

cays on the large accelerators have tended to confirm this theory. Marshak's research interests have included the energy sources of stars, atomic nuclei, and neutron diffusion, along with the work on elementary particles for which he was recognized with this award.

EPS honors von Klitzing with Hewlett-Packard Prize

Klaus von Klitzing of the Technical University of Munich has been selected by the European Physical Society to receive the 1982 Hewlett-Packard Prize. The award is presented annually in recognition of outstanding achievements in solid-state physics and includes a cash prize of 20 000 Swiss Francs (approximately \$9700) which is donated by the Hewlett-Packard Co.

The Society cited von Klitzing for "his work on the quantized Hall resistance in a two-dimensional electron gas." His experimental work employed the thin inversion layer of a metal-oxide semiconductor field effect transistor to form a two-dimensional electron gas. At low temperature and in the presence of a high magnetic field, von Klitzing observed that the Hall voltage went through well-defined plateaus as the gate voltage was varied. He determined that these plateaus occurred when the Landau level was fully occupied; the Hall conductivity was then a simple multiple of e^2/h (PHYSICS TODAY, June 1981, page 17).

The results of von Klitzing's experimental work have made it possible to verify with very high precision the value of the fine-structure constant, limited chiefly by the precision of voltage measurements. The effect also promises to provide an absolute standard of resistance, good to one part in 10^8 . Following von Klitzing's discoveries, many other experimenters have duplicated his results with other materials and extended the understanding of the phenomenon.

in brief

Steven Weinberg has been appointed to the Jack S. Josey Chair of Science at the University of Texas at Austin. He will also hold the title of Regental Professor, a designation for faculty who have won the Nobel Prize. Weinberg had held the Higgins Professorship at Harvard University and was a senior scientist at the Smithsonian Astrophysical Laboratory.

Kenneth L. Kiewer has joined Argonne National Laboratory's staff as associate

laboratory director for physical research. Kiewer was senior physicist and professor of physics at Iowa State University and associate director for science and technology at Ames Laboratory.

Robert L. Merlino of Columbia University has become assistant professor of physics and astronomy at the University of Iowa.

Milton Chang, executive vice-president and chief operating officer of Newport Corporation, has been elected to the Board of Directors of Uniphase Corporation.

New York Academy of Sciences honored several physicists: **Marvin L. Goldberger**, President of Caltech received the Presidential Award for service; **Ralph Alpher** of General Electric in Schenectady, New York, and **Robert Hermann** of the University of Texas, Austin, shared the Award in Physical and Mathematical Sciences; **Robert Griffiths** of the Department of Physics at Carnegie-Mellon University received the A. Chriessy-Morrison Award; and **Theodore Brewster Taylor** of the Applied Solar Technology Institute won the Boris-Pregel Award.

obituaries

Merle A. Tuve

Merle A. Tuve (1901-1982) pursued a distinguished career in science for half a century, making fundamental contributions in fields as diverse as atmospheric physics, nuclear spectroscopy, explosion seismology, biophysics, radio astronomy and image intensification for optical telescopes.

Tuve was born in Canton, South Dakota, on 27 June 1901. He acquired his early interest in electricity by building a telegraph line to the home of his childhood friend, Ernest O. Lawrence. He studied engineering at the University of Minnesota, receiving a graduate degree in physics, and became an instructor at Princeton before studying and teaching at Johns Hopkins.

Tuve's doctoral thesis at Johns Hopkins (1926) described the method by which he and Gregory Breit verified directly the existence of the ionosphere and measured its height. At a receiver several kilometers from a radio transmitter modified to emit short pulses, they measured the delay of signals reflected from the ionosphere relative to ones following a direct path. This work opened the field to research on the upper levels of the atmosphere. In addition, their studies of echoes from

Kenneth Teegarden has been named as the new director of the Institute of Optics in the University of Rochester's College of Engineering and Applied Science. He succeeds Nicholas George, who will now be able to devote his full time to research and teaching.

The University of Toronto has chosen **Irvine I. Glass**, professor of aerospace studies, to receive the highest honor the University bestows, that of University Professor. This title, usually held until age 65, is conferred in recognition of excellence in teaching and research and includes a research grant of \$4000 per year for five years.

