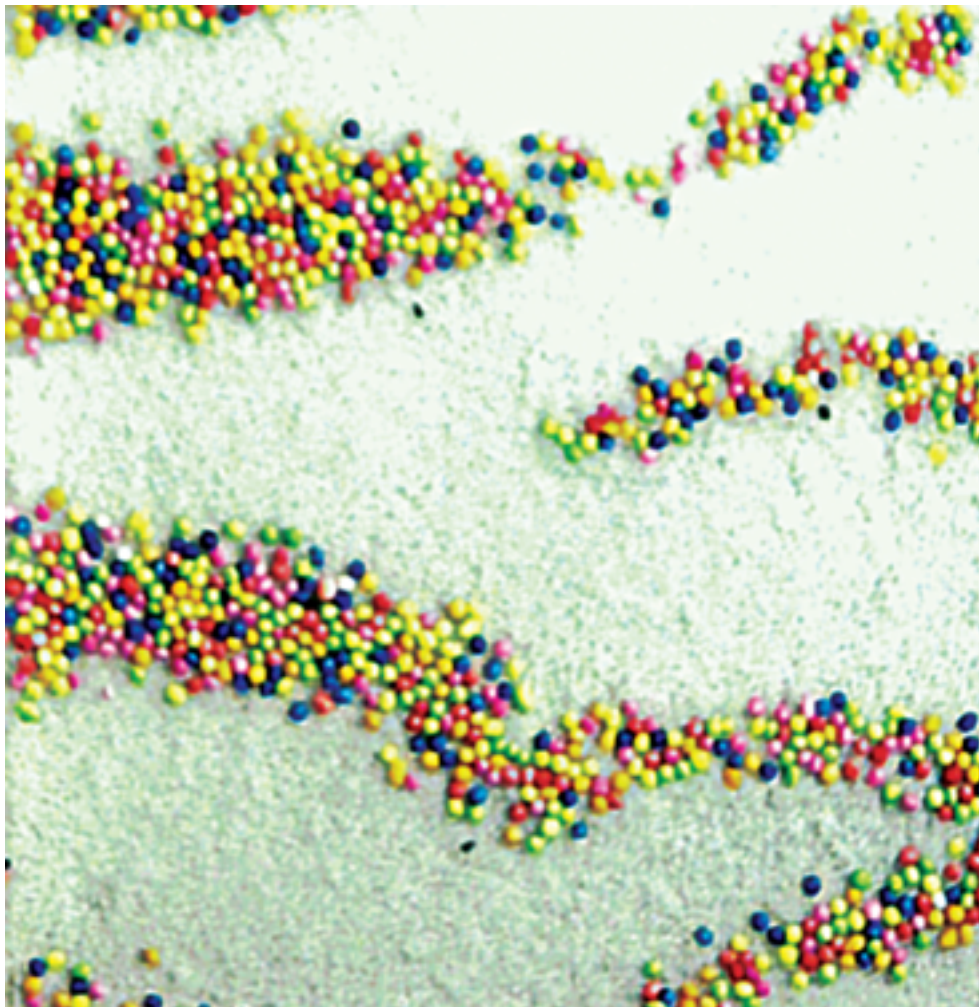


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# Institute of Physics

## Nonlinear and Complex Physics Group

**NEWSLETTER****July 2009****Issue no. 1**

*Photo: Top view of the stripe pattern formed by horizontally oscillating a mixture of polystyrene beads (white) and sugar particles (coloured). Tom Mullin's Group, Manchester Centre for Nonlinear Dynamics, University of Manchester.*

[http://www.iop.org/activity/groups/subject/Nonlinear\\_and\\_Complex\\_Physics/index.html](http://www.iop.org/activity/groups/subject/Nonlinear_and_Complex_Physics/index.html)

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### 1. Chair's Welcome

Welcome to this first issue of the **Newsletter** of the **Nonlinear and Complex Physics Group (NCPG)**. As outlined below, the group was launched at a lively kickoff meeting held in Manchester in April. The prime objective of our group is to provide a forum for discussion amongst physicists working in this exciting interdisciplinary area. The field is recognized as one of increasing importance with the new initiative from EPSRC and the European Union <http://www.epsrc.ac.uk/CallsForProposals/Complexity.htm> for example.

