

THE LONDON MATHEMATICAL SOCIETY NEWSLETTER

No. 195

June 1992

FORTHCOMING SOCIETY MEETINGS

Friday 19 June 1992, Burlington House

W.B.R. Lickorish, V.G. Turaev

Monday 29 June - Wednesday 1 July 1992

Joint meeting of AMS and LMS, Cambridge

Friday 16 October 1992, Burlington House

Meeting on Functional Analysis

L.J. Bunce, E.M. Christensen, A. Connes, C.M. Edwards

Friday 20 November 1992, Burlington House

Annual General Meeting

J.F.C. Kingman, P. Whittle

FUTURE BRITISH MATHEMATICAL COLLOQUIA

1993	Reading University	29 March - 1 April
1994	University of Wales College of Cardiff	28 - 31 March
1995	Heriot-Watt University	4 - 6 April

ROYAL SOCIETY OF EDINBURGH

Amongst those recently elected to Fellowship of the Royal Society of Edinburgh were: Dr James Howie, Department of Mathematics, Heriot-Watt University; Professor Alan Newell, Department of Mathematics and

Computer Science, University of Dundee; Dr Stephen Pride, Department of Mathematics, University of Glasgow; Dr Andrew Ranicki, Department of Mathematics, University of Edinburgh.

G.E. HARRY REUTER

Professor G.E. Harry Reuter who was elected an ordinary member of the London Mathematical Society on 14th June 1951, died on 20th April 1992. He was a member of

Council from 1963-70, Vice-President from 1964-66 and 1969-70, Secretary 1966-69 and LMS Monographs Editor from 1968-77.

ALAN J. ELLIS

Professor Alan J. Ellis who was elected an ordinary member of the London Mathemat-

ical Society on 16th May 1963, died on 22nd April 1992, at the age of 51.

JOINT MEETING OF THE AMERICAN AND LONDON MATHEMATICAL SOCIETIES

The first joint meeting of the American Mathematical Society and the London Mathematical Society will be held in Cambridge from Monday 29 June to Wednesday 1 July 1992.

The following Invited Addresses will be given in the Babbage Lecture Theatre.

Monday 19.45 - 20.45

J.M. Ball, "*Energy minimization and microstructure*".

Tuesday 11.30 - 12.30

B.H. Gross, "*Langlands parameters in representation theory and number theory*".

Tuesday 16.45 - 17.45

N.J. Hitchin, "*Einstein metrics and algebraic geometry*".

Wednesday 11.30 - 12.30

E. Witten, "*Localization and gauge theories*".

Wednesday 16.45 - 17.45

L.C. Evans, "*Harmonic maps and Hardy spaces*".

There will be ten Special Sessions of selected twenty-minute papers, each session having three periods of two and a half hours: AM 8.45 - 11.15, PM 14.00 - 16.30. The organizers and titles of the sessions, and the times they will take place, are as follows. Except where indicated, the Special Sessions will be held at Mill Lane.

A. Beardon, W.J. Harvey, C.M. Series, "*Discrete group actions*"; Tuesday AM, Wednesday AM, PM.

B. Bollobas, R.L. Graham, "*Probabilistic Combinatorics*"; Tuesday AM, PM, Wednesday PM.

J.H. Coates, "*Number Theory*"; Tuesday PM, Wednesday AM, PM.

J.E. Goodman, D.G. Larman, "*Discrete Geometry and Convexity*"; Tuesday PM, Wednesday AM, PM.

R.D. James, "*The microstructure of crystals*"; Tuesday AM, PM, Wednesday AM.

V.F.R. Jones, A.J. Wasserman, E.C. Lance, "*Operator Algebras*"; Tuesday AM, PM, Wednesday AM.

R. Kannan, "*Current trends in numerical analysis of nonlinear problems*"; Tuesday AM, PM, Wednesday AM.

W.M. Kantor, J. Saxl, "*Groups: finite and algebraic*"; Tuesday AM, PM, Wednesday PM.

W.B.R. Lickorish, "*Geometric topology in low dimensions*"; Tuesday AM, Wednesday AM, PM.

C.S. Sadosky, "*Classical Analysis*"; Tuesday PM, Wednesday AM, PM, all in the Cockcroft Lecture Theatre.

