CRYSTALLOGRAPHY NEWS

BRITISH
CRYSTALLOGRAPHIC
ASSOCIATION

No. 3 DECEMBER 1982

Contents

BCA NEWS

The announcement in Stockholm of Nobel Prizes for this year brought the splendid news that the Chemistry Prize had been awarded to Dr. Aaron Klug. It was for his work on electron microscopy and X-ray crystallography in relation to nucleic acid complexes (viruses and chromatin). The award continues the remarkable sequence of Nobel Prizes won by researchers at the Medical Research Council's Laboratory of Molecular Biology at Cambridge, and the Association joins in congratulating Dr. Klug on his achievement.

Further in this issue you will see a programme of a BCA Open Meeting on " Safety Regulations for X-ray Crystallography" which will be held on Tuesday 11th January at Imperial College. This meeting, which has been organised at very short notice by Professor Blow, will allow a full discussion of proposed radiation safety regulations, with the participation of senior representatives from the Health and Safety Executive. A separate poster is included to help publicise this open meeting - all interested persons are welcome.

The consultative document on " The Ionising Radiations Regulations 198-" has now been published by the HMSO, and the deadline for comments and submissions is 18th April 1983. We hope to distribute to members a short precis of those sections of greatest interest to crystallographers (probably in the March issue). The document itself may be bought from Government bookshops for £6.50. The " Guidance Notes on X-ray Optics" have not yet appeared.

The final piece of news on the radiation safety front is that the BNCC has decided to recommend that the Royal Society's Radiation Safety Sub-committee be dissolved. This is because of the emergence of a BCA committee of similar composition and purpose (to which I referred to in the last issue). This means that the BCA will now be the proper channel for dealing with these matters. (The Chairman of this BCA committee is Professor D.M. Blow, FRS., Department of Physics, Imperial College, London SW7 2BZ).

With preparations for the 1983 Spring Meeting well in hand, our thoughts can begin to turn to 1984. That Spring Meeting will be held on 2nd-5th April, 1984 at the University of Nottingham. (The very late Easter in 1984 would have made a meeting in Holy Week inconvenient - for instance, Scottish university terms start before Easter in that year).

Finally, there is a second small poster with this issue, which is designed to provide information about the BCA and attract new members to the Association. Please bring it to the attention of your colleagues and, if possible, display it at your place of work.

Andrzej Skapski

Aaron Klug

Klug has transformed the interpretation of electron micrographs from a subjective art into an exact science and has used that science to unravel the structures of viruses and chromosomes. He applied to electron microscopy principles of physical optics similar to those used in X-ray crystallography.

Klug's methods require that the specimen possesses some form of periodicity such as is often present, or can be induced, in biological structures. If an electron micrograph of such a specimen is subjected to Fourier analysis, the Fourier terms due to the regularly repeating features stand out from the general noise that is due to the irregular distortions of individual molecules. Both the amplitudes and phases of the Fourier terms can be measured. The effects on the image of spherical abberration and underfocussing can be measured independently, and the results of these measurements can be used to apply corrections to the Fourier terms. Finally, the corrected Fourier terms can be recombined to form an image of the specimen. At first Klug and his collaborators used optical methods for image analysis and recombination, but later they found densitometry and digitizing of the image, followed by Fourier analysis by computer, to be more powerful and to facilitate correction for electron optical artefacts.

Two-dimensional electron micrographs tend to be confused by the overlapping of the many features that lie within the depth of focus of the objective lens; for many years this was regarded as a limitation inherent in electron microscopy. In the X-ray analysis of crystals three-dimensional images are built up by combining the Fourier terms of images projected in many different directions. D. De Rosier and Klug argued that similar methods must be applicable to electron microscopy. If a series of images of the same specimen is taken at different angles of

tilt and each image is transformed into its Fourier terms, then recombination of all these terms builds up a three-dimensional image.

Before any of this work had started D. Caspar and Klug predicted that the protein shells of spherical viruses, such as polio virus, can be classified according to their symmetry, rather like the planar point groups. Klug's advances in electron microscopy allowed him and his collaborators, principally J.T. Finch and R.A. Crowther, to test and confirm that theory, and to obtain well-resolved three-dimensional images of many other large biological molecules. Their most recent and spectacular discovery concerns the regular beaded structure of chromosomes, each bead consisting of a protein spool around which are wound two turns of double-helical DNA.

