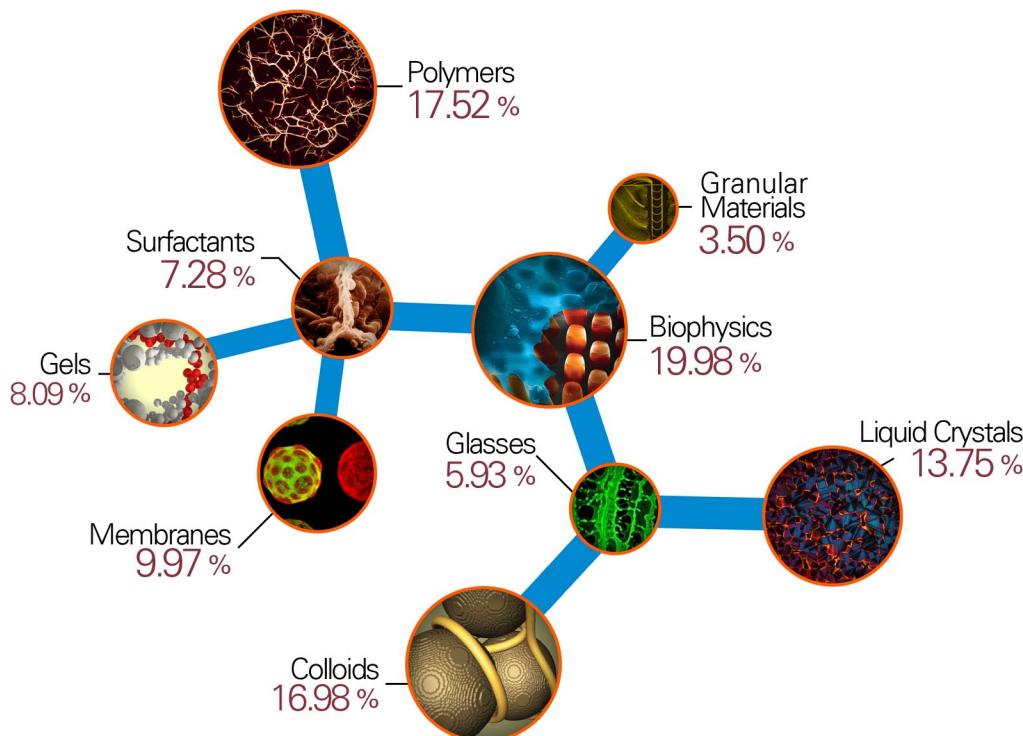
The distribution of registered SMW groups by location.

- Australia/Africa
- Asia
- Europe
- South America
- North America



what do they study?

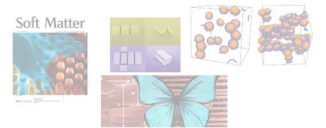
A look at what research topics registered SMW groups investigate.