There will also be sessions of ten-minute contributed papers on the following topics: "*Analysis and probability*", "*Number theory*", "*Differential equations*", "*Geometry*", "*Algebra*", "*Graphs and combinatorics*", "*Function algebras*", "*Special functions and applied mathematics*". A booklet giving full details of the programme will be available at the start of the meeting. Participants are reminded that registration will be at Robinson College from 9.00 am to 5.00 pm on Monday 29 June and at Mill Lane from 9.00 am to 5.00 pm on Tuesday 30 June.

LONDON MATHEMATICAL SOCIETY

FRIDAY 19 JUNE 1992

V.G. TURAEV (Strasbourg)
will speak at 3.30 on

Quantum Invariants and the Shadow Topology of Low-dimensional Manifolds

W.B.R. LICKORISH (Cambridge)
will speak at 5.00 on

The Temperley-Lieb Algebra and 3-manifold Invariants

(1991 Senior Whitehead Prize Lecture)

Tea will be served at 4.30

The meeting is at the Geological Society
Burlington House, Piccadilly, London W1

All interested are very welcome.

CHANGES IN SCHOOL MATHEMATICS - CONSEQUENCES FOR THE UNIVERSITY CURRICULUM

Changes in pre-university mathematics are an important factor in the current debate on the future shape and content of degree courses. This is made clear in the recent LMS report on honours degrees in Mathematics and Statistics. Keith Hirst has recently completed a report for the University of Southampton. The following article highlights the issues addressed and some conclusions reached. Copies of the full report (98 pp) are available from the author, price £4 including postage (cheques payable to the University of Southampton).

Introduction

Changes in train in the school mathematics curriculum will impinge upon Higher Education through the 1990s. Students who have done GCSE are now with us. National Curriculum assessments at Keystage 4 (the end of compulsory schooling), and new A-level courses are planned to begin, leading to entry into Higher Education from 1996. We outline here various curriculum developments, including GCSE, the place of AS-level, and the possible modifications to the A-level examination system in the aftermath of the Higginson Report. Access to Higher Education and the undergraduate curriculum are also considered.

GCSE

The change from O-level to GCSE has had a major impact on school mathematics. It has involved syllabus alterations, but also changes in teaching styles and modes of assessment, attempting to increase pupil participation and exploration. A system of differentiated examination papers is designed to enable pupils to show what they can do by entering for papers at a level appropriate to their abilities. In mathematics there are currently three levels, with some overlap between them. Coursework has been introduced as a requirement in all mathematics syllabuses, and this has been the aspect most discussed. Such changes cause controversy and debate, and this is continuing at a political as well as an educational level. A report from HMI on the first two years of GCSE was generally favourable, observing many positive benefits in the classroom, while expressing some reservations, includ-

ing the needs of the most able, and suggesting issues needing further work. They report that pupils were almost unanimous in their approval of GCSE.

The differences between GCSE and O-level do not appear so great if judged only from the printed syllabuses. Calculators are mentioned explicitly in GCSE but not in O-level. The reduction in algebra appears to be fairly small, and there is more emphasis in GCSE syllabuses on applications, modelling and problem solving. The real differences emerge when one studies examination papers. The questions in GCSE are set more in everyday contexts and require less abstract thinking, and there are generally more diagrams and illustrations than in O-level. There is less algebra on many of the papers and more applied arithmetic: indeed many consider that algebra as a school subject pre-16 has almost ceased to exist.

A-levels in Mathematics

There is a gap between GCSE and A-level as a consequence of the incomprehensible policy of the government in reforming the pre-16 curriculum without considering the knock-on effects post-16. The gap is severe in algebra and manipulative aspects of trigonometry, and a number of Sixth Form Colleges need to mount "crash courses" in algebra, covering the common areas of manipulation. They have produced revision booklets covering things such as indices, factorisation, equations, manipulating formulae; but are disturbed at the false picture of A-level mathematics painted by such an early diet of manipulative exercises.

