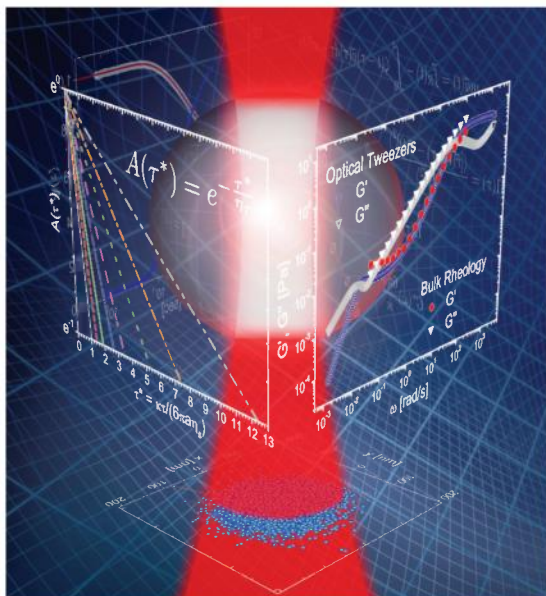

THE BRITISH SOCIETY OF RHEOLOGY

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THE BRITISH SOCIETY OF RHEOLOGY

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THE BRITISH SOCIETY OF RHEOLOGY



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Hon Bulletin Editor:

Prof. Robert J. Poole

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The Quadrangle, Liverpool, L69 3GH

ISSN 1469-4999

EDITORIAL

Welcome to Volume 56 (issue #3) of the British Society of Rheology Bulletin. In this issue of the Bulletin we have an article from the 2014 Annual Award winner, Dr Simon Haward, on “Microfluidic Extensional Rheology” together with another set of tales from the pen of Ralph Oliver (please savour these as Ralph promises these will be his last contributions for a while). On a sadder note, many of you will have already heard about the sudden death of Prof. Alexei Likhtman, and we pay tribute here (thanks to Prof. Tom McLeish for providing this worthy overview of Alexei’s life and contributions to rheology). Finally, there are new guidelines for our annual and travel awards and these can be found in the BSR news section.

Rob Poole, Liverpool Jan 2016.

SUBMISSIONS TO THE BULLETIN

Submissions to the Bulletin are welcomed. Electronic submissions by email to the Editor (bulletin@bsr.org.uk) are preferred in word format (e.g. .doc or .docx). Please always provide a contact name, address, e-mail, or telephone number in case of problems. The deadline for submission is Feb. 15th, June 15th and Oct. 15th, respectively, for three issues annually.

COVER ILLUSTRATION

The cover image is a graphical abstract of microrheology with optical tweezers. It depicts a laser trapped glass microsphere and some of the main functions relating the bead's trajectory to the viscoelastic properties of the suspending fluid. The image has been reproduced and adapted from: Tassieri M., 'Linear microrheology with optical tweezers of living cells 'is not an option'', *Soft Matter*, 2015,11, 5792-5798.

AIMS OF THE SOCIETY

The way liquids flow and solids deform affects all aspects of life.

Extraction and processing of crude oil, moulding of plastics, use of toothpaste, spreading of margarine, painting and the lubrication of joints in the human body are all examples of processes depending upon rheological behaviour. Rheology is defined as the science of the deformation and flow of matter.

If your work is concerned with rheology in any way, then you have much to gain by joining the British Society of Rheology, including

- advance your knowledge by attending our conferences
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- learn of current instrumentation and accessories plus new developments.
- access to non-Newtonian Club linking industry and academia
- travel Grants, Poster Prizes, Career Opportunities
- network with fellow members who, while working in a different discipline or industry, may be facing similar problems to yours

The Society is non-profit making and is registered as a charity. For the details, you are warmly welcome to visit our web site <http://www.bsr.org.uk/>, and to apply for membership on-line.

Microfluidic Extensional Rheometry

Simon Haward

Okinawa Institute of Science and Technology, Onna-son, Okinawa
904-0495, Japan

It was a great honour for me to be recognized by the British Society of Rheology when I received the Society's Annual Award for 2014 at the INNFM meeting at Ruthin Castle, Wales in the Spring. The award certificate states "for major contributions to the measurement of extensional characteristics of complex fluids". Personally, I don't consider my contributions to be all that major compared with those of the giants on whose shoulders I balance precariously (or of some of my peers) and I certainly never expected to get any awards. However, I happily bow before the superior judgement and wisdom of the BSR Council and I'm very grateful for their decision!

My interest in extensional flows extends back to my undergraduate days in the Physics Department at the University of Bristol, where I carried out a final year project with Jeff Odell (who Tam Sridhar once described to me as being the "father of extensional rheometry"). We performed a very simple experiment – dropping ball-bearings through a long tube of polymer solution. We were trying to gain a better understanding of effects that had been reported by Ken Walters and co-workers [1], where spheres that fell along the same path through a viscoelastic fluid would have a terminal velocity that depended on the time interval between releasing successive spheres. Generally, the second and subsequent spheres to fall would have a greater terminal velocity than the first, and an anomalously long time interval was required between spheres (relative to the relaxation time of the fluid) before a reproducible terminal velocity could be measured. In our experiment we were measuring the terminal velocities of the spheres and simultaneously recording the birefringence in the trailing wakes of the spheres in an attempt to relate the effect with some long-lived change in the fluid microstructure, the hypothesis being that polymers would become highly oriented near the stagnation point at the trailing edge of the sphere and coil→stretch hysteresis [2, 3] would keep the microstructure in the wake aligned for long times. Although we didn't find definitive answers to our questions, we observed some intriguing phenomena – extremely

elongated birefringent wakes that appeared like finely-structured comet tails extending behind the falling spheres (see Fig. 1). My interest was piqued and I continued to work with Jeff chasing birefringent strands on and off for the next 10 years, until he retired to become a foster parent and I moved to join Gareth McKinley at MIT.

