

## In Remembrance

*(The following article originally appeared in the Wednesday, May 8, 2002, issue of MIT Tech Talk, reprinted here by kind permission.)*

### Retired MIT professor Felix Villars dies at 81; was pioneer in biological physics

**P**rofessor Emeritus Felix M. H. Villars, 81, a theoretical physicist who changed directions in mid-career and became a pioneer in biological physics, died of cancer Saturday, April 27 at his home in Belmont.

“Felix was a theoretical physicist of great breadth and versatility,” said John W. Negele, the W.A. Coolidge Professor of Physics, who was director of the Center for Theoretical Physics when Villars retired in 1991. “He was a gifted and caring teacher with an encyclopedic mastery of physics and enviable clarity of mind.

“He had a vision of bringing the concepts and rigor of physics to bear on fundamental problems in medicine and biology. By his tireless efforts in teaching at MIT and Harvard Medical School and in writing a series of textbooks, he played a seminal role in creating a new generation of physician-scientists.”

Villars, who was a member of the MIT faculty for 41 years, played a central role in the development of the Harvard-MIT Division of Health, Sciences and Technology. He embraced the concept that physics and engineering can provide a foundation for advancing medical science. Many classes of medical students and PhD candidates at HST benefited from Villars’ insights.

“Professor Villars’ inspirational teaching and curriculum development helped to achieve a major objective of HST, the advancement of the health sciences, by promoting their productive interaction with the physical sciences and engineering,” said Irving M. London, founding director of HST.



Photo: Donna Coveney/MIT

“Throughout my years of contact with Felix, I always found him to be a patient listener, insatiably curious, intellectually rigorous, and always kind and considerate,” said Dr. Richard Cohen, the Whitaker Professor of Biomedical Engineering at HST. “It was a true privilege to have had the opportunity to work with such a preeminent scientist and fine human being. He certainly had a great impact on my career and served as a role model as scientist, teacher and colleague. I will miss him greatly and remember him often.”

#### **BROAD IMPACT**

Villars’ research had impact on diverse areas of physics.

In the infancy of quantum electrodynamics, he and the Swiss Nobel laureate Wolfgang Pauli developed a simple and elegant method to regulate the mathematical singularities in quantum field theory and extract finite physical results. The resulting method, known as “Pauli-Villars regularization,” was widely influential and is known and used by all students of field theory.

In nuclear physics, he was the first to recognize that the exchange of mesons generating the nuclear force also contributes to the electromagnetic properties of nuclei. With this insight, he calculated the magnetic moments of the three-body nuclei helium and hydrogen and laid the foundation for the systematic study of the effects in nuclei of meson exchange current. He also developed the theory governing the collective rotations of deformed nuclei, such as uranium. Building upon these theoretical developments, both meson exchange currents and rotational states in deformed nuclei were fields of active investigation at MIT’s Bates Electron Accelerator Center in Middleton.

Villars collaborated with two other eminent theoretical physicists of his generation at MIT on problems in atmospheric physics. With Institute Professor Victor F. Weisskopf, he studied the scattering of radio waves due to atmospheric turbulence. He and Institute Professor Herman Feshbach studied the effect of the earth’s magnetic field on ionization in the atmosphere.

Later, Villars studied biology and mastered the complexity of biological systems. He then applied rigorous mathematical analysis to elucidate the functioning of biological systems. On the basis of this work, he developed insights not previously discovered by biologists and physiologists who had been working in these areas for years. His mission also included teaching these discoveries.

#### **BRILLIANT LECTURER**

Villars was an extraordinary teacher. He delivered brilliant lectures to both graduate and undergraduate students in nearly every subject offered by the Department of Physics. He had the gift of inventing original and insightful problems, which he formulated with great clarity. Students who solved these problems

developed insight and confidence in the power and usefulness of the principles of physics.

His courses in quantitative physiology and respiratory pathophysiology at HST were master classes for medical students who sought a deep quantitative insight into organ physiology in health and disease.

His undergraduate textbook, a three-volume work titled “Physics with Illustrative Examples from Medicine and Biology,” co-authored with MIT professor George B. Benedek, demonstrated to students at the very beginning of their college careers that the principles of physics could illuminate the inner workings of a broad range of biological and medical phenomena.

“His knowledge was profound, encyclopedic and crystal clear,” said Benedek, the Alfred H. Caspary Professor of Physics. “He freely helped his students and professional colleagues to understand deeply an exceptional range of science. He was a rare intellect and brilliant teacher who elevated those who had the good fortune to know him.”

Born in Biel, Switzerland on Jan. 6, 1921, Villars received the diploma in physics and mathematics from the Swiss Federal Institute of Technology in Zurich in 1945. He was awarded the Kern Medal for an outstanding undergraduate thesis. During World War II, he served in the Swiss army as a meteorologist and then returned to the Swiss Federal Institute to earn his doctorate in 1946.

From 1946 to 1949, he was a research assistant at the Swiss Federal Institute of Technology, where he collaborated with Pauli on their paper on quantum field theory. He married the former Jacqueline Dubois in 1949 and they moved to the United States, where he was a visiting member of the Institute for Advanced Study in Princeton, N.J., for a year before settling permanently at MIT.

He began his MIT career as a research associate in 1950, was appointed assistant professor in 1952, associate professor in 1955, and full professor in 1959. He served as chair of the faculty from 1980 to 1983. He was also a lecturer at Harvard Medical School.

In addition to his wife, he is survived by four children, Fred of Philadelphia, Cecile of Belmont, Monique of the Netherlands, and Philip of Northboro; a brother and sister, Hans and Mireille of Switzerland; and three grandchildren. Burial will be at the family’s summer home on Cape Cod. A memorial service will be held at MIT in the fall. A memorial fellowship fund will be established at MIT. ●