27 January 1984 • Vol. 223 • No. 4634 $2.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

NEW FROM BECKMAN:

Digital accuracy in a tabletop centrifuge

The AccuSpin™ centrifuge from Beckman. It brings today's technology to tabletop centrifugation.

Controls are digital for accuracy that can't be matched by analog models. Flashing diagnostics and digital displays let you know run conditions at a glance. A digital speed control system maintains set speed with *no* overshoot—accurate to 10 rpm.

Programmed acceleration gives you a gentle start to protect gradients. Dual braking lets you select a gentle stop. And the AccuSpin is so quiet, it's hard to believe it's running.

High Speeds for Rapid Throughput

The AccuSpin centrifuge reaches 5900 rpm and 4800 *g* with fixed angle rotors, 4200 rpm and 3200 *g* with the horizontal rotor. Maximum capacity is one full liter.

Designed for Convenience

The AccuSpin FR has an advanced, frost-free refrigeration system so there's never ice or water in the rotor chamber. Both models have an easy-to-clean, removable bowl and front motor access for fast brush changes and minimal down time.

Safety Features

Like all Beckman centrifuges, the AccuSpin is designed for UL listing and CSA approval. It's equipped with self-seating rotor buckets, steel barrier ring and automatic door interlock. To protect against tube breakage, the tube holders are rubber-based. Clear plastic covers provide aerosol protection—with no special tools or adapters required.

The digital AccuSpin centrifuge. It's setting new standards for tabletop centrifuges. For details ask your Beckman representative, or write: Beckman Instruments, Inc., P.O. Box 10200, Palo Alto, CA 94304.

BECKMAN

Circle No. 102 on Readers' Service Card

ISSN 0036-8075

27 January 1984

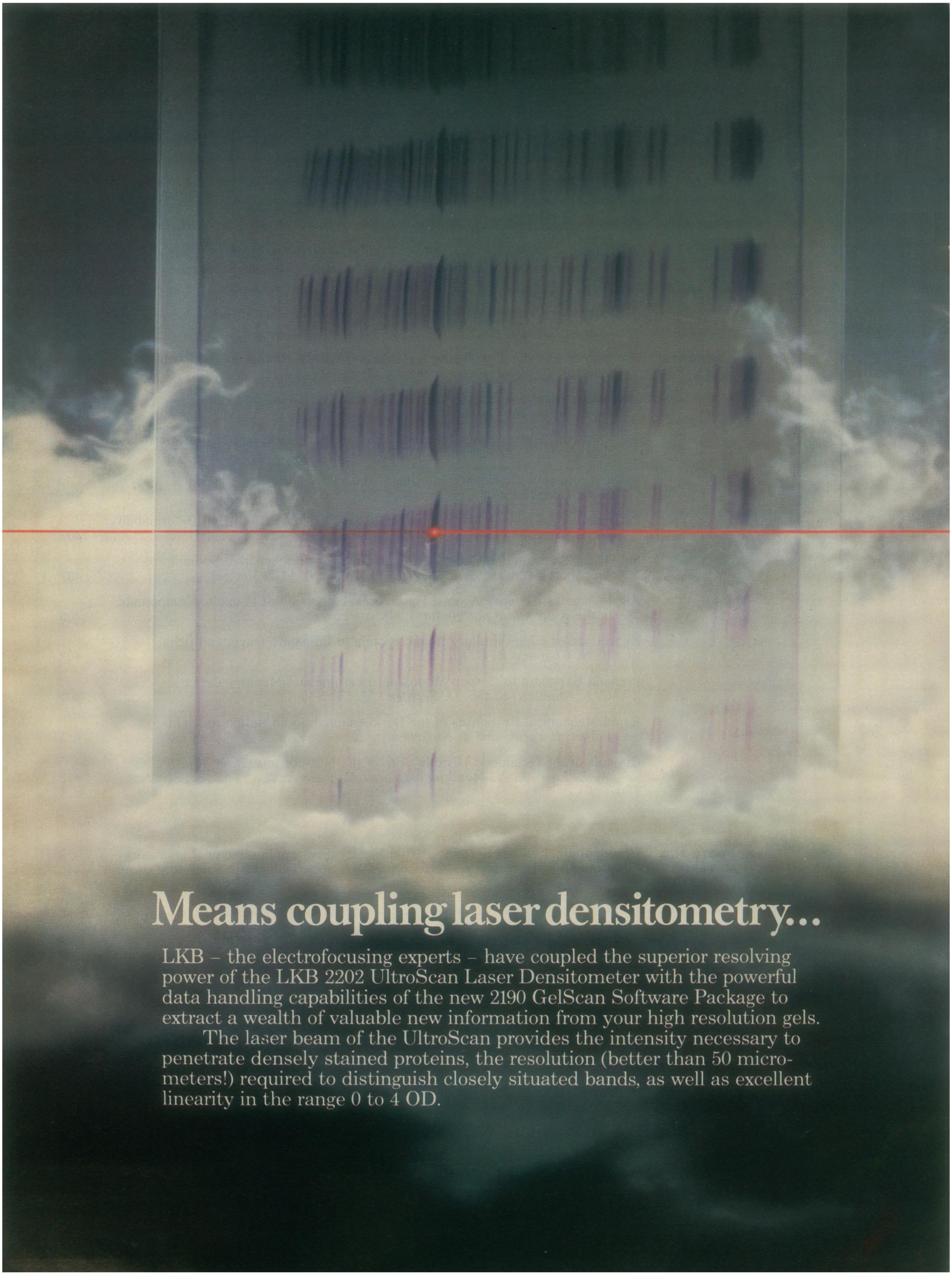
Volume 223, No. 4634

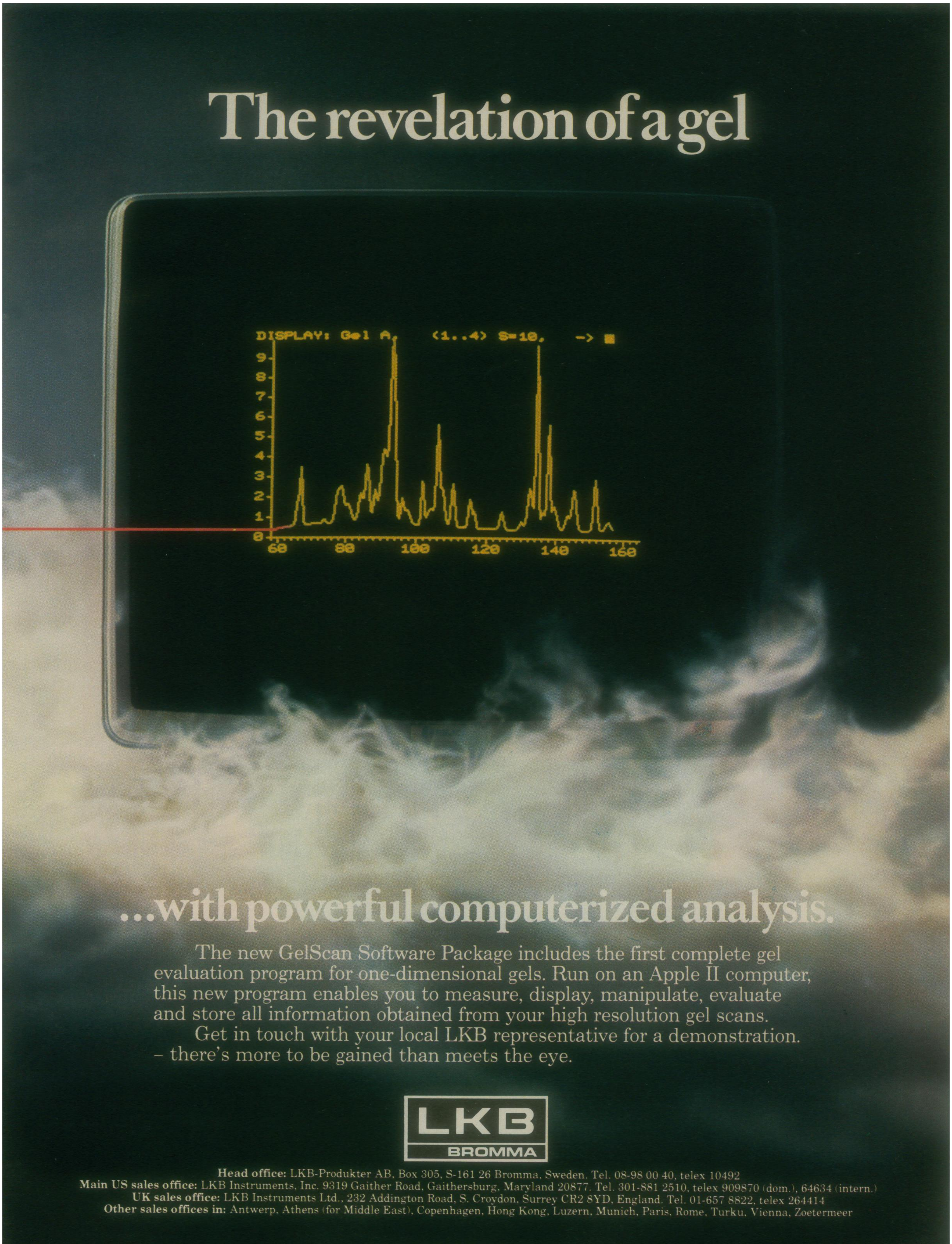
SCIENCE

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with **The Scientific Monthly®** Domestic individual membership and subscription (51 issues): $53. Domestic institutional subscription (51 issues): $90. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $65. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $3 ($3.50 by mail); Biotechnology issue, $5 ($5.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