M. F. PERUTZ

3

DONATIONS TO THE BCA

The following generous donations from Industry are gratefully acknowledged.

Standard Telecommunication Laboratories Ltd	£500
United Kingdom Atomic Energy Authority	£500
The Boots Company Ltd	£250
Tioxide International Ltd	£250
BICC Research and Engineering Ltd	£250
BPB Industries plc	£250

This third list records donations received in the period September - November 1982.

In addition the number of Founder Members has increased by 5.

4

BRITISH CRYSTALLOGRAPHIC ASSOCIATION

ANNOUNCE AN OPEN MEETING ON

SAFETY REGULATIONS FOR X-RAY CRYSTALLOGRAPHY

in Lecture Room 1, Physics Dept., Imperial College, London, SW7 2BZ
(Entrance in Prince Consort Road, near Queen's Gate) on

Tuesday, January 11th, 1983

Chairman: Prof. Sir David Phillips
(President of the British Crystallographic Association)

2.15 X-ray safety regulations: what do they cost?
Prof. D.M. Blow (Biophysics Section, Imperial College)

2.50 The new draft ionising radiation regulations with particular emphasis on the code of practice dealing with X-ray optics.
Mr. W.T. Baker (Health Physicist and Radiation Safety Officer, Sheffield University)

3.25 Tea

4.00 Preparation of Notes for guidance on X-ray optics
Mr. Pat Hurley (Pye Unicam, Cambridge)

4.35 Response and discussion
with participation by Mr. P. Beaver (Health and Safety Executive).

Admission £2 including tea, payable at the door.

6

NOTICE

THE ANNUAL GENERAL MEETING
OF THE
BRITISH CRYSTALLOGRAPHIC ASSOCIATION
will take place
in the Main Lecture Theatre

Royal Holloway College
Egham Hill, Egham,
Surrey, TW20 0EX

at 5 pm on Wednesday, 30 March 1983.

The Agenda will be distributed to Members with the March issue of "Crystallography News".

PHYSICAL CRYSTALLOGRAPHY GROUP

ANNUAL GENERAL MEETING 1983

The 40th Annual General Meeting of the Physical Crystallography Group will be held at 5.00 pm on Tuesday 29th March at Royal Holloway College.

Nominations for the position of Honorary Secretary and Treasurer and for two positions on the committee should reach the Honorary Secretary of the Group on or before 22nd March 1983. Nominations should be accompanied by the written consent of the nominee and proposed by not less than three members of the Group. The Agenda for the AGM will be distributed with the March issue of Crystallography News.

Dr. R.H. Fenn,
Honorary Secretary,
Physics Department,
Portsmouth Polytechnic,
King Henry I Street,
Portsmouth, Hants,
PO1 2DZ.

Chemical Crystallography Group

The next Annual General Meeting will be held at Royal Holloway College on 29 March 1983 at 16.30 h during the 1983 BCA Spring Conference. At that time the Chairman PROFESSOR G.A. SIM and two committee members, DR. A.J. GEDDES and DR. P. MURRAY-RUST are due to retire.

Nominations for the vacancies are now invited from Group members and should be sent to the Secretary before 14 March 1983.

R.W.H. Small (Secretary),
Chemistry Department,
The University,
Lancaster LA1 4YA.

7

Autumn Meeting of the Chemical Crystallography Group, 1982

As usual the Autumn Meeting was held during the Royal Society of Chemistry's Autumn Meeting. This one was held at the Heriot-Watt University on 22-23 September 1982. The topic " Neutron and Electron Diffraction including Accurate Electron Density Studies" attracted about 40 participants. As is often the case with smaller meetings the programme stimulated the most lively of discussions.

In her paper on accurate electron density studies Professor Aafje Vos outlined the most recent work on deformation density and described her own investigations combining theoretical modelling of some silicate structures with careful control of experimental parameters. This was followed by Dr J Howard who gave an account of the use of neutron and X-ray studies to investigate deformation density in metal-metal bonds. Dr M Eisenstein described a theoretical study of neutral and charged species of NO_2 and SO_2 which underlined the role of d electrons in density studies.

