

Liquids and Complex Fluids Group
Institute of Physics

Newsletter July 2006

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Welcome from the current joint Chairs.

Welcome to the first newsletter of the new Liquids and Complex Fluids Group. Towards the end of 2005 and following advice from IoP the Liquids Group and Complex Fluids Group merged into a single group, the Liquids and Complex Fluids Group, which consists of around 150 members. At the inaugural Committee meeting of the new Group in January 2006 it was agreed that new leadership was needed, and Stuart Clarke and Cait MacPhee have kindly agreed to step into the breach, acting as Chair and Secretary respectively until such time as their appointments could be confirmed by an AGM (now planned for January 10 2007). As current joint chairs we would like to put on record our heartfelt thanks for the superb efforts made by the secretaries of the two groups, Phil Salmon and Peter Olmsted, in their excellent steering of the Group merger through the maze of IoP bureaucracy. Without their substantial dedication to the cause, the merger would undoubtedly have foundered.

This new newsletter should enable you to find out more about the group, its interests and activities, as well as Liquids and Complex Fluids research across the country. One of the exciting new additions to our programme will be an annual Winter School for graduate students, providing a thorough grounding in all of the key topics crucial to this area of research. Members of the group are also organising a number of key meetings exploring cutting-edge science, and we urge you to get involved.

The newsletter editor, Stuart Clarke, welcomes any comments or additional material that members would like to submit for consideration for future editions. Please do give Stuart and Cait your full support in this exciting new phase of the Liquids and Complex Fluids Group.

Alan Soper and Wilson Poon

What is the Liquids and Complex Fluids Group?

The Liquids and Complex Fluids Group aims to advance research on the liquid state of matter by fostering collaborations within a broad spectrum of experimentalists, theorists and computer simulators. Our scope encompasses both the microscopic and mesoscopic length scales in systems that range from 'simple' liquids to soft condensed matter. Topics range from the structure and dynamics of pure liquids of all kinds to complex fluids such as emulsions, gels, foams, colloids, and liquid crystals. The group also has strong interests in synthetic and bio-polymers, and thus enjoys close collaboration and overlap with the Polymer Physics Group. There are also strong ties with other liquid matter researchers through the Faraday Division of the Royal Society of Chemistry

and the Liquids Board of the European Physical Society. Other topics covered include liquid mixtures and solvation phenomena, liquids and glasses under extreme conditions, confined liquids and fluids at interfaces, the glass transition and arrested states of matter (including the structure of glasses and amorphous solids), crystal growth in liquids, and self-assembly from solution. The field also has strong links with biologically-inspired physics and nanotechnology.

A distinctive aim of the group is postgraduate education, particularly, via our own graduate school aimed at underpinning the education of the next generation of workers in the field. Another aim will be the development of new instrumentation for work on liquids and complex fluids at UK X-ray and neutron sources together with sophisticated data interpretation tools.

COMMITTEE MEMBERSHIP

Members of the committee welcome suggestions and comments from group members to help facilitate the running and development of the group.

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EVENTS

Winter School

The Winter Postgraduate School, 'Solutions in the Snow' will be held at Coseners' House, Abingdon, Oxon from 7th – 10th Jan 2007. This school is the first of a three year rolling course to enable students in the field to get a firm grounding in all the key topics that underpin research in this area over the duration of a typical Ph D. The material will cover all the key approaches theoretical, experimental and computer simulation through a series of lectures given by established specialists in the relevant fields. In 2007 the course will focus on colloids, polymers, water and simulation methods. It is also hoped that the school will enable networking between students and other attendees. Ph D students with appropriate interests are strongly encouraged to apply. 30 free places and student travel bursaries are available. More details and application forms from Stuart Clarke or via the group website.

Meetings

Members are warmly invited to a workshop on "Current Challenges in Liquid and Glass Science" will be held on the 10-17th of January 2007. The venue will be The Coseners' House, Abingdon, Oxon and organised by Phil Salmon and Alan Soper.

A meeting on 'Confined Fluids' organised by Neal Skipper will be held in September 2007 at University College, London. Details to follow.