J. David Cohen, formerly with Bell Laboratories, has become assistant professor in the physics department of the University of Oregon in Eugene. **John W. Farley**, from the University of Arizona, has become an assistant professor. **Roger Haydock**, from Cambridge University, has joined the staff as an associate professor. **Nilendra Deshpande**, formerly of the Institute of Theoretical Science, has become an associate professor. **John T. Mosley** has been appointed Director of the University's new Chemical Physics Institute.

buildings demonstrated the practicability of pulsed radar. At Tuve's urging, the US Navy initiated its development of this device.

In 1926, Tuve joined the staff of the Carnegie Institution of Washington, and in 1927 he and Breit undertook the investigation of the atomic nucleus with beams of accelerated particles. Their first accelerator, though technically a success in that it eventually produced a beam of 1-MeV protons, gave them many disappointments. An oil-insulated Tesla coil indeed produced the voltages required but punctured any vacuum tube tried except at voltages well below their goal of 5 MV.

With co-workers Lawrence R. Hafstad and O. Dahl, Tuve developed out of the adversity of the oil baths the multistage accelerator tube that is the heart of so many accelerators today. Learning of Van de Graaff's electrostatic generator, he immediately substituted it for the Tesla coil to produce the combination of multistage tube and belt generator that quickly led to the first Van de Graaff accelerator. It was a device that Tuve and his co-workers developed into a splendid instrument. They invented methods for controlling the voltage and distributing it evenly along the tube, for focusing the beam



TUE

and for measuring the total voltage through a corona-free resistor. It was their design for the ion source that was used throughout the 1930s on similar machines.

The 1.2-MV machine that Tuve built with Hafstad and Dahl in 1933 opened a new world of phenomena to them. Data on the $\text{Li}^7(p,\alpha)\text{He}^4$ reaction measured the energy dependence of barrier penetration. The bombardment of lithium with protons yielded something more beautiful, however—the first charged particle resonance, the 440-keV resonance of $\text{Li}^7(p,\gamma)\text{Be}^8$. This observation of the energy dependence of a (p,γ) cross section set the experimental foundation of nuclear reaction theory. It opened up nuclear spectroscopy, to which Tuve's group contributed many other resonances.

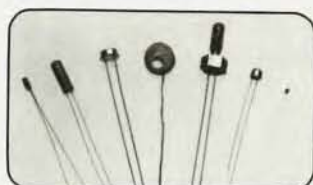
Tuve always sought the simplicities of nature. The goal that he and Breit set themselves in 1927 was the measurement of the scattering of protons by protons, the most direct measure of nuclear forces. It was a goal of which they never lost sight for over a decade. As Breit mastered the quantum mechanics for analyzing the results, Tuve with Norman P. Heydenburg and Hafstad set about mastering the instrumental techniques for measuring $\text{H}(p,p)\text{H}$. The experiment involved two problems that are difficult even with modern equipment: how to observe protons with energies as low as 100 keV and how to measure the current of the incident beam in a scattering chamber filled with hydrogen. The paper describing this experiment was followed by another describing the analysis; the two will be read and reread by generations of physicists. The results, which have never been improved upon significantly, measured the attractive nuclear forces that overwhelm the repulsive Coulomb force when the distance between the protons is small. The results could be described by a single

Cryogenic Thermometry Instrumentation Calibrations

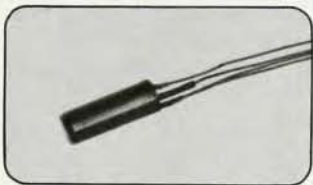
TO MEET YOUR NEEDS.



DRC-84C Temperature Controllers combine si-diode sensors and platinum RTD's to span 1.4 to 800K range.



Lake Shore silicon diode sensors are available calibrated, uncalibrated or matched to standard curves.



Germanium sensors are repeatable to $<0.5\text{mK}$. Carbon glass has least magnetic field dependence.



DRC-80 Thermometers feature dual-sensor input, interchangeable sensors, BCD and IEEE interfaces.



CST-900 Transmitters convert cryogenic temperatures to 4-20mA signals for industrial monitoring.



Versatile DTC-500A provides three-term temperature controllability to better than ± 0.5 millikelvin.

Whether your needs call for detection, measurement, or control of cryogenic temperature, Lake Shore can help. A wide selection of sensors, compatible instrumentation, reliable temperature calibrations, and competent applications assistance are just a few of the reasons you should come to Lake Shore . . . we know cryogenics COLD!