COVER

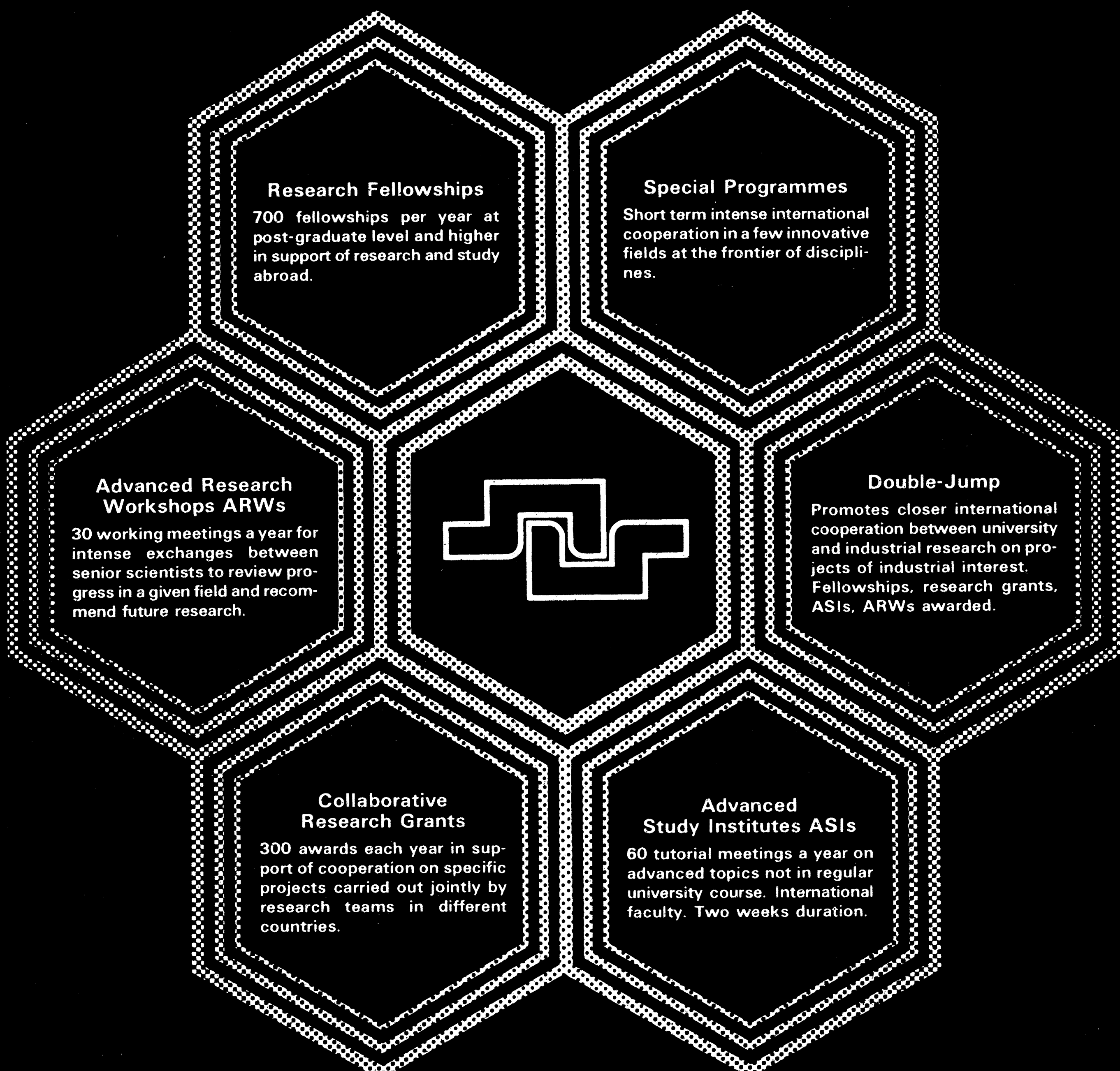
The deployment of Pershing II and cruise missiles in Europe has created some painful and potentially lasting military and political problems for the United States and its Western allies (see page 371). This photo shows a platoon of three Pershing II missiles erected for a test at Fort Sill, Oklahoma, in mid-1983. The missiles declared operational on 31 December 1983, in Mutlangen, West Germany, are identical except that they lack the red and yellow stripes. [Martin Marietta Aerospace]


Means coupling laser densitometry...
LKB – the electrofocusing experts – have coupled the superior resolving power of the LKB 2202 UltroScan Laser Densitometer with the powerful data handling capabilities of the new 2190 GelScan Software Package to extract a wealth of valuable new information from your high resolution gels.
The laser beam of the UltroScan provides the intensity necessary to penetrate densely stained proteins, the resolution (better than 50 micrometers!) required to distinguish closely situated bands, as well as excellent linearity in the range 0 to 4 OD.


The revelation of a gel
DISPLAY: Gel A, (1..4) S=10, ->
9
8
7
6
5
4
3
2
1
0
60
80
100
120
140
160
...with powerful computerized analysis.
The new GelScan Software Package includes the first complete gel evaluation program for one-dimensional gels. Run on an Apple II computer, this new program enables you to measure, display, manipulate, evaluate and store all information obtained from your high resolution gel scans.
Get in touch with your local LKB representative for a demonstration. – there's more to be gained than meets the eye.
LKB
BROMMA
Head office: LKB-Produkter AB, Box 305, S-161 26 Bromma, Sweden. Tel. 08-98 00 40, telex 10492
Main US sales office: LKB Instruments, Inc. 9319 Gaither Road, Gaithersburg, Maryland 20877. Tel. 301-881 2510, telex 909870 (dom.), 64634 (intern.)
UK sales office: LKB Instruments Ltd., 232 Addington Road, S. Croydon, Surrey CR2 8YD, England. Tel. 01-657 8822, telex 264414
Other sales offices in: Antwerp, Athens (for Middle East), Copenhagen, Hong Kong, Luzern, Munich, Paris, Rome, Turku, Vienna, Zoetermeer
Circle No. 157 on Readers' Service Card

Many Activities : One Goal

the advancement of Science & Technology



NATO International Scientific Exchange Programmes

NATO Scientific Affairs Division, B-1110 Brussels, Belgium, Tel.(02) 241.44.00

1984

NATO Advanced Study Institutes

Cours d'été

ADVANCED STUDY INSTITUTES (ASIs) are tutorial courses of two weeks' duration on new, important topics for up to 10(scientists and research students. They aim at the dissemination of advanced scientific knowledge and promotion of internationa contacts among scientists. No tuition fees are requested from participants; some may obtain small grants through the meetin Director to assist with travel and living expenses.

Each meeting is held under the responsibility of its Director, to whom all requests for information, attendance or support should b addressed. The meetings marked ● are of particular industrial interest. One meeting is a Training Course sponsored under the Specia Programme on Marine Sciences (MS). **Locations and dates may change.** Titles and addresses have been abridged. Many meetings are c an interdisciplinary nature : please check all subject areas.

PUBLICATIONS :
Proceedings of meetings are published in the NATO ASI Series by : **Plenum – Reidel – Nijhoff – Springer Verlag.**

LIFE SCIENCES

MOLECULAR FORM & FUNCTION OF THE PLANT GENOME
Dr. L. VAN VLOTEN-DOTING, Dept. of Biochemistry, P.O. Box 9505, 2300 RA Leiden, The Netherlands
4-14 July 1984 : Renesse, The Netherlands 438/83

CELLULAR & MOLECULAR ASPECTS OF DEVELOPMENTAL BIOLOGY
Mr. R. STORA, Division Théorique, CERN, CH-1211 Geneva 23, Switzerland
1-27 July 1984 : Les Houches, France 444/83

NEW DEVELOPMENTS & METHODS IN MEMBRANE RESEARCH & BIOLOGICAL ENERGY TRANSDUCTION
Prof. L. PACKER, Membrane Bioenerg. Gp., Dept. Physiology/Anatomy, Univ. California, Berkeley, CA 94720, USA
16-29 August 1984 : Spetsai, Greece 449/83

GENOME ORGANIZATION & FUNCTION
Prof. H.G. ZACHAU, Inst. F. Physiol. Chem., Goethestr. 33, D-8000 München 2, Germany
30 August-12 September 1984 : Spetsai, Greece 693/83

CELL TRANSFORMATION
Dr. J.E. CELIS, Inst. of Chemist., University, Langelandsgade 140, DK-8000 Aarhus, Denmark
2-12 September 1984 : Alcabideche, Portugal 760/83