One Day Meetings

A one day meeting on 'Lipid Membranes', organised by Peter Olmsted will be held in Summer 2007 at the IOP in London. Details to follow.

A one day workshop on 'Mesoscale Modelling – Where's it going?' coordinated by David Heyes, will be held in late summer /Autumn 2007 at the IOP in London. Details to follow.

Other meetings of possible interest to Group Members

2006

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| 31 July - 03 Aug | MACRO Group UK International Conference on Polymer Synthesis, University of Warwick |
| 29 Aug - 01 Sep | 6th International Conference on polymer-solvent complexes and intercalates (PSCI-6), The University of Manchester |
| 3 - 7 Sep | 4th International workshop on nonequilibrium thermodynamics and complex fluids, Rhodes, Greece |
| 11 - 12 Sep | RSC Macro Group - 11th Meeting of the UK Polymer Colloids Forum, The University of Manchester |

13 -14 Sep	AQUANET Second International Conference on Natural Aquatic Colloids and Nanoparticles, University of Plymouth
17 - 20 Sep	2nd Eurosummer School on Biorheology & Symposium on Micro Mechanobiology of Cells, Tissues and Systems, Varna, Bulgaria
17-22 Sep	20th Conference of the European Colloid and Interface Society, Budapest, Hungary
2-5 Oct	Newton Complex Fluids meeting, Newton Institute, Cambridge
14-17 Nov	Annual Jülich Soft Matter Days, Gustav-Stresemann-Institut, Bonn, Germany
22-24 Nov	ILL Soft Matter User meeting, Grenoble, France
24 - 26 Nov	IoP Young Physicists' Conference, Birmingham
11-12 Dec	Annual Meeting of the British Society of Rheology, University of Manchester

2007

22 Mar	The Physics of Self-Assembling Peptides, The IoP, London
02 - 04 April	RSC Colloid & Interface Science Group- Nanoparticles: New Opportunities and Challenges for Colloid Scientist, University of Warwick
9-13 July	'Statphys 23' IUPAP Statistical Physics Conference, Genova, Italy
15-19 July	' Soft,Complex and Biological Matter' (SOCOBIM) Satellite to Statphys 23, near Palermo, Sicily
10 - 12 Sep	Physical Aspects of Polymer Science 22nd Biennial Meeting of the Polymer Physics Group, Durham

2008

27 June - 1 July (tentative)	7 th Liquid Matter Conference, Lund, Sweden
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STUDENT BURSARIES

Student Travel Bursaries are available to enable students, who are members of the group to attend relevant meetings. Bursaries are typically of the order of £50 for UK meetings and £100 for international meetings. They can be used to attend meetings organised by the group and are available to students for other meetings with appropriate content. Anyone receiving a bursary will be expected to write a short meeting report for inclusion in the Group Newsletter as a condition of funding. Application forms can be found on the group web-site and should be completed and submitted to the Group Secretary.

PRIZES

Nominations for the biannual 2007/8 Liquid and Complex Fluids Group Young Scientist Award are invited. The winner will receive £200 a certificate and will give a lecture at a general meeting. Those eligible for awards should be members of the Group and work in the UK or Ireland, be UK or Irish citizens or have strong UK or Irish connections. The Liquids and Complex Fluids Committee defined "Young Scientists" as those individuals with no more than 5 years postdoctoral experience (allowing for career breaks), following the award of a PhD. Those who are currently paid employees of the Institute, members of Council and those under contract to the Institute are not

eligible for awards. Nomination forms are available on-line on the group web-site and the closing date for receipt of nominations is 2nd April 2008.

WEB PAGES

The committee are extremely grateful to Phil Salmon for his excellent job in establishing the group website. This site contains many useful pages covering activities of the group and related matters, application forms for bursaries and other information. Any suggestions for material to include etc. please contact Cait MacPhee.

AGM NOTIFICATION

It is intended to hold the AGM at the time of the Winter School and the Group Workshop on "Current Challenges in Liquid and Glass Science" on the Wednesday Jan 10th 2007. This would enable attendance by people attending the Winter School and the Workshop. Given that the Winter school is intended to be a fixed point in the group calendar, it is intended to hold the AGM each year at a similar time.. i.e. the Wednesday at the end of the Winter School each January. Please put these dates into your schedules.

