

OBITUARIES

Felix Hans Boehm

Eminent nuclear experimentalist Felix Hans Boehm passed away on 25 May 2021, a few days before his 97th birthday. His scientific career spanned the second half of the 20th century and coincided with the evolution of nuclear experimental physics—from “in-house,” relatively small-scale experiments performed by a handful of physicists to large-scale efforts at an external facility with a significant group of participants. Those massive undertakings require long and costly preparations and substantial running times. Felix made significant contributions at each stage of that evolution.

Felix was born on 9 June 1924 in Basel, Switzerland. He received his undergraduate degree from the University of Geneva and his PhD in physics from ETH Zürich. Paul Scherrer was his thesis supervisor, and Wolfgang Pauli taught him theoretical physics and was a member of Felix’s PhD exam committee. During his student days, Felix was interested in electrophysiology, among other things, and was able to collaborate with Walter Hess, who later became a Nobel laureate for physiology.

After a short stint at ETH, Felix crossed the Atlantic to work at Columbia University with Chien-Shiung Wu, affectionately known as Madame Wu. In 1953 Felix moved to Caltech, where he spent the next half century. It was an exciting time: In 1956 parity violation in weak interactions was proposed and experimentally verified. Felix and several collaborators, primarily Aaldert Wapstra, were able to quickly set up a new apparatus and observe parity violation in nuclear beta decays, thus confirming Wu’s initial findings.

Felix’s next undertaking was to show that parity is also violated in nuclear electromagnetic transitions, a consequence of the current–current structure of the weak interactions that was proposed by Murray Gell-Mann and Richard Feynman. Felix’s frequent face-to-face dis-

cussions with them were clearly a motivating factor in his decision to take on such a challenging project. To enhance the observable, he chose relatively heavy nuclei in which the gamma transitions were strongly hindered. Eventually, he observed in 1972 a percent parity violation in the decay of the spin-8, odd-parity isomer of hafnium-180, a world record.

Even more challenging was Felix’s attempt to observe the time-reversal violation in nuclear transitions, which is still hypothetical. Although he observed what was seemingly time-reversal violation in the decay of iridium-191, the interaction of the photon with atomic electrons causes a phase shift that resembles the phase caused by time-reversal non-conservation.

After a sabbatical at CERN in 1972, Felix turned his attention to nuclear structure and used muonic and pionic atoms to study it. He started an experimental program at the recently established Los Alamos Meson Physics Facility (now the Los Alamos Neutron Science Center). While there, he performed, among other work, tests of the Klein–Gordon equation using pions.

In the 1980s Felix initiated a number of groundbreaking experiments in neutrino physics that paved the way for many contemporary activities and discoveries in the field. He started working on neutrino oscillations using nuclear reactors as sources: first at a baseline of tens of meters at the Institut Laue–Langevin research reactor in France, in collaboration with his friend and colleague Rudolf Mössbauer, and then at the Gösgen power plant in Switzerland. Their careful measurements did not reveal oscillations, in contradiction to hints from other experiments.

After the early indications for atmospheric neutrino oscillations, in 2000 Felix helped build the kilometer-baseline experiment at the Palo Verde Nuclear Generating Station in Arizona. One kilometer was indeed the correct baseline for a discovery, but Felix and colleagues missed it because of the experiment’s insufficient sensitivity to the mixing parameter.

Oscillations were finally discovered by collaborations that included alumni from Palo Verde: first with KamLAND in Japan at a 100 km baseline and then by the Daya Bay Reactor Neutrino Experi-



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ment in China, at the same 1 km baseline as the Palo Verde experiment but with a substantially better sensitivity to small mixing. In many ways, Felix’s confidence in using nuclear reactors to study neutrino oscillations was finally vindicated.

Continuing his work in the area of neutrinos, Felix developed double beta decay experiments. He first used a simple germanium detector and then built a pioneering time-projection chamber filled with 5 kg of isotopically enriched xenon. To some extent, the liquid-phase EXO 200 detector and the future 5 ton nEXO follow Felix’s early work.

In 1995 Felix received the Tom W. Bonner Prize in Nuclear Physics from the American Physical Society. He had an early engagement with the Aspen Center for Physics, and he served as a trustee from 1976 to 1979. Over the years he taught and mentored many colleagues who went on to have successful careers worldwide.

Felix was creative and fearless in charting new directions and was uncompromising in interpreting the data. His sense of humor and many cultural interests beyond physics were an inspiration to many colleagues. He is deeply missed.

Petr Vogel

*California Institute of Technology
Pasadena*

Giorgio Gratta

*Stanford University
Stanford, California*

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