his MS (1959) and PhD (1961) in electrical engineering from Stanford University. He then joined Bell Laboratories, where his initial research on gas lasers led to his 1964 discovery of laser action on the excited vibrational rotational transitions of carbon dioxide. This discovery and his subsequent invention of vibrational energy transfer between molecules eventually led to the demonstration that the carbon-dioxide laser could achieve high cw and pulsed power output without sacrificing high conversion efficiencies. Using the CO_2 laser, Patel made pioneering studies of nonlinear optical processes in the infrared region. In 1969 he invented the spin-flip Raman laser, a tunable infrared laser that uses high-power molecular lasers as its source of pump radiation. With the Raman laser, Patel made high-resolution spectroscopic studies of the ground and vibrationally excited states of molecular gases; he further demonstrated the laser's usefulness in detecting concentrations of atmospheric pollutants as small as one part in 10^{12} at atmospheric pressure. He developed the software that controlled the first laser-based spectroscopic equipment to take real-time measurements, via balloon, of stratospheric nitric oxide. The information obtained in these experiments was important to the understanding of the problem of ozone depletion by man-made nitrogen-oxide emissions from sources such as the SST. Patel became the director of Bell's electronics research laboratory in 1970. He became director of the physical research laboratory in 1976 and, in 1981, became executive director of research of Bell's physics division. Patel's current research interests include measurements of Lamb shifts in heavy hydrogenic atoms, the spectroscopy of highly transparent liquids and solids, and the surgical and medical applications of CO_2 lasers.

PATEL

American Academy of Arts and Sciences elects new members

The American Academy of Arts and Sciences recently elected 85 new members, including the following whose work is in physics or related fields: Howard C. Berg, Caltech; Raymond Davis Jr, Brookhaven National Laboratory; Richard E. Dickerson, University of California at Los Angeles; David J. Gross, Princeton University; Pierre C. Hohenberg, Bell Laboratories; Walter D. Knight, University of California at Berkeley; Roland W. Schmitt, General Electric Company; Abner E. Shimony, Boston University; William P. Slichter, Bell Laboratories, and James A. Westphal, Caltech.

The Academy also elected 19 new foreign members, including astrophysicist Donald Lynden-Bell of Cambridge University, Cambridge, UK.

in brief

Charles E. Whittle, assistant director of the Institute for Energy Analysis at Oak Ridge Associated Universities since its founding in 1974, has been appointed director of that institute. ORAU is a nonprofit association of some 50 colleges and universities that conducts research in energy-, health- and environment-related fields for the Department of Energy and other private and governmental organizations, as well as for its own member institutions. His predecessor, Alvin M. Weinberg, will remain at the Institute as a Distinguished Fellow and will continue his current research.

Richard H. Kropschot, associate director of the US DOE Office of Basic Energy Sciences for the past five years, was appointed head of Lawrence Berkeley Laboratory's newly established engineering division. Prior to joining DOE, he worked for 28 years at the National Bureau of Standards, becoming, in 1978, chief of the thermophysical properties division.

Richard T. Williams, formerly head of the ultraviolet technology section, optical probes branch of the Naval Research Laboratory in Washington, D.C., has joined the physics department at Wake Forest University in North Carolina as a Reynolds Professor of Physics.

James F. Decker, formerly director of applied plasma physics and director of scientific computing at the Department of Energy, has been appointed deputy director of the DOE Office of Energy Research.

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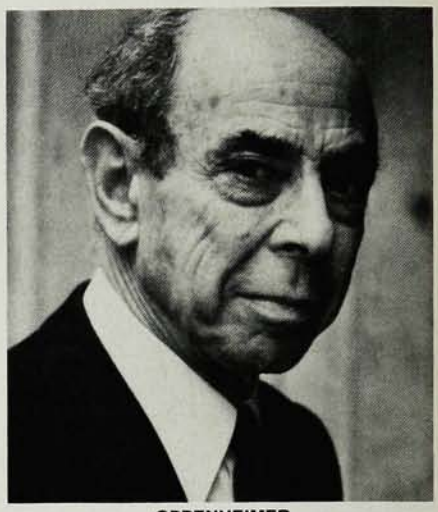
The University of Iowa has announced the following appointments: **John A. Goree,** formerly of Princeton University, has become an assistant professor of physics, with research emphasis in experimental plasma physics; and **Paul D. Kleiber,** formerly of the University of Iowa Laser Facility, has become an assistant professor of physics, with research emphasis in laser physics.

Ronald Ransome, formerly of the Max Planck Institut für Kernphysik, has become an assistant professor in the physics department at Rutgers University.

obituaries

Frank Oppenheimer



OPPENHEIMER

Frank Oppenheimer died on 3 February 1985 in Sausalito, California. Professionally a physicist, Oppenheimer was also a musician, a rancher and, not least, a teacher and an educator.

Oppenheimer was a graduate of Johns Hopkins; he worked at the Cavendish Laboratory in England and the Istituto di Arceti in Italy and received his PhD at Caltech in 1939. After spending 1939–40 at Stanford University, he went to work with Ernest O. Lawrence on the electromagnetic separation of uranium isotopes at Oak Ridge. He then came to the Los Alamos weapons laboratory in late 1943. There he became right-hand man to Kenneth T. Bainbridge, who was in charge of all preparation for the Trinity test site in the southern New Mexico desert. Oppenheimer had the primary responsibility for the instrumentation of that first nuclear explosion.

Reflections and discussions about the military and historical consequences of nuclear weaponry were never absent from the wartime centers of the Manhattan Project, as Alice Kimball Smith's history makes clear (A. K. Smith, *A Peril and a Hope: The Scientists' Movement in America* 1945–47, Chicago, 1965). At isolated Los Alamos they were muted, though I remember a good many. I was an administrative assistant to Robert Oppenheimer, and I later wrote the wartime history of the laboratory. What was latent at Los Alamos got strong expression after Hiroshima and Nagasaki. Frank Oppenheimer was involved in the beginning of the Association of Los Alamos Scientists, and somewhat later he joined in the national Federation of American Scientists. I think we all soon realized that we were plowing fresh ground, politically. There simply were no informed and intelligent party platforms on the subject, Left, Right or "Center." From then on, for many of us, the cause of nuclear pacificism preempted political energies. Not pacifists from the beginning, those who worked on the Manhattan Project knew what their work had done to two cities, and what upward of a millionfold enhancement of explosive power could mean for the institution of war. If that realization came too late, it has seemed to come far later to the big political world. Though we and others failed in those early efforts toward some system of international controls, the commitment has remained. With Oppenheimer it surely did.

After the war, Oppenheimer returned to Berkeley for a time and then in 1947 went to the University of Minnesota. There he undertook research that proved to be a landmark in the development of cosmic-ray physics. At that time there was still no firm knowledge of the nature or origin of the rays. The mean value of their upwardly skewed energy distribution was greater, by a factor of a thousand, than the greatest cyclotron energies, and no known astronomical process could produce such energies. Fermi first pointed out that atoms could reach such energies by equipartition with the stars; but whatever the mechanism of their acceleration, the crucial step was to catch the primary rays themselves at high altitudes. Oppenheimer chased balloons across the Minnesota countryside by car and plane and, later, at low altitudes, across the Caribbean—courtesy of the US Navy. His group and that of B. Peters (University of Rochester) collaborated; the one using cloud chambers, the other photo emulsions.