TOXICOLOGY OF THE NERVOUS SYSTEM
Prof. C.L. GALLI, Inst. Pharmacology & Pharmacognosy, Univ., Via Balzaretti 9, 20133 Milan, Italy
10-21 September 1984 : Maratea, Italy 794/83

RADIATION CARCINOGENESIS AND DNA ALTERATIONS
Prof. F.J. BURNS, Dept. Environ. Medicine, NY Univ. Medical Ctr., 550 First Ave., New York, NY 10016, USA
30 September-13 October 1984 : Greece 795/83

CELLULAR AND MOLECULAR CONTROL OF DIRECT CELL INTERACTIONS IN DEVELOPING SYSTEMS
Dr. H.J. MARTHY, Lab. Arago (LA 117 CNRS), F-66 650 Banyuls-sur-Mer, France
10-23 September 1984 : Banyuls-sur-Mer, France 831/83

DRUGS AFFECTING LEUKOTRIENES AND OTHER EICOSANOID PATHWAYS
Prof. F. BERTI, Dept. Pharmacology, Univ., Via Balzaretti 9, 20129 Milan, Italy
3-14 September 1984 : Erice, Sicily, Italy 858/83

SENSORY PERCEPTION AND TRANSDUCTION IN ANEURAL ORGANISMS
Dr. G. COLOMBETTI, CNR Istituto di Biofisica, Via San Lorenzo 26, I-56100 Pisa, Italy
3-14 September 1984 : San Miniato, Italy 911/83

BIOPOLYMERS ●
Dr. E. PIŞKIN, Hacettepe Univ., Chemical Engineering Dept., P.K. 716 Kizilay, Ankara, Turkey
27 August-5 September 1984 : Izmir-Çesme, Turkey 951/83

NMR IN LIVING SYSTEMS
Prof. T. AXENROD, Dept. Chemistry, City College of City Univ. of New York, New York, NY 10031, USA
26 August-7 September 1984 : Maratea, Italy 962/83

PRIMARY PHOTO-PROCESSES IN BIOLOGY AND MEDICINE
Prof. T.G. TRUSCOTT, Paisley College, Dept. Chemistry, Paisley, Renfrewshire, PA1 2BE, Scotland, UK
16-28 September 1984 : Bressanone, Italy 982/8

EXCITED STATE PROBES IN BIOLOGY AND MEDICINE
Dr. A.G. SZABO, Div. Biol. Sciences, Nat. Research Council, 100 Sussex Drive, Ottawa, Ontario K1A 0R6, Cana
17-28 September 1984 : Acireale, Catania, Italy 986/8

CHROMOSOMAL PROTEINS AND GENE EXPRESSION
Prof. G.R. REECK, Dept. Biochemistry, Kansas State University, Manhattan, KS 66506, USA
10-19 September 1984 : Sitges, Spain 993/8

PICTORIAL INFORMATION SYSTEMS IN MEDICINE
Prof. K-H. HÖHNE, Inst. Math. & Computer Sc. in Medicine, Univ., Martinistrasse 52, 2000 Hamburg 20, Germa
27 August-7 September 1984 : Braunlage, Germany 994/8

ECOLOGY

EPIDEMIOLOGY & QUANTITATION OF ENVIRONMENTAL RISK IN HUMANS FROM RADIATION OTHER AGENTS
Prof. A. CASTELLANI, ENEA, Dept. RAD-PAS, Nuclear Stdy Ctr, POB 2400 AD, Rome, Italy
1-10 September 1984 : San Miniato, Italy 448/8

STRATEGIES AND ADVANCED TECHNIQUES FOR MARINE POLLUTION STUDIES
Dr. H.J.M. DOU, Labo. Chimique Organique A, Centre Scientif. St.-Jérome, F-13397 Marseille Cedex, Fran
19-29 October 1984 : France 711/8

SOCIAL, BEHAVIOURAL AND POLITICAL SCIENCES

ADVANCES IN MEASURING COGNITION AND MOTIVATION
Prof. S.H. IRVINE, Dep. of Psychology, Plymouth Polytechnic, Drake Circus, Plymouth PL4 8AA, UK
December 1984 : Nice, France 963/8

VISION AND IMAGE UNDERSTANDING
Dr. A. BORSELLINO, Istituto di Sciênze Fisiche dell'Universita, Viale Benedetto XV, 5, 16132 Genova, It
1-12 July 1984 : Erice, Italy 966/8

PHYSICS

SOLID-STATE BATTERIES ●
Prof. C.A.C. SEQUEIRA, Lab. de Electroquimica, Inst. Sup. Technico, Av. Rov. Pais, 1096 Lisboa Codex, Portu
2-14 September 1984 : Alcabideche, Portugal 228/8

NATURAL CONVECTION – FUNDAMENTALS & APPLICATIONS ●
Prof. S. KAKAÇ, Dept. of Mechanical Engineering, University of Miami, Coral Gables, FL. 33124, USA
16-27 July 1984 : Izmir-Çesme, Turkey 433/8

ITICAL PHENOMENA – RANDOM SYSTEMS – GAUGE THEORIES
: R. STORA, Division Théorique, CERN, CH-1211 Geneva 23, Switzerland
August-7 September 1984 : Les Houches, France 458/83

N-EQUILIBRIUM PHONON DYNAMICS
f. W.E. BRON, Depart. of Physics, Indiana University, Swain Hall-West 117, Bloomington, IN 47405, USA
August-7 September 1984 : Les Arcs, France 682/83

NDAMENTAL FORCES
R.M. TURNBULL, Dept. of Natural Philosophy, The University, Glasgow, G12 8QQ, UK
August-1 September 1984 : St. Andrews, UK 683/83

AVY ION COLLISIONS
f. M. LEVY, Lab. Phys. Théor. & Htes Energ., Tour 16, 4 Pl. Jussieu, F-75230 Paris Cedex 05, France
15 September 1984 : Cargèse, Corsica, France 689/83

CHNIQUES & CONCEPTS OF HIGH ENERGY PHYSICS
f. T. FERBEL, Dept. of Physics & Astronomy, Univ. Rochester, Rochester N.Y. 14627, USA
13 August 1984 : St. Croix, Virgin Islands, USA 690/83

NDAMENTAL PROCESSES IN ENERGETIC ATOMIC COLLISIONS
f. H. KLEINPOPPEN, Atomic Physics Lab., Univ. Stirling, Stirling, FK9 4LA, UK
-21 September 1984 : Alcabideche, Portugal 755/83

ICROSCOPIC THEORY OF STRUCTURAL PROPERTIES AND LATTICE DYNAMICS OF SOLIDS
f. J.T. DEVREESE, D. Natuurkunde, Univ. Instelling Antwerpen, Universiteitsplein 1, B-2610 Wilrijk, Belgium
-29 July 1984 : Antwerp, Belgium 749/83

IYSICS OF NEW LASER SOURCES ●
F.T. ARECCHI, Istituto Nazionel di Ottica, Largo e Fermi, 6, 50125 Firenze, Italy
-21 July 1984 : San Miniato, Italy 750/83

IYSICS OF PLASMA-WALL INTERACTION PROCESSES IN CONTROLLED FUSION RESEARCH
f. DE POST, Jr., Plasma Physics Lab., Princeton University, PO Box 451, Princeton, NJ 08544, USA
-31 August 1984 : St. Jovite, Canada 830/83

N-EQUILIBRIUM QUANTUM STATISTICAL PHYSICS
f. M.O. SCULLY, Dept. of Physics & Astronomy, Univ. of New Mexico, Albuquerque, NM 87131, USA
16 June 1984 : Santa Fe, New Mexico, USA 952/83

PERSYMMETRY
f. K. DIETZ, Physikalisches Inst., Nussallee 12, D-5300 Bonn 1, Germany
-31 August 1984 : Germany 983/83

PROVED METHODS FOR EXAMINING THE SUBMICRON WORLD
f. J.Wm. MCGOWAN, Nat. Museum of Sc. & T., 1867 St. Laurent Blvd., Ottawa, Ontario K1A 0M8, Canada
/ 1984 : Baddeck, Nova Scotia, Canada 991/83

HEMISTRY, GEOPHYSICS AND ASTROPHYSICS

NDAMENTALS & DEVELOPMENTS OF PHOTOCATALYTIC &
OTOELECTROCHEMICAL PROCESSES
f. M. SCHIAVELLO, Ist. Ingegneria Chim., Univ. di Palermo, Viale dell Scienze, 90128 Palermo, Italy
May-3 June 1984 : Palermo, Italy 81/83

ABILITY OF THE SOLAR SYSTEM & ITS MINOR NATURAL & ARTIFICIAL BODIES
f. V. SZEBEHELY, Univ. of Texas, Dept. of Aerospace Engineering, Austin, TX 78712-1085, USA
17 August 1984 : Cortina d'Ampezzo, Italy 680/83

NDAMENTAL & TECHNOLOGICAL ASPECTS OF ORGANO-F-ELEMENT CHEMISTRY ●
f. T.J. MARKS, Dept. of Chemistry, Northwestern Univ., Evanston, IL 60201, USA
-21 September 1984 : Maratea, Italy 694/83