The present A-levels will be with us until at least 1995, even if the government's timetable for their replacement is adhered to. The present interboard core consists just of pure mathematics, and so we see considerable variations between boards over the balance between mechanics and statistics. In some non-core topics, particularly matrix algebra, there is wide variation of provision, and so none can be assumed in planning undergraduate courses. Proof as a mode of argument is generally not part of mathematics pre-16, and in single subject A-level is

largely restricted to the deductions needed in sequential calculations. Mathematical induction is absent from the majority of single subject syllabuses. Nearly all questions involving equations, vectors, complex numbers, etc. have numerical rather than algebraic coefficients. This changes only to a small extent overall in Further Mathematics. Single subject candidates may have a substantial proportion of their assessment carried out by short questions, and so will be relatively untested on the conventional half hour questions set in many university examinations, requiring skills of deduction and synthesis of information. Because of choices available on A-level examination papers it is possible for good grades to be obtained while omitting some part(s) of the core syllabus.

A/AS Examination Reform

The pressures for reform have come from many sources. The consequences of GCSE are a factor, but the needs of industry and commerce, expressed sometimes in terms of a broader curriculum and transferable skills, are also important. The government's response has been to promote AS-levels as its vehicle for broadening. The Higginson Committee, and most of those who submitted evidence, favoured a five subject curriculum, but this was rejected by the government. The Higginson report contained much else, which has entered into current thinking through SEAC and its programme of reform. At the end of 1989 SEAC appointed four working parties charged with formulating general principles which would underpin the reform of A/AS subject examinations. These were concerned with Syllabus Structure and Development, A/AS Interrelationships, Assessment and Reporting, and the Conduct of Examinations. The Secretary of State made only a partial response to the SEAC recommendations, and given the rapid pace of change in other parts of the curriculum it is difficult to forecast the final shape of A-levels. A few generalisations can be attempted however. It is suggested that A-levels should grow out of AS. This is quite different from the original concept of AS as Advanced Supplementary courses. There will probably be a reduction in the number of syllabuses. Coursework may become a feature, with a maximum of 20% imposed, and a heavy reliance on terminal examina-

tions. Modularity is likely to become more prominent, with the London Board modular syllabus and SMP 16-19 being two models currently offered in mathematics. The SMP 16-19 scheme in particular is being adopted by large numbers of sixth forms. It includes a skill-based Problem Solving module, and emphasis on the use of graphics calculators or graph plotting packages for microcomputers.

A new draft A/AS core syllabus has been prepared by SEAC. This contains less material than the present one. Indeed the core is placed within the AS syllabus. There is less algebra and trigonometry, and all that is said about integration for instance is "The concept of integration. The evaluation of area. The relation between integration and differentiation." There is no standard set of functions listed whose derivatives and integrals should be known. It is only a draft, but is indicative of the kind of core we might expect. In the absence of any hint of a differentiated post-16 curriculum in mathematics the current suggestion that A-level should be available to those achieving level 7 of the National Curriculum has serious consequences for mathematics, demonstrated by a considerable list of basic items which do not appear until level 8 or above. This includes trigonometry, congruent triangles, scientific notation for numbers, and many others.

Student Supply

Another important factor in the future of mathematics in Higher Education is student recruitment. The proportion of entrants with double mathematics continues to fall. A-level entries for Mathematics and for Physics are declining faster than the drop in the 18-year-old population. Taking 1984 as a base year, in 1991 the age cohort had declined to 79%, while A-level entries in Physics were 75% and in Mathematics 70% of their 1984 values. It seems clear from discussions with teachers that there is some increase in dropout at the beginning of the sixth form caused by the gap from GCSE. However for many pupils curriculum choices are made earlier, and so we must work with a younger age group.

There are a number of groups we should look to if we wish significantly to increase the proportions entering science based subjects.

The first is women. Currently male:female ratios for A-level entries are roughly 1.5:1 for Chemistry, over 2:1 for Mathematics, nearly 4:1 for Physics and nearly 5:1 for Computing. It is worth noting that there are considerable variations, so that for example the M:F ratio for JMB in 1989 was 3.17:1 for Pure Mathematics with Mechanics, but 0.86:1 for Pure Mathematics with Statistics. Other groups under-represented include ethnic groups, some socio-economic groups, and mature students. The latter is one group the government has signalled when speaking of widening access.