Dr D W H Rankin, in a superbly illustrated talk with carefully superimposed projections, showed that quite different results can be expected when X-ray studies on crystals are compared with gas phase electron diffraction studies on the same compounds. In two separate papers Dr B Beagley and Dr C D Garner described EXAFS using quite contrasting approaches and indicated the possibilities of this technique in structural studies. To Dr M S Lehmann we were indebted for a powerful review of the range of chemical problems which can be investigated by neutron diffraction including recent work on the density of unpaired electrons. The final paper was by Mr D Haselden who had used Rietveld neutron profile refinement methods to settle a controversial problem in zeolite structures.

RWHS

8

Applications of Microprocessors in Crystallography - November 25th 1982

A one-day meeting was held as a joint meeting between the Physical Crystallography Group and the Electronics Group and the topics of the papers were chosen to be sufficiently general to interest members of both groups.

Dr. K. Robinson of the SERC Computing Division discussed the SERC common base policy as applied to software and hardware. The particular hardware chosen is the ICL PERQ system which was demonstrated during the lunch break and the chosen supported languages are Pascal and Fortran running under the Unix operating system. Later both Dr. E. Owen and Dr. M.W. Thomas emphasised the urgent need for standardisation in hardware and software for microprocessor systems. It was pointed out that the present situation is complicated by the rapid technological changes and the fact that there are many different standards bodies who do not coordinate their activities.

Dr. T. Robinson described the ORION computer system and Dr. B.K. Tanner described several applications of the MINICAM interface system. Mr. M.R. Evans gave a general review of the role of microprocessors in an industrial laboratory and illustrated his talk with three very different examples of microprocessor applications - signal averaging, motor torque/speed analyser and an industrial test-rig. Mr. C. Dineen described the difficulties he had experienced in achieving good reliability with a microprocessor controlled X-ray diffraction system. Both r.f. and mains noise were troublesome and difficulties were encounted in isolating the equipment from the noisy environment. The discussion following this paper revealed that other people had also experienced noise problems.

Dr. R.E. Hubbard described some crystallographic colour graphics programs he had developed on the Research Machines 380Z computer and demonstrated some of these in the lunch break.

Mrs. M.A.G. Halliwell, Dr. P.F. Embrey and Dr. W.A. Wooster described three very different crystallographic applications which were designed to speed up routine crystallographic measurements and/or calculations.

The meeting illustrated the variety of ways in which microprocessor have been used by the scientific community and served to emphasise the enormous changes which have taken place within the last ten years.

From our Aberdeen correspondent

Waiting for a multibus

by Mike Rojargon.

Tension mounted as I waited, in a stand-alone mode, at the single-user workstation beside the Cambridge Ring; my basic requirement was for a multibus to take me to the microchip shop. I didn't know the bus cycle times under the new Unix operating system, or whether the multi-master operation system implied an intelligent crate controller. Would it be a fast bus with front-end processing and a control store onboard? Above all, how fast could you drive it, with so many talkers and listeners on board?

A family of floating-point chips joined me; to improve interface protocol we installed a general purpose handshaking I/O device, and thus learned to talk to one another. A versabus, operating invisibly and controlled by programmable interrupt logic, exploited its instrumentation to drive stepping motors over the wide area network and stopped beside us. To our relief, it was not an onboard expansion bus but a relatively low-technology system-back-plane bus - just what was needed to standardise a common hardware base over the local area network. The system parameters being thus defined, we got onboard and used our own devices to locate bits to drive the modules through the standard architecture of software. Some processing primitives added signal averages, and we proceeded to transport our portable software by a bus-independent specification to the correct geographical and logical address. When a byte of data was put onboard and examined by listeners on the bus, we realised that when a lot of software brains sit down to rewrite CAMAC drivers, it is all too easy, in terms of bus structures, to get into a mess .....

Next issue: Carry on bussing, by IEEE, ISO, ECMA, ANSI and CCITT.

THE SIXTH BRAGG LECTURE

Professor Michael Woolfson spoke ably on "Structural Crystallography in the 1980's" in Manchester on Wednesday 27 October and in Cambridge on the following day. The Chairman at UMIST was Professor Durward Cruickshank, who, before introducing the speaker, called upon Dr John Robertson to make a presentation to the Fifth Bragg Lecturer, Professor Henry Lipson. This consisted of an engraved glass goblet incorporating in the design the Fourier synthesis of copper sulphate. At Cambridge, the chair was taken by Dr Will Taylor. Many distinguished crystallographers attended one or other lecture; and the presence of Lady Bragg at the Cambridge lecture was particularly welcome.