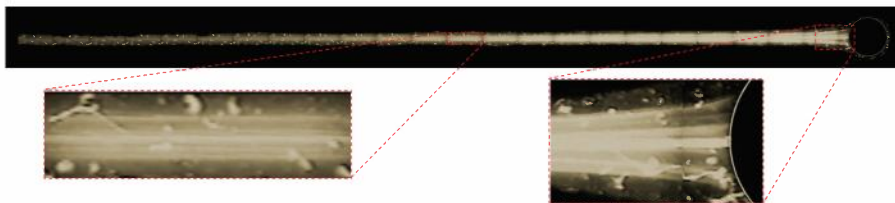


FIG. 1 birefringent wake behind a 10 mm diameter steel sphere falling (left to right) through a 0.7 wt.% solution of $M = 10.2 \times 10^6 \text{ g mol}^{-1}$ polystyrene in dioctyl phthalate.

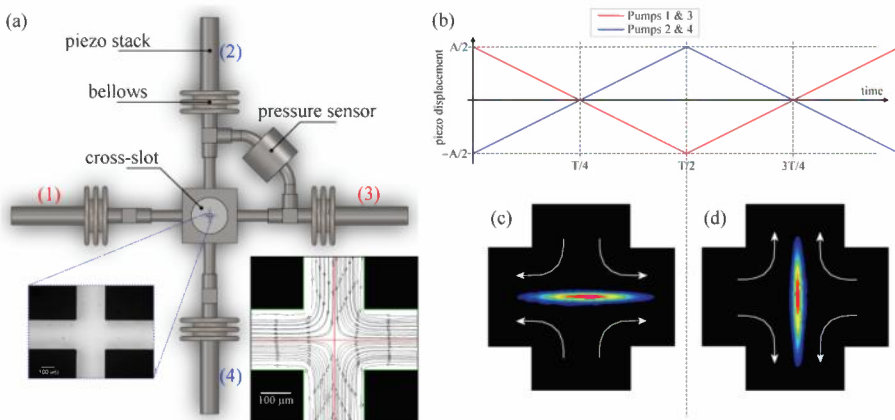


FIG. 2 (a) schematic representation of the EFOR device. The bottom-left inset shows a light micrograph of the actual cross-slot device with a channel width of $200 \mu\text{m}$. The bottom-right inset shows streamlines in the cross-slot measured with a Newtonian fluid. Where the symmetry axes cross at the centre of the device is a stagnation point. (b) oscillatory displacement profiles applied to the micropumps in order to drive flow in the cross-slot. (c), (d) false colour images of the birefringence observed in a 0.03 wt.% solution of $M = 10.2 \times 10^6 \text{ g mol}^{-1}$ polystyrene in dioctyl phthalate during the first and second half-cycles of the piezo displacement profile, respectively (arrows indicate the flow direction in each case).

In my last project with Jeff, I worked on developing his “extensional flow oscillatory rheometer”, or EFOR, building on the original contributions of Steve Carrington [4, 5]. This is an ingenious device with a “cross-slot” flow channel at its heart and an individually controllable oscillatory micropump comprised of a piezo stack and a bellows connected to each of the four channel inlets/outlets (see Fig. 2).

Jeff had realized that by applying triangular deformation profiles to the piezo stacks (with opposing pairs of pumps oscillated in phase with each other, but 180° out of phase with the diametrically opposed pair, see Fig. 2b) the bellows could be squeezed and expanded in order to cycle a small volume of fluid repeatedly through the stagnation point located at the centre of the cross-slot, generating an oscillatory extensional flow with a constant strain rate. This approach, combined with miniaturization of the cross-slots down to the microfluidic scale provided significant advantages over regular continuous flow experiments, particularly in terms of reducing the required sample volume and being able to achieve high extension rates for low inertia. In addition, the EFOR allowed independent control of both the applied strain rate and the total fluid strain, which had not been possible before. Optical techniques allowed quantitative assessment of the flow field and the flow-induced birefringence, and a pressure transducer was connected across a neighbouring pair of inlets/outlets in order to perform viscometry. As we developed our techniques, we achieved measurements with volumes of fluid on the order $\sim O(10\text{-}100\text{ }\mu\text{L})$, which allowed us to examine extensional flow effects in samples of physiological fluids [6, 7]. We found the EFOR to be an ideally suited platform for the study of transient effects in extensional flows and also for examining the effects of flow-induced fracture of polymer chains. The EFOR readily enables the measurement of strain or stress accumulation during startup, in quasi-steady state, and also of strain or stress decay upon the cessation of flow [8]. Characteristic times can be obtained for stretching polymers in solution from their quiescent state (coil $\rightarrow$ stretch) and for the process of recoiling from the stretched state (stretch $\rightarrow$ coil), thus allowing a direct assessment of hysteresis in the coil $\rightarrow$ stretch $\rightarrow$ coil cycle. We also made observations of the buckling of birefringent elastic strands in the interval when the flow reverses direction (i.e. near time = $T/2$, see Fig. 2b), a striking manifestation of the hysteresis, and likely with important consequences in cyclic extensional flows of polymer solutions such as in porous media [9].

When I took up a postdoctoral position in the McKinley group in 2010, I was hoping and expecting to learn from the experts all about filament stretching extensional rheometry (FiSER). However, I was surprised to find the FiSER device in Gareth's lab was essentially a museum piece – it hadn't been used in around 5 years, and nobody in the group knew how it worked. About the first time I powered-up the instrument, one of the motors that run up and down the linear stage actually caught fire and sent out a powerful jet of flames and black smoke! Gareth's stories of motors flying completely off of the rails at high speed and becoming embedded in the ceiling did nothing to reassure me. It took around 6 months (and a lot of frayed nerves) for me to renovate the FiSER into a more-or-less useable (and safe) state. In the meantime I continued working with the cross-slots – taking the opportunity to learn more about wormlike micelles and to study the purely-elastic flow instabilities that had recently been reported in the literature [10, 11], see Fig. 3.

