

the highest grade on the condition that he not attend the lectures. Asher's first article in theoretical physics, written when he was a second-year undergraduate, was recommended by Louis de Broglie for publication in the *Comptes Rendus*. The article was accepted and appeared in the journal in 1954. A few years later, the physics department got a major boost when Nathan Rosen, the "R" of the celebrated EPR (Einstein-Podolsky-Rosen) gedanken experiment, joined the faculty. Asher became Nathan's graduate student, and their association grew into a lifelong mutual admiration. (Asher outlived his mentor and asked to be buried next to him.)

For his doctoral thesis, Asher calculated the gravitational radiation from an orbiting star. Although the existence of such radiation is indirectly proven by the decreasing periods of binary pulsars, antennas sensitive enough to measure it directly are only now being built. Making a precise calculation of gravitational radiation from astrophysical sources is a topic of much current interest because of its relevance to LIGO, the Laser Interferometer Gravitational Wave Observatory, and the planned LISA, the Laser Interferometer Space Antenna.

Asher joined Technion after receiving his PhD in 1959. He was rapidly promoted to full professor and remained at the university for the rest of his career. He was appointed Distinguished University Professor in 1988.

His work ranged from solving practical problems to tackling visionary and foundational issues. Work with one graduate student on the statistical properties of matrix elements of chaotic systems led to what is now known among mathematicians as the Feingold-Peres conjecture and among physicists as the Feingold-Peres theory. But Asher's greatest impact was on the foundations of quantum theory and the theory of quantum information. He was one of six authors of the 1993 quantum teleportation paper published in *Physical Review Letters*. That paper showed that even though no direct measurement can extract complete information about the state of a quantum particle, a combination of entanglement and classical communication can be used to transfer the state perfectly to another particle that has never been near the first particle. Quantum teleportation has since been experimentally confirmed in several laboratories. When a reporter asked Asher if quantum teleportation could teleport the soul as well as the body, Asher answered, characteristically, "No, not the body, just the soul."

In another important contribution, Asher showed that if conceptually re-

versing the direction of time for just one of two particles results in a nonphysical situation with negative probabilities, the two particles must be entangled. This criterion of entanglement (in mathematical terms, nonpositivity of the partial transpose of the system's density matrix) has since spawned a rich qualitative and quantitative theory of entanglement and other manifestations of nonlocality in quantum mechanics. Asher's last two students, Netanel Lindner and Petra Scudo, worked on the problem of efficiently communicating a different kind of information, namely, spatial directions and reference frames, using quantum particles.

Asher was a man of strong opinions, which he encapsulated in aphorisms such as

- Unperformed experiments have no results.
- Quantum phenomena do not occur in a Hilbert space, they occur in a laboratory.
- Quantum mechanics needs no interpretation.
- Never underestimate the ingenuity of experimental physicists.

His textbook *Quantum Theory: Concepts and Methods* (Kluwer Academic, 1993) is arguably the modern successor of John von Neumann's book *Mathematical Foundations of Quantum Mechanics* (Princeton U. Press, 1955). The uncertainty principle, for which Asher had little use, is relegated to a single entry in the index that points to the same page of the index.

In most arenas, Asher feared no one and did not aim to please. In 1983, while chairman of the physics department at Technion, he nominated—during the days of the Israel-Lebanon war—Menachem Begin, Israel's then prime minister, for the Nobel Prize in Physics. As justification, Asher said Begin deserved the physics prize as much as the peace prize, which he had shared with Egyptian President Anwar al-Sadat in 1978. The prime minister's office did not appreciate the humor, and the Technion president felt it necessary to apologize to the Swedish Academy. The academy responded that it feared the Technion president may have lost some of the spirit of good Jewish humor.