The Undergraduate Curriculum

Three national subject curriculum reports have been produced in recent months by the Institute of Physics, the Engineering Professors Conference, and the LMS. There is some common ground among these, largely concerned with broad curriculum aims such as the development of skills of understanding and communication, rather than specific syllabus topics, and in the case of mathematics

and physics with structural questions relating to four year degrees. All three refer to the overloaded curriculum in some form, and also to changes in teaching and learning approaches. There was also an international study of service teaching carried out by the International Commission on Mathematical Instruction (ICMI) in 1988. Among the problems discussed were those of student motivation, which appear to be worldwide, and possible radical change related to algebraic computing packages.

Conclusion

Planning the future undergraduate curriculum in mathematics in a more widely accessible form, which will continue to stretch the most able, and which will be seen as attractive by young people and others entering higher education, is something which will and should occupy a significant amount of time of the academic community as a whole. This article, and the associated report, aim to inform the debate.

K.E. Hirst

ELECTRONIC DISCUSSION GROUP FOR THE UK MATHEMATICS COMMUNITY

The CTI Centre for Mathematics and Statistics has established an electronic discussion group for members of the UK mathematics community called *cti-maths*. It is open to all mathematicians in the UK (and overseas) who want to share information of general interest.

In the short term, the objectives of the discussion group are to provide a forum for exchanging information on general topics of interest to mathematicians. In particular, requests for information and details of new conferences and seminars. In many respects the discussion group will provide some of the features of a newsletter or bulletin board, but with greater immediacy and interaction. More specialist groups, dealing with specific

subject areas, can be added at a later date.

New members can subscribe to the discussion group by sending an email message to mailbase @uk.ac.mailbase with the single line *join cti-maths* *firstname surname* (for example, *join cti-maths Pam Bishop*) as the text of the message. This command adds your name to the *cti-maths* list, your email address is automatically taken from the "reply to" field in your email header. Once you have joined the *cti-maths* list, mail can be sent to all its members by emailing to *maths-consortium* @uk.ac.mailbase.

If you would like further help and advice on the *cti-maths* list please contact Pam Bishop at the CTI Centre for Mathematics and Statistics.

PHYSICAL INTERPRETATIONS OF RELATIVITY III

The British Society for Philosophy of Science is sponsoring an international conference 'Physical Interpretations of Relativity Theory III' to review the development, status and potential of the various physical interpretations of the formal structure of relativity theory. The meeting will take place between Monday 14th and Friday 18th September 1992

at Imperial College, London. Copies of the brochure, registration forms and information concerning the meeting may be obtained from Dr M.C. Duffy, School of Technology, Sunderland Polytechnic, Chester Road, Sunderland SR1 3SD. Telephone: 091 515 2856, fax: 515 2703.

**LONDON MATHEMATICAL SOCIETY
SPITALFIELDS DAY
FRIDAY 12TH JUNE 1992**

PROGRAMME

- 11.00 am S.K. Donaldson (Oxford)
 Application of gauge theory to 4-manifold
 topology
- 12.30 Buffet Lunch
- 2.00 pm J-L. Brylinski (PennState)
 The canonical 3-form on a Lie group,
 central extensions and reciprocity laws
- 4.00 pm G.B. Segal (Cambridge)
 The space of surfaces

The Spitalfields Day will be held at the Mathematics Research Centre, University of Warwick, Coventry CV4 7AL, telephone: 0203-523053, fax: 0203-524182. Everyone is welcome to attend. Advise Elaine Shields before 5th June if you intend to come in order to help plan for lunch.

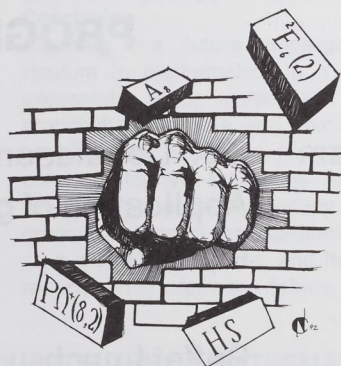
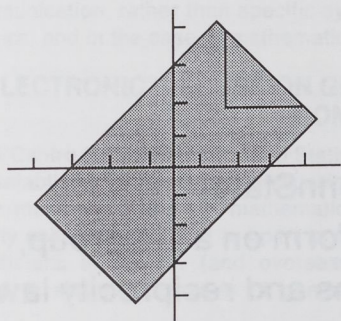
LONDON MATHEMATICAL SOCIETY