Woolfson illustrated his lectures with numerous lucid demonstrations, with which he was helped by Mr Matt Hill. After an historical introduction, he reminded the audience of how an image is formed from scattered light, and how unknown phases cause problems in the reconstruction of a crystal structure from its diffraction pattern. Since the electron density is non-negative, and the electrons are clustered around atoms, the phases cannot be random. For centro-symmetric structures, by choosing the origin at the centre, the phases are 0° or 180°: that is, the signs are + or -. For structure factors of large magnitude, the products of their signs

$s(h_1k_1l_1)s(h_2k_2l_2)s(h_1 + h_2, k_1 + k_2, l_1 + l_2)$ is probably + 1.

Bragg interpreted Cochran's sign relationships visually, by mapping out the +s and -s on two sheets: a transparent sheet laid upon an opaque one. With the origin on a +, +s nearly always lay over +s, and -s over -s; whereas with the origin on a -, a +- pairing nearly always occurred. One could build up the signs of the structure factors by this direct method.

For non-centrosymmetric structures, the problem is much more difficult as the phases can take any value between 0° and 360°. For large structure amplitudes, the phases of the reflexions $h_1k_1l_1$; $h_2k_2l_2$; $-(h_1 + h_2)$, $-(k_1 + k_2)$, $-(l_1 + l_2)$ add to approximately zero (modulo 360°). Two known phases give an indication of a third. The tangent of a phase is given by Hauptmann and Karle's (1956) formula. By symbolic addition, Karle & Karle solved the first non-centrosymmetric structure, L-arginine dihydrate in 1964, and iterative refinement with the tangent formula gave self-consistency.

A quiet revolution has been going on in crystal structure determination for the past couple of decades. By direct methods, thousands of relatively small molecules have had their structures determined. 65% of all the structures solved in 1982 employed direct methods, (and 35% non-direct methods). It is a tribute to Professor Woolfson that 45% of the total were solved by his multiple tangent formula MULTAN Computer program. We congratulate him on adding another brilliant Bragg Lecture to an already illustrious sequence.

MM

10.

EIGHTH EUROPEAN CRYSTALLOGRAPHIC MEETING

This meeting will be held in Liege, Belgium, from Monday 8th to Friday 12th, August 1983. The conference site is the Sart Tilman campus of the University of Liege in a forest estate near the city.

The conference will include invited plenary lectures and some oral papers chosen from submitted abstracts. Most contributed papers will be presented in poster sessions.

The main topics are:

1. Crystallography in Biochemistry and Pharmacology.
2. Inorganic and Organic Structures.
3. Crystallographic Aspects of Materials Science.
4. Computational Methods in Crystallography.
5. Electron Diffraction and Electron Microscopy.

Commercial and non-commercial exhibitions of relevance to crystallography will take place during the conference.

The second circular, including registration and accommodation forms, will be sent to you if you contact: ECM-8 Secretariat, Universite de Liege au Sart Tilman, Laboratoire de Crystallographie, Institut de Physique B5, B-4000 Liege, Belgium.

11.

A Gordon Conference on "Electron Distributions and Chemical Bonding" will be held at Plymouth State College, New Hampshire, July 11-15, 1983. As the title implies, the emphasis will be on the application of charge density studies to better understand the electronic nature of the chemical bond. In keeping with Gordon Conference tradition, the experimental aspects of the subject will be emphasized.

Attendance is limited by the accommodations available. BCA members who wish to attend and particularly those who have material to contribute either orally or by poster should contact the General Chairman.

Professor G. A. Jeffrey
Department of Crystallography
University of Pittsburgh
Pittsburgh, PA 15260 USA

12.

G. A. Jeffrey is the recipient of a Senior U.S. Scientist Award (Humboldt-Preis) for 1983-84 from the Alexander von Humboldt Foundation. This award is granted in recognition of past accomplishments in research and teaching. It entitles the recipient to stay and carry out research of his own choice at research institutes in the Federal Republic of Germany; in this case, at the Freie Universität, Berlin, and at the Universität, Hamburg.

13

THE J. D. HANAWALT

POWDER DIFFRACTION AWARD

The first J. Donald Hanawalt Powder Diffraction Award will be presented at the joint meeting of the Denver Conference on Applications of X-Ray Analysis and the American Crystallographic Association in Snowmass, Colorado, in August, 1983.

