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## 1. Welcome

This is the newsletter of the IOP Mathematical and Theoretical Physics Group in 2009. Its main purpose is to inform about the **forthcoming Annual General Meeting (AGM) on Friday 27<sup>th</sup> November** at the University of Loughborough. Moreover, it contains information on recent and future meetings sponsored by the group, opportunities for research students in Mathematical and Theoretical Physics such the IOP Research Student Conference Fund, and information on the committee structure.

## 2. Announcement of the AGM

The next AGM will take place at the School of Mathematics, Sir David Davies Building, Loughborough University on Friday 27<sup>th</sup> November 2009.

**Note:** The exact time (approx 12:00-13:00) and room will be announced on the AGM notice. Directions to the School of Mathematics can be found here <http://www.lboro.ac.uk/departments/ma/miscPages/find.html>

In case that the AGM should not be quorate, a second meeting will take place on Friday 4<sup>th</sup> December 2009 at the Open University in Milton Keynes. The agenda will cover a report of the officers, decisions on grant funding as well as the election of a new Honorary Treasurer and a new committee member.

We invite nominations for these two posts, see item 3. The formal AGM notice has been appended at the end of this newsletter.

## 3. Call for nominations

We invite nominations for the posts of Honorary Treasurer and for a new committee member. Nominations must reach the Honorary Secretary by email (see committee member list at the end of the newsletter) by 26<sup>th</sup> November 2009. Candidates have to be members of the Mathematical Physics group of the IOP, and nominations must be supported by two group members.

## 4. Announcement of forthcoming meetings

### (a) Open Statistical Physics, 10<sup>th</sup> March 2010, Open University, Milton Keynes

The Department of Mathematics and Statistics at the Open University is planning to host a one-day conference **Open Statistical Physics** on 10<sup>th</sup> March 2010. The meeting will be organised by Michael Wilkinson ([m.wilkinson@open.ac.uk](mailto:m.wilkinson@open.ac.uk)), Uwe Grimm ([u.g.grimm@open.ac.uk](mailto:u.g.grimm@open.ac.uk)) and Paul Upton ([p.upton@open.ac.uk](mailto:p.upton@open.ac.uk)). It is the intention that it should be open to as wide a range of contributions as possible. The meeting will have an unusual format, and talks will include a discussion of an open problem as well as the presentation of results. The term 'statistical physics' is to be interpreted broadly. For instance, abstracts on topics related to biological applications, turbulence, financial mathematics, etc, would be most welcome.

Because the object is to get the broadest possible communication between participants, all in attendance are encouraged to make a presentation, if they wish to do so. If a sufficiently large number of people express an interest, the presentations will be split between several parallel sessions (grouped according to subject area). The format of presentations will be 35 minute slots (30 minutes presentation, 5 minutes questions) for people who have a permanent position. Students and postdoctoral workers will have 20 minutes (15+5), unless they report their own independent work (reference to a preprint on the arXiv would be evidence for this).

There will be no conference fee thanks to the Department's financial support for the meeting. To simplify administration, any additional funds which may be available to support travel expenses will be divided according to distance of the speaker's affiliation from Milton Keynes.

If you are interested in attending such a meeting, please contact one of the organisers by email by the end of November, including a title for your contribution and a reference to a preprint describing the work (if one exists). The organisers will circulate a list of proposed contributions to everyone who expressed an interest, and ask for confirmation of participation in January.

The organisers hope that a meeting of this type will expose participants to a wide range of research problems and results that they might not otherwise encounter. If it is a success, they intend to organise a similar event in future years.

**(b) Mathematical Virology III at the University of Cumbria, 27<sup>th</sup>-31<sup>st</sup> August 2010**

A workshop on **Mathematical Virology** will be organised at the University of Cumbria in Ambleside (27<sup>th</sup>-31<sup>st</sup> August 2010) by Peter Stockley (Leeds) and Reidun Twarock (York). This interdisciplinary workshop will bring together high-profile researchers as well as young scientists and research students from the disciplines Mathematics, Mathematical Physics, Biophysics and Biology, to discuss experimental and theoretical challenges at the forefront of virology. A collaboration of these disciplines is key for our understanding of the mechanisms underlying viral diseases. This workshop focuses on important aspects of virus research such as the structure and physical properties of viruses, their formation, the structure and injection of the viral genomic material, and viral evolution.