LYMER BLENDS AND MIXTURES ●
D.J. WALSH, Dept. Chemical Eng. & Chem. Techn., Imperial College, Prince Consort Road, London SW7, UK
13 July 1984 : London, UK 686/83

ADING PROVENANCE FROM ARENITES
G.G. ZUFFA, Dip. Scienze della Terra, Univ. Calabria, 87030 Castiglione Cosentino, Stazione Cosenza, Italy
10 June 1984 : Rende (Cosenza), Italy 868/83

SMIC RADIATION IN CONTEMPORARY ASTROPHYSICS
f. M.M. SHAPIRO, Van Allen Hall, Univ. of Iowa, Iowa City, IA 52242, USA
15 November 1984 : Erice, Italy 944/83

VANCES IN CHEMICAL REACTION DYNAMICS
P.M. RENTZEPIS, Phys. & Inorg. Chem. Res., Bell Labs., 600 Mountain Av., Murray Hill, NJ 07974, USA
17 August 1984 : Crete, Greece 948/83

E DEEP PROTEROZOIC CRUST IN THE NORTH ATLANTIC PROVINCES
f. J. TOURET, Inst. Aardwetenschappen, Vrije Univ., Postbus 7161, 1007 MC Amsterdam, The Netherlands
30 July 1984 : Moi, Nr. Stavanger, Norway 953/83

ENDS IN INTERFACIAL ELECTROCHEMISTRY
A.F.S. DA SILVA, Dept. Quimica, Fac. Ciencias, Univ. do Porto, P-4000 Porto, Portugal
13 July 1984 : Viana do Castelo, Portugal 958/83

OLOGICAL SYNTHESIS OF THE CALEDONIAN ROCKS OF THE UK
A.L. HARRIS, J. Herdman Lab. Geology, Univ., Brownlow Str., Liverpool, PO Box 147, Liverpool L69 3BX, UK
August-2 September 1984 : Wales/Scotland, UK 984/83

PLICATIONS OF NEW SPECTROSCOPIC TECHNIQUES TO COAL SCIENCES
: B.M. LYNCH, Dep. Chemistry, St. Francis Xavier Univ., Antigonish, Nova Scotia, Canada B2G IC0
18 August 1984 : Antigonish, Nova Scotia, Canada 985/83

PLANETARY PHYSICS
Prof. S.K. RUNCORN, School of Physics, University, Newcastle-upon-Tyne NE1 7RU, UK
26 March-6 April 1984 : Newcastle-upon-Tyne, UK 1013/83

AIR-SEA TRANFER PROCESSES - TRAINING COURSE (MS)
Dr. K. KATSAROS, Dept. Atmosph. Science AK-40, Univ. Washington, Seattle, Washington 98195, USA
Date to be announced : Lake Washington, USA 1016/83

MATHEMATICS

COMPUTATIONAL MATHEMATICAL PROGRAMMING
Prof. K. SCHITTKOWSKI, Inst. fuer Informatik, Univ. Stuttgart, Azenbergstr. 12, 7000 Stuttgart 1, Germany
23 July-2 August 1984 : Bad Windsheim, Germany 478/83

OPERATORS AND FUNCTION THEORY
Dr. S.C. POWER, Dept. Mathematics, Univ. Lancaster, Bailrigg Lancaster, LA1 4YL, UK
15-26 July 1984 : Lancaster, UK 518/83

RINGS AND GEOMETRY
Prof. R. KAYA, Anadolu Universitesi Fen-Ed., Fakultesi, Ogretim Uyesi, Eskisehir, Turkey
2-14 September 1984 : Istanbul, Turkey 696/83

UNIVERSAL ALGEBRA AND RELATIONS
Prof. P. BERTHIAUME, Sémin. Math. Sup., Univ., C.P. 6128, Succ. A, Montreal, Que., Canada H3C 3J7
16 July-3 August 1984 : Montreal, Canada 697/83

GRAPHS AND ORDERS
Dr. I. RIVAL, Dept. Math. & Stat., Univ., 2500 University Drive N.W., Calgary, Alberta T2N 1N4, Canada
20 May-1 June 1984 : Banff, Canada 969/83

INFORMATICS

CONTROL FLOW & DATA FLOW – CONCEPTS OF DISTRIBUTED PROGRAMMING ●
Prof. F.L. BAUER, Inst. Inform., Techn. Univ., Arcisstr. 21, Postfach 20 2420, D-8000 München 2, Germany
31 July-12 August 1984 : Marktoberdorf (Nr Munich) Germany 685/83

NEW SYSTEMS & ARCHITECTURES FOR AUTOMATIC SPEECH RECOGNITION & SYNTHESIS ●
Prof. R. DE MORI, Comp. Sc., 1455 De Maisonneuve Blvd West, Rm H961-22, Montreal, Quebec, Canada H3G 1M8
2-14 July 1984 : Bonas, France 712/83

RELATIONAL DATA BASE SYSTEMS DESIGN AND IMPLEMENTATION ●
Dr. C.J. ROGERS, Software & Inform. Syst. Div., TRW Def. Syst. Gp., 1145 Arques Av., Sunnyvale, CA 94086, USA
17 June-29 July 1984 : Bad Windsheim, Germany 992/83

LOGICS FOR VERIFICATION AND SPECIFICATION OF PROGRAMS ●
Dr. K.R. APT, L.I.T.P., Univ. de Paris VII, 2 Place Jussieu, F-75251 Paris, France
15-19 October 1984 : France 995/83

APPLIED SCIENCES & ENGINEERING

GLASS CURRENT ISSUES ●
Dr. J. DUPUY, Dép. Physique des Matériaux, 43 Bd. du 11 Nov.1918, 69622 Villeurbanne, Cedex, France
2-13 April 1984 : Tenerife, Spain 10/83

INDUSTRIAL ROBOTIC VISION ●
Dr. A. OOSTERLINCK, Centrum Menselijke Erfelijkheid, Minderbroedersstraat 12, B-3000, Leuven
6-17 August 1984 : Leuven, Belgium 135/83

PHYSICS & ENGINEERING OF MEDICAL IMAGING ●
Dr. R. GUZZARDI, Nuclear Measurements Unit, C.N.R., Inst. Clin. Phys., Via Savi, 8, I-56100 Pisa, Italy
23 September-5 October 1984 : Maratea, Italy 139/83

THERMODYNAMICS & FLUID MECHANICS OF TURBOMACHINERY ●
Prof. A.S. ÜÇER, Mechanical Engineering Dept., Middle East Techn. Univ., Ankara, Turkey
17-28 September 1984 : Izmir-Çesme, Turkey 435/83

ADAPTIVE METHODS IN UNDERWATER ACOUSTICS ●
Ing. H. URBAN, Fried. Krupp GmbH, Krupp Atlas-Elektronik, PO. Box 44 85 45, D-2800 Bremen 44, Germany
30 July-10 August 1984 : Lüneburg, Germany 439/83

ADVANCED AGRICULTURAL INSTRUMENTATION ●
Dr. W.G. GENSLER, Dept. of Electrical Engineering, Univ. Arizona, Tucson, AZ 85721, USA
27 May-9 June 1984 : Italy 736/83

MINERAL PROCESSING DESIGN ●
Prof. Z.M. DOGAN, Mining Engineering Department, Middle East Technical Univ., (METU) Ankara, Turkey
6-17 August 1984 : Ankara, Turkey 772/83

OPTICAL METROLOGY ●
Dr. O.D.D. SOARES, Lab. de Fisica, Faculdade de Ciencias, 4000 Porto, Portugal
6-17 August 1984 : Povoa de Varzin, Portugal 945/83

MICROARCHITECTURE OF VLSI COMPUTERS ●
Dr. P. ANTOGNETTI, Istituto di Eletrotechnica, Univ. of Genova, Viale Cause 13, 16145 Genova, Italy
July 1984 : Urbino, Italy 970/83

APPLICATIONS OF THE MATERIAL SCIENCES TO THE PRACTICE OF ORTHOPEDIC SURGERY ●
Dr. M. DUJOVNY, Dept. Neurological Surgery, Henry Ford Hospital, 2799 W. Grand Blvd, Detroit, MI 48202, USA
15-28 July 1984 : Marbellia, Spain 972/83

rther information on a particular meeting should be obtained from the meeting Director named above.
rther information on the NATO Science Programmes may be obtained from : NATO Scientific Affairs Division, B-1110 Brussels, Belgium.

NATO Advanced Research Workshops

Tables rondes de l'OTAN

ADVANCED RESEARCH WORKSHOPS (ARWs) are working meetings which enable leading researchers, scientists and engineers to review the state-of-the-art in specific topics in fast moving fields and to formulate recommendations for the future. They are of about five days' duration : **attendance is limited and usually by invitation only.**

Each meeting is held under the responsibility of its Director, to whom all requests for information, attendance or support should be addressed. Four of the meetings are being sponsored by the Special Programmes on Global Transport Mechanisms (GTM), Selective Activation of Molecules (SAM), Materials Science (Mat.S) and the Survey Group on Astronomy (Astron.). The meetings marked ● are of particular industrial interest. **Locations and dates may change.** Titles and addresses have been abridged. Many meetings are of an interdisciplinary nature : please check all subject areas.

