

ERWIN LOUIS HAHN, 1921-2016

Professor Erwin Louis Hahn, on the faculty in the Department of Physics at UC Berkeley since 1955, passed away peacefully on September 20, 2016.

Erwin Hahn was the discoverer of spin echoes, a breakthrough in physics which led ultimately to the development of MRI technology, which continues to improve medical diagnostics and change the lives of millions of people around the world today.

The seventh child of Hungarian/German Jewish immigrants, Erwin was born in Farrell (near Sharon), Pennsylvania on June 9, 1921 and grew up in Sewickley. Interested in science from an early age, his oldest brother bought him a chemistry set when he was six years old. "It was a great plague to my mother," he recalled. He received a scholarship to Juniata College, where, although he was slowly becoming "impressed by the fundamental concepts of physics", he took a degree in Chemistry in 1943. Following a year of graduate studies in physics at Purdue University, Erwin was invited to work on the Manhattan Project in Los Alamos, but his recent marriage and a lack of married housing meant that he was unable to take up the post. He was then drafted into the Navy, where he taught sonar and radar for nearly two years and thereby (decisively for his career) gained an insight into electronic pulses. When the war ended Erwin continued his graduate studies at the University of Illinois, receiving his Ph.D in June 1949. A month later, having continued as a postdoc, he noticed what he first thought was "an irritating glitch" on the screen of his oscilloscope. When it recurred he took a closer look, and what he found was seminal.

The research area was initially called Nuclear Magnetic Resonance (NMR). In an early article, Erwin Hahn wrote: "... the spin echo is displayed by atomic nuclei which behave like spinning bar magnets [in a magnetic field]. An applied radiofrequency pulse... causes the nuclei to tip in unison, and after the pulse is removed, the nuclei emit a coherent radio signal. The signal gradually disappears as the nuclei get out of phase... and misalign. The nuclei can be caused to realign and produce a spontaneous echo radio signal following the action of a second radiofrequency pulse, or subsidiary echoes after more than two pulses." A decade after the 1949 discovery, Erwin showed how two pulsed magnetic field gradients switched in polarity also refocused echoes, a phenomenon now called "gradient echo". Essentially all MRI imaging pulse sequences today incorporate spin and gradient echoes.

Erwin Hahn has been quoted by a colleague as saying, "There is nothing that nuclear spins will not do for you, as long as you treat them as human beings."

NMR had no concrete application in those early years, and Erwin went on to make significant contributions in other areas, such as optics. From Illinois he progressed to Stanford on a National Research Council Fellowship, and worked at IBM's Watson Lab in New York, where he was also an associate in the Physics Department at Columbia University. In 1955 he became an Assistant Professor at UC Berkeley, in 1961 a Full Professor, and finally Professor Emeritus in 1991. A popular and sought-after teacher, Erwin supervised numerous Ph.D students, many of whom have achieved great professional success themselves.

Erwin's death is a blow to the physics community both nationally and internationally. He will be remembered as an extraordinarily gifted scientist, ranked among the greats of the 20th century, with many of whom he interacted. A Nobel Prize eluded him, but he received countless other awards and distinctions, among them the Wolf Prize in 1984, and memberships of the American and Russian Academies of Science and the British Royal Society. Several honorary doctorates, including one from Oxford University in 2009, also recognized his lifetime achievement. The Erwin L. Hahn Institute for Magnetic Resonance Imaging in Essen, Germany, bears his name, as will UC Berkeley's personal tribute, an Erwin Hahn Graduate Fellowship. In May 2016 he received his final award, the highest honor

from the International Society for Magnetic Resonance in Medicine (ISMRM): the Gold Medal.

The support which Erwin received from his spouses during his two long marriages was incalculable. He was married twice, to Marian Ethel Failing in 1944 and, after her death in 1978, to Natalie Woodford Hodgson in 1980. Erwin's children and stepchildren will remember their father and stepfather as a great character, distracted, idiosyncratic, self-absorbed and often hard to live with, but also deeply entertaining and loveable.

Erwin's colleagues and the wider scientific community, too, will remember him not only as a brilliant scientist but as a witty, funny, charming and gregarious personality. His extraordinary sense of humor and collection of anecdotes and limericks, both decorous and otherwise, were legendary. He told the most off-color jokes it is possible to imagine. He juggled, going onstage in the Navy to entertain his fellows. He was a keen violinist, playing chamber music and in various orchestras. He enjoyed camping and the outdoors, taking many hiking trips in the Sierras with family and friends. He was a great traveler, combining his many sabbaticals abroad with forays to interesting places, many of them off the beaten track. In his later years, together with Natalie, he took up amateur acting.

Erwin was one of a kind: capable both of eliciting shrieks of hilarity from undergraduates by playing tunes on his head to demonstrate resonance in his Physics of Music class, and of talking seriously before august bodies such as the British Royal Society and the Russian Academy of Sciences. Scientist and teacher, father and husband, beloved friend to many: Erwin Hahn will be much missed.

Erwin Hahn is survived by his widow Natalie Hahn, his children David, Deborah and Katherine, his stepchildren Welles and Elisabeth, his grandchildren Andrew and Christopher Hahn and Cecilia Caruso, and his great-grandchildren Owen, Hudson and Ethan Hahn.