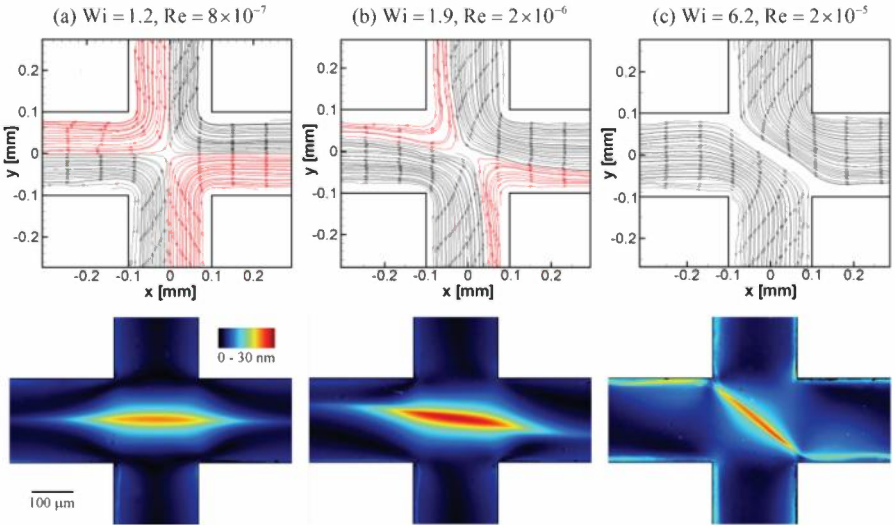


FIG. 3 Streamlines (top) and associated false colour images of the optical retardation for flow of a wormlike micellar solution (60 mM cetylpyridinium chloride + 100 mM sodium salicylate) in the cross-slots at the Weissenberg (Wi) and Reynolds (Re) numbers indicated. (a) At low Wi the flow field is steady and symmetric. (b) above some critical value Wi_{crit} , flow bifurcates and becomes asymmetric. (c) as Wi increases further the asymmetry becomes more pronounced. Note the small values of the

Reynolds number, indicating that the instability is purely elastic in origin [12].

This work on elastic instabilities started a productive collaboration with Manuel Alves and Mónica Oliveira, both experts in numerical simulations of viscoelastic flows. Manuel had been working on a scheme to optimize the shape of fluidic devices in order to achieve specific desired characteristics of the flow field. In particular he had generated a form of the cross-slot geometry with an unusual wall profile. Numerical simulations showed the geometry would provide a homogeneous extensional rate over a significant length scale, thus providing a significant advantage over standard cross-slots in terms of their function as extensional rheometers. We resolved to construct such a geometry and test it experimentally – the device we had fabricated (nicknamed OSCER – Optimized Shape Cross-slot Extensional Rheometer [13]) is shown in Fig. 4a.

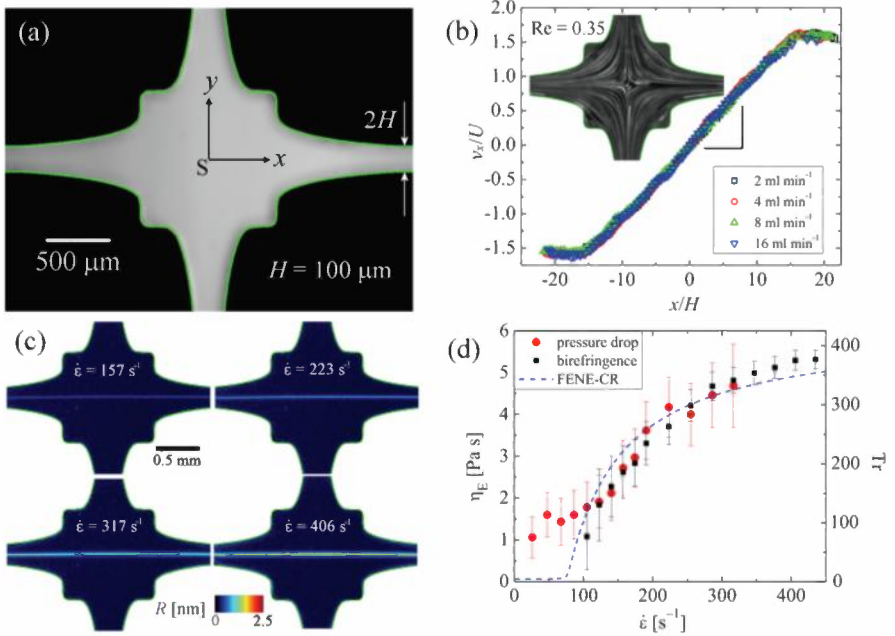


FIG. 4 (a) Transmitted light micrograph of the OSCER geometry, with the prescribed, numerically-optimized wall profile superimposed in green. Flow enters along $\pm y$ and exits along $\pm x$; the stagnation point, S, is located at the origin. (b) Results of preliminary flow characterization experiments with a Newtonian fluid (66 wt.% glycerol in water). The velocity gradient

along the $y = 0$ axis scales with the average flow velocity, U , and is nominally constant over a length scale of $\pm 15H$, where H is the channel half-width. The elongation rate is given by $\dot{\epsilon} = \partial v_x / \partial x = 0.1066U/H$, in near-perfect agreement with the numerical prediction. The inset shows a streak image obtained at low Reynolds number to give a qualitative impression of the flow field. (c) Images of flow-induced birefringence obtained with a dilute solution of polyethylene oxide at various elongation rates – note the localization and uniformity of the birefringent strand along the outflow axis. (d) extensional viscosity of the dilute PEO solution determined from independent measurements of the birefringence and the excess pressure drop and compared with the prediction of a FENE model [13].

I must admit, when I first saw the shape of the numerically-optimized cross-slot I was more than a bit sceptical. However, the results of my first characterization experiments with Newtonian fluids were convincing, showing a homogeneous strain rate that varied with the applied flow rate in precise agreement with the numerical prediction (Fig. 4b). With polymer solutions I observed the most beautifully localized and uniform birefringent strands located along the outflowing stagnation point streamline – a striking visual demonstration of both the uniform strain rate along the outflow axis and the high strains available there (Fig. 4c). Using a stress-optical coefficient to convert between birefringence and stress (hence extensional viscosity), I obtained the curve shown by the black squares in Fig. 4d. The data compared well with the extensional viscosity computed using global measurements of the excess pressure drop and also (remarkably) with the prediction of a FENE dumbbell model [13]. I think I speak for all the collaborators involved in the project, in saying that we felt we had made something of a breakthrough in our ability to measure the real steady-state extensional viscosity of dilute polymer solutions.