The natural world is rich with nonlinear processes ranging from the flows in the atmosphere and rivers to traffic on motorways and network activity on the world wide web. Nonlinear phenomena are evident at all length-scales in the physical world ranging from the motion of vortices in Bose Einstein condensates at the quantum level to the spoked patterns observed in Saturn's rings at the astrophysical scale. Intermediate scale problems which are vibrant research areas in physics, include the great unresolved problem of classical physics, fluid flow turbulence, and pattern formation in nonlinear optics and photonic crystals. This significant increase in research activity in the areas of nonlinear and complex physics over the past thirty years or so, is primarily a result of the advent of powerful computing resources which are easily accessible. All this activity has, however, shaken our innate belief as physicists that we can ultimately obtain solutions to any complex physical problem. We are now faced with the realization that there are distinct limits to predictability for nonlinear systems and that chaos is the norm. On the other hand, recent advances in complexity theory have shown that patterned correlated structures can emerge out of an apparently random background. Hence there is real hope for the resolution of problems which have previously been considered as too complex.

It has become clear that significant progress has been made in understanding the fundamentals involved in many of these areas and commonality in observed phenomena has been established. The concepts of fractal structures, predictability horizons and catastrophic changes in behavior with smooth variation of control parameters are now common parlance across the disciplines. Moreover, many of the ideas developed in fundamental research are finding applications in practical problems found in the fields of engineering, business and biology.

The group also provides a natural home for those physicists interested in applying physics-based techniques to complex problems outside of traditional physics, such as in the life and social sciences. For instance, the physics of complexity has found application in the geosciences, ecology, finance and demography. Researchers using techniques such as agent-based modelling and simulation, cellular automata and system dynamics all fall within the group's remit. In several cases, of course, links to other Institute groups are also appropriate, and we aim to take a collaborative approach whenever possible. In summary, we aim to provide the opportunity for crossfertilization of ideas between disciplines from a central Physics base. So, come and join us now at [http://www.iop.org/activity/groups/subject/Nonlinear\\_and\\_Complex\\_Physics/index.html](http://www.iop.org/activity/groups/subject/Nonlinear_and_Complex_Physics/index.html).

*Tom Mullin, Chair (NCPG)*

## 2. Reports from previous events

- **Inaugural Meeting of the Nonlinear and Complex Physics Group, Manchester 22 April 2009.**

The inaugural meeting for the Nonlinear and Complex Physics Group was held at the University of Manchester on 1st-2nd April 2009. The purpose of the meeting was to launch the new IoP group demonstrating the diverse and interdisciplinary nature of nonlinear and complex physics through a series of talks covering a range of scientific fields.

There were six invited speakers, four UK-based and two overseas, as well as forty-three delegates with diverse scientific interests, which prompted fruitful discussions.

After an introduction by **Prof. Tom Mullin (Manchester)**, the meeting opened with **Prof. Jerry Gollub (Haverford, Cambridge)** who presented a review of recent experiments on nonlinear fluid systems: a novel method for characterising fluid fields, stretching of fluid elements, and issues on reversibility and chaos. Another two talks followed on the first day of the meeting, by **Prof. Gian-Luca Oppo (Strathclyde)** on nonlinear structures in photonics and **Prof. Sascha Hilgenfeldt (Illinois at Urbana-Champaign, USA)** on interfacial mechanics of cellular matter, showing interesting parallels between foam structure and the retina of fruit flies. Each talk was an hour long including questions, and frequent tea breaks encouraged further informal discussion. The second day opened with **Prof. Detlef Lohse (Twente, Netherlands)** who talked about surface cavitation on micro- and nanometer scales. **Prof. Kishan Dholakia (St. Andrews)** discussed techniques of optical micromanipulation and their relation and applicability to problems in nonlinear physics. Finally, **Philip Ball (Nature)** closed the meeting with a lively talk on the complexity of the crowd, examining whether the physics of complex systems can truly tell us anything about sociology, history, economics and politics.

Further details and the handbook of the meeting can be found in the conferences archive on the IoP website ([http://www.iop.org/Conferences/Forthcoming\\_Institute\\_Conferences/NCPG/index.html](http://www.iop.org/Conferences/Forthcoming_Institute_Conferences/NCPG/index.html)).