As in previous workshops, a special session sponsored by the IOP Mathematical Physics group will be dedicated to applications of Mathematical Physics techniques in virology.

A website will be available from January 2010. If you are interested in this event, please email Reidun Twarock (rt507@york.ac.uk).

**(c) 28th International Colloquium on Group-Theoretical Methods in Physics, 26<sup>th</sup>-30<sup>th</sup> July 2010, Newcastle**

The **28th International Colloquium on Group-Theoretical Methods in Physics** will be organised by Maia Angelova (Newcastle) and Wojtek Zakrzewski (Durham) at Northumbria University in Newcastle from 26<sup>th</sup> to 30<sup>th</sup> July 2010. It will bring together Mathematical Physicists interested in Group Theory applications in a wide range of topics, including mathematical biology. About 250 international participants are expected. For further information, please contact Maia Angelova (maia.angelova@unn.ac.uk).

**(d) Classical and Quantum Integrability workshops**

A series of workshops on **Classical and Quantum Integrability** will consider a wide range of topics in Integrable systems and related areas. The topics and venues are as follows:

- Friday, November 27th, 2009 in **Loughborough** :

[\*Integrable Day: Integrable systems and representation theory\*](#)

- Friday, March 12th, 2010 in **Edinburgh**:

[\*Integrability and Number Theory\*](#)

- Friday and Saturday, April 23rd and 24th, 2010 in **Glasgow**:

[\*Integrable Systems: algebraic aspects\*](#)

- Friday and Saturday, May 14th and 15th, 2010 in **Leeds**:

[\*Variational problems in integrable systems and geometry\*](#)

These meetings are also partially funded by the [London Mathematical Society](#), so there is some support available to enable research students and post-docs to attend these meetings.

## 5. Recent events organised or supported by the group

**(a) The sixth International Conference on Aperiodic Crystals APERIODIC'09** (Liverpool, 13-18 September 2009) chaired by Ronan McGrath (Liverpool) and Uwe Grimm (Open), was the first major conference in this interdisciplinary research field held in the UK. The conference, which is organized under the auspices of the Commission on Aperiodic Crystals of the International Union of Crystallography (IUCr), followed on from Aperiodic'94 (Les Diablerets, Switzerland), Aperiodic'97 (Alpe d'Huez, France), Aperiodic'2000 (Nijmegen, The Netherlands), Aperiodic'03 (Belo Horizonte, Brazil) and Aperiodic'06 (Zao, Japan). The next conference in the series will take place in Australia in 2012.

Aperiodic'09 attracted about 110 participants from across the world, including 20 UK-based scientists (the second largest group after Japan who sent 21 delegates), across a range of disciplines including mathematicians, physicists, crystallographers and materials scientists. The remit of the conference covers two broad areas of research, incommensurately modulated and composite crystals on the one hand, and quasicrystals on the other hand, sharing the property that they are aperiodically ordered solids. The programme comprised 3 tutorial lectures on the Sunday afternoon, 13 invited and 40 contributed plenary talks, and more than 40 posters, which were presented at two afternoon

poster sessions. Topics range from mathematical foundations, mathematical models, new materials, sample preparation, structure determination, physical properties and surface properties to industrial applications. A tutorial also covered recent research on complex metal alloys, which are periodically ordered solids with large unit cells, and share some of the properties of quasicrystalline solids. Funding provided by the IoP Mathematical and Theoretical Physics Group was used to partially support two speakers on the mathematical side of the programme. A related EPSRC-supported workshop on Mathematical Aspects of Aperiodic Order was held in Leicester in the week preceding the conference, and attracted about 40 participants.

Highlights of the conference included a public lecture "Simple sets of shapes that tile the plane but cannot ever repeat" by Roger Penrose and a visit by Alan L. Mackay, bringing together two distinguished UK scientists who made seminal contributions to the subject. Besides the scientific programme, the conference also offered a presentation by the author Ann Lingard, whose latest novel "The Embalmer's Book of Recipes" features a mathematician working on quasicrystals as a main character.