This award is sponsored by the JCPDS - International Centre for Diffraction Data. It is to be presented every three years for an important, recent contribution to the field of powder diffraction. The award will consist of a certificate and $1000. The awardee is expected to submit an abstract and present a paper on the work being recognized at the designated scientific meeting; travel expenses will be provided.

For this first award, work that is to be eligible must have been published between 1 August 1970 and 31 August 1982. There are no restrictions as to age, experience, or nationality of the recipient.

A committee has been appointed to select the 1983 award. The members are J. W. Caum, G. J. McCarthy, D. K. Smith, and C. M. Foris, chairman.

The selection committee will welcome suggestions, nominations, and documentation of accomplishments for possible recipients by 1 January 1983 from any interested persons. These should be addressed to C. M. Foris, E. I. du Pont de Nemours & Co., 356 Experimental Station, Wilmington, Delaware 19898, USA.

BCA LOGO COMPETITION

Since first broaching the subject of a Logo Competition in the last issue, I have already received some entries, even from as far away as the USA.

As the object is to give the BCA an eye-catching logo, the rules are very simple and unrestrictive:

1) Anybody can enter.

2) Not more than 5 entries per person.

3) Each entry to be on a sheet of paper or card not bigger than 20 x 20 cm. (They will be displayed, so designer's name on the back please)

4) Deadline is Friday 25th March, by which time I should receive your entry at: Dept. of Chemistry, Imperial College, London SW7 2AY.

5) The winner will be announced at the Conference Dinner on Wednesday, 30th March.

6) I will make sure the Secretary does not win.

And here are a few points which you might bear in mind:

a) While logos in glorious Technicolor may be attractive, they could cause problems in reproduction and would certainly be expensive to use. So the logo should preferably rely for its impact on imaginative design rather than colour.

b) Do not be inhibited by the fact that some good logo designs have already appeared. Minor variants on a given idea are quite acceptable.

c) Please remember that where letters are used, they should read BCA rather than BAC. (The Association may be flying high, but we are certainly not the British Aircraft Corporation!).

So, the best of luck with your designing - Lagavulin awaits!

Andrzej Skapski

P.S. If your 9-year old son wins, Dad (or Mum) will get the bottle - suitable compensation to be settled within the family.

15

ST. VINCENT'S SCHOOL OF MEDICAL RESEARCH, MELBOURNE

Applications are invited for the post of Senior Research Officer, (NH & MRC) to work with Dr. N. Isaacs on the crystal structure of human platelet factor 4.

The appointment will be made for a period up to three years from 1st January, 1983. Applicants should have Ph.D. qualifications with experience in X-ray crystallographic methods. Experience in protein crystallography, while not essential, would be an advantage.

Salary range $A20,963 - $A27,538 per annum.

Applications stating full personal particulars, qualifications and experience and the names of three referees should be addressed to The Chief Executive Officer, St. Vincent's School of Medical Research, Victoria Parade, Fitzroy, 3065, Australia.

Further particulars may be obtained from Dr. N. Isaacs, Telephone No. (03) 41-0221 Extn. 302.

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16

CRYSTALLOGRAPHY NEWS

Camera-ready contributions are welcome at any time, but to ensure inclusion in the March issue, should reach the editor by 21 February: Dr Moreton Moore, Department of Physics, Royal Holloway College, Egham, Surrey, TW20 0EX. (Tel: Egham 35351 ext. 36).

17

CRYSTALLOGRAPHIC STATISTICS

The Twelfth International Congress of Crystallography, held in Ottawa in 1981, included for the first time a session entirely devoted to crystallographic statistics. Eight papers were presented at the session, and there were several papers on related topics presented in other sessions. Fifteen of the papers have now been published by the Indian Academy of Sciences at a very attractive price. In most cases the texts have been expanded by the authors from the versions presented at the Congress; three papers published in full elsewhere are represented by extended abstracts. The contributions (abbreviated titles) are:

Introduction	A. J. C. Wilson
Crystallographic Statistics - General Review	H. Hauptman
Bayesian Statistics - An Overview	S. French and S. Oatley
Intensity Statistics - Survey, Computer Simulation and the Heavy-Atom Problem	U. Shmueli
Non-Ideal Distributions in Theory and Practice	U.Shmueli and A.J.C.Wilson
The Probability of Validity of Phase Relations	G. B. Mitra and S. Ghosh
Effects of Heavy Atoms and Symmetry	G. D. Nigam and S. Ghosh
Measurability of Bijvoet Differences	S. Parthasarathy
Non-Independence	(Editorial comment)
Statistics of Recorded Counts	J. L. de Boer
Alternatives to $\underline{R}$ Tests	S. M. Rothstein
Residual $\underline{R}_2$ as a Discriminator Criterion	A. T. H. Lenstra
Alternatives to Least Squares	(Editorial comment)
Robust/Resistant Technique for Refinement	W.L.Nicholson, E.Prince, J.Buchanan and P. Tucker
Statistical Errors and Series Termination in Electron Density	A.A.Shevyrev and V.I.Simonov
Data Reduction and Error Analysis	R.H.Blessing and G.T.DeTitta
Secondary 'Least-Squares' Minima	R. Rothbauer
Wiener Methods for Electron Density	D.M.Collins and M.C.Mahar

The indexes occupy 13 pages

CRYSTALLOGRAPHIC STATISTICS: Progress and Problems. Edited by S. Ramaseshan, M. F. Richardson and A. J. C. Wilson. Pp. iv + 313. Bangalore: Indian Academy of Sciences.

Orders, accompanied by a remittance, should be sent to the Indian Academy of Sciences, Bangalore 560 080, India. The following prices include postage (surface mail) anywhere in the world:

	Full rate	Reduced rate for individuals
U.S. dollars	$ 18.00	$ 9.00
Pounds sterling	£ 9.00	£ 5.00
Indian rupees	R 50.00	R 25.00

Copies purchased at reduced rate should not be passed to libraries.

FORTHCOMING MEETINGS (M) AND COURSES (C)

21-23 March 1983	Microscopy of Semiconducting Materials (M) St Catherine's College, Oxford. Dr A G Cullis, RSRE, St Andrew's Road, Malvern, Worcs, WR14 3PS.
21 March - 1 April 1983	X-ray Crystallography and drug action: current perspectives (C), Erice, Italy. (see previous issue)
28 - 30 March 1983	EPS Condensed Matter Conf. (M) Lausanne Dr E Mooser, Institut de Physique Appliquée, EPFL-Ecublems, P O Box 96, CH-1015 Lausanne, Switzerland.
28 - 31 March 1983	BCA Spring Meeting (M) Royal Holloway College, Egham, Surrey Dr M Moore, Department of Physics, Royal Holloway College, Egham, Surrey, TW20 0EX (Booking form in this issue).
11 - 13 April 1983	Int. Conf. on Insulating Films on Semiconductors (M) Eindhoven J E Verweij, INFOS 83, Philips Research Labs., Prof. Holstlaan Bld., WAG 1, P O Box 80.000, 5600 JA Eindhoven, Netherlands.
11 - 13 April 1983	Proterozoic 83 (M) Lusaka, Zambia The Organising Secretary, Proterozoic 83, Geological Society of Zambia, P O Box 50135, Lusaka, Zambia.
11 - 13 April 1983	RSC Dalton Div. Annual Congress: Polyhedral Clusters of Main Group Elements. (M) University of Lancaster Dr J F Gibson, RSC, Burlington House, London, W1V 0BN.
11 - 15 April 1983	1. Principles of Electron Microscopy Course (C). 2. Specialised Transmission E.M. Course (C). Leeds University The Administrator, Royal Microscopical Society, 37/38 St Clements, Oxford, OX4 1AJ.
13 - 15 April 1983	Molecular Graphics Society Annual Meeting (M) Brighton Dr Andy Morffew, IBM UK Scientific Centre, Athelstan House, St Clement Street Winchester, Hants, SO23 9DR
17 - 22 April 1983	Scanning Electron Microscopy 1983 (C) Dearborn, Michigan, USA Dr Om Johari, SEM, Inc., P O Box 66507, AMF O'Hare (Chicago), Il 60666, USA.
18 - 22 April 1983	Intermag (M) Philadelphia, Pennsylvania Dr W Doyle, Sperry Univac, P O Box 500, Blue Bell, Pennsylvania 19424, USA