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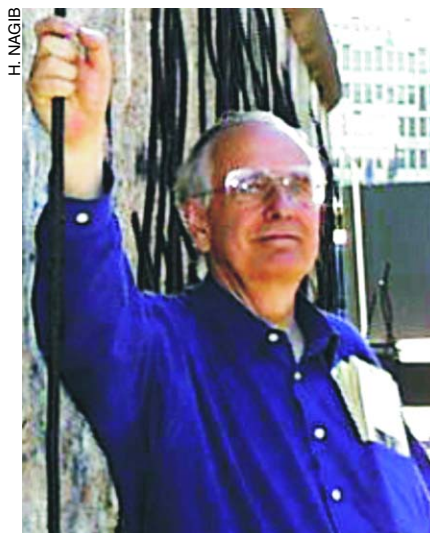
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Dietrich Wolfgang Bechert

The fluid mechanics community has lost Dietrich Wolfgang Bechert, retired chief scientist at the Institute for Turbulence Research of the German Aerospace Organization (now called DLR) in Berlin. Dietrich died on 1 December 2004 in Berlin of complications after a successful chemotherapy. His death was a shock because he had always downplayed the seriousness of his health problems.



Dietrich Wolfgang Bechert

Dietrich was open, caring, and sensitive, and had a great sense of humor. To those familiar with Berliner slang, his wit is preserved in cryptic acknowledgments in some of his scientific publications. Inspired by his superiors, particularly Eberhard Pfizenmaier, the director of his institute, he pursued his work with uncompromising perfectionism and persistence. Dietrich's passionate dedication to his work and his refusal to grant requests for quick results made him one of the preeminent experimentalists in fluid mechanics; he was also well versed in theory.

I had the immense privilege of learning firsthand his exceptional qualities in the fall of 1987, when, equipped with water and cookies, Dietrich and I spent many nights in the basement of the Institute for Turbulence Research. There, we experimentally investigated the theoretical prediction that low-density jets develop self-excited oscillations below a critical density. Measurements were impossible during the day because of vibrations from scores of shopping buses from Poland that were parked, engines running, in front of the building.

Born in Munich on 7 August 1936, Dietrich received his *diplom* in mechanical engineering from the Technical University Darmstadt in 1962. He subsequently pursued his doctoral work at TU Berlin under Rudolf Wille, who directed both the university's Hermann Föttinger Institute and DLR. Dietrich, who joined DLR in 1965 as a scientific collaborator, received his PhD in 1968 for his thesis on planar jets deviated by lateral flow. In 1986, TU Berlin awarded him the *habilitation*, and the DLR named him *Seniorwissenschaftler* (chief scientist) in 1989.

For nearly 40 years, Dietrich worked at DLR, except for a brief stint at 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 in 1971 and a sabbatical in the US at the University of Houston in 1980–81. The photo on page 66 shows him in 2000 next to a remaining section of the Berlin Wall, within which he had lived for 25 years.

Dietrich's remarkable scientific achievements cover acoustics, flow instabilities, turbulence, and biology-inspired fluid mechanics. They include the definitive experimental test (in 1975) of the unsteady Kutta condition at a nozzle lip, followed in the early 1980s by the only fully quantitative experiment on the coupling between an acoustic field and Kelvin–Helmholtz instability waves at the origin of a planar two-stream mixing layer. Beginning in the mid-1970s, he used the directional-microphone-array technique to resolve the question of whether the dominant noise produced by fast trains was aerodynamic in nature or came from the wheels. That research prompted a long-term collaboration on railway noise between DLR and German Rail.

His most widely noted research concerned the drag-reducing properties of shark skin and other structured surfaces. In the late 1980s he built a unique oil channel and a novel differential balance to measure turbulent skin friction to within a fraction of a percent. In the mid-1990s, after years of painstaking improvements to that flow facility, he clarified what large-eddy break-up devices, or LEBUs, do to turbulent boundary layer flows.

Also during the mid-1990s, he optimized the so-called riblet surface—a surface with tiny ridges running in the direction of the flow—and achieved the world record for drag reduction by riblet surfaces: about 10%

relative to a smooth surface. Dietrich worked with the 3M Co on a riblet foil that was later used on a prizewinning America's Cup yacht (Cup rules have since barred its use) and tried on commercial airplanes. The foil did lead to substantial fuel savings, but its price and maintenance problems prevented its widespread use.

