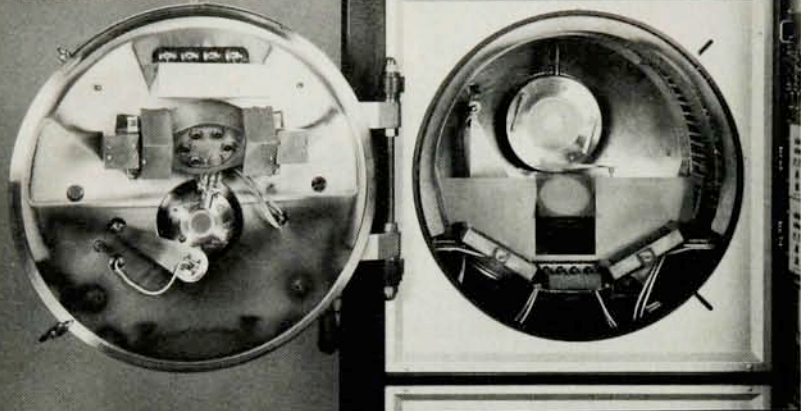


ION BEAM SOURCES ...SYSTEMS ...SOLUTIONS



Today, ion beams are an integral part of many demanding thin film processes; but these now-routine applications once required some not-so-routine solutions. At Ion Tech, we design ion beam solutions from ion sources to complete systems. And our solutions include more than a vacuum system and hardware: quality, training, applications support, and service are part of Ion Tech's commitment to a total solution. If your thin film process might benefit from an ion beam, give us a call.

AVS Show-Booth #711

Circle number 75 on Reader Service Card

ION SOURCE SOLUTIONS from . . .

ION TECH, INC.
2330 East Prospect
Fort Collins, CO 80525
303 221-1807

Probe of the universe." Pawel O. Mazur (Syracuse University) received the third prize of \$200 for "Are there topological black hole solitons in string theory?" Yong-Shi Wu (University of Utah) and Zi Wang (Utah State University) received the fourth prize of \$150 for "Present time variation of Newton's gravitational constant in superstring theories." Amos Ori (Racah Institute of Physics, Israel) and Tsvi Piran (Racah Institute and the Institute for Advanced Study, Princeton) received the fifth prize of \$100 for "Self-similar spherical gravitational collapse and the cosmic censorship hypothesis."

in brief

Dan Baker, a physicist at Los Alamos National Laboratory, in June became head of the Laboratory for Extraterrestrial Physics at the NASA Goddard Space Flight Center in Greenbelt, Maryland.

John Fabian, a former space shuttle astronaut and director of space at the US Air Force Headquarters, in July became vice president for space systems at ANSER (Crystal City, Virginia).

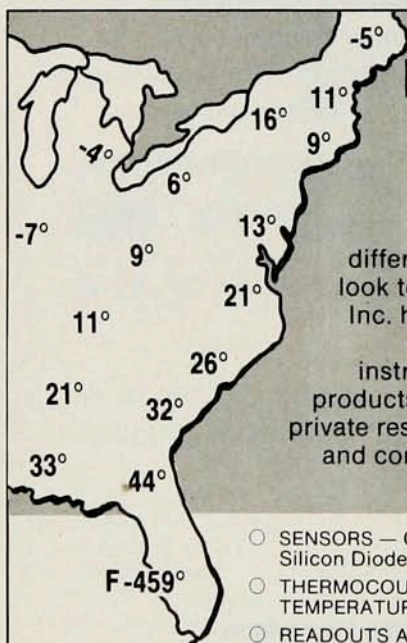
Neil Stein, formerly director of research and development at Spex Inc. (Edison, New Jersey), has become vice president of operations at Instruments SA Inc. (also in Edison).

obituaries

Paul Matthews

Paul Taunton Matthews, who made major original contributions to meson theory and who served in policy advisory positions to Great Britain's Science Research Council and CERN, died on 26 February, a few days after he was struck by a truck while riding his bicycle in Cambridge, England. He was on his way at the time to check some facts for the collected writings of Paul A.M. Dirac, which he was editing. Matthews was 67 years old.