For further information, see <http://www.aperiodic09.org/>

**(b)** A workshop on **Finite Temperature Non-Equilibrium Superfluid Systems FINESS 2009** was held at van Mildert College in Durham during 14-17 September 2009. It has been a follow-up event to a workshop on Non-equilibrium behaviour in superfluid gases at finite temperature that was held in Sandbjerg, Denmark, in June 2007. Topics discussed at the workshop included kinetic equations, classical field theory, Kadanoff-Baym equations, projected Gross-Pitaevskii equations, the truncated Wigner approximation, in particular as applied to cold, trapped atomic and molecular gases, but also on solid state systems that can be treated in a formally similar way.

The funding of the IOP Mathematical & Theoretical Physics Group was used to sponsor one of the sessions at this meeting. In this session, Dimitri Gangardt (School of Physics and Astronomy, University of Birmingham) reported on mobile impurities in one dimensional quantum liquids: dissipation vs.integrability. Wojciech Zurek (Los Alamos National Laboratory) spoke about causality in condensates: grey solitons as remnants of BEC formation.

The meeting was attended by about 57 residential participants, and 6 day participants. From these, there were 23 invited speakers, with the

remaining participants presenting their work in two poster sessions organised during the workshop. The meeting was also attended by Tim Smith, Senior Publisher of New Journal of Physics. The structure of the meeting was such that it encouraged discussion, with a third of the time of each invited talk allocated for questions. Questions were also allowed during the talks, and this allowed for an interactive forum as this option was used by most participants. It was agreed to hold another meeting in 2 years' time, with a tentative proposal being Heidelberg (currently under investigation).

More information can be obtained from the workshop website: <http://massey.dur.ac.uk/finess/talks.html>

**(c)** The symposium **QUANTUM (Groups + Foundations + Information)** took place at the University of York on 29-30 September 2008 to celebrate the achievements of Professor Anthony Sudbery. The symposium reflected Professor Sudbery's diverse research activities during his distinguished career, and the event integrated three distinct research areas: *Quantum algebraic methods* in particle physics and field theory; *foundational aspects of quantum mechanics* such as its interpretation and the role of time; various topics related to *quantum information*. A dedicated IOP session featured plenary talks by Alan J Macfarlane (University of Cambridge) on "Algebraic Structure within the QR Algorithm", Almut Beige (University of Leeds) on "Macroscopic Quantum Jumps and Quantum Computing" and Sandu Popescu (University of Bristol) on "Time Quantum Mechanics". Among the 49 participants there were also a number of graduate students, who made ample use of the opportunity to present a poster and discuss their work with other participants.

The meeting was organised by Prof Paul Bush, Dr Atsushi Higuchi, Dr Reidun Twarock and Dr Stefan Weigert, with support from the London Mathematical Society and the Mathematical and Theoretical Physics Group of the IOP. A Festschrift in honour of Professor Anthony Sudbery's 65<sup>th</sup> Birthday has been compiled. For further information, see the following website: <http://maths.york.ac.uk/www/TonySudberyFest>

**(d)** A workshop on **Applications of Group Theory in Mathematical Biology** has been organised by Prof Anne Taormina and Prof Reidun Twarock at Collingwood College, Durham, in December 2008. This one-day workshop has explored the application of mathematical physics techniques to the study of biological systems, in particular, viruses. The

workshop celebrated the involvement of the Department of Mathematical Sciences in the newly established Durham [Biophysical Sciences Institute](#), as well as the launch of a new [MSc in Biomathematics](#), that started in October 2009.