Apart from being useful for characterizing the extensional rheology of complex fluids, the OSCER device is also receiving attention from research groups wishing to carry out controlled deformation experiments on soft particles, cells, drops and DNA. My own work is proceeding by using the idealized flow field in the OSCER device as a platform for the study of elastic instabilities in extensional flows (as I talked about in my presentation at Ruthin Castle in March). I hope to publish some definitive results very soon!

I must acknowledge many people who I have worked with and been inspired by, especially: Jeff Odell, Gareth McKinley, Xue-Feng Yuan, Manuel Alves, Mónica Oliveira, and Rob Poole, as well as the help and support of all the brilliant students and researchers in the groups I've been a part of at the University of Bristol, MIT, the University of Porto and now at Okinawa Institute of Science and Technology.

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Alexei Likhtman, 1971-2015

Alexei Likhtman, a leading scientist in Theoretical Soft Matter Physics, has died aged 44.

Born in 1971 into a family with strong scientific tradition, Alexei was educated in Moscow. He was awarded a Diploma in Physics with honours from the Physics Department of Moscow State University (MGU) in 1994. He remained at MGU for his PhD research, supervised by Professor Alexander Semenov. The topic, his first foray into polymer physics, was the calculation of the extraordinary ordered nanoscale patterns of chemical separation that are spontaneously generated within polymer melts whose molecules contain extended regions of different chemistry but joined together. These systems maintained a lifelong fascination for Alexei, as did the collaboration with the experimental group in Crete that the Russians worked with closely. The relationship with Crete remained strong and close until the end of Alexei's life. A more important lifelong partnership also began in Moscow - it was as students there that Alexei and Katrina met and married in December 1990. The family grew after their daughters Sonya and Asya were born while Alexei was working on his PhD thesis. Helping to look after two little girls however did not stop him from producing a high quality piece of work. Till the end of his days Alexei remained a loving, committed, hands on dad, always reliable and extremely loyal to his family. The family stayed in Moscow for two more years, with Alexei as a Scientific Fellow at Moscow State University, before moving to the U.K, in 1998, where he took up a position as a Research Assistant in the Department of Applied Mathematics at Leeds University, where Semenov, now his colleague, had also moved. That initial one year position marked the beginning of family's long life in the UK.

Alexei stayed at Leeds from 1998 until 2007: in 1999 he moved to the Department of Physics and Astronomy, where he worked on theories of fast flow of entangled polymer melts, including theory and simulations of the convective constraint release model, supervised by Professor Tom McLeish, and working collaboratively with Prof. Scott Milner at an extended international workshop at the Kavli Institute of Theoretical Physics in Santa Barbara. In 2002, Alexei's research had developed to the point where he was awarded an Advanced EPSRC Fellowship, which he held from 2002-2005 in the School of Physics and Astronomy. In this

period, Alexei worked on developing new models of polymer dynamics, simultaneous description of rheology, neutron spin-echo, neutron scattering, diffusion, dielectric spectroscopy and NMR experiments, the theory of chemical reactions in polymers and computer simulations. This work has been recognized in many ways, including the best paper award of the Journal of Rheology (2006). From 2005-2007 Alexei held his Fellowship in the Department of Applied Mathematics, also as University Fellow, supervising a team of three postdoctoral researchers working on molecular simulations of polymer melts, slip-links model of entanglements and experimental rheology. Although a theoretician, he worked with experimental colleagues in different laboratories and performed experiments himself, learning and questioning every single detail. As a result, he personally developed the most reliable experimental protocol for measuring the flow properties of polymer melts yet found by the Leeds lab. For an experimentalist, it was a treat to interact with Alexei in this context, a unique experience that led to improved experiments. Co-supervising a PhD student, Richard Graham, the two formulated a now-celebrated non-linear but easily-computable mathematical model for the flow of linear polymers of well-defined length (the ROLiE-Poly model).

He worked hard not only on brilliant new theoretical science, but on making this accessible to others. For example, his foresight and energy led to the creation, with long-time colleague Jorge Ramirez, of a free software tool (called REPTATE) that enabled experimental scientists in universities and industry to sort their polymer flow data and compare it quickly and efficiently to theoretical models, greatly accelerating fundamental research and its application.

In May 2007, Alexei moved to the Department of Mathematics and Statistics at the University of Reading, as Professor of Mathematical Physics. There, together with Prof. Mark Matsen, he created a new group of theoretical polymer physics and within a few years had put Reading 'on the map'. The group focused on the microscopic foundations of the tube theory and using a blend of theory and multi-scale simulation to dig deeper, and with more care, into the underlying physics than any other group in the world. A testimony of Alexei's brilliance is his unique ability to bridge concepts and methodologies from different fields. He did so in his recent simulation work by using concatenated ring polymers to study polymer entanglements.



The Non-Newtonian Club is an informal discussion group under the auspices of the BSR, which provides low-cost, informal one-day meetings to provide a forum for industrial and academic rheologists to meet together and to present work in progress. A good mix of speakers from industry and academia is the norm and also for research students working on industrially related projects to present their results. There is no charge for the meeting.

Rheometry. 19th April 2016		
Imperial College London, Skempton Building*, Level 2, Room 207, South Kensington Campus, London SW7 2BX		
10:15-10:45	Registration & Refreshments	
10:45-10:50	Welcome & introduction to meeting	
10:50–11:20	Prof David Heyes Department of Mechanical Engineering Imperial College London	Molecular Dynamics computer simulations of confined liquid film tribology
11:20- 11:50	Mr Steve Goodyer Anton Paar	Understanding Errors in Rotational Rheometry
11:50-12:20	Prof Malcolm Mackley (co-author: Simon Butler) Department of Chemical Engineering and Biotechnology University of Cambridge	Fast Filament Stretching of Stuff
12:20-13:05	Lunch	
13:05 -13:30	Dr Joanna Li-Mayer ¹ (co authors: Dr Maria Charalambides ¹ , Dr Annette Glauser ² , Mr Daniel Lewis ²), ¹ Department of Mechanical Engineering, Imperial College London and ² AWE	Characterisation and micromechanical modeling of a highly filled hyper-viscoelastic polymeric particulate composite
13:30-13:55	Mr Andre Zamith Cardoso Chemistry Department University of Liverpool	Phase transitions in low molecular weight peptide-based surfactants/hydrogels
13:55-14:20	Dr Andreas S. Poulos Department of Chemical Engineering Imperial College London	Orthogonal superposition rheometry of model colloidal glasses