Born in Broda, India, the son of a clergyman who was professor of English at the Madras Christian College, Matthews came to England at the age of six and was educated at Mill Hill School and Clare College, Cambridge, where, in 1940, he received a first-class honors degree in mathematics. During the war he served in China with the Friends' Ambulance Unit distributing



Florida Temperatures Plummet Near Absolute Zero

If you're looking for a measurable difference in cryogenic instrumentation, look to the South. Scientific Instruments, Inc. has been involved in the design and development of cryogenic sensors, instruments and systems since 1967. SI products are being supplied to universities, private research facilities, space laboratories, and commercial users in the United States and throughout the world.

- SENSORS — Germanium Resistance, Gallium Arsenide, Silicon Diode and Platinum Resistance Thermometers.
- THERMOCOUPLES AND LIQUID LEVEL AND TEMPERATURE AEROSPACE PROBES
- READOUTS AND CONTROLLERS — Digital Temperature Indicators
- LIQUID LEVEL INDICATORS AND DETECTOR PROBE ASSEMBLIES

For more information on standard and custom cryogenic products contact Scientific Instruments, Inc.
Detailed data sheets are currently available.



Scientific Instruments Inc.

1101 25th Street • West Palm Beach, Florida 33407
Telephone: (305) 659-5885 • Telex: 51-3474

POSITIONING PROBLEM SOLVERS



IS YOUR INTEREST IN MOTION CONTROL?
Then don't make a move without this FREE catalog!
To receive your catalog write or call...

Canadian customers call us direct!

ORIEL
CORPORATION

250 LONG BEACH BLVD., P.O. BOX 872, STRATFORD, CT 06497-0872 (203) 377-8282

FRANCE
ORIEL S.A.R.L., Paris
Tel. 371-00-60

UNITED KINGDOM
ORIEL SCIENTIFIC LTD.
Kingston-upon-Thames, Surrey
Tel. 01-549-4525

Circle number 77 on Reader Service Card

DYCORTM QUADRUPOLE GAS ANALYZERS

Available with Electron Multiplier
New Rack Mount or Bench Models

COMPLETE INSTRUMENT

\$5595.00

(MADE IN U.S.A.)



The DYCOTR Quadrupole Gas Analyzer tells you exactly what's in your vacuum system with a glance at the high resolution display. Whether your application is gas analysis, process monitoring, leak detection, or vacuum evaluation, the microprocessor-based models provide you with the ultimate in performance.

Our engineers would be pleased to discuss your application. For literature, contact AMETEK, Thermox Instruments Division, 150 Freeport Road, Pittsburgh, PA 15238. Tel: (412) 828-9040.

STANDARD FEATURES

- 1-100 AMU • Dual Filaments
- Faraday Cup Detector
- 100% Front Panel Control
- 9" High-Resolution Display
- Graph or Tabular Data Display
- RS232 Computer Interface
- 10^{-4} to 5×10^{-12} Torr Pressure Range
- Background Subtraction

OPTIONAL FEATURES

- Pressure vs. Time Display • 1-200 AMU
- Graphics Printer For Hard Copy
- Sample System For Higher Pressures
- 12" High-Resolution Display

AVS Show-Booth #802

AMETEK
THERMOX INSTRUMENTS DIVISION

Circle number 78 on Reader Service Card

PHYSICS IN JAPAN

Special December '87 Issue of PHYSICS TODAY

Explores the broad panorama of modern physics in Japan

Scheduled articles

OBSERVATIONAL NEUTRINO ASTROPHYSICS

by M. Koshiha (International Center for Elementary Particle Physics, University of Tokyo)

X-RAY ASTRONOMY

by Minoru Oda (Institute of Space & Astronautical Science, Tokyo)

HIGH T_c SUPERCONDUCTORS

by Shoji Tanaka, Koichi Kitazawa (University of Tokyo)

ULTRAFINE PARTICLES

by Chikara Hayashi (Ulvac Corporation)

GRAPHITE INTERCALATION COMPOUNDS

by Hiroshi Kamimura (University of Tokyo)

*The advertising deadline for this special issue of PHYSICS TODAY is November 2, 1987. To place an ad, contact:

Advertising Representatives

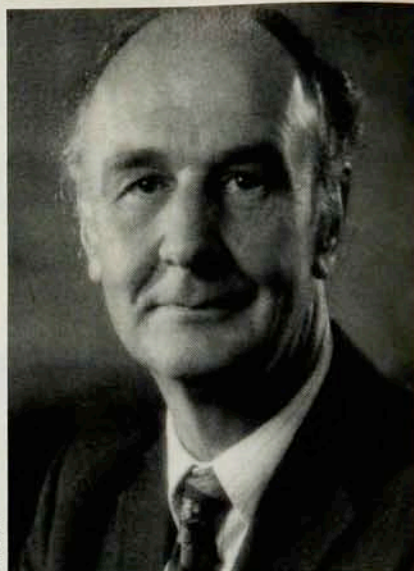
Bob Finnegan
Lois Kimmelman
Arnie Schweitzer
(212) 661-9404

Western States

Kittle & Kirstine
(818) 579-7910 or
(415) 969-9933

Europe

The Pattis Group
England
(01) 427 9000



ARGENT

MATTHEWS

medical supplies to the Chinese National Medical Service and to mission hospitals. At the war's end he returned to Cambridge to do research in mathematical physics.

In September 1950 he went for a year to the Institute for Advanced Study at Princeton, where he contributed to different aspects of particle physics and quantum field theory. He returned to Cambridge for a year as an Imperial Chemical Industries research fellow before going to Birmingham University, where he lectured for the next five years. He went back briefly to the US as visiting professor at the University of Rochester, returning to Britain as reader in theoretical physics at Imperial College. His standing as an international expert in quantum field theory was recognized with his appointment in 1962 to a chair at Imperial College, which he held until 1976.

His *Quantum Mechanics* was published in 1963 and that year he was elected as a fellow of the Royal Society. While department head at Imperial College, Matthews helped shape science policies in both Great Britain and Europe. Between 1972 and 1975 he was dean of the Royal College of Science (1972-75), a member of Britain's Science Research Council (1972-74) and at the same time chairman of the SRC's nuclear physics board and a member of the CERN scientific policy committee.

Matthews's energy and enthusiasm were unbounded. During this period he wrote his second book, *The Nuclear Apple*. In 1976 he received the coveted Rutherford Medal for his contributions to elementary-particle physics, and the following year he accepted the vice chancellorship of Bath University. He arrived at Bath determined to raise

MACSYMA

**automates symbolic mathematics.
And yields enormous improvements in
speed, accuracy and modeling power.**

If you work with quantitative models in scientific or engineering disciplines, MACSYMA can increase your modeling power. MACSYMA combines symbolic and numeric computation. And enables you to accurately manipulate symbolic expressions in a fraction of the time required manually.

Wide range of capabilities

MACSYMA offers the widest range of capabilities for symbolic computations in applied mathematics of any commercially available program. For example:

Algebra: MACSYMA can manipulate large expressions, expand, simplify and factor expressions, handle matrices and arrays, and solve systems of equations.

Calculus: MACSYMA can differentiate, perform definite and indefinite integration, take limits, expand functions in Taylor or Laurent series, solve differential equations, and compute Laplace transforms.