PUBLICATIONS :
Proceedings of meetings are published in the NATO ASI Series by : **Plenum – Reidel – Nijhoff – Springer Verlag.**

LIFE SCIENCES

MECHANISMS OF PERCEPTION & ORIENTATION TO INSECT PHEROMONES
Dr. M.C. BIRCH, Dept. of Zoology, South Parks Road, Oxford OX1 3PS, UK
5-10 August 1984 : Oxford, UK 75/82

MODELLING THE GROWTH OF WHEAT
Dr. W. DAY, Dept. of Agricult. & Horticult., Univ. Bristol, Long Ashton Research Station, Bristol BS18 9AF, UK
9-12 April 1984 : Bristol, UK 437/83

FUNCTION, STRUCTURE & GENETICS OF PROKARYOTIC & EUKARYOTIC ELONGATION FACTORS
Dr. A. PARMEGGIANI, Laboratoire de Biochimie, Ecole Polytechnique, F-91128 Palaiseau Cedex, France
16-20 July 1984 : Thiverval-Grignon, France 743/83

THE PHYSIOLOGY OF THIRST AND SODIUM APPETITE
Dr. G. DE CARO, Inst. of Pharmacology, Univ. of Camerino, 62032 Camerino, Italy
11-21 July 1984 : Camerino, Italy 767/83

VISUAL SPATIAL PROSTHESES FOR THE BLIND ●
Prof. D.H. WARREN, College Humanities & Social Sciences, Univ. of California, Riverside, CA 92521, USA
30 April-3 May 1984 : San Bernardino, USA 710/83

HUMAN IN VITRO FERTILIZATION - PRESENT PROBLEMS AND PROSPECTS
Prof. J. TESTART, Inserm 187, Gynéc.-Obstét., Antoine-Béclère, 157 rue Pte-de-Trivaux, 92141 Clamart, France
19-22 September 1984 : Cargèse, Corsica, France 757/83

MECHANISMS OF SECONDARY BRAIN DAMAGE
Prof. A. BAETHMANN, Inst. Surgical Research, Univ., Klinikum Grosshardern, 7000 München 70, Germany
19-23 February 1984 : Mauls/Sterzing, Italy 774/83

MULTIDISCIPLINARY ANALYSIS OF EVOLUTIONARY RELATIONSHIPS AMONG RODENTS
Dr. W.P. LUCKETT, Dep. Anatomy, Univ., Medical Sciences, G.P.O. Box 5067, San Juan, Puerto Rico 00936, USA
2-6 July 1984 : Paris, France 788/83

SYMPOSIUM ON BIOLOGY OF INVERTEBRATE AND LOWER VERTEBRATE COLLAGENS
Dr. S. BAIRATI, Dept. General Physiology & Biochemistry, Univ. of Milano, Via Celoria 26, 20133 Milano, Italy
3-6 June 1984 : Como, Italy 956/83

THE IN VITRO EFFECTS OF MINERAL DUSTS
Prof. E.G. BECK, Inst. of Hygiene, Justus-Liebig Univ., 63 Giessen, Germany
11-14 September 1984 : Schluchsee-Hochschwarzwald, Germany 976/83

STANDARDIZATION OF METHODOLOGY FOR THE MYCOLOGICAL EXAMINATION OF FOODS
Dr. J.E.L. CORRY, Min. of Agriculture Fisheries & Food, (Food Sc. Div.), 65 Romney Str., London SW1P 3RD, UK
July 1984 : Boston, USA 980/83

COORDINATE REGULATION OF CHOLESTEROL METABOLISM IN THE LIVER
Dr. A. SANGHVI, Dep. of Pathology, Univ. of Pittsburgh, School of Medicine, Pittsburgh, PA 16261, USA
October 1984 : Santa Fe, New Mexico, USA 990/83

ECOLOGY

ENVIRONMENTAL MONITORING FOR ARCHITECTURAL CONSERVATION
Dr. R.A. LIVINGSTON, RD-677, Res. & Dev., EPA, 401 M St SW, Washington, DC 20460, USA
11-15 June 1984 : Rome, Italy 459/83

POPULATION BIOLOGY - THE INTERFACES
Dr. P. JACQUARD, Dep. Physiologie Ecologique, C.N.R.S., B.P. 5051, 34033 Montpellier, France
28 May-2 June 1984 : Montpellier, France 876/83

SOCIAL, BEHAVIOURAL & POLITICAL SCIENCES

RESEARCH IN USER-COMPUTER INTERACTION ●
Prof. B. SCHACKEL, Dept. of Human Sciences, University of Technology, Loughborough, UK
9-14 September 1984 : Cambridge or Loughborough, UK 968/83

PHYSICS

CONDENSED MATTER RESEARCH USING NEUTRONS, TODAY & TOMORROW
Dr. S.W. LOVESEY, Rutherford Appleton Lab., Chilton, Oxfordshire, OX11 0OX, UK
26-29 March 1984 : Abingdon, Nr. Oxford, UK 479/83

CHEMISTRY, GEOPHYSICS AND ASTROPHYSICS

THE MORPHOLOGY & DYNAMICS OF THE POLAR CUSP
Prof. A. EGELAND, Inst. of Physics, Univ. Oslo, P.O. Box 1048, Blindern, N-Oslo 3, Norway
20-27 May 1984 : Lillehammer, Norway 434/83

COMPOSITION & INTERACTIONS OF SOIL COLLOID SURFACES
Prof. M.F.L. DE BOODT, Fakult. Landbouw, RUG, Coupure Links 533, B-9000 Gent
2-8 September 1984 : Gent, Belgium 515/83

MOLECULAR ASTROPHYSICS – STATE OF THE ART & FUTURE DIRECTIVES
Dr. G.H.F. DIERCKSEN, Inst. Astrophysik, Karl-Schwarzschild-Str. 1, D-8046 Garching bei München, Germany
8-14 July 1984 : Bad Windsheim, Germany 741/83

EVOLUTION OF STRUCTURE IN THE UNIVERSE
Prof. M.J. REES, Inst. of Astronomy, Madingley Road, Cambridge CB3 OHA, UK
January 1984 : Santa Barbara, California, USA 768/83

CHAOS IN ASTROPHYSICS
Prof. J.R. BUCHLER, Dept. of Physics, Univ. of Florida, Gainsville, FL 32611, USA
8-11 April 1984 : Palm Coast, Florida, USA 797/83

PHASE TRANSITIONS IN THE VERY EARLY UNIVERSE
Prof. R. BAIER, Fakultät für Physik, Univ. Bielefeld, Postfach 8640, D-4800 Bielefeld 1, Germany
4-8 June 1984 : Bielefeld, Germany 859/83

TRANSPORT IN NON-STOICHIOMETRIC COMPOUNDS ●
Prof. G. SIMKOVICH, Dept. Mat. Sc. & Eng., 206 Steidle Bldg, Penn. State, University Park, PA 16802, USA
10-16 June 1984 : University Park, Pennsylvania, USA 861/83

POLYDIACETYLENES - SYNTHESIS, STRUCTURE AND ELECTRONIC PROPERTIES ●
Dr. R.R. CHANCE, Corporate Technology, Allied Corporation, P.O. Box 1021R, Morristown, NJ 07960, USA
12-17 August 1984 : Stratford-upon-Avon, UK 959/83

COMPUTER SIMULATION OF CONDENSED MATTER (Mat.S)
Dr. C.R.A. CATLOW, Dep. Chemistry, Univ. College London, 20 Gordon Street, London WC1H 0AJ, UK
22-27 July 1984 : Norwich, UK 758/83

ICE IN THE SOLAR SYSTEM (Astron.)
Prof. A. DOLLFUS, Observatoire de Paris, 92190 Meudon, France
16-19 January 1984 : Nice, France 450/83

BIOGEOCHEMICAL CYCLING OF S & N IN REMOTE AREAS (GTM)
Dr. J.N. GALLOWAY, Environmental Studies Dept., Univ. Virginia, Charlottesville, VA 22903, USA
8-12 October 1984 : St. Georges, Bermuda 771/83

THE CHEMISTRY OF WEATHERING (GTM)
Dr. J.I. DREVER, Geology Dep., Univ. of Wyoming, Laramie, WY 82071, USA
25-29 June 1984 : Bonas, France 977/83

LASER STUDIES IN REACTIONS KINETICS VIA THE SELECT. ACTIVAT. OF MOLECULES (SAM) ●
Prof. E.W. SCHLAG, Inst. F. Physik. und Theoret. Chemie, Lichtenbergstrasse 4, 8046 Garching, Germany
24-27 September 1984 : Bavaria, Germany 1000/83

SELECTIVE ACTIVATION OF ORGANIC COMPOUNDS - ELECTROSYNTHESIS (SAM) ●
Dr. J.H.P. UTLEY, Dept. Organic Chem., Queen Mary Coll., Univ. of London, Mile End Road, London E1 4NS, UK
9-13 September 1984 : Oxford, UK 1011/83