14:20 -14:50	Prof A Russell Davies Cardiff School of Mathematics Cardiff University	Derivative Spectroscopy and the Continuous Relaxation Spectrum
14:50 – 15:20	Dr Manlio Tassieri (& 8 co-authors) School of Engineering, University of Glasgow	i-Rheo: Measuring the materials' linear viscoelastic properties 'in a step'!
15:20-16:00	BSR Annual General Meeting (AGM)	
16:00-16:45	Prof Geoffrey Maitland Department of Chemical Engineering Imperial College London	The intriguing world of clay-inorganic nanoparticle suspensions: practical opportunities and theoretical challenges

* it is essential you inform Maria Charalambides (m.charalambides@imperial.ac.uk) or Steve Goodyer (steve.goodyer@anton-paar.com) in advance if you are planning to attend. Please indicate any catering requirements. Skempton building is building 27 on the attached map.

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Alexei achieved enormous academic distinction, and his achievements came remarkably quickly - testament to his brilliance as a scientist. Several theoretical works on the linear and non-linear viscoelasticity of entangled polymers carry his name, including the famous Likhtman-McLeish model (2002) for slow flows (which was 90% Likhtman) and the GLaMM model (2003) for fast flows (with Graham and Milner). His Advanced EPSRC Fellowship came at the age of 31, and he was appointed Professor of Mathematical Physics in Reading at the age of just 35. Yet while undoubtedly successful himself, Alexei was equally proud of the many achievements of the group he developed. For example, in September this year he spoke glowingly of how two poster prizes out of three available at the Institute of Physics Polymer Physics Biennial Conference were won by post-doctoral researchers from his team. In the same month, he was appointed as the first Mercator Fellow of the Freiburg-Strasbourg-Basel-Mulhouse International Research Training Group on 'Soft Matter Science'. He enjoyed a productive visit to Strasbourg, during which he described himself as "feeling like a PhD student again" (possibly partly due to the position that his former PhD supervisor, Semenov, now holds there!). This is typical of his modesty and enthusiasm.

Alexei was one of those wonderful scientists who remind us that just because something is obvious, doesn't make it true. Alexei would challenge every idea that we had at Leeds - including the ones that we thought were obviously true. But the way in which he demolished your ideas was so kind and so surgically precise that it always felt good somehow. He was a particularly vociferous critic of the bad habit that much of the polymer rheology community had got into, of presenting theory together with data from just one technique, then subtly altering the parameters when data from a different technique was brought into comparison. A wonderful paper from 2005 compared his remarkable 'slip-link model' to data on rheology, NMR and diffusion measurements simultaneously. He leaves us a permanent reminder that you learn more from theory when it disagrees with experiment and that an experimentalist should have a good grasp of theory and vice versa.

Alexei was a wonderful colleague, and all those who were lucky enough to work with him benefitted immensely from his enthusiasm, support and wisdom. Alexei was an intellectual powerhouse, a truly curious mind, a

wonderfully creative thinker, a brilliant teacher at undergraduate and graduate levels, with academic gravitas way beyond his years, yet completely approachable, modest and always friendly in a natural way that charmed anybody who met him. The superb group he built in Reading and the quality of people he brought in reflect his vision and sense of commitment.

He was hugely supportive of those for whom he felt he had a responsibility. His dedication to his PhD students and his research team went well beyond professional duty. He sought to provide a family-like environment for the group, especially supportive for those who were far from home. He presented himself as an exemplary reference figure for all the young people in his group, full of energy and full of life. In this continuous work of hospitality and welcome he was supported by his family, to whom he was utterly devoted as husband and father.

Alexei was so much more than an academic and an intellectual. He truly enjoyed life and always managed to combine professional activities with hobbies and family activities. He did so last summer when he visited friends with his family following a workshop and seminar. He had a passion for so many things ranging from sports (especially swimming and hiking) to photography. A truly happy, free spirited man, full of energy and passion for things he did, he had as infectious a love of life as a tireless desire to find scientific truth. He was a great admirer of nature and outdoors with real care about the world and people around him. He was a great friend, a funny, spirited, yet always serious person, and his daily passionate presence, his enthusiasm for science, his warm friendship, will be sorely missed.

Alexei died on 11 October 2015 following a fall while hiking in Maryland, USA. He is survived by his wife Katrina, and their two daughters, Sonya and Asya.

RHEOLOGY ABROAD

D.R. OLIVER

In 1963, whilst spending the summer in Ottawa, I found out that a World Rheology Congress was to be held at Brown University (Rhode Island) in September. With a small daughter in tow, Jill and I set off in an old Ford V8 for a tour in New England and New York, taking in the conference on the way back. My main memories of the meeting were of the pleasant surroundings, chatting to a confident Anthony Pearson for the first time and a series of highbrow lectures by Americans like Truesdell. These were quite over my head and made me wonder whether I was in the right meeting!

A memorable congress was held five years later in Kyoto, Japan. Together with Ken Walters, Mervyn Jones and John Hutton, we joined a European group of Rheologists on a far eastern tour. The Polar flight to Tokyo via Anchorage, Alaska was spectacular and sitting in a downtown café the same day I felt as though the chair was gently swaying, due to travel weariness. We remembered the flashing neon signs, having to remove shoes to enter Japanese temples and masses of colourful umbrellas when it rained. I've forgotten where we saw the "second biggest Buddha in Japan", which was massive and made people wonder what the biggest one was like.

The old capital city of Kyoto had a fine conference centre and our hotel was central, but my memories are more down to earth. Walking through a dark alleyway one night, we saw a sign which read,

“Visiting stranger, beware of the young ladies who will try to entice you from windows and doorways. Do not accept their offers and avoid a horrible experience”.