## 3. Forthcoming events supported by the NCPG

- **European Conference on Complex Systems (ECCS 2009), University of Warwick, 21st-25th September 2009**

**Registration deadline:** early July 2009

**Registration fees:** 1-day=£64, 2-day=£128, 3-day=£191, 4-day=£205 and 5-day= £218.

**Website:** [http://www2.warwick.ac.uk/fac/cross\\_fac/comcom/events/eccs09/](http://www2.warwick.ac.uk/fac/cross_fac/comcom/events/eccs09/)

- **Condensed Matter and Materials Physics (CMMP 2009), University of Warwick, 15th-17th December**

**Summary:** The conference will include a wide range of symposia, with speakers and contributions from the UK and abroad. The plenary, invited and contributed talks, along with poster sessions, will cover the most exciting and topical aspects of condensed matter and material physics.

**Contact:** [jenny.bremner@iop.org](mailto:jenny.bremner@iop.org)

**Website:** [http://www.iop.org/Conferences/Forthcoming\\_Institute\\_Conferences/CMMP09/page\\_32870.html](http://www.iop.org/Conferences/Forthcoming_Institute_Conferences/CMMP09/page_32870.html)

- **Novel Aspects of Surfaces and Materials (NASM 2010),  
Chancellor's Hotel and Conference Centre, Manchester, 11th-15th  
April 2010**

**Summary:** The conference is the third in the series and will include presentations on current applied physics challenges, developments and approaches to surfaces and materials. The invited speakers will share their vision and knowledge on contemporary research and technology.

**Contact:** [V.Vishnyakov@mmu.ac.uk](mailto:V.Vishnyakov@mmu.ac.uk), [dawn.stewart@iop.org](mailto:dawn.stewart@iop.org)

**Website:** [http://www.iop.org/Conferences/Forthcoming\\_Institute\\_Conferences/NASM\\_10/index.html](http://www.iop.org/Conferences/Forthcoming_Institute_Conferences/NASM_10/index.html)

#### 4. Other events

- **Three-day meeting: Introductory Lectures on Aspects of Complexity,  
University of Manchester, 6th-8th July 2009**

**Summary:** A 3-day meeting exploring how physicists can contribute to the biological, economic and social sciences, aimed principally at graduate students and established physicists who are interested in learning about these novel applications. On each day there will be a different theme, with one introductory lecture, three research talks, and ending with an overview lecture summarising the state of the subject, giving perspectives on current research and looking to the future. The talks will be 50 minutes plus 10 minutes of questions.

**Registration deadline and fee:** 03 July 2009, £5.00.

**Contact:** [anne.morrow@manchester.ac.uk](mailto:anne.morrow@manchester.ac.uk)

**Website:** <http://www.theory.physics.manchester.ac.uk/complexitymeeting/>

#### 5. Items of interest

- **UK Nonlinear News:  
[www.maths.leeds.ac.uk/applied/news.dir/index.html](http://www.maths.leeds.ac.uk/applied/news.dir/index.html)  
Department of Applied Mathematics, University of Leeds.**

An excellent source of online news for researchers in the applied and theoretical sides of nonlinear mathematics.

## 6. Group Committee

Chair:

**Professor Tom Mullin MInstP**  
Department of Physics and  
Manchester Centre for Nonlinear Dynamics  
University of Manchester

Secretary:

**Dr Jonathan Kobine MInstP**  
Division of Civil Engineering  
University of Dundee

Treasurer:

**Dr William Nuttall CPhys MInstP**  
Judge Business School  
University of Cambridge

Ordinary Members:

**Dr Jean Boulton CPhys FInstP**  
Visiting Fellow  
Cranfield University

**Miss Daphne Klotsa**  
Department of Physics  
University of Bath

**Dr Giampaolo D'Alessandro**  
School of Mathematics  
University of Southampton

**Dr Alain Nogaret CPhys MInstP**  
Department of Physics  
University of Bath

**Professor Mark Fromhold**  
School of Physics and Astronomy  
University of Nottingham

**Dr Nicholas Watkins**  
Environmental Change and  
Evolution Programme  
British Antarctic Survey

**Dr Tobias Galla MInstP**  
RCUK Fellow  
Department of Physics  
University of Manchester

## 7. Acknowledgements

The NCPG committee would like to give a warm thank you to Dr. Anne Juel for her contribution to the organisation of the Inaugural Meeting of the NCPG in Manchester.

## 8. Contributions to the Newsletter

We welcome any comments and material that members would like to submit for future editions. Please email Daphne Klotsa at [d.klotsa@bath.ac.uk](mailto:d.klotsa@bath.ac.uk).

This newsletter is also available on the web and in larger print sizes

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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