1992 POPULAR LECTURES

Imperial College - Friday 26 June 1992
Leeds University - Friday 3 July 1992

Dr Peter Neumann

A Breakthrough in Algebra
The Classification of the
Finite Simple Groups



Dr Leslie Mustoe

Heads I Win, Tails you Lose
How to use the Theory of Games

The Lectures are intended to be suitable for a general audience and no specific mathematical knowledge will be assumed. Although the talks are not primarily intended for professional mathematicians, everyone is welcome and some members may wish to apply for tickets for friends and relatives.

LONDON: 7.30 pm Peter Neumann, 8.30 pm refreshments, 9.00 pm Leslie Mustoe. The Great Hall, Sherfield Building, Imperial College, South Kensington, London SW7. Admission free, with ticket in advance. Apply by Friday 19 June to Miss S.M. Oakes, London Mathematical Society, Burlington House, Piccadilly, London W1V 0NL. A stamped addressed envelope would be appreciated.

LEEDS: 7.00 pm Peter Neumann, 8.00 pm refreshments, 8.30 pm Leslie Mustoe. Rupert Beckett Lecture Theatre, Arts Building, University of Leeds. Admission free, with ticket in advance. Apply by Monday 29 June to Mr L. Smith, Department of Mathematics, University of Leeds, Leeds LS2 9JT. A stamped addressed envelope would be appreciated.

Yu. V. Egorov, M. A. Shubin,
Moscow State University (Eds.)

Partial Differential Equations I

Foundations of the Classical Theory

1992. V, 259 pp. 4 figs. (Encyclopaedia of Mathematical Sciences, Vol. 30)
Hardcover £48.50
ISBN 3-540-52002-3

PDE's are as old as calculus itself, occurring as examples in the papers of Newton and Leibniz. Since the beginning, they have been strongly linked to physics and the other sciences. This, the first volume of the PDE subseries of the Encyclopaedia, presents an introduction to the classical theory, emphasizing along the way physical methods and physical interpretations. The first of the two chapters in the book contains a derivation of some of the classical partial differential equations, with a discussion of the limitations of the physical models upon which the derivations are based. The second chapter discusses the classical methods for studying PDE's, including the theory of distributions and the Petrovskij classification into elliptic, parabolic and hyperbolic equations. Among the more advanced methods discussed are spectral theory, the method of planar waves and the theory of semigroups. Although much of the material is standard, the approach reflects the latest organization of material. Every topic considered is placed in its present context in mathematical research, yet the book never loses sight of the nonspecialist reader with an interest in physical applications.

Yu. V. Egorov, M. A. Shubin,
Moscow State University (Eds.)

Partial Differential Equations III

The Cauchy Problem. Qualitative Theory of Partial Differential Equations

1991. VII, 197 pp. (Encyclopaedia of Mathematical Sciences, Vol. 32)
Hardcover £48.50 ISBN 3-540-52003-1

Two general questions regarding partial differential equations are explored in detail in this volume of the Encyclopaedia. The first is the Cauchy problem, and its attendant question of well-posedness (or correctness). The authors address this question in the context of PDEs with constant coefficients and more general convolution equations in the first two chapters. The third chapter extends a number of these results to equations with variable coefficients. The second topic is the qualitative theory of second order linear PDEs, in particular, elliptic and parabolic equations. Thus, the second part of the book is primarily a look at the behavior of solutions of these equations.

There are versions of the maximum principle, the Phragmen-Lindelöf theorem and Harnack's inequality discussed for both elliptic and parabolic equations.

The book is intended for readers who are already familiar with the basic material in the theory of partial differential equations.

Springer-Verlag

- Heidelberger Platz 3, W-1000 Berlin 33, F.R. Germany □ 175 Fifth Ave., New York, NY 10010, USA
□ 8 Alexandra Rd., London SW19 7JZ, England □ 26, rue des Carmes, F-75005 Paris, France
□ 37-3, Hongo 3-chome, Bunkyo-ku, Tokyo 113, Japan
□ Room 701, Mirror Tower, 61 Mody Road, Tsimshatsui, Kowloon, Hong Kong
□ Avinguda Diagonal, 468-4°C, E-08006 Barcelona, Spain □ Wesselényi u. 28, H-1075 Budapest, Hungary

tm.30.448/SF2



Summer in Cambridge

The American Mathematical Society joins the London Mathematical Society in welcoming mathematicians from around the world to Cambridge, England, June 29–July 1, for the first joint meeting between the two societies. The AMS is pleased and honored to help foster international cooperation among mathematicians.