Signed: Chief of Police

Diplomacy not being my strongest suite, I told this story at the Congress Dinner, with the added comment, “But I wondered, how did the Police Chief know it was a horrible experience?”

The Americans and Brits laughed out loud, but our hosts seemed rather unimpressed.

Another disgraceful story from the same night was that, having gone back to our room in a jolly state and having had enough of the free saki available, John Hutton and I went on our balcony and looked down, we were a dozen floors up and straight above the main entrance; several toffs and their ladies were getting out of their car to come into the front entrance. Perhaps we thought that a spray of saki would feel like a heavy rain shower – perhaps two wooden cupfulls was overdoing things! All hell was let loose – we’d been spotted! We shut the door, put all lights off and dived into our beds in full evening dress. Feet pounded in the corridor, with much yelling and shouting, but as we calmed down we realised that the pounding was coming from the corridor above and the excited staff had mis-counted our floor!

The flights to Cambodia was memorable for good views of American army camps in Vietnam, which were large and square, and the ongoing flight to Siem Reap in a lovely, shiny old Dakota. We were told that it would start to rain at four o’clock and our old plane flew quite steadily between towering banks of thunder clouds before making a dry landing just in time. On the bus to the temples of Angkor Wat, tropical rain beat down for the predicted three hours. Just as the older Roman buildings at Pompeii are being slowly exposed beneath layers of volcanic ash, so the temples of Angkor are being gradually reclaimed from the jungle. However, most of our party will have been more familiar with Roman history than with that of the Khmer people of Indo-China. This makes the temples highly impressive and well worth a visit.

The tour ended with a stay in Bangkok with a trip to the “floating market”. Most of the boats carried about twenty people and had a large Ford car engine on the back driving a propeller which seemed to be controlled by a long pole. As the huge array of fruit, vegetables, spices, jewellery and silk dresses drifted past a backdrop of gleaming mellow minarets, we were given a snack of juicy meat in a huge crispy lettuce leaf. A relaxed finish to a hectic three weeks.

My main memories of the next congress in Lyon were of standing in the rain in a queue to get lunch and finding a fine restaurant where they had strawberries of three different sizes. Before going to Gothenburg in 1976, Neville Waters stayed with us and, remarkably, found a colourful description of a rather naughty show (at a Gothenburg nightclub) in an English ladies magazine which had been left in his room. We went along one night and found that the show matched the description, a very Swedish show which would make the Abba girls blush!

The bay of Naples, on its south side, curls round past Erculanium, nearby Pompeii and on to Sorrento, with the Isle of Capri slightly further out to sea. So, as the sun rose over our hotel in Sorrento, we would head down to the harbour to catch the ferry to Naples, the venue for the 1980 congress. We could look back to the hard rock cliff on which Sorrento was perched. To swim in the sea from our hotel, we went down (instead of up) on the hotel lift, emerged deep inside the cliff and walked through a cool passage to the hotel’s own jetty in the sea, where there were no sandy beaches. Pompeii is always worth visiting, giving remarkable insight into the advanced features of Roman city life and the varied personal habits of its people.

The conference dinner was totally chaotic. It was boiling hot, and the starting drinks were all in their bottles on a long table at one end of a big room. When waiters eventually appeared, they slowly began to uncork the bottles, had a chat and let it be known that no one could

drink until the president had arrived! They then took half an hour to fill the glasses.

Meanwhile, the thirsty throng slowly pressed forwards to meet a solid line of waiters who held their ground. But the front line was weak on both flanks and we soon took advantage, the young waiter on our end of the table being overwhelmed by long arms and no-one defended the back of the table, where random gaiety erupted. Drinks went flying, but most were quickly consumed and our well-behaved rearguard were lucky to get a drink at all.

The buffet meal was no better, with fine food stacked on a central table in the middle of a much smaller room initially closed off. After welcoming speeches (and more drinking) the doors to the room were suddenly opened and the hungry horde pressed in. If manners maketh man, there were few men here! I could not get near any waiter carving turkey, pieces of which were snatched on leaving the knife; legs and wings had a very brief existence. At the far end of the table was a large plate of calamari, which I could only get to by going down on my knees and reaching up and over the counter to grab a handful! There was nowhere to sit down and wives stood no chance unless they sent their husbands into the scrum to forage for them. No other congress meal could compete with this one for organised mayhem, but such events stick in the mind and are talked about for years afterwards – unlike the successful ones.

George Orwell probably chose “1984” as a book title because it seemed to be well into the future; it was also the year of the attempt to kill Margaret Thatcher in the Brighton hotel bombing. We remembered it for that year’s World Congress in the glamorous Acapulco. Our hotel had a swimming pool which surrounded a large island in the garden, of varying depths and widths and with a bar in the main part where you sat on stools in the water by the bar and drank margaritas with the legs still immersed. One night, a race was organised round the pool which was rather spoiled by people cheating and taking a short cut across the island!

Eirean Jones and I went across the road one evening to an Italian restaurant and ordered a bottle of Chianti, which the Mexican waiters had never heard of. Alarm bells should have rung, but a Lasagne was on its way and, as an afterthought, we ordered a bottle of Liebfraumilch which was highlighted in a basket alongside the table. When the bill came, the two meals were about 25 pounds and the wine 80 pounds! Eiron refused to pay and after a long stand-off, they threatened to call the police. Foreseeing a dismal visit to the cells, we were on the verge of paying when they halved the price of the wine and we then capitulated. We had not realised the huge mark-ups on imported wine!

Acapulco's speciality is cliff diving, when young men do swallow dives into the sea from high cliff ledges. The art is to dive as the sea surges upwards, otherwise the shallow channel can have disastrous consequences for the diver. Less well-known is the paragliding taking place each day from the beach. An instrument firm offered free rides and we took full advantage. We were strapped (solo) into the harness with the parachute trailing a fast boat heading straight out to sea. With a stiff, warm breeze, a jog of a few paces would inflate the chute and lift you off the ground.

One accident occurred in our group when the parachutist lurched sideways and knocked over a cameraman, causing a nasty cut. But normally, you rose quickly and soon had a perfect view of the bay, with one man in the boat watching you whilst the other drove the boat. Turning downwind was interesting, because with the wind speed now subtracted from the speed of the boat, you lost height rapidly and the boat needed full power to keep you airborne. This was rather disconcerting and spectators said I had come quite close to the water at this time.