27 - 30 April	1983	Protein Nucleic Acid Interactions (M) Sitges, Spain. Prof. J A Subirana, Escuela T S Ingenieros Industriales, Diagonal, 647, Barcelona (28), Spain.
16 - 20 May	1983	5th National School and Conf. on X-ray analysis. (M) Melbourne, Australia. Mr R A Coyle, P O Box 90, Parkville 3052, Victoria, Australia.
17 - 19 May	1983	21st Meeting of the European High Pressure Research Group (M) Copenhagen, Denm Dr B Andersen, Chemical Lab. IV, H C Ørsted Inst., Universitetsparken 5, DK-2100 Copenhagen, Denmark.
23 - 27 May	1983	6th Int. Conf. on Ion Beam Analysis (M) Tempe, Arizona. Prof. I S T Tsong, Dept. of Physics, Arizona State Univ., Tempe, AZ 85287, USA
31 May - 2 June	1983	4th International Conf. on CVD (M) Eindhoven, Netherlands. G. Verspui, Philips Centre for Technology, Building SAQ, 5600 MD Eindhoven, The Netherlands.
12 - 16 June	1983	EUCHEM Conf. on High Resolution Electron Microscopy (M) Skepparholmen, Stockholm Dr Per Stenson, Swedish National Committee for Chemistry, Upplandsgatan 6A, S-111 23 Stockholm, Sweden.
21 - 30 June	1983	5th Summer School on Computing Techniques in Physics (C) Bechyně Castle, Czechoslovakia Dr J Nadrchal, Institute of Physics, ČSAV, Na Slovance 2, 18040 Praha 8, Czechoslov
4 - 8 July	1983	4th Int. Conf. on Solid State Ionics (M) Grenoble, France. M Kleitz, SSI 83, ENSEEG, BP 44, 38401 Saint Martin d'Heres, France.
11 - 15 July	1983	Gordon Conf. on Electron distribution and chemical bonding (M) Plymouth, New Hampshire, USA Prof G A Jeffrey, Dept of Crystallography, Univ of Pittzburgh, Pittsburgh, PA 15260, USA.
19 - 21 July	1983	Inter/Micro 83 (M) King's College, Cambridge, Mrs S Mark, McCrone Research Institute Ltd., 2 McCrone Mews, Belsize Lane London, NW3 5BG
20 - 30 July	1983	School on Direct Methods and Macromolecular Crystallography (C) Buffalo, New York Dr Jane F Griffin, Medical Foundation of Buffalo, Inc., 73 High Street, Buffalo, New York, 14203, USA

24 - 29 July	1983	15th Meeting of the Federation of European Biochemical Societies (M) Brussels. 15th FEBS Meeting, Brussels International Conference Centre, Parc des Expositions, B-1020 Brussels, Belgium.
1 - 5 August	1983	ACA Meeting and Denver diffraction Conf. (M) Snowmass, Colorado, USA Prof. R D Witters, Dept. of Chemistry, Colorado School of Mines, Golden, CO 80401, USA
1 - 10 August	1983	International School on Teaching Crystallography for Materials Science (C) Brasilia, Brasil. Prof. S Caticha Ellis, Instituto de Fisica, UNICAMP - C.P.1170, 13100 Campinas S.P. Brasil.
6 - 9 August	1983	2nd USA - French Cooperative Science Seminar on Topography (M) Snowmass, Colorado Prof Sigmund Weissman Rutgers Univ., Mechanics and Materials Science Dept., Piscataway, NJ 08854, USA
6 - 12 August	1983	41st Annual Mtg. of the Electron Microscopy Society of America (M) Phoenix, Arizona. Dr C Ward Kischer, Dept. of Anatomy, Health Sciences Center, Univ. of Arizona, Tuscon, AZ 85724, USA.
7 - 10 August	1983	Applications of X-ray Topographic Methods to Materials Science (C) Snowmass, Colorado, USA Prof. S Weissman, Dept. of Mechanics and Materials Science, Rutgers University Priscataway, New Jersey 08854, USA.
8 - 12 August	1983	8th European Crystallographic Mtg. (M) Liège M. Léon Dupont, Institut de Physique B5, Université de Liège au Sart-Tilman, B-4000 LIÈGE, Belgium.
18 - 27 August	1983	Int. School on Crystallographic Computing (C) Kyoto, Japan Prof. T Ashida, Dept. of Applied Chemistry, Faculty of Engineering, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464, Japan.
30 August - 2 September	1983	Electron Microscopy EMAG 83 (M) Guildford Meetings Officer, IoP, 47 Belgrave Sq., London, SW1X 8QX
30 August - 2 September	1983	14th Mtg. of Crystallographers in Australia (M) C.B. Alexander Agricultural College, Tocal, Paterson, NSW H R Tietze, Dept. of Chemistry, Univ. of Newcastle, NSW, 2308, Australia.