The [scientific programme](#) focussed on virus dynamics and assembly, and attracted around 25 researchers, mainly from York and Durham. The speakers contributed to the interdisciplinary atmosphere of the meeting, as we heard talks from two virologists, three biophysicists and a theoretical particle physicist. The opening talk, by Peter Stockley from the Astbury Centre for Structural Molecular Biology at Leeds University, gave us some insights of the crucial role played by RNA in the assembly of some viral capsids, such as the bacteriophage MS2. He emphasized the interplay between virologists and mathematicians when it comes to model such assemblies. The second talk, by Kasper Peeters, from the Department of Mathematical Sciences at Durham, described a top-down approach to viral capsid vibrations, which highlights intriguing patterns of vibrational modes in Caspar-Klug viruses. Namely, the occurrence in all capsids studied, of a very low-frequency plateau of 24 non trivial modes, whose presence is rooted in the group theory of the icosahedron and its dual, the dodecahedron. The third talk was a nice complementary account of virus dynamics, this time from an all-atom perspective. Eric Dykeman, from the York Centre for Complex Systems, explained how the simulations provide insights in the movements of atoms in different regions of the capsid. For instance, the atoms around the 5-fold and the 3-fold axes have small relative displacements, while the beta sheet body shows gliding motion. In the fourth talk, by Paul Yeo, from the Department of Biological and Biomedical Sciences, we discovered the interests of the small virology group in Durham, centred on structural studies of the nucleocapsids of the Respiratory Syncytial Virus (RSV) which causes severe affections in children under 6 months of age, as well as on the interaction of RSV with the cytoskeleton and lipid rafts. Tom McLeish, from the Physics Department in Durham, talked us through physical mechanisms by which proteins could use intramolecular dynamics to communicate signals across large molecular distances. Coarse-grained models are used for the calculation of vibrational modes contributing to allostery in proteins. Last but not least, Ard Louis from the Rudolph Peierls Centre for Theoretical Physics in Oxford, showed how theoretical and computer simulation techniques were used to study the statistical mechanics of a wide variety of biological and soft matter systems, in particular the self-assembly of viruses and DNA nanostructures.

**(e)** A satellite workshop on **Geometric Aspects of Discrete and Ultra-Discrete Integrable Systems** was held at the University of Glasgow

from 30<sup>th</sup> March until 3<sup>rd</sup> April 2009 as part of the Isaac Newton Institute Programme on Discrete Integrable Systems. The local organisers were Claire Gilson, Christian Korff and Jon Nimmo. The workshop brought together different communities of researchers working on classical and quantum aspects of integrable systems as well as experts on combinatorial representation theory and crystals. The scientific programme included the following three strands:

1. Birational Yang-Baxter maps, tropical R-matrices and geometric crystals,
2. Cellular automata, box and ball systems, combinatorial R-matrices and crystal bases,
3. Geometry associated with discrete integrable systems.

There will be a proceedings volume for this workshop in the online journal *Symmetry, Integrability and Geometry: Methods and Applications* ([SIGMA](#)). Deadline for paper submission is the **15th November 2009**.

Participants as well as non-participants are invited to submit contributions related to the scientific theme of the workshop.

For further information, including a list of speaker and online versions of the presentations see:

<http://www.gla.ac.uk/departments/mathematics/research/isamp/gadudis>

## 6. IoP Research Students Conference Funds

We encourage research students to apply for funding via the Research Student Conference Fund, see advert below. For the next round of student bursaries, you will need to apply by the 1<sup>st</sup> December 2009.

**Supporting research students**

**Research Student Conference Fund**

Providing financial support to research student members, to attend international conferences and major national meetings.

Apply for up to £250 during the course of your PhD.

Applications are considered on a quarterly basis and should reach the Institute by: 1 March, 1 June, 1 September or 1 December

For further information see [www.iop.org](http://www.iop.org) or contact [supportandgrants@iop.org](mailto:supportandgrants@iop.org)

**IOP** Institute of Physics

## 7. Call for workshop proposals

The Mathematical and Theoretical Physics Group organises scientific meetings and occasionally other activities of interest to its members. The committee always welcomes suggestions of topics for meetings; people interested in organising a meeting or who would like to suggest a topic suitable for a meeting are invited to contact the Honorary Secretary (see committee membership below). The group supports around six meetings a year on average.

## 8. Current committee membership

|   |                            |
|---|----------------------------|
| Prof Uwe Grimm (Chair)                  | u.grimm@physics.org        |
| Dr Nicola Wilkin (Vice-Chair)           | n.k.wilkin@bham.ac.uk      |
| Dr Christian Korff (Honorary Secretary) | c.korff@maths.gla.ac.uk    |
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| Prof Patrick Dorey                      | p.e.dorey@durham.ac.uk     |
| Prof Anne Taormina (Web Editor)         | anne.taormina@durham.ac.uk |
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**This newsletter is also available on the web and in smaller print sizes**

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