Landing required skill on the part of the boat driver as he sped along the shoreline, then turned out to sea and slowed down carefully, allowing the paraglider to sink onto the sand at walking speed. At least that was the theory. On the next day, with a stronger wind, the

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paraglider just hovered and refused to descend until he was pulling the boat backwards with him, which was seen as unsafe for landing. I saw one paraglider repeat this procedure three times before making a vertical landing. There were about twenty Rheologists on the list for paragliding, but in the end over forty took to the skies in the allocated time.

A visit to Australia must include a look around the island continent. In Sydney itself, where the 1988 Congress was held, Jill and I stayed in Dover Heights, off the northern end of Bondi beach, which was smaller and more urbanised than we expected. The Blue Mountains are an easy drive from Sydney and are unusual in that the last twenty miles are a gradual rise through heavy bush country with the road crossing several bridges over steep-sided valleys. These had caused severe difficulties for the early explorers, even with skilled native help. The town of Kootoomba could well be in the American West and is flanked by steep cliffs and jagged spikes; beyond it a narrow road, with many hairpin bends, leads down to flatter farming country beyond.

The final leg of our trip to Heron Island, on the Great Barrier Reef, was by helicopter. This was made scarier by the all-round glass cabin (including underfoot), which made Jill want to sit at the back between two other people! But the tiny island was lovely, with coral beaches, meals outside with exotic birds for company, scuba diving and a lovely quick walk all the way round the island on the beach. Here, the weather was perfect, but the next week, staying in Perth, we decided to take a boat trip to Rottness Island, which is out in the Indian Ocean. The sun shone, but soon a full gale was blowing and the waves became mountainous. I survived the usual problems by standing by a large, open hatch and being soaked by wind-borne spray, Jill, down below, did not. We recovered on the island, but the return journey was even worse. We both sat on the open rear deck but often had to stand and hang onto support posts. At one stage, the captain had to “heave to”, or slow down and let the bows face straight into the towering seas. A young man hanging grimly on to a

post, turned a whiter shade of pale green and slowly slumped onto a seat, curled up and seemed to fall asleep. Yet half an hour later he marched straight along the quay smiling happily. We were not smiling, but lived to tell the tale.

We have been lucky to visit such varied parts of the world in our pursuit of the science of Rheology and to have met such wonderful people. Some like Art Metzner, Jo Meissner, David Boger, Manfred Wagner and Jim Ferguson should be given a belated mention. But the real omission must be that of Rheology itself for without it we would have been desk-bound and boring!

British Society of Rheology News

The BSR Annual Award

The Annual Award is intended to recognise a significant contribution to rheology, either through a single paper (in which case a group of co-authors can receive the award) or more sustained activity of a single individual. The Award is decided based on scientific merit. Long service is not a factor, and nominations of early career scientists / research workers are welcomed. The final decision is taken by the Council of the British Society of Rheology. If, in a given year, there is no suitable nominee, then the Award will not be given.

Eligibility

The recipient of the BSR Annual Award (lead recipient if a group) should be either a rheologist working in the UK, or an international rheologist who has strong ties to the BSR. The recipient need not be a member of the BSR at the time of nomination. No-one may receive the award more than once. Current serving members of BSR Council are excluded, barring exceptional cases where a very long serving member of Council would otherwise be permanently ineligible.

Award details

The recipient should give an Award Lecture at a BSR conference, usually in December of the year of the award. The winner will be presented with a certificate and a monetary prize of £300 along with expenses for the recipient (and his or her partner, if desired) to attend the conference. The recipient should write a feature article for the BSR Bulletin. Notification of the recipient of the Award shall be made to New Scientist, Nature, Physics Today etc. and other rheology societies.

Application process

A nomination should be made by a member of the British Society of Rheology in good standing. Nominations for an individual should consist of a brief citation (two sides of A4 at most) detailing the nominee's contribution to rheology. This document should also make clear how the

nominee fits the eligibility criteria. A full CV for the nominee is not necessary; it should be possible for the nominating person to proceed without help from the nominee. A nomination for a single scientific paper should consist solely of a brief description (two sides of A4 at most) of the content of the paper and its impact on rheology (including citation data and records of any conferences, projects, etc. which have followed on from the paper). This document should also make clear how the lead author fits the eligibility criteria. Nominations should be sent to the president (president@bsr.org.uk).

BSR Student Travel Awards

The British Society of Rheology seeks applications for travel awards from its student membership, with the objective of encouraging students to disseminate their research. Travel awards are available to student members of the Society to present their research by paper or poster at a conference that contains a strong rheological element. The awards are expected to supplement existing sources of funding that would not cover the whole cost of attending the conference on their own. Suitable conferences include the International Congress of Rheology, the Annual European Rheology Conference and conferences organized by the Society.

For the duration of 2016, as a trial to coincide with International Congress on Rheology in Kyoto, the BSR will waive the usual rule that students must normally have been a member of the Society for 9 months. Moreover, the society will accept applications at any time of year, with successful applicants notified within four weeks.

Applications for a travel award should be sent to the Secretary (secretary@bsr.org.uk). Submissions should include the name and location of the conference, the title, authors and abstract of the paper submitted to the conference, a breakdown of the projected costs of attending the meeting and a brief supporting letter from the research supervisor. The support of the British Society of Rheology should be mentioned in the conference presentation, and the Society's logo may be used for this purpose. Payment of the bursary will be made on receipt of a conference report suitable for publication in the Bulletin of the Society.

Simon Cox
BSR Honorary Secretary

Commentary on the 345th Council Meeting of the BSR – Department of Mathematics, UCL

The 345th Council meeting was held in the maths department at UCL, hosted by our President Helen Wilson, in a room that would be familiar to those members who attended the 2011 mid-winter meeting “Complex Flows of Complex Fluids”.

