those who had the fortune of interacting with him. We shall dearly miss him.

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Juerg Xaver Saladin

Juerg Xaver Saladin, a pioneer in nuclear structure studies and a professor emeritus at the University of Pittsburgh, passed away on 29 May 2014 in Pittsburgh, Pennsylvania.

Born on 25 July 1929 in Solothurn, Switzerland, Juerg pursued his undergraduate and doctoral studies at ETH Zürich, from which he received BS and PhD degrees in nuclear physics in 1954 and 1959, respectively. His doctoral thesis on nuclear scattering and polarization was completed under the direction of Pierre Marmier. As a postdoctoral researcher at the University of Wisconsin–Madison, Juerg continued to pursue his interest in polarization measurements in transfer reactions.

Juerg joined the faculty of the department of physics and astronomy at the University of Pittsburgh in 1961. Shortly afterward, he began his research studies using the newly installed, and the world's first, three-stage Van de Graaff accelerator. He was among the first to use the reorientation effect in Coulomb excitation to carry out precise measurements of the quadrupole moments of nuclear excited states and infer nuclear shapes. Particularly noteworthy were his group's comprehensive studies of the transition of nuclear deformation from a prolate shape to an oblate shape.


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Juerg Xaver Saladin

In the early 1970s, Juerg developed a quantum mechanical formulation of the Coulomb excitation process, which allowed a more accurate computation of cross sections compared with the earlier semiclassical calculations. That code was used for an extensive study of hexadecapole deformation in rare-earth nuclei. His results showed a beautiful evolution from positive deformation values ("barrel" nuclei) at the beginning of the nuclear shell to negative values ("clover-leafed" nuclei) in the second half of the shell.

In the 1980s Juerg used gamma-ray spectroscopy to study nuclear structure at high spins. He conceived and constructed the Pittsburgh array of Compton-suppressed germanium detectors—a first for a university group. He and his collaborators used the array at several laboratories to explore the structure and shapes of nuclei, how different shapes might coexist and mix, and how nuclear shapes could evolve with increasing angular momentum. That work, with collaborators who were, in many cases, his former students, culminated in studies of highly elongated "super-deformed" medium-mass nuclei.

Juerg was the director of Pitt's Nuclear Physics Laboratory from 1980 until 1997. Although he retired from the university in 1998, he maintained his passion for nuclear physics and continued his research for many years as a professor emeritus.

During an academic career spanning nearly 40 years, Juerg mentored more than 30 graduate students and postdoctoral fellows. Not only did he provide his students with a superb, broad, and balanced training experience, he also invariably acted as their greatest advocate as they launched their careers. Remarkably, Juerg continued his personal and professional association with his former students long after they had graduated, and he followed their careers with great interest. Many of his former students considered him a dear friend and a father figure to whom they turned regularly for support, wise counsel, and sound advice. Their appreciation was in evidence when 17 of his former students, including several from overseas, attended the symposium held in honor of his retirement.

A lover of classical music, Juerg had a great sense of humor and was full of interesting life stories, which he loved to relay. A particularly memorable event occurred when he was a young captain in the Swiss Army and was leading an armored column on practice maneuvers during a storm. They got lost and arrived at a nondescript barbed-wire fence. Undeterred, Juerg ordered the wires to be cut and the column to keep moving. Sometime later, the column reached a border crossing that was manned by French border guards—on the wrong side! Only then did he realize that they had been conducting their military exercise in the wrong country, making him the most recent commander to invade France.

Juerg had boundless energy and a contagious enthusiasm for science, which he conveyed to the next generation. He will be remembered for his warm, vibrant personality and for the profound and lasting effect he has had on his friends, students, and colleagues.

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Charles Hard Townes

Charles Hard Townes died peacefully on 27 January 2015 in Oakland, California. Coinventor of the maser and laser, he was famous as well for his research in microwave spectroscopy and astronomy.

Charlie was born on 28 July 1915 in Greenville, South Carolina, the fourth of six children. He grew up on a farm, and he often emphasized that his interest in science and nature started there, when he and his older brother, Henry (later a well-known entomologist), explored the woods and streams around their home. After graduating from Furman University in 1935, he got his master's at Duke University and carried out his PhD work at Caltech. His thesis, completed in 1939 under William Smythe, was on the separation of isotopes and the determination of their nuclear spins. He then took a position at Bell Labs in New York, where he worked on secondary electron emission from surfaces bombarded with ions.

During World War II, Charlie worked on shortwave aircraft radar. Profiting from the technical know-how he had gained, in 1945 he began exploring the properties of molecules with high-resolution microwave spectroscopy, initially at Bell Labs and, starting in 1948, as an associate professor at

Columbia University. Over the next seven years, Charlie and his students and postdocs carried out breakthrough studies on molecular structure and on spins and quadrupole moments of atomic nuclei. That research culminated in the seminal 1955 textbook *Microwave Spectroscopy* by Charlie and Arthur Schawlow, his postdoc and brother-in-law.