30 August - 2 September	1983	2nd Internat. Conf. on Databases (M) Cambridge Dr S M Deen, Dept. of Computer Science, University of Aberdeen, AB9 2UB, Scotland.
3 - 10 September	1983	5th Internat. Summer School on Crystal Growth (C) Riederalp, Switzerland. Dr H Arend, Lab. für Festkörperphysik ETH, CH-8093 Zurich, Switzerland
5 - 9 September	1983	IUPAC 29th Int. Symp. on Macromolecules (M) Bucharest IUPAC MACRO '83, Calea Plevnei 139, R-77131 - Bucharest, Romania
5 - 9 September	1983	10th Int. Congress on X-ray Optics and Microanalysis (M) Toulouse ICXOM 10 - Sécretariat, Laboratoire d'Optique Electronique du CNRS, 29 rue Jeanne Marvig, BP 4347, 31055, Toulouse Cedex, France.
5 - 10 September	1983	8th Iberoamericano Congress of Cryst. (M) Buenos Aires & La Plata Dr Maria A R de Benyacar, Avda del Libertador 8250, 1429 Buenos Aires, Argentina.
6 - 8 September	1983	Scanning Electron Microscopy in Geology (M) Oxford The Administrator, Royal Microscopical Soc., 37/38 St Clements, Oxford OX4 1AJ.
12 - 16 September	1983	7th Internat. Conf. on Crystal Growth (M) Stuttgart, Fed. Rep. Germany Dr K W Benz, Kristallabor., Physikalisches Institut der Universität Pfaffenwaldring 57, 7000 - Stuttgart - 80, Fed. Rep. Germany.
13 - 16 September	1983	13th European Solid state device research Conf. & 8th symposium on solid state device technology (M) Canterbury. The Meetings Officer, IoP, 47 Belgrave Sq., London SW1X 8QX.
19 - 21 September	1983	3rd Hungarian Conf. on Crystal Growth (M) Budapest HCCG-3, Eötvös Loránd Physical Society, Budapest, Pf 240, H-1368, Hungary
25 - 30 September	1983	5th Europ. Mtg on Ferroelectricity. (M) Torremolinos, Spain Dr B Jiménez, Centro de Fisica Aplicada "L. Torres Quevedo", Serrano 144, Madrid-6, Spain.
26 - 30 September	1983	Specialised course in Scanning Electron Microscopy (C) Cambridge The Administrator, Royal Microscopical Society, 37/38 St. Clements, Oxford, OX4 1AJ

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19 - 23 March	1984	4th General Conf. of the Condensed Matter Division of the European Physical Society (M) The Hague Mr F M Mueller, Physics Lan., Toernooiveld, NL-6525 ED Nijmegen, The Netherlan
6 - 20 May	1984	Internat. School on Direct Methods of Solving Crystal Structures (C) Erice, Sicily Prof. L Riva di Sanseverino, Istituto di Mineralogia, Piazza di Porta San Dorato 1, 40127, Bologna, Italy.
29 July - 4 August	1984	8th International Biophysics Congress (M) Bristol, England Dr H C Watson, Dept of Biochemistry, Univ. of Bristol, Medical School, University Walk, Bristol BS8 1TD
9 - 18 August	1984	XIII I.U. Cr. Congress (M) Hamburg Prof. Dr. H Saalfeld, Mineralog-Petrogr. Institut, Universität Hamburg, Grindelallee 48, D-2000 Hamburg 12, Fed. Rep. Germany.

BCA SPRING MEETING: RHC 28-32 March 1983

REGISTRATION FORM

To be returned to Dr M Moore, Department of Physics, Royal Holloway College, Egham, Surrey TW20 0EX to reach him before 1 March 1983. The favour of an early reply would be greatly appreciated.

Name (Prof/Dr/Mr/Mrs/Miss).....

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1.(a) Conference fee, including refreshments, reception and four lunches @ £32	£
OR One day conference fee, with lunch @ £16 Date.... March 1983	£
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