The meeting opened in the usual fashion with apologies for absence, approval of the minutes of the previous council meeting (at Ruthin Castle in April), following up actions arising from that meeting, and nobbling a newly-elected Ordinary member to write this Commentary. A less usual feature was the virtual presence of Rob Poole, who had unavoidably had to cancel his travel down to London at the last moment, and joined us via Skype. This experiment was less successful than hoped, with an intermittent connection and poor sound, preventing Rob from being able fully to participate in the meeting. Despite this disappointment, we agreed that we should consider more adequate video conferencing arrangements for future meetings. With the council members now well dispersed across Great Britain, travel time and cost is a consideration for the Council meetings, at least for those meetings that cannot be arranged to be co-incident with BSR or other rheology meetings where a majority of council are already present.

The President’s report included a note that the recent European Society of Rheology meeting she had attended as the BSR representative had been dominated by a discussion of problems with the ESR website. So it is not just us. Peter our web editor was not present, but informed Council in a written report that work towards a new BSR website remained slow. Problems with our existing website continue to accumulate, but fixing them would be an even larger job than replacing it, so it limps on – now as a precaution, with even more frequent backups by Simon and Peter.

Following the review of the membership list agreed at the previous council meeting, Maria our Membership Secretary reported that there are 318 members remaining. 6 are new; 7 retired and long-standing members have been changed to honorary status; 99 persistent non-payers have been removed.

You have in your hands a bulletin produced by our new printers. Previously we have had a high gloss laminated cover, as this was necessary for the high quality cover graphics. This is no longer the case (perhaps due to the improved rheology of printing inks arising from the work of members?) and adds technical difficulty, delay and cost to production of the bulletin, as well as making the bulletin harder to recycle after use. Manlio our Publications Manager passed around specimens from the printer of both laminated and un-laminated versions of the bulletin. It really was very hard to discern the difference, and we agreed to proceed without lamination in future. The council considered two nominations for this years' Annual Award. Both candidates were excellent, but with very different profiles, and there was much debate around the table until a consensus emerged on who should be the recipient this year, with the second nomination to be carried over into next year. It was apparent from the documents in front of us, that the nomination procedure and guidance to nominees on criteria for selection was unclear, and council members were unanimous in their support for the President's suggestion that this must be addressed before nominations for next years' award are invited. Preparation of a clear and professional set of guidelines is in progress, and will be discussed at the next council meeting (which will follow the mid-winter meeting in Glasgow).

There were no applicants for the Student Travel Awards. Concerned with the potential to be swamped by opportunistic applications, Council had previously imposed deadlines for applications, and conditions of nine months prior BSR membership. However, the evidence suggests that the concern was excessive. The application deadline under discussion was before the mid-winter meeting had been advertised. Travel awards are seen as an important mechanism to attract members in training, and the BSR finances are healthy, so

there was a consensus that we should amend the application scheme so that it is more used. Revised guidelines are imminent.

The final substantive business was discussing future scientific meetings, including considering dates and venues for future Non-Newtonian Club meetings and the 2016 mid-winter meeting, so that they could be announced at the 2015 mid-winter meeting in Glasgow.

Phil Threlfall-Holmes
Ordinary member of Council

INDUSTRY NEWS: News from Anton Parr

Anton Paar launches the Litesizer™ 500: particle analysis by light scattering

The Litesizer™ 500 determines the size and stability of nanoparticles and submicroparticles in liquids by using light-scattering. Combining key technological advances and ingeniously simple software has resulted in a high-performance instrument that produces state-of-the-art particle analysis at the touch of a button.

Particle systems can be complex... but measuring them doesn't have to be!

The size and stability of nanoparticles and microparticles are crucial to their function as well as to their processing and transport properties. Anton Paar now introduces the Litesizer™ 500, a light-scattering device for particle analysis that gives you rapid and accurate insight into your particle systems. In one simple and elegant instrument, the Litesizer™ 500 provides all the tools for optimizing your particle systems by revealing how they change with time, pH, temperature and concentration. The Litesizer™ 500 determines particle size, zeta potential, and molecular mass by using light-scattering technology, in combination with transmittance measurements. The pièce de résistance of the instrument is its ingeniously simple software. The user interface is a one-page workflow, where input parameters, results and analysis are all on a single page. You can set up measurement series in a few seconds, and produce the analysis and report you need at the touch of a button. You can also compare results from different experiments when it's convenient for you.

“No other light-scattering device is so intuitive,”

said Jakob Santner, Head of Characterization at Anton Paar.

“A subtle but powerful feature of the Litesizer™ 500 is its ability to measure transmittance. It gives the user instant feedback about their sample, and it allows the device to automatically adjust parameters like the focus position, measurement angle, and measurement duration. The Litesizer™ 500 really is a smart device.”

Further technological advances include cmPALS, the novel patented technology (European Patent 2 735 870) that re-defines the state of the art in zeta potential measurements. In addition, highly developed algorithms in the Litesizer's firmware technology allow you to resolve several different particle sizes in a single suspension. The Litesizer™ 500 is a high-performance light-scattering instrument that will simplify your particle analysis and free up your time, so you can concentrate on what your particles are doing, rather than trying to figure out how to use the instrument.

For further information contact info.gb@anton-paar.com or call 01992 514730

CONFERENCE DIARY

2016	CONFERENCES & MEETINGS
28-29 Jan Paris, France	First workshop on Flow and Processing of Highly Filled Materials F. Lequeux, P. Cassagnau, G. Ducouret, R. Valette francois.lequeux@espci.fr http://ezuslyon.wix.com/hfmaterials
2-3 Mar Regensburg, Germany	Rheology of Building Materials M. Greim - greim@schleibinger.com www.schleibinger.com/k2016.htm
1 Apr Zurich, Switzerland	20th Anniversary Meeting of the European Society of Rheology P. Fischer - peter.fischer@hest.ethz.ch esr2016.ethz.ch
19 Apr London, UK	Non-Newtonian Club Meeting Including BSR AGM. Maria Charalambides (m.charalambides@imperial.ac.uk) or Steve Goodyer (steve.goodyer@anton-paar.com)
8 – 13 Aug Kyoto, Japan	The XVIIth International Congress on Rheology (ICR2016) Chair: Hiroshi Watanabe (Kyoto University, Japan) More information can be found at http://icr2016.com/index.php?ICR2016



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Highlight 3 of 6 **New extensional tests**

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