One emerging goal was the push to millimeter and even IR wavelengths, where many molecules have their rotational–vibrational transitions. However, the lack of electronic oscillators made progress difficult. But the general idea of exploiting atomic and molecular transitions as natural oscillators, along with wave amplification through stimulated emission, led to the maser in the early 1950s. Since Albert Einstein's 1917 paper, numerous physicists have considered the possibility of exploiting stimulated emission. Inversion population had been demonstrated by Willis Lamb and Robert Retherford in 1950 and by Edward Purcell and Robert Pound in 1951. However, because of inherent losses in the apparatus, none of the researchers demonstrated a practical level of gain sufficient for applications.

Charlie told the story of how he had a "eureka" moment in 1951 while sitting on a park bench in Washington, DC: A device with substantial gain could be developed by employing a Paul quadrupole focuser to generate an intense beam of ammonia molecules in the excited state and feeding the beam through a resonant cavity whose highly conducting walls would help to supply the necessary positive feedback.

Indeed, in 1954 Charlie, student James Gordon, and postdoc Herbert Zeiger reported the operation of the first NH_3 maser and demonstrated its potential as oscillator, amplifier, and clock. Independently, Aleksandr Prokhorov and Nikolai Basov at the Lebedev Physical Institute in Moscow proposed a maser device of a similar design.

The foundational work by Charlie, Prokhorov, and Basov instantly created the new field of quantum electronics. For their achievements, they were awarded the 1964 Nobel Prize in Physics.

The demonstration of the first practical maser, together with a conceptual paper in 1958 with Schawlow describing how an "optical maser" could be constructed by embedding the active medium in a Fabry–Perot open resonator, led the way to the plethora of short-wavelength lasers that have since been invented. In the early 1960s, Charlie and his students used a ruby laser for

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Charles Hard Townes

research in the new field of nonlinear optics. Among Charlie's discoveries during that period were stimulated Brillouin scattering and self-trapping of optical beams.

Charlie was drawn to new, unexplored territories of scientific inquiry. Once he had done the initial exploring, he was happy to move on and leave the wonderful playgrounds to others; he did so in 1955 when he left microwave spectroscopy and in the early 1960s when he moved his attention away from the laser.

After the 1957 "Sputnik shock," Charlie felt a strong duty to help his country with scientific and technical advice. He spent 1959–61 in Washington, DC, as vice president of the Institute for Defense Analyses. There he founded the JASON advisory group. Later Charlie served on the Apollo program advisory committee and the science advisory committees to four US presidents. In the early 1980s he chaired the MX missile basing committee under President Ronald Reagan.

After several years as provost of MIT, Charlie returned to basic research in the late 1960s. He joined the University of California, Berkeley, and worked in microwave and IR astrophysics. Charlie had been interested in astronomy for some time. With his students—including Arno Penzias, who later shared the Nobel Prize for the discovery of the cosmic microwave background—and colleagues at the US Naval Research Laboratory, Charlie put his first tunable ruby maser from 1956 to good use as a sensitive amplifier for radio astronomy. In a paper for the 1957 General Assembly of the International Astronomical Union, he laid out a detailed list of interesting radio and millimeter transitions of atoms and molecules. That paper was a prescient preview of the emerging field of astronomical molecular spectroscopy. At Berkeley, Charlie and William Welch pioneered the field with their detection of ammonia and water in interstellar space in 1969. Their work demonstrated that interstellar clouds are much denser than previously thought and that many species of molecules can form.

Charlie's work on detecting rapidly moving ionized gas clouds at the center of the Milky Way provided the first evidence for a concentration of mass there of about 4 million solar masses. By 1982 Charlie and his team were fairly certain that the object was a massive black hole, whose existence in galactic nuclei had been proposed by Donald Lynden-Bell and Martin Rees. With increasing resolution and precision, detailed studies of orbiting stars have since confirmed Charlie's conclusion.

At Berkeley, Charlie also pioneered the development of IR spatial interferometry, which kept him busy until a few years ago. By extrapolating radio-interferometry techniques to a wavelength of 10 μm and replacing electronic oscillators with carbon dioxide lasers, Charlie resolved and mapped the IR emission from dusty stars at a level of detail far surpassing that possible even with the largest ground-based telescopes.

Charlie was devoted to his family and was a deeply spiritual person. He was an active member of the local church communities wherever he lived and strongly felt that science and religion are not in opposition but constitute different but related routes for exploring and understanding the universe. His levelheadedness, fairness, optimism, and humanity were rooted in that spirituality. To his colleagues and students, Charlie was a role model and a revered mentor. He deeply cared for his students. The intensity and vibrancy in his research group was legendary, driven by Charlie's relentless curiosity and boundless energy. It was an enormous privilege to be a member of the Townes group. The passing of Charles Townes marks the end of an era. The community of physicists will miss this great man and colleague.

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