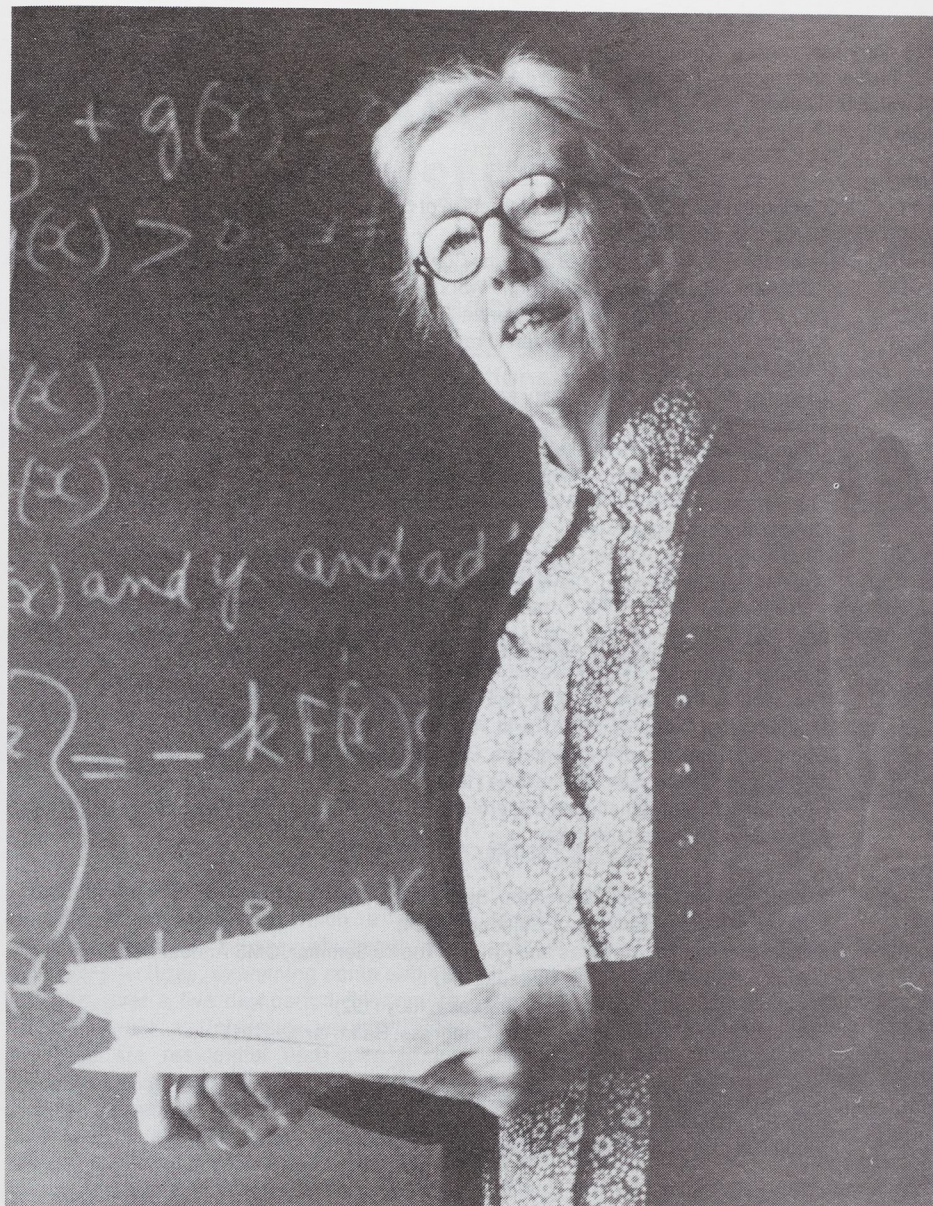
While you're attending the meeting at Cambridge, visit our exhibit on the second floor of the Mill Lane Lecture Room Block. See our newest publications, learn about our electronic products, and talk with us about membership services.



