was the predecessor of positron emission tomography scanning, which is used today in nuclear medicine.

Laughlin was vice president of the cancer center from 1966 to 1972 and, from 1980 until his retirement, was a professor of radiology at Cornell University Medical College. He was an emeritus member of the Sloan-Kettering center. During his career, he published more than 200 papers on biophysics and medical physics topics.

An active participant in a number of organizations, Laughlin was a founder and president, from 1964 to 1965, of the American Association of Physicists in Medicine (AAPM). He also led several societies: the Health Physics Society (1960–61), International Organization of Medical Physics (1969–72), and Radiation Research Society (1970–71). He chaired the Medical Advisory Committee of the New York City Department of Health from 1960 through 1978 and, in 1992, was vice president of the Radiological Society of North America. Laughlin was the editor-in-chief of *Medical Physics* (1988–96), a consultant to the Atomic Bomb Casualty Commission and Los Alamos National Laboratory, and a fellow of many organizations.

Among his many honors were AAPM's William D. Coolidge Award (1974), the Distinguished Scientific Achievement Award of the Health Physics Society (1982), the Aebersold Award of the Society of Nuclear Medicine (1984), the Gold Medal of the American College of Radiology (1988), the Marvin M. D. Williams Professional Achievement Award of the American College of Medical Physics (1992), and the Gold Medal of the American Society for Therapeutic Radiology and Oncology (1993).

Laughlin was very proud of his Scottish heritage and was known for appearing at parties dressed in a red tartan vest. He was an inveterate music lover: He and his wife, Eunice, enjoyed the Wednesday evening subscription series at the Metropolitan Opera and subscribed to the Rockefeller University concert series. He loved to coax unwary visitors into playing squash and wicked croquet games in his backyard.

Jean St. Germain
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New York City

Hans Pauly

Hans Pauly, a highly respected, internationally known leader in the development of molecular-beam scattering studies of intermolecular forces, died of a heart attack on 13 March 2004 at his home in Göttingen, Germany. He had been a founding director of the Max Planck Institut für Strömungsforschung (Max Planck Institute for Fluid Dynamics; renamed the Max Planck Institute for Dynamics and Self-Organization in 2004) in Göttingen and was instrumental in transforming that institute into a world-class center for molecular-beam research.

Born in Bonn on 12 November 1928, Pauly grew up in Cologne and Bonn. He entered the University of Bonn in 1949, a few years after its reopening following World War II. He devoted his *diplom* project, which he carried out under the direction of Wolfgang Paul, the newly appointed professor of experimental physics who would later share the 1989 Nobel Prize in Physics, to the construction of a special ion source for the just-developed quadrupole mass filter. Subsequently, he was fascinated by the vision of Paul's colleague, Rudolf Jaeckel, who wanted to explore atomic collision processes in vacuum diffusion pumps to improve the pumps' performance.

Working largely independently, Pauly realized the basic importance of intermolecular potentials. To investigate them properly, he constructed in 1955 the first prototype of a modern molecular-beam apparatus, which in itself was a remarkable accomplishment considering the still-adverse postwar conditions. His successful measurements of the velocity dependence of integral atom–atom scattering cross sections confirmed the $v^{-2/5}$ law predicted by H. S. W. Massey and C. B. O. Mohr in 1933. Pauly's findings thereby provided the first direct experimental confirmation of the R^{-6} radial dependence of the fundamentally important long-range attractive potential predicted in the 1930s by Fritz London and others. In his 1958 doctoral dissertation, entitled "Streuversuche an Molekularstrahlen" ("Molecular Beam Scattering Experiments"), Pauly developed and anticipated many aspects of modern quantum mechanical approximations for calculating atomic collision cross sections.

Hans Pauly

His research and the parallel independent molecular-beam experiments on chemical reactions in the US, triggered by the breakthrough experiment of Ellison Taylor and Sheldon Datz in 1955, were responsible for the ensuing rapid developments in molecular-beam scattering experiments in the early 1960s. His work also stimulated the research of US scientists Richard Bernstein, Datz, Ned Greene and his colleague John Ross, Dudley Herschbach, and Erhard Rothe and colleagues and inspired related studies in Europe largely by the German groups of Dieter Beck, Otto Osberghaus and Christof Schlier in Freiburg, and Hans-Gerhard Bennewitz and one of us (Toennies) in Bonn. It was the spectacular successes of those groups that ultimately convinced the Max Planck Society to reorganize the MPI Strömungsforschung in 1969 to make molecular-beam scattering research a central part of that institute.

In the newly reorganized institute, Pauly and his colleagues continued their precise measurements of scattering cross sections. They systematically investigated elastic integral and small-angle differential cross sections and resolved glory undulations and identical particle oscillations and resonances, first for alkali atom projectiles and then for nonalkali systems with all kinds of targets. To extend the collision energy range to more than 1000 eV, an effective charge-exchange source was developed. Similar experiments were carried out for measuring large-angle differential cross sections and completely resolved the supernumerary rainbow oscillations with superimposed, closely spaced interference oscillations. Through a newly developed, highly efficient scheme, the measured cross sections could be inverted to obtain precise experimental potential curves for the first time.