UTILIZ. OF ACTIVATED DIOXYGEN SPECIES IN THE SELECT. OXIDAT. OF SUBSTRATES (SAM) ●
Prof. G. MODENA, Ist. di Chimica Organica dell'Universita, via Marzolo, 1, 35131 Padova, Italy
25-29 June 1984 : Galzignano (Padua), Italy 770/83

ASYMMETRIC CATALYSIS (SAM)
Prof. B. BOSNICH, Dept. of Chemistry, Univ. Toronto, 80 St. Georges St., Toronto M5S 1A1, Canada
2-7 January 1984 : Florida, USA 756/83

MATHEMATICS

DIFFERENTIAL GEOMETRY IN STATISTICAL INFERENCE
Prof. D.R. COX, Dept. Mathematics, Imperial College, Huxley Building, 180 Queen's Gate, London SW 7 2BZ, UK
9-11 April 1984 : London, UK 701/83

COMBINATORIAL ALGORITHMS ON WORDS
Ing. A. APOSTOLICO, Ist. di Scienza dell'Inform., Fac. di Scienze, Univ. di Salerno, I-84100 Salerno, Italy
18-22 June 1984 : Salerno, Italy 804/83

INFORMATICS

FORMAL SOFTWARE DEVELOPMENT METHODS ●
Prof. D. BJORNER, Dansk Datamatik Center, Lundtoftevej 1 C, DK-2800 Lyngby, Denmark
21-25 May 1984 : Denmark 979/83

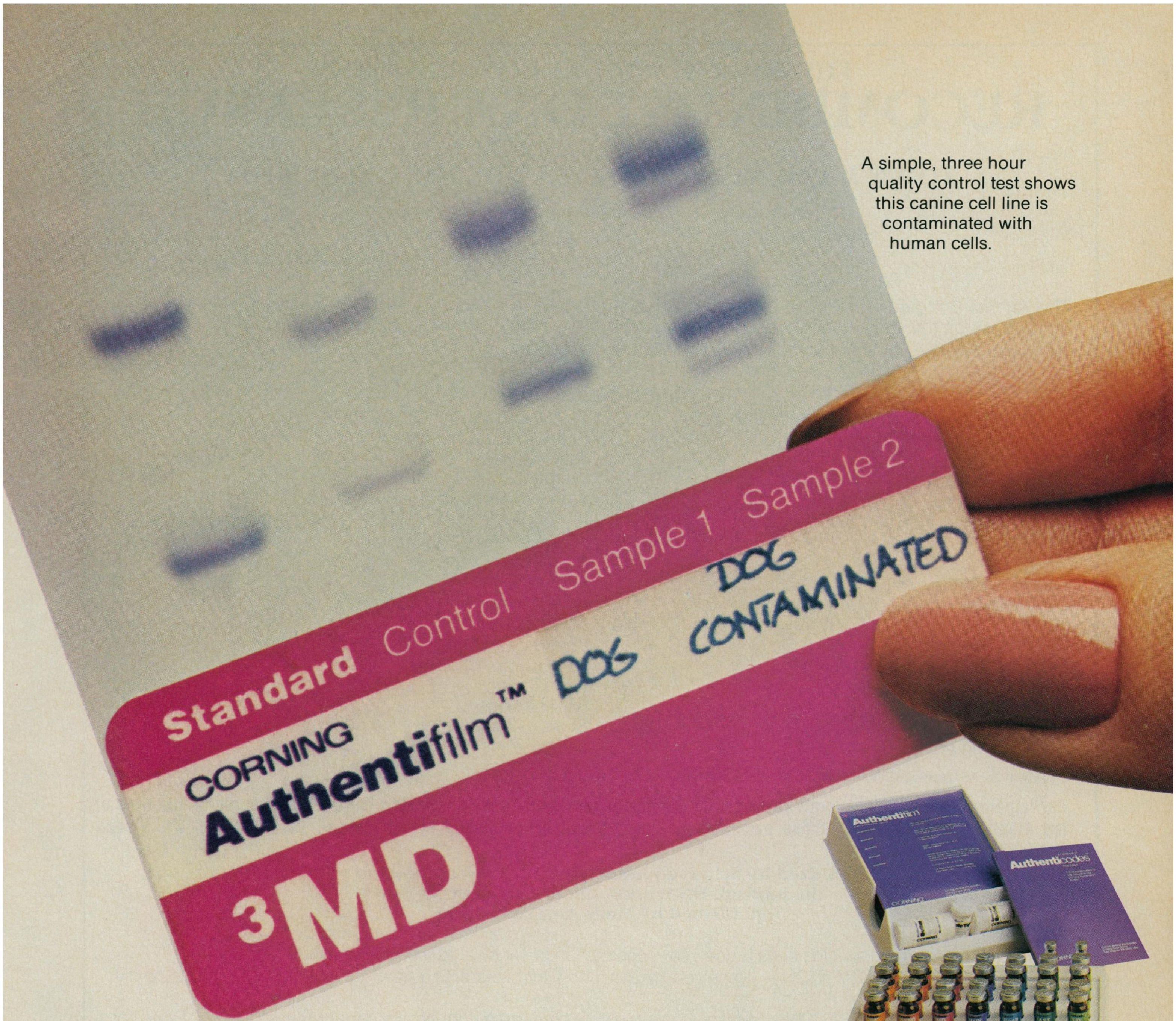
APPLIED SCIENCES & ENGINEERING

PARTIAL PRESTRESSING – FROM THEORY TO PRACTICE ●
Prof. M.Z. COHN, Dept. Civil Engineering, Univ. Waterloo, Waterloo, Ontario, N2L 3G1, Canada
18-22 June 1984 : St. Rémy-lès-Chevreuse, France 764/83

PROBLEMS IN SERVICE LIFE PREDICTION OF BUILDING MATERIALS (Mat.S) ●
Dr. G.J. FROHNSDORFF, Bldg 226, Room B-368, National Bureau of Standards, Washington, DC 20234, USA
10-12 September 1984 : Paris, France 429/83

SEMICONDUCTOR DEVICE RELIABILITY (Mat.S) ●
Dr. C.M. MELLIAR-SMITH, Bell Telephone Labs, 2525 North 12th St., Reading, PA 19604, USA
Date & Place to be announced 534/83

APPLICATION OF FRACTURE MECHANICS TO CEMENTITIOUS COMPOSITES (Mat.S)
Prof. S.P. SHAH, Dept. Materials Eng., Univ. Illinois, Box 4348, Chicago, IL 60680, USA
June 1984 : Evanston, Illinois, USA 2/82



A simple, three hour quality control test shows this canine cell line is contaminated with human cells.

A Cell of a Mess that's Easy to Avoid

A single contaminating cell can turn a whole culture into a tissue of lies…man turns into mouse…dog turns into man.

Until now, running quality control on cell lines has been time consuming and expensive. Karyotyping requires an expert working several days with costly equipment to render a somewhat subjective judgement of cell purity.

Now you can monitor cell contamination quickly, surely, inexpensively with Corning's new AuthentiKit™ System.

Simple isoenzyme electrophoresis gives you a definitive, hardcopy answer in three hours in eight simple steps learned easily even by those *not* familiar with electrophoresis…for much less than the cost of a typical karyotyping.

All you need is simple, routine equipment and one of our kits to authenticate four cell lines.

Don't cell yourself short.

Call us at 800-255-3232 to discuss your particular cell quality control. Or, write for literature and a journal reprint pack.

Corning Medical and Scientific, 333 Coney St., East Walpole, MA 02032.

The Most Trusted Tools Of Science

CORNING

Circle No. 120 on Readers' Service Card

Please send to Serono Symposia, Via Ravenna 8 - 00161 Rome - Italy

terministic prejudices. Einstein's position was based, not on his commitment to determinism, but on a strong distaste for the "spooky actions at a distance" suggested by the quantum doctrine that $s_2(a)$ acquires its value only as a result of the faraway measurement made on particle 1.

What is remarkable about J. S. Bell's analysis, and what the experiments of A. Aspect *et al.* confirm, is that Einstein's view not only is at odds with the ontological precepts of the Copenhagen interpretation but is also numerically incompatible with the results of other spin correlation experiments. It is worse than a breach of quantum metaphysics to assign a value to $s_2(a)$ before the faraway measurement on particle 1—it is demonstrably inconsistent with the observed facts.

It is tempting to say that the only property of particle 2 changed by the measurement of particle 1 is what we know about particle 2, as in Rohrlich's example of the tossed coin. But the suggestion that the major difference between the classical and quantum examples lies in the presence or absence of a detailed dynamics insufficiently emphasizes what is most peculiar about the quantum case. The state of the coin is heads or tails, whether or not we know it. Particle 2, on the other hand, does not possess a value of $s_2(a)$ until we carry out a distant measurement of $s_1(a)$. After that it does. It is this state of affairs that has given rise to some of the bizarre philosophical positions Rohrlich mentions. I share his distaste, but it should be stressed that many of those positions are hardly more peculiar than the unadorned facts.