American Mathematical Society

Post Office Box 6248, Providence, Rhode Island 02940

Telephone 401-455-4000



Dame Mary Lucy Cartwright (b. 1900) was educated at St Hugh's College Oxford, graduating in 1923. She then taught in schools for four years before reading for her DPhil and, in 1930, becoming a Yarrow Research Fellow at Girton. In 1935 she became a Cambridge University Lecturer in mathematics, and from 1959 to 1968, Reader in the Theory of Functions, on which she wrote over 50 papers. From 1949 to 1968 she was Mistress of Girton, becoming a Fellow there on her retirement. She was elected to Fellowship of the Royal Society in 1947 and was awarded their Sylvester medal in 1964, and honoured with the DBE in 1969. The London Mathematical Society awarded her the De Morgan Medal in 1968. She was the Society's 49th President from 1961-63.

DIARY

The diary lists Society meetings and other events publicised in previous issues of the Newsletter. For further information, refer to the figure in brackets, which is a cross reference to the LMS Newsletter Number.

1992

JUNE

- 8-13 Continuum Models for the Microstructure of Crystals Conference, Heriot-Watt University, Edinburgh (193)
- 9-12 Analysis and Optimization of Systems Conference, Sophia-Antipolis, France (190)
- 15-17 Computer Algebra and Applications Workshop, France (194)
- 15-20 Fourier Analysis and Partial Differential Equations Conference, Spain (192)
- 15-26 Numerical Analysis - Shell Models, France (193)
- 19 LMS Meeting, London
- 22-26 Dundee Conference on Ordinary and Partial Differential Equations, Dundee (188)
- 22-26 Moonshine and Related Topics Workshop, Glasgow (194)
- 25-27 Discontinuous Groups Workshop, King's College London (193)
- 26 Popular Lectures, Imperial College, London (194)
- 27-3 July The Penrose Transform and Analytic Cohomology in Representation Theory Conference, Massachusetts, U.S.A. (186)
- 29-30 The Development of Mathematics from 1900 to 1950 Colloquium, Luxembourg (189)
- 29-1 July Joint AMS/LMS Meeting, Cambridge (155)(193)

JULY

- 1-4 New Index Theorems and Applications Conference, Oxford (192)
- 3 Popular Lectures, Leeds University (194)
- 4-14 Evolutionary Problems, LMS Durham Symposia, Durham (178) (189)
- 6-10 Mathematical Conferences in Perth, Australia (186)
- 6-10 European Congress of Mathematics, Paris, France (180) (188)
- 11-18 St Andrews Colloquium, St Andrews (185)
- 13-24 Séminaire de Mathématiques Supérieures, Bifurcations and Periodic Orbits of Vector Fields, Montréal, Canada (189)

AUGUST

- 10-14 Sussex Fourier Analysis Workshop, Sussex University (193)
- 10-14 Kinetics of Phase Transitions, Edinburgh (194)
- 10-18 Representations of Algebras and Related Topics Seminar, CMS Annual Seminar Carleton University, Ottawa, Canada (194)
- 16-29 Wavelets and Their Applications, Tuscany, Italy (192)
- 22-24 Theoretical and Applied Mechanics Congress, Haifa, Israel (191)

SEPTEMBER

- 3-4 Irish Mathematical Society meeting, Waterford, Ireland (193)
- 4-9 Homotopy Theory Conference, Gargnano, Italy (191)
- 30-1 Studies in Computer Algebra for Industry, Bath (192)

1993

JULY

- 5-9 14th British Combinatorial Conference, Keele (188)
- 12-16 Combinatorial Mathematics and Combinatorial Computing conference, Adelaide, Australia (189)

The Newsletter is published monthly except in August. Items and advertisements for inclusion in the Newsletter should be sent to the Editor, Susan Oakes, London Mathematical Society, Burlington House, Piccadilly, London W1V 0NL, to arrive before the first day of the month prior to publication. Telephone 071- 437 5377, Fax 071-439 4629, E-mail lms@uk.ac.kcl.cc.oak.