30 newsletters since January 2009



75 featured articles and publications



70 featured conferences and meetings



128 registered research groups



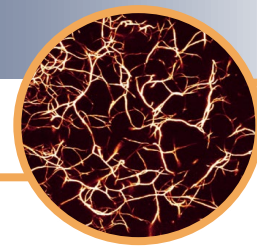
spread throughout

93 various universities and institutes



located in

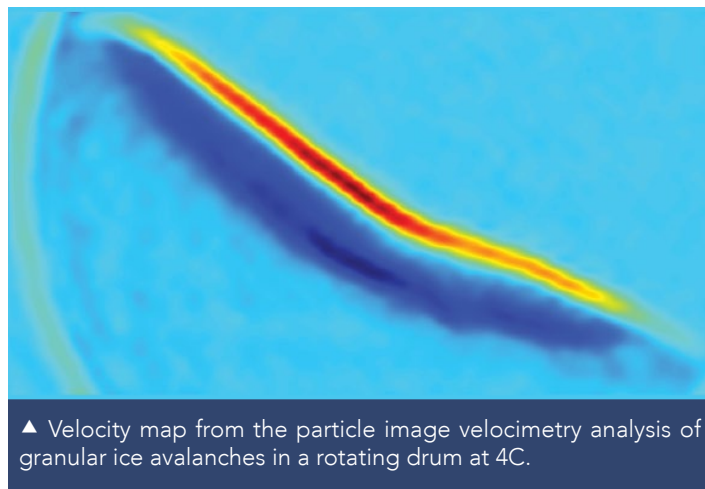
33 different countries



Scaling Laws for Melting Ice Avalanches

B. Turnbull. *Physical Review Letters*, 2011, Vol.107, Issue 25, DOI: 10.1103/PhysRevLett.107.258001

The physics of avalanche flows is poorly understood. Ice particles rapidly accelerate to great speeds and become extremely mobile. To understand the processes behind these phenomena, Dr. Turnbull of the University of Nottingham tests the theory that localized ice melting significantly alters flow dynamics. This hypothesis implies avalanches cannot be wholly modeled as a classical dry granular shear flow. A drum half filled with spherical ice particles 5mm in diameter is held at a series of constant temperatures and rotated at a constant angular velocity. Positions of the ice spheres were recorded through bursts of high speed video recording. The experiment focused on analyzing speeds in the shear layer as a means to model the avalanching layer and revealed melting alone is responsible for changes in the shear layer velocity. Shear layer velocity is assumed to be a function of drum rotation rate, particle diameter, the product of the fill fraction and a characteristic length scale of the drum, the specific



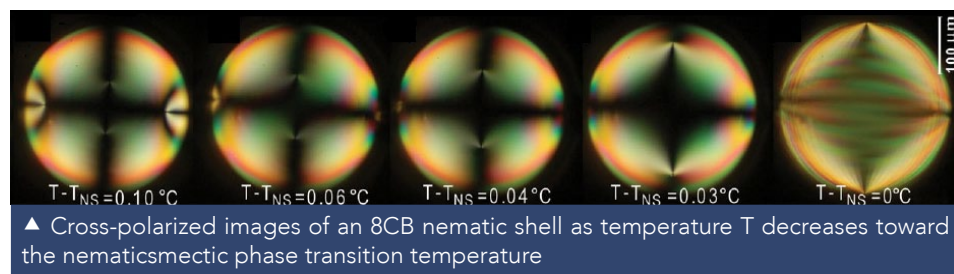
▲ Velocity map from the particle image velocimetry analysis of granular ice avalanches in a rotating drum at 4C.

energy required to melt ice and time elapsed since the beginning of the experiment. Other factors influencing melting and therefore shear flow velocity are shear layer thickness and acceleration due to gravity. Shear velocity increases with particle melting and changes avalanche regime from granular at the start of the avalanche to surging as the liquid fraction in the shear layer increases. This study presents a scalable, preliminary mathematical model for avalanche flow.

[Read the full paper in *Physical Review Letters*.](#)

Nematic-Smectic Transition in Spherical Shells

Teresa Lopez-Leon, Alberto Fernandez-Nieves, Maurizio Nobili and Christophe Blanc. *Physical Review Letters*, 2011, Volume 106, Issue 24, DOI: 10.1039/c1sm06564e



▲ Cross-polarized images of an 8CB nematic shell as temperature T decreases toward the nematic-smectic phase transition temperature

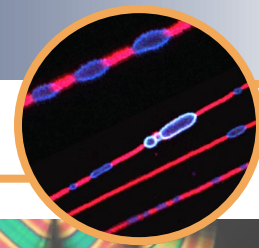
Liquid crystals confined to a spherical shell are model systems ideal for studying topological problems and generating colloids with a valence. Researchers from Laboratoire Charles Couloumb and Georgia Institute of Technology study the effect of anisotropy on the

Frank elastic constants by decreasing temperature to the nematic-smectic transition temperature and observing defect pairs. As the temperature decreases, defect pairs progressively arrange themselves into a great circle and a smectic shell is formed as the temperature

drops below the nematic-smectic transition temperature. The transition between these two limiting configurations proceeds continuously through a series of equilibrium states in which the defects typically arrange at the vertices of a rhombus.