Those and related experiments stimulated calculations by quantum chemists throughout the world. Subsequent investigations at the institute were devoted to understanding the interactions of electronically excited atoms, either short lived (laser excitation) or long lived (metastables). Careful execution and extraordinary precision coupled with elegant theoretical

modeling were hallmarks of the Göttingen research. Pauly retired from the institute in 1996.

A quiet, gentle, and modest person with the proverbial humor of a Rhinelander, Pauly occasionally enjoyed a good joke. As a colleague and group leader, he was open for discussions and would freely share his deep insights and vast experience. His students and coworkers are deeply grateful to him for supporting them generously, while simultaneously giving them sufficient freedom for their own scientific development.

Pauly will long be remembered for his many reviews, some with one of us (Toennies), but especially for his authoritative two-volume monograph *Atom, Molecule and Cluster Beams* (Springer, 2000). He is missed not only by his wife and two children, but also by the molecular-beam community. We have lost a great scientist, an inspiring teacher, and a loyal colleague.

Udo Buck
Rudolf Düren
J. Peter Toennies
Max Planck Institute for Dynamics and Self-Organization
Göttingen, Germany

Rendel Sebastian Pease

Rendel Sebastian Pease died in Oxford, England, on 17 October 2004 after a short illness. Bas, as he was commonly known, was a former director of the UK research program on controlled thermonuclear fusion research (CTR) and a pioneer in the global program to develop a reactor system based on the fusion of hydrogen isotopes. His vision, scientific acumen, international outlook, and often sheer bloody-minded persistence ensured that the CTR program was never without funding nor indeed out of the headlines.

Bas was born on 2 November 1922 in Cambridgeshire, England, into an academic family. It is difficult to ignore the influence of his distinguished family background on his ambition and confidence. His father was a geneticist at Cambridge University and his grandfather a cofounder in 1884 of the Fabian Society, a socialist think tank. On the maternal side, Bas's grandfather was Josiah Wedgwood, a Labour Cabinet minister. Through the Wedgwoods, Charles Darwin and John Maynard Keynes appear in the family tree, which also boasts of 10 fellows of the Royal Society by 1900. In 1977 Bas kept the family tradition going by being elected a fellow in the society.

During the early 1940s, Bas studied physics at Trinity College, Cambridge. His studies were interrupted by a spell of wartime service, during which he was directed to the Royal Air Force Bomber Command's Operational Research Service. As a member of an operational unit that studied bombing strategy, he had the task of assessing the effectiveness of radar guidance.

After finishing his interrupted BSc in 1947, Bas joined the general physics division of the United Kingdom Atomic Energy Authority (UKAEA) at Harwell. His contributions to early solid-state structure research on fission-reactor-relevant materials, for which he, in collaboration with George Kinchin, used mostly x-ray analysis, have often been cited. To quote Mick Lomer, an early colleague and later successor to Bas as director of Culham Laboratory, "Bas was the itinerant particle that mediated many interactions."

In 1955 Bas moved to the CTR program, whose flagship at Harwell was the toroidal pinch experiment ZETA. The role of radiation loss was highlighted in the determination of a critical pinch current now known as the Pease current. Following international declassification of controlled fusion research in 1958, the main proponent countries—the UK, the US, and the USSR—were pursuing different routes toward the goal of CTR: ignition. The performance of the fusion devices in the West was, however, some seven orders of magnitude short of the requirements for ignition. It was not surprising, therefore, that in 1967 a UK committee assessing the prospects for a fusion reactor recommended a severe cut in the fusion budget. A second problem was the growing and continuous pressure from the UK government to diversify UKAEA staff into commercially viable activities. Bas was appointed director for fusion research in 1968 at the Culham Laboratory. He solved the first problem through his international contacts and the second by minimal concessions to nonfusion activities. At the time, the laboratory was recognized internationally as a CTR powerhouse, and Bas was determined to preserve if not enhance its reputation.

Bas maintained excellent relations with scientists outside the UK. Despite the prevailing cool political climate between the Soviet Union and the West, in 1969 Bas sent a team of UK scientists led by one of us (Peacock) to make measurements on T3, a Soviet tokamak device. The Anglo–Soviet experiments confirmed the outstanding performance of the tokamak and had an almost immediate impact on CTR worldwide. The photograph below shows Bas discussing the Anglo–Soviet experiments on the T3 tokamak with Mel Gottlieb, director of the Princeton Plasma Physics Laboratory, at a conference in Dubna, USSR, in October 1969. Bas's international outlook and contacts paid dividends again in 1978, when, as director of Culham, he ensured that UKAEA would host the European Joint European Torus (JET) project, which is the largest operational fusion experiment in the world.

Rendel Sebastian Pease (right), with Mel Gottlieb

Director of Culham from 1968 until 1981 and then program director for fusion until his retirement in 1987, Bas presided over many advances in our understanding of the behavior of high-temperature plasmas in magnetic fields. His annual talks in which he reviewed the lab's entire program were regarded by the staff as a tour de force. Bas initiated several important fusion reactor studies. He insisted that whatever the funding situation, the UK should have an in-house fusion program