In later years, Dietrich became convinced that Nature had much to teach engineers; the difficulty was in seeing and understanding what Nature had to offer. Inspired by birds that raise their feathers on the suction side of their wings during a slow-landing approach, Dietrich started a research program on anti-return-current flaps in the late 1990s. That program successfully delayed and stabilized flow separation on a motorized glider plane. He was also closely involved in the German Research Foundation's (DFG's) priority program on control of complex turbulent shear flows.

Dietrich's outstanding scientific achievements have been internationally recognized. In 1986, he won the DFG's Ernst Mach Prize. The first Bionic Prize of the Society for Technical Biology and Bionics, Saarbrücken, and the Association for Bionics, Taufkirchen, was presented to him in 1992. He received the Philip Morris Research Prize in the transport and traffic category in 1998.

After he retired in 2001, Dietrich remained active on the lecture circuit and in the DFG's priority program on flow control. His last major talk was the 2004 Lanchester Lecture "Aerodynamics and Biology" at the Royal Aeronautical Society in London.

You are sorely missed, Dietrich, by your family, your friends, and the fluid mechanics community.

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Martin Jacob Berger

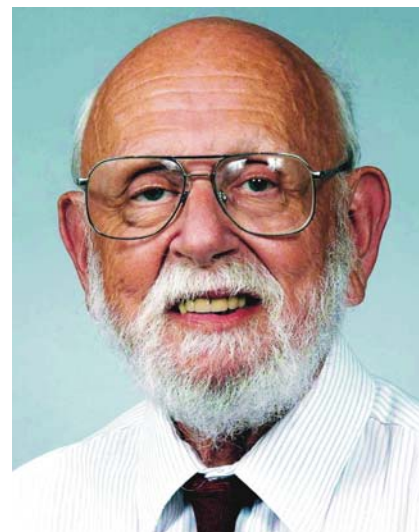
Known as the father of electron and proton Monte Carlo methods, Martin Jacob Berger, chief of the radiation theory section of the National Bureau of Standards (now NIST) for more than 20 years, died in Bethesda, Maryland, on 6 November 2004 from the effects of a hematoma after a fall in which he struck his head.

Born in Vienna in 1922, Martin left Austria in 1938 just before its annexation by Nazi Germany. After 18 months in England, he immigrated to the US in 1940 and earned a BS in physics from the University of Chicago three years later. He became a US citizen in 1944, joined the Army,

and served in the Aleutian Islands until 1946. Shortly after his discharge, he began his graduate work at the University of Chicago and earned an MS (1948) and a PhD (1951), both in physics. He prepared his doctoral thesis under Marcel Schein on "Multiple Scattering of Fast Protons in Photographic Emulsions" and stayed on for a one-year postdoctoral fellowship in mathematical statistics.

Martin had heard that Ugo Fano and Lew Spencer of NBS had been doing work on ionizing radiation, so he wrote to them, was invited for an interview, and was hired. In September 1952 he joined the radiation theory section, headed by Fano, within the atomic and radiation physics division, led by Lauriston Taylor. Twelve years later Martin became chief of the radiation theory section and was in charge of as many as 12 physicists; he held that position—through various reorganizations and a renaming—until his retirement in 1988.

At NBS in the 1950s, Martin concentrated first on the transport of gamma rays and the development of photon Monte Carlo methods. He pioneered Monte Carlo calculations in complex media and extended them to realistic configurations involving boundaries and inhomogeneities. For the work on photon transport, Martin collaborated with colleagues in the radiation theory section to survey and compile cross-section information. One such colleague was Rosemary McGinnies, who wrote several important early evaluations. In 1960 Martin married Rosemary; they later had three children and six grandchildren. Over the years, Martin retained his interest in photon-interaction cross sections and collaborated on critically evaluated databases that



Martin Jacob Berger