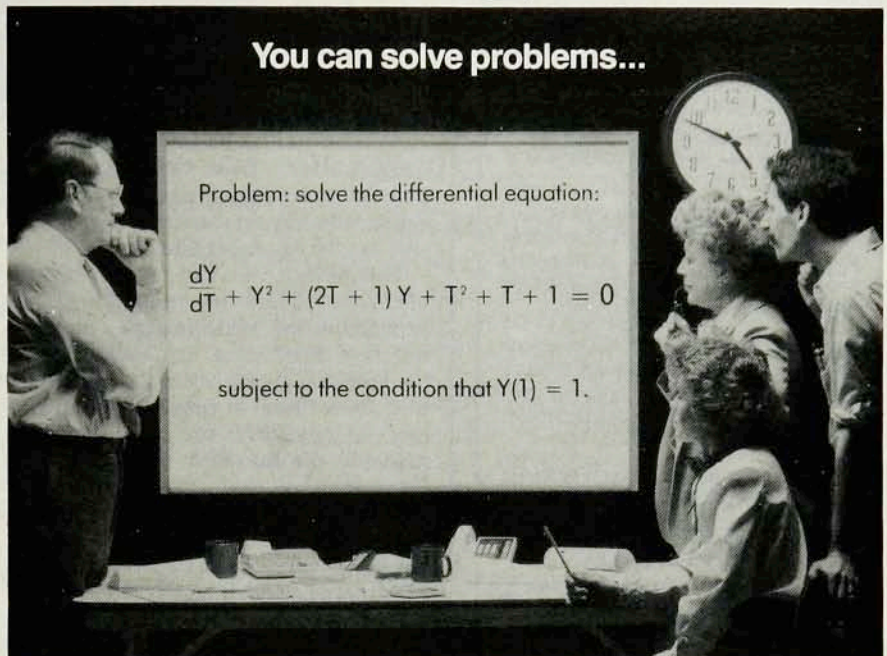
Numerical analysis: You can perform numerical analysis using MACSYMA® language, compute with arbitrary precision arithmetic, use a library of numerical analysis routines, and generate FORTRAN code.

Graphics and interfaces:

MACSYMA can generate report-quality graphics in 2D or 3D, with perspective, hidden line removal, and captions. MACSYMA also interfaces with the mathematical text processors 'TeX' and 'troff'.

Broad base of applications

Throughout the world thousands of scientists, engineers and mathematicians are using MACSYMA in such diverse applications as aeronautical design, structural engineering, fluid mechanics, acoustics, CAD, electronic and VLSI circuit design,



You can solve problems...

Problem: solve the differential equation:

$$\frac{dY}{dT} + Y^2 + (2T + 1)Y + T^2 + T + 1 = 0$$

subject to the condition that $Y(1) = 1$.

Symbolically...

```
(C1) DEPENDS(Y,T)$
(C2) DIFF(Y,T)+Y^2+(2*T+1)*Y+T^2+T+1;
(D2) dY/dT + Y^2 + (2T + 1)Y + T^2 + T + 1
(C3) SOLN:ODE(D2,Y,T);
(D3) Y = - (%C T %E^T - T - 1) / (%C %E^T - 1)
(C4) SOLVE(SUBST([Y=1,T=1],D3),%C),NUMER;
(D4) [%C = 0.5518192]
(C5) SPECIFIC.SOLN:SUBST(D4,SOLN);
(D5) Y = - 0.5518192 T %E^T - T - 1 / 0.5518192 %E^T - 1
```

and Numerically.

```
(C6) FORTRAN(D5)$
      Y = -(0.5518192*T*EXP(T)-T-1)
      1 / (0.5518192*EXP(T)-1)
```

electromagnetic field problems, plasma physics, atomic scattering cross sections, control theory, maximum likelihood estimation, genetic studies, and more.

Available on many computer systems

Current systems include:

- Symbolics 3600™ Series
- VAX & MicroVAX II
- SUN-2 & SUN-3
- Apollo
- Masscomp

Other versions will be following soon.

For an information kit about all the ways MACSYMA can work for you, just call

1-800-MACSYMA.

In Mass., Alaska or Hawaii only, call (617) 621-7770.

Or please write to us at
**Computer-Aided Mathematics Group
Dept. M-PT4
Symbolics, Inc.
Eleven Cambridge Center
Cambridge, MA 02142**

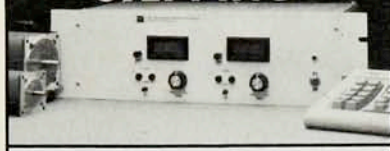
MACSYMA

**The most comprehensive software for
mathematical computing.**

symbolics™

Circle number 79 on Reader Service Card

LOW-COST INTELLIGENT STEPPING



THE NEW SMC-202A PROVIDES INTELLIGENT STEPPING MOTOR CONTROL FOR MUCH LESS THAN YOU WOULD EXPECT.

A Motorola 6809 microprocessor provides intelligent motion control including acceleration/deceleration ramping, stored program control, relative and absolute positioning. RS-232C interface standard, GPIB/IEEE-488 optional.