Cryogenic Thermometry • Instrumentation • Calibrations

 Lake Shore
Cryotronics, Inc.

64 E. Walnut St., Westerville, OH 43081 • (614) 891-2243

In Europe: Cryophysics: Witney, England • Jouy en Josas, France
Darmstadt, W. Germany • Geneva, Switzerland

In Japan: Niki Glass Co., Shiba Tokyo

Circle number 64 on Reader Service Card

KLINGER^{SCIENTIFIC} POSITIONING 'INGEN-EERING'

Klinger... Innovator in Micro-positioner Technology... Offers Precise, Repeatable Accuracy for Motor-Driven and Manual Positioning.

Eliminate guess-work... avoid costly problems. Klinger's precise 'Ingen-eering' and craftsmanship delivers Sub-micron position repeatability... with Linear Resolution to 0.1 micron... Angular Resolution to 0.001°.

Choose from a selection of Linear, Rotation and Elevation Stages. Stepping motor-driven units are computer compatible, utilizing programmable controllers with digital readout. They



provide backlash-free "Homing" capability with position feedback provided by optical encoders. Pre-loaded ball bearing guides assure high precision tracking. Virtually flawless stainless steel construction accounts for the long term durability and reliability. Now, here are a few applications...

- Integrated Circuit Manufacture and Testing
- Fiber Optic Positioning
- Ultra-Precision Machining
- Tracking and Interferometry
- Metrology and Elipsometry

Klinger... The Micropositioner 'Ingen-eering' People.

KLINGER^{SCIENTIFIC}

110-20 Jamaica Avenue
Richmond Hill, N.Y. 11418
(212) 846-3700

In Canada:
Optikon Corporation Ltd.
410 Conestogo Road
Waterloo, Ontario N2L 4E2 (519) 885-2551

Phone 212-846-3700
or write
for Catalog.



Circle number 65 on Reader Service Card

function of energy, the 1S_0 phase shift. This phase shift resulted from the same potential need to describe the scattering of neutrons by protons, provided a Coulomb term was added. It gave the first evidence that the nuclear component of the p-p force was the same as the n-p force—an idea that has been of extreme importance in the theory of the nucleus. These proton-proton scattering measurements also formed the basis for Hans Bethe's explanation of hydrogen burning by the sun through $H^1(p, e^+ \nu) H^2$.

The study of proton-proton scattering has, like Tuve's ionosphere and nuclear-resonance work, turned into a branch of physics, with the same experiment being repeated as ever higher energies are achieved with ever larger accelerators. Despite the unparalleled effort, none of these experiments—possibly not even all of them taken together—can match those measurements of 1936 for the quality of knowledge gained.

The outbreak of World War II touched Tuve deeply, and the defeat of France followed by the Battle of Britain brought him to the Navy asking them what they needed. The answer was a fuse for anti-aircraft artillery that would cause the shell to burst if it passed within 10 or 20 meters of the target. Within days Tuve and colleagues were dropping electron tubes off buildings and shooting them from a homemade cannon. These first efforts, which Tuve rapidly expanded into the Applied Physics Laboratory of Johns Hopkins University, culminated in a successful proximity fuse by 1942. These fuses, manufactured by the millions, allowed the US fleet to move into the Western Pacific, stopped the buzz bomb attacks on England, and were crucial in turning the Battle of the Bulge.

After the war, Tuve returned to the Carnegie Institution of Washington. As the new director of the Department of Terrestrial Magnetism he initiated programs in biophysics, geophysics and radio astronomy. He set up seismometers in the Andes and Alaska. He brought to the US the first radio-telescope, a captured German radar dish, with which he and Howard Tatel mapped the galaxy for its radio hydrogen. Noting that optical astronomy was limited by the poor efficiency of photographic emulsions, he organized a national science-industry partnership for developing an electronic image-intensifying device for optical telescopes. This device, which amplifies the energies of the photoelectrons, has effectively tripled the diameters of the world's astronomical telescopes.

After retirement, Tuve continued his radio-astronomical observations, with an all-sky survey of the velocities of

radio hydrogen. Here too he made fundamental contributions.

PHILIP H. ABELSON
Science

Douglas S. Billington

Douglas Sheldon Billington, the first director of the Solid State Division at the Oak Ridge National Laboratory, died of cancer on 9 April 1982, at the age of 69. He was internationally known for his pioneering research to determine the effects of nuclear radiation on materials. He wrote (with James H. Crawford) a book on this subject, *Radiation Damage in Solids*.