LIQUIDS AND COMPLEX FLUIDS GROUPS IN THE UK

Focus on Edinburgh

Research into soft condensed matter physics at the University of Edinburgh ranges from the study of fundamental principles - such as the mechanisms of self assembly and reasons why such processes can get 'stuck' in long-lived metastable states - to more applied topics such as the behaviour of industrial products and an exploration of biological systems (including living cells). Work on hard condensed matter centres on the behaviour of materials under high pressure. The three major arms of modern physics - experiment, theory and computer simulations - are used to tackle these problems; indeed, one of the strengths of the Edinburgh Group is the close manner in which experiment, theory and simulation work together.



The experimental soft matter work focusses on well-characterised, model colloids in which a 'tunable' attraction is induced by adding non-adsorbing polymer. Research in recent years has centred on elucidating the nature of various non-equilibrium states in these systems. The current highlight is the exploration the non-linear rheology of various colloidal glasses at the single-particle level using fast confocal microscopy. New activities starting now include work on the collective behaviour of bacteria ('living colloids'), e.g. in forming biofilms, and in the physico-mechanical and rheological characterisation of simple self-assembling polypeptide filaments.

Much of the experimental research takes place in COSMIC, a cross-disciplinary centre where physicists, physical chemists and biologists work side by side. COSMIC utilises the interaction of light with matter for advanced characterisation, visualisation and control of materials at the molecular level. Techniques available include ultra-fast real-time spectroscopy, advanced single-molecule imaging and optical micromanipulation (tweezing). These have been employed to study a diverse assortment of systems ranging from water-methanol mixtures through protein and DNA solutions to colloidal clusters and gels.

Statistical mechanics and simulation are the major theoretical tools we use for investigation of many forms of condensed matter, although we also work on non-traditional areas such as ecosystem dynamics and the jamming of traffic. There has in recent years been a shift away from purely equilibrium problems to working on systems that are out of equilibrium. Examples in soft matter systems include colloids that are subjected to shearing; here exotic phenomena such as jamming and rheological chaos are seen. Likewise a fluid of mixed contents shows complex phenomena when subjected to a steady chemical potential gradient - this arises in drying, dissolution and mixing processes. In studying multiphase systems, the Lattice Boltzmann (LB) methodology has proved an invaluable tool.



A binary lipid vesicle, reconstructed from multi-photon microscopy images

Computer simulation can also provide molecular-level insight into the complex dynamics of even simple systems. Molecular dynamics (MD) simulations of aqueous amphiphiles reveal that apparently miscible solutions can show micro-immiscibility at the molecular scale, giving rise to anomalous thermodynamics and relaxation properties. For example, MD simulations show that the water molecules form large clusters that persist for long times.

We are also able to probe the structures and properties of materials at extremes of pressure and temperature through the creation in 2001 of the Centre for Science at Extreme Conditions (CSEC). Pressure provides an extremely powerful means of examining the relationship between structure and properties, both towards a better understanding of fundamental phenomena and for the improved design of applied materials. Moreover, pressure is a 'clean' variable in that it can bring about large changes in structure and properties without altering the chemical composition or thermal energy of a system. This makes high-pressure systems particularly amenable to computational study, and there is a vigorous international programme of ab initio all-electron calculations of high-pressure structural stability. Using state-of-the-art in-house instrumentation, combined with the powerful x-ray and neutron facilities available at the Daresbury and Rutherford-Appleton Laboratories in Cheshire and Oxfordshire, respectively, CSEC supports a multidisciplinary approach to the study of materials at the atomic scale under extremes of pressure and temperature. Highlighting this multidisciplinary approach, CSEC includes on its staff a microbiologist specialising in bacteria living under extreme conditions, and the exotic materials that these organism generate (such as novel exo-polysaccharides).

For further information contact Cait MacPhee or Wilson Poon, or visit <http://www.ph.ed.ac.uk/cmatter/>