N. DAVID MERMIN
Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853

I am grateful to Mermin for pointing out that I have not been sufficiently explicit about at least one point in my article. He refers to the case when the directions a and b are the same, that is, when the two spinning particles have their spins measured along the same direction.

In this case one must distinguish two separate matters. One is the law of conservation of angular momentum, which guarantees that the spins of the two particles are always in opposite directions (no matter what direction is chosen), because the total spin of the system has been zero before the breakup into two particles. It means that no matter what the outcome of the spin measurement of the particle that is measured first, $s_1(a)$, the spin measurement of the other particle will give the opposite result, $s_2(a) = -s_1(a)$. No action-at-a-distance scenario need be invoked here. This is simply a matter of satisfying a conservation law.

The other matter deals with the prediction of the outcome of the spin measurement $s_1(a)$. It can be one of two values, and therefore $s_2(a)$ will be one of two values. Which one it will be is just as probabilistic as $s_1(a)$. But because of the conservation law, $s_2(a)$ is determined uniquely once $s_1(a)$ is known, whether $s_2(a)$ is measured later or at the same time. In that respect the situation is the same as the toss of a coin.

The difference between the coin toss (classical mechanics) and the breakup into two spinning particles (quantum mechanics) is (i) that the coin toss has a detailed dynamics which in principle can be known and then permits one to predict the outcome from the initial conditions, while the breakup does not have such a dynamics (no hidden variables that make the outcome deterministic); and (ii) that the quantum mechanical prediction involves probability *amplitudes* while the classical prediction (when the detailed dynamics is not known) involves probabilities. It is the latter difference that is responsible for the difference between quantum mechanical and classical correlations.

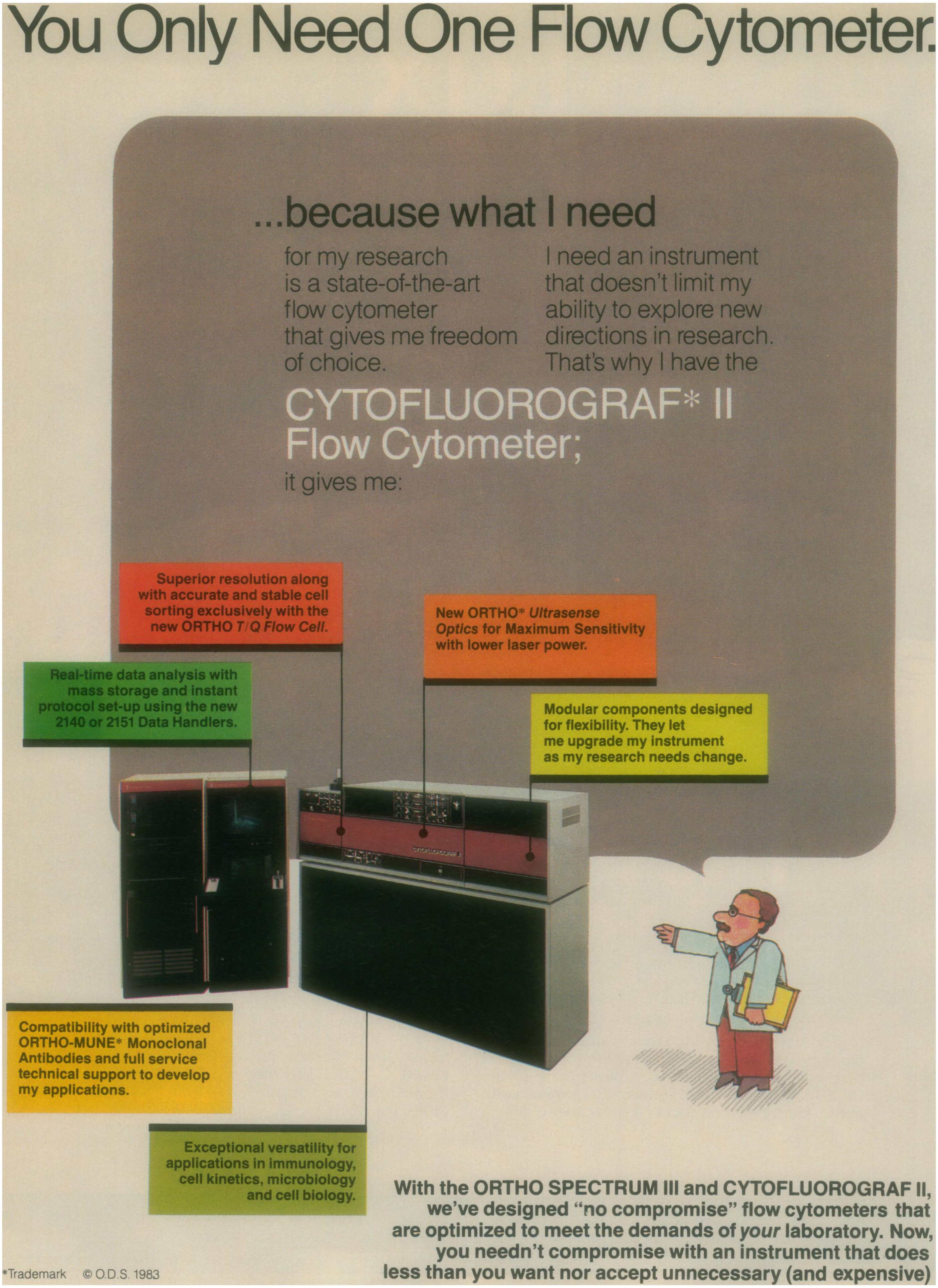
F. ROHRLICH
Department of Physics, Syracuse University, Syracuse, New York 13210

Digit Counting

I congratulate *Science* on printing 23-digit and 29-digit numbers without typographical error in the item "What does it mean to factor?" by Gina Kolata (Research News, 2 Dec., p. 1000). I infrequently encounter an error of any sort in *Science*; however, I find it difficult to reconcile the claim that 2 to the 193rd minus 1 is a 58-digit number with its decimal representation 12,554,203,470, 773,361,527,671,578,846,415,332,832, 204,710,888,928,069,025,791. Perhaps 12 is considered indistinguishable from a single digit in this transcendent realm?

WALTER I. NISSEN, JR.
7414 Birch Avenue, Takoma Park, Maryland 20912

Erratum: The review of *Temperature* in the issue of 6 January (p. 44) was written by Robert J. Soulen, Jr.


You Only Need One Flow Cytometer.
...because what I need
for my research is a state-of-the-art flow cytometer that gives me freedom of choice.
I need an instrument that doesn't limit my ability to explore new directions in research. That's why I have the
CYTOFLUOROGRAF* II Flow Cytometer;
it gives me:
Superior resolution along with accurate and stable cell sorting exclusively with the new ORTHO *T/Q Flow Cell*.
New ORTHO* *Ultrasense Optics* for Maximum Sensitivity with lower laser power.
Real-time data analysis with mass storage and instant protocol set-up using the new 2140 or 2151 Data Handlers.
Modular components designed for flexibility. They let me upgrade my instrument as my research needs change.
Compatibility with optimized ORTHO-MUNE* Monoclonal Antibodies and full service technical support to develop my applications.
Exceptional versatility for applications in immunology, cell kinetics, microbiology and cell biology.
With the ORTHO SPECTRUM III and CYTOFLUOROGRAF II, we've designed "no compromise" flow cytometers that are optimized to meet the demands of *your* laboratory. Now, you needn't compromise with an instrument that does less than you want nor accept unnecessary (and expensive)
*Trademark © O.D.S. 1983

Cahn can show you how to save more than $7,000 per year by using our microbalances instead of an analytical balance to weigh expensive biochemicals and reagents for HPLC analysis. Or any analysis involving rare, perishable, or hazardous samples.

Cahn microbalances weigh samples to the nearest 0.1 microgram with an accuracy of 1%. Using our microbalance, you don't need to prepare large samples of costly (greater than $20/mg) compounds for analysis. If you use an analytical balance, you need to prepare 1.0 mg for a qualitative analysis and 10.0 mg for a quantitative analysis. Some difference!

Now Cahn Microbalances offer the RS-232 interface for printers, computers, etc.

If you are using commercially prepared . . . **nucleic acids • enzymes • steroids • hormones • peptides • prostaglandins**
. . . Cahn microbalances will save you thousands. Furthermore, in many cases your expensive samples will be recoverable and reusable after analysis by HPLC or other techniques. A prime example: ACTH.

Let a qualified Cahn representative document how you can save a considerable sum by using our rugged, easy-to-use microbalances. Circle the reader service number to find out more, or better yet, call our toll free number **(800) 423-6641.** Cahn Instruments, Inc., 16207 S. Carmenita Road, Cerritos, CA 90701 USA. Telephone (213) 926-3378, TWX 910-583-4806.