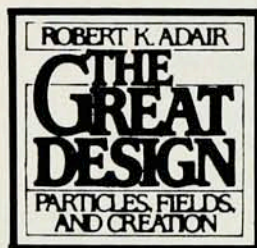
Provides computer, manual, or joystick control of up to 2 stepping motors. Prices start at \$995 for complete controller with all power supplies and motor drives built in.

Standard and custom stepping motor controllers available.

FOR COMPLETE INFORMATION WRITE OR CALL:

 **MAXWELL ELECTRONICS**
P.O. BOX 12033 RESEARCH TRIANGLE PARK NC 27709
800-922-0460 919-846-1633

Circle number 80 on Reader Service Card



From relativity and quantum mechanics to strong and weak interactions, gauge invariance, and cosmology, this comprehensive and accessible account of modern physics explains the discoveries that have changed the way we view the universe.

384 pp.; 159 linecuts,
\$24.95

At better bookstores or directly from
**OXFORD UNIVERSITY
PRESS**

Department NW, 200 Madison Ave
New York, NY 10016

Circle number 81 on Reader Service Card

teaching standards, but he was told to expect a cut in the university's budget and was compelled to stop hiring any more faculty or staff. Despite such limitations, Bath fared considerably better during the period of Matthews's leadership than many other academic institutions. While undergraduate intake remained static, the number of doctorates awarded by Bath increased considerably.

On his retirement in 1983, Matthews returned to Cambridge to teach. His advice on policy matters was eagerly sought after. That year he was appointed chairman of the government's select advisory committee on radioactive waste management.

Matthews never lost touch with students, to whom he was always approachable and stimulating. I met him for the first time in 1950 at the Cavendish Laboratory in Cambridge. I had gone there to request Nick Kemmer to take me on as a research student. In my first interview with Kemmer, he said: "All theoretical problems in quantum electrodynamics have already been solved by Tomonaga, Schwinger, Feynman and Dyson. Paul Matthews has done nearly the same for meson theories. He is finishing his PhD this year. Ask him if he has any problems left."

With characteristic generosity Matthews suggested the problem of renormalizing spin-zero mesons to all orders. He told me to work on it "till I get to work in the fall. If you don't solve it by then, I'll take it back."

During the few months that Matthews was still in Cambridge before his holiday I had daily contact with him. He provided me with intellectual as well as physical sustenance. This was just after the war, when Britain was in the throes of severe austerity, and to find a table at which Paul and his wife, Manzi, offered kosher sausages and other delights that defied the rationing allocations was for me the epitome of bliss.

I joined Matthews as a colleague in early 1951 at the Institute for Advanced Study, where we began a collaboration that continued over the next 14 years. He returned to Cambridge and acted as examiner for my PhD. We subsequently worked together on a field-theoretic formulation of Richard Feynman's path integrals. After I joined Imperial College in 1957, Matthews followed. We worked together on dispersion relations and on unitary symmetries.

I came to admire him more and more for his physics and his humanity. His clarity of thought and exposition were legendary among physicists and students. Imperial's undergraduates vot-

ed him best lecturer in physics year after year. His own insistence on excellence continued unblemished when, later, as vice chancellor at Bath, he was recognized by Britain's University Grants Commission for transforming the place into one of the country's model universities. With his untimely death, Britain and the physics world have lost a collegial giant and a prince among men, and I, one of the dearest of personal friends.

ABDUS SALAM
*International Centre for
Theoretical Physics
Trieste, Italy*

*Imperial College of Science and Technology
London, England*

George H. Vineyard

George H. Vineyard, director of Brookhaven National Laboratory from 1973 through 1981 and president-elect of The American Physical Society, died of cancer on 21 February 1987. He was 66 years old.

Vineyard's distinguished career centered on basic research in theoretical solid-state physics. In addition, he held many administrative positions at Brookhaven, culminating in his appointment as the laboratory's fourth director. He resigned to return to full-time research, remaining active even during his illness.

Born in St. Joseph, Missouri, in 1920, Vineyard studied physics at MIT, receiving his BS degree in 1941, and his PhD in 1943 with a thesis on the behavior of space charge in the cavity magnetron. From 1943 to 1946 he was on the staff of the MIT Radiation Laboratory, working on microwave electronics and radar.

VINEYARD