Born in Spearfish, South Dakota, Billington attended Yankton College, where he received a BA degree in chemistry in 1934. He did graduate work at the University of Iowa. He earned an MS degree in chemistry and metallurgy in 1941 and a PhD degree in the same fields in 1942. His professional career began in 1932 as a chemist with the Utah and Idaho Sugar Company. From 1935 through 1939 and again in 1942 and 1943, he was a research metallurgist with the Beryllium Corporation of America and from 1943 through 1946, he held a similar position with Linde Air Products Company.

Billington was one of the first scientists to recognize the importance of understanding the effects of nuclear radiation on materials, and he performed some of the first experiments to determine these effects. He performed this very early research on radiation damage from 1946 through 1949, when he was a staff member of the Naval Research Laboratory on loan to the Oak Ridge National Laboratory. He joined Oak Ridge in 1949 as chief of the

BILLINGTON



radiation effects section of the Metallurgy Division, and in 1950 he was named director of the newly established ORNL Physics of Solids Institute. This Institute was reorganized into the Solid State Division about a year later, and Billington served as an extremely capable and effective director of this Division for 21 years. In 1972 he was appointed senior research adviser to the ORNL Program Planning and Analysis Office; he later held the same position with the Metals and Ceramics Division. After his retirement in 1977, he continued his association with ORNL as a frequent consultant to the Metals and Ceramics and Solid State divisions.

MICHAEL K. WILKINSON
Oak Ridge National Laboratory
ALVIN M. WEINBERG
Institute for Energy Analysis

M. S. Rabinovich

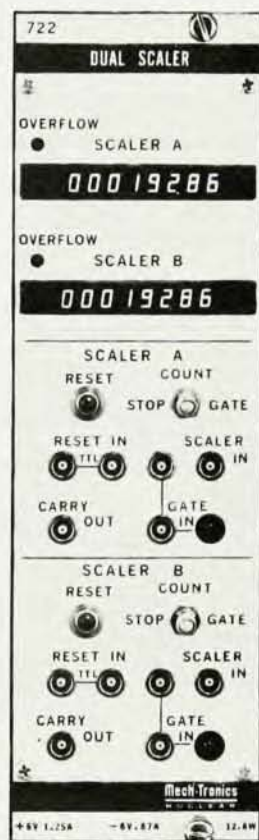
Matvey Samsonovich Rabinovich, a leading Soviet plasma physicist and a highly respected member of the international plasma-physics and controlled-fusion community, died in Moscow on 7 May 1982.

Rabinovich was born in Kazan on the Volga River. Following high school, he worked for a few years in a metal factory before he entered the University of Moscow, where he majored in physics. After graduation, he joined FIAN (the Institute of Physics of the Soviet Academy of Sciences), working with the accelerator team and under the tutelage of E. L. Feinberg. In the 1950s he became one of the leaders of accelerator theory in the Soviet Union and received both the Lenin and the State prizes for his contributions to the field. In 1957 he organized a new laboratory, the Fusion and Plasma Physics Laboratory of FIAN, which he led with great distinction until his last days. His knowledge of accelerator physics led him to the most sophisticated areas of fusion, in particular, stellarators, whose cause he championed during the many years they were out of fashion, with an energy and dedication which accounts in part for their recent renaissance.

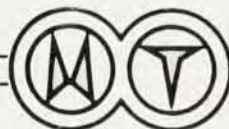
His initial research on accelerators concerned problems of betatron orbits and the collective effects involved in the capture of electrons from the injector. His later work dealt with synchro-phasatron modeling and cyclotron magnet and orbit calculations. In collaboration with Vladimir Iosifovich Veksler he studied collective acceleration problems, including the acceleration of plasma bunches by radiation.

Rabinovich's stellarator research began with experiments on the L-1 stel-

DUAL SCALER



Model 722
\$1100.00



- Dual Eight Decade 100 MHz Scaler
- Dual Eight Digit Displays with Overflow Indicator
- 50 Ohm Lemo Connectors
- Electrical and Manual Reset and Gate Control

Mech-Tronics

NUCLEAR

430A Kay Ave., Addison, IL 60101

For more information
WRITE OR CALL COLLECT
(312) 543-9304

Circle number 66 on Reader Service Card