WEEKLY Qualitative Preparation	Analytical Balances	**CAHN Microbalances**
Sample Required	1.0 mg.	0.1 mg
Accuracy	±0.1 mg (10%)	±0.0001 mg (0.1%)
Sample Cost	$45.00	$4.50
Sample Cost/ Year	$2,340.00	$234.00
Savings/Year	—	**$2,106.00**

MONTHLY Quantitative Preparation	Analytical Balances	**CAHN Microbalances**
Sample Required	10.0 mg.	0.1 mg
Accuracy	±0.1 mg (1%)	±0.0001 mg (0.1%)
Sample Cost	$450.00	$4.50
Sample Cost/ Year	$5,400.00	$54.00
Savings/Year	—	**$5,346.00**

COST COMPARISONS

CAHN

Circle No. 70 on Readers' Service Card

When solutions are problems... turn to Brinkmann.

Büchi Rotavapor R-110 and RE-120

Proven performance worldwide.
Büchi joins Brinkmann to bring you *the most versatile and widely used* rotary evaporation systems throughout the world, combining proven safety and reliability with innovative technology.

The R-110 and RE-120 are equipped with electronically controlled sparkless induction motors having variable speeds up to 220 rpm. Each model has a chemically inert Teflon*-coated vacuum seal, which can easily be inserted and removed by hand. The unique pear-shaped flask provides more surface area for evaporation and simplifies access to dried residue. And a choice of three assemblies makes the R-110 and RE-120 the most versatile, compact, and efficient rotary evaporators to meet your evaporation needs.

Take a turn for the better with these high-performance rotary evaporation systems. For more information about the Büchi Rotavapor R-110 and RE-120, call or write: Brinkmann Instruments Co., Division of Sybron Corporation, Cantiague Road, Westbury, NY 11590, Tel: 800-645-3050; in New York, 516-334-7500. In Canada: 50 Galaxy Blvd., Rexdale, Ont. M9W 4Y5, Tel: 416-675-7911.

*Teflon is a trademark of the E.I. Du Pont Co.

Choice of three assemblies makes the R-110 and RE-120 even more...

Versatile: Standard assembly with continuous-feed feature is ideal for general laboratory use.

Compact: B assembly with continuous feed and vertical space-saving design is well suited for high-boiling solvents.

Efficient: C assembly with two-piece cold-trap condenser provides the most efficient means of condensing solvent vapors and low-boiling solvents.

rotary evaporation systems
Brinkmann

SYBRON

For information circle reader service number 33
For a demonstration circle reader service number 34

BRK-5029

27 January 1984, Volume 223, Number 4634

SCIENCE

Engineering and the National Science Foundation

In the scientific and technical communities of both the federal and private sectors, it is widely recognized that an effort to strengthen engineering at the National Science Foundation is desirable and timely. The engineering professional societies and engineering schools have been dissatisfied with NSF programs for many years. The engineering academic community has not found NSF to be an effective source of assistance as undergraduate enrollments have expanded while out-of-date laboratory facilities and inadequate research funding have decreased the ability of the schools to attract an adequate number of faculty members or full-time graduate students.

The organizational position of engineering within the NSF administration has been improving. Engineering has emerged from a division status, to part of a Directorate of Engineering and Applied Science, to its present position as a separate directorate. Presumably engineering is no longer considered as one of the sciences or simply the application of science but rather an enterprise with distinctive characteristics of its own.

One of these characteristics is the concentration of activities in industry. More than three-quarters of the engineers in the United States are employed in industry; industrial laboratories have done the outstanding research in many fields. Since much engineering research is best carried out by teams of specialists and is frequently heavily dependent on equipment, an industrial site may often be better adapted for effective engineering research than the usual academic environment.

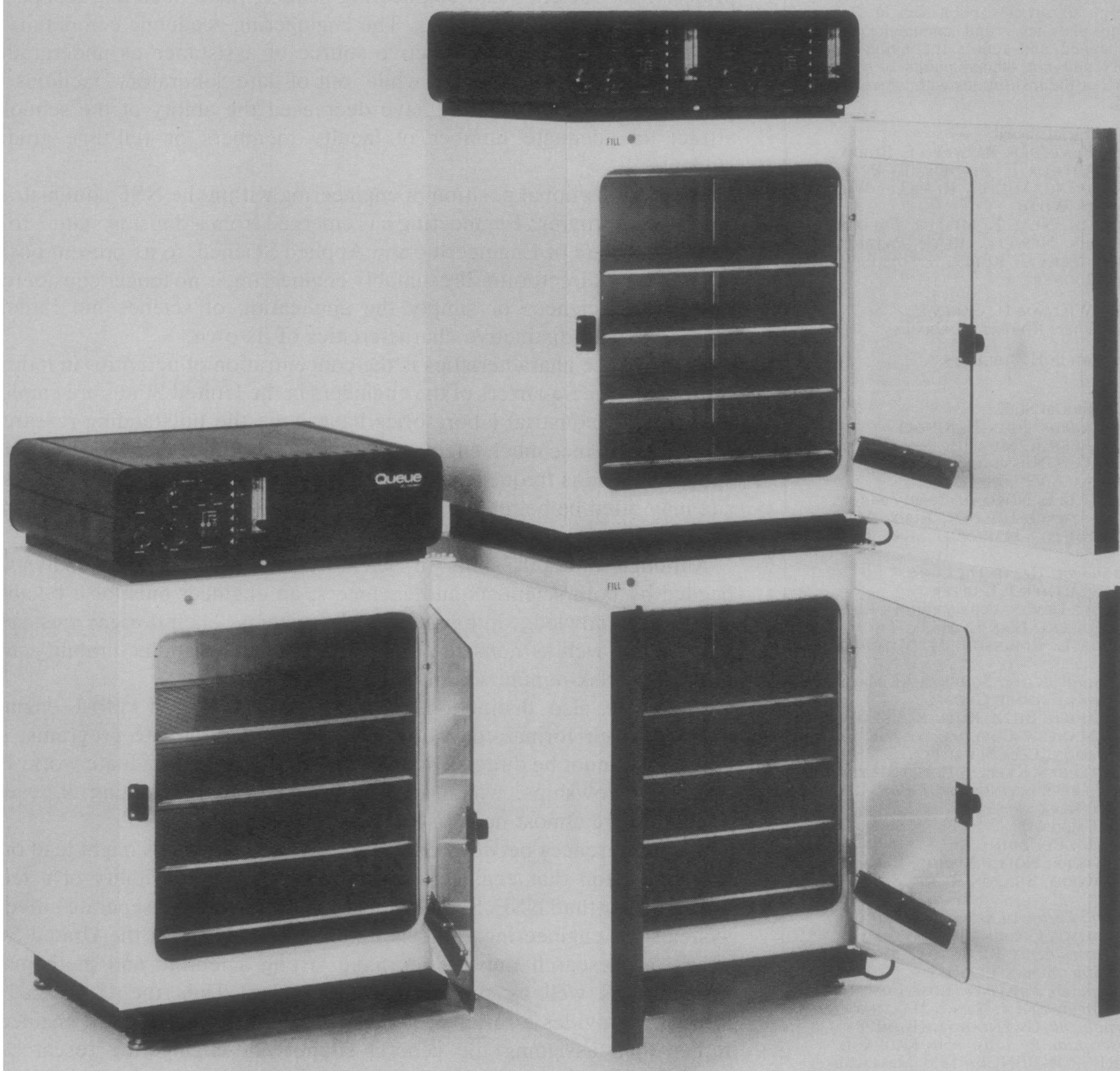
Although in-depth skills in scientific and mathematical analysis are needed by both scientists and engineers, an engineer must also be able to synthesize knowledge into products and systems. Their designs must satisfy scientific as well as nonscientific criteria such as manufacturability, maintainability, risk-minimization, and cost-effectiveness.

There are also distinctions in the academic world. Most engineers complete their formal education in 4-year undergraduate programs; such programs cannot be directed simply to preparation for graduate work. Postdoctoral fellowships, which are so important in the training of research scientists, are almost nonexistent among engineers.

Such differences between engineering and the sciences might lead one to the conclusion that engineering should be the responsibility of a federal agency other than NSF. Some countries have developed separate university systems for engineering and scientific education, but in the United States nearly all research universities have strong scientific and mathematical programs as well as schools of engineering. Thus the U.S. academic structure provides a rationale for expanding NSF activities in engineering rather than assigning the general support of engineering research and education to other agencies.

However, of even greater importance is the fact that the scientific and engineering enterprises operate most effectively when their borders are kept indistinct. Increases of scientific knowledge and understanding have given great impetus to engineering and technological advances. In turn, engineering and technological advances have frequently led to expansion of scientific knowledge. The interplay of science and technology, which is crucial to the rapid advance of both science and engineering, should not be hampered by institutional barriers.

If engineering in NSF is strengthened, three objectives can be simultaneously served. First, badly needed assistance to the academic engineering community can be more efficiently provided; second, the synergism between science and engineering can be reinforced; and third, the nation's technological capability can be strengthened. A dynamic engineering program at NSF is one of the most highly leveraged investments in the nation's technological future that the federal government can make.—F. KARL WILLENBROCK, *Cecil H. Green Professor of Engineering, Southern Methodist University, Dallas, Texas 75275*


Queue
FILL
FILL