

Please send this report to the Secretary of the European Mechanics Council, Professor Bengt Lundberg, School of Engineering, Uppsala University, Box 534, S-751 21 Uppsala, Sweden, within one month after the Colloquium.

General

Euromech Colloquium No: Euromech. 323

Title: Reaction-Diffusion Phenomena in Physical and Chemical Systems

Co-Chairmen: Prof. J. H. Merkin
Dr. D. J. Needham

Place and country: Norwich, U.K.

Dates: 4th - 7th July 1994.

Finance

The conference fee £160 included 4 nights bed and breakfast,
reception, conference dinner,
tea, coffee.

Funding: UKA: £200

Accommodation (type and cost):

Campus accommodation, single rooms,
£28 per night.

Meals:

Self catering except for Conference Dinner.

Participation

Total number of participants: 28

Distribution of participants by country:

| Code | Country | Number | Code | Country | Number |
|------|----------------|-----------|------|-------------|----------|
| A | Austria | _____ | IRL | Ireland | _____ |
| B | Belgium | <u>1</u> | LT | Latvia | _____ |
| BG | Bulgaria | _____ | LV | Lithuania | _____ |
| CH | Switzerland | <u>1</u> | N | Norway | _____ |
| CS | Czechoslovakia | <u>1</u> | NL | Netherlands | <u>1</u> |
| D | Germany | <u>2</u> | P | Portugal | _____ |
| DK | Denmark | _____ | PL | Poland | _____ |
| E | Spain | _____ | R | Rumania | <u>1</u> |
| EE | Estonia | _____ | S | Sweden | _____ |
| F | France | <u>1</u> | SF | Finland | _____ |
| GB | Great Britain | <u>13</u> | YU | Yugoslavia | _____ |
| GR | Greece | _____ | CIS | CIS | _____ |
| H | Hungary | <u>2</u> | - | Others | <u>5</u> |
| I | Italy | _____ | | | |

Is there need of another colloquium on the same subject? Which year? This was the first colloquium in this area. It was felt that this should be followed by a further colloquium possibly in 1996.

Participants

There were 30 participants at the Colloquium, drawn from 12 different countries. Most of the main European groups working on reaction-diffusion systems were represented, as well as an important group from North America. The research interests of the participants covered a wide spectrum, both theoretical and experimental, of applications involving reaction-diffusion mechanisms.

Colloquia arrangements

The Colloquium was arranged to try to keep the cost to a minimum. Accommodation (bed and breakfast) was provided (for 4 nights) in a University Hall of Residence. This was of a perfectly acceptable standard (had ensuite facilities) and was relatively inexpensive. An informal University reception (Monday evening) and a more formal Colloquium dinner (Wednesday evening) were included. Other meals were not included in the cost as it was felt that participants could avail themselves of the wide ranges of meals provided on campus. These arrangements proved to work well.

The general arrangements for the Colloquium were handled by the UEA Conference Office. These included final mailing, receipts, room allocation, production of programme etc., as well as the hire of the lecture room, provision of coffee/tea and biscuits at the mid-morning/mid-afternoon breaks. A small charge was made for this service, which was thought to be of good value.

Some financial help was made available from the two departments involved (School of Mathematics, UEA and Department of Applied Mathematics, Leeds), though, in the end, very little of this was required.

Programme

In drawing up the programme for the Colloquium we attempted to achieve three objectives. Firstly, we wanted to allow each speaker sufficient time to present their research in a full and informative way. Secondly, we tried to give time for participants to discuss their work informally and, finally, we hoped that there would be opportunities for the participants to get to know each other.

For the first point, we allowed 40 minutes for each presentation. This was not to be rigidly adhered to, and a little extra time was allowed if required. Sufficient time, usually about 10 minutes, was allowed at the end of each talk for questions and comments. To meet the second point, we allowed 2 hours for lunch and had 20 minute breaks in both morning and afternoon sessions. We also arranged for extra rooms to be available for discussions. Finally, we arranged two occasions when the participants could all gather informally, and there were plenty of other meeting points on campus. It was felt that these aims were achieved successfully.

Scientific Developments

The participants were encouraged to present 'work in progress', rather than work already written up and published. This turned out to be the case, with talks very much reflecting the present state of thinking in this area. This provided a very useful insight into most of the current research being undertaken in Europe in the field.

One of the main themes running through the talks given at the Colloquium was reaction-diffusion travelling waves. These were shown to arise in a wide variety of applications, for example contaminant transport, polymer production semi-conductor super lattices, chemical systems (both autocatalytic and excitable), biological models of plankton growth and population dynamics. Several talks were presented describing the initiation and structure of travelling waves, and it was seen that a wide variety of behaviour is possible. Further talks were concerned with the stability of these waves and here it was seen that uniform wave fronts could break up to produce complex spatiotemporal structures. There were several talks concerned with the

perturbation of waves by an external stimulus (noise, an applied electric field or photo-electric effects), again interesting and unusual complex behaviour was reported.

Most of the talks presented on this topic were theoretical in nature, though there were several interesting experimental studies reported. These were concerned mostly with excitable systems (modelled via the Belousov-Zhabotinsky, BZ, reaction) and were concerned with signal transmission in coupled BZ systems and with wave splitting caused by an applied electric field. Both of these cases showed some novel and unexpected results.

An alternative approach to studying chemical waves using lattice-gas automata was reported. This methodology is applicable for modelling systems which are too small for continuum models and too large to follow individual molecules. Some interesting insights were presented using these ideas, particularly the questions of how small can a system be before fluctuations destroy macroscopic coherence, and the concept of a fuzzy attractor.

Pattern formation within reaction-diffusion systems was the subject of several talks. An authoritative overview of the present state of this topic was provided by an acknowledged expert in the field, with further talks being given on pattern formation in coupled systems and the similarities in pattern forms in population models and electrochemical systems.

Talks were also presented on some recent developments in the theoretical understanding of reaction-diffusion systems. These were concerned with new methods for establishing the existence or non-existence of global solutions and the construction of sub- and supersolutions. These talks provided useful insights into the latest work in this topic.

The strong underlying impression given by the talks was that a very wide range of disparate applications had been considered, leading to some relatively simple, though nonlinear, models and that these models were capable of providing a rich variety of complex spatiotemporal behaviour. Although considerable progress has already been made much remains to be fully analysed and understood. This area is very much a 'live' and active field of research.

Future

It was generally thought that the Colloquium was a success. It provided a very useful meeting point at the European level for the interaction of different groups working on reaction-diffusion systems. There was a lively interaction between the participants and the mix of theory and experiment were favourably commented on.

It was suggested that the theme of reaction-diffusion in physical and chemical systems should be taken up with future Colloquia arranged on this topic. Although it would probably be preferable for others to arrange any future colloquia on this area (for a fresh viewpoint), if no such offer is forthcoming the present organisers would be happy to arrange a future meeting under the Euromech aegis, if thought appropriate.