The ratio of diagonals in the rhombus depends on the elastic constant; this relationship offers possibilities to control the position of defects and potentially the directionality of interactions between shells. A different set of defects, primary and secondary curvature walls, form in the smectic phase.

[Read more in *Physical Review Letters*.](#)



Frontiers of Soft Matter 2012

Frontiers of Soft Matter 2012 is a symposium honoring Professor Noel A. Clark on the occasion of his 70th birthday. It will take place at the University of Colorado in Boulder from May 16-18, 2012. Early registration takes place before April 1st, payment through the secure server is highly encouraged. There are twenty invited speakers.

Abstract submission for poster display may be emailed to Prof. David Walba at walba@colorado.edu no later than April 30th.

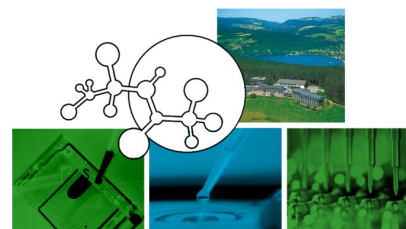
To read more or register, visit the website. [To read more or register, visit the website.](#)

Black Forest Focus on Soft Matter 7

The Black Forest Focus on Soft Matter is "a conference series hosted by the FRIAS School of Soft Matter Research. So far, six conferences have been held as part of this series, each with 40-70 participants. The seventh BFF "Multidimensional optical spectroscopy and imaging: temporal and spatial resolution at the cutting edge" will take place between 15th and 17th March 2012 at Hotel Saigerhoeh, Saig/Titisee,

Black Forest.

The idea is to address resolution in space and time, focusing on the larger challenges and interesting new approaches on different levels (single molecule, nanooptics, attosecond, x rays, photoelectrons, ultrafast 2D spectroscopy). The workshop will focus on exploring new opportunities made possible by recent developments in coherent ultrafast spectroscopy and by



the ability to control optical fields on the nanoscale.

[Visit the website](#) to read more and register before the deadline on January 31st.

Editors Note: Image Citations

Listed below are the image citations used for the info-graphic on page 2:

- **Polymers** - Structure of Actin Cross-linked with Alpha-actinin: A Network of Bundles" O. Pelletier, E. Pokidysheva, L.S. Hirst, N. Bouxsein, Y. Li, and C. R. Safinya Phys Rev. Lett. 91, 14 (2003).
- **Granular Materials** - F.Melo et al. Physical Review E. 84, 041304 (2011).
- **Biophysics** - Ryan D. Sochol et al. Soft Matter, 2011, 7, 460
- **Liquid Crystals** - Transition from the columnar LC phase

to the crystalline phase in a sample of small fragments of double-stranded DNA. Giuliano Zanchetta, University of Milan, Italy

- **Glasses** - Byung Mook Weon and Jung Ho Je. Capillary Force Repels Coffee-Ring Effect. Physical Review E 82, 015305R (2010)
- **Colloids** - Miha Ravnik and Slobodan Zumer. Soft Matter, 2009, 5, 269-274
- **Membranes** - Jorge Bernardino de la Serna. Giant unilamellar and multilamellar vesicles (liposomes) (40X). <http://www.nikonsmallworld.com/detail/year/2007/46>
- **Gels** - Mariella Dentini. Soft Matter, 2010, 6, 1785-1792.
- **Surfactants** - Brian A. Hills. J Appl Physiol 87:1567-1583, 1999.

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

Linda S. Hirst, Adam Ossowski and Dmitri Medvedko



SoftMatterWorld.org