Moo-Young Han

Moo-Young Han (한무영, 韓武榮), a cofounder of color *SU*(3) symmetry, passed away on 15 May 2016 in Durham, North Carolina.

Born on 30 November 1934 in Seoul, Korea, Moo-Young spent a year as an engineering student at Seoul National University after the end of Korean hostilities in 1953. He arrived in the US in 1954 to attend Carroll College (now Carroll University) in Waukesha, Wisconsin, and graduated in 1957 with a major in electrical engineering. He received his PhD in theoretical physics, with an emphasis on the symmetry principles of elementary-particle physics, under George Sudarshan from the University of Rochester in 1963. After three years of postdoctoral research at Boston University, Syracuse University, and the University of Pittsburgh, he joined the physics faculty at Duke University, where he taught physics for the next 44 years. He also taught physics at the University of California, Merced, in 2008 and at Seoul National University in 2009, and he was an adjunct professor at the Korea Advanced Institute of Science and Technology in Daejeon in 2013.

Moo-Young made a seminal contribution to elementary-particle physics in 1964 when he was a postdoctoral fellow at Syracuse. Murray Gell-Mann and George Zweig had just proposed the quark model as a concrete realization of the "flavor" *SU*(3) scheme of classifying a myriad of new particles observed in accelerators. Regarding the quarks as real particles was a problem, however, because they violate Pauli's principle that two or more identical spin-½ entities cannot occupy the same quantum state. Moo-Young made a bold proposal for solving the problem: introducing an additional symmetry, known later as "color *SU*(3)." The Pauli principle could be rescued in that scheme since a quark of a given flavor comes in three colors. When Moo-Young circulated the idea in a preprint, he found that Yoichiro Nambu from the University of Chicago had independently issued a similar preprint. They decided to publish jointly, and the celebrated Han–Nambu paper was born. Although the full implications of the Han–Nambu theory were not widely appreciated at that time, it was a huge step; it provided the basis of the non-abelian gauge theory of strong interaction and

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paved the way for the standard model as the theory of fundamental building blocks of the universe.

Extensively praised by his students at Duke for his ability to explain complex concepts to them and to laypeople, in 1972 Moo-Young received the Alumni Distinguished Undergraduate Teaching Award, the highest teaching honor bestowed on Duke faculty members. His talent in exposition is evident in the six books he wrote. Three of them deal with the popularizations of modern physics: *The Secret Life of Quanta* (TAB Books/McGraw-Hill, 1990, translated into Japanese and Spanish), *The Probable Universe: An Owner's Guide to Quantum Physics* (TAB Books/McGraw-Hill, 1993), and *Quarks and Gluons: A Century of Particle Charges* (World Scientific, 1999). In *A Story of Light: A Short Introduction to Quantum Field Theory of Quarks and Leptons* (World Scientific, 2004), he explained quantum field theory for nonspecialists. He expanded the book in 2014 to cover recent experimental evidence of the Higgs particle. The revised second edition, titled *From Photons to Higgs: A Story of Light*, is a clear and succinct introduction to the current status of elementary-particle physics written for beginning graduate students. In the same year, Moo-Young collaborated with Tohru Eguchi to edit *Nambu: A Foreteller of Modern Physics* (World Scientific), a volume celebrating Nambu's achievements in physics.

Moo-Young supported and encouraged scholars of Korean heritage in scientific and academic fields by providing a platform for information exchange. He was president of the Association of Korean Physicists in America in 1985–86 and of the Korean-American Scientists and Engineers Association in 1991–92, the founding chairman of the Society of Korean-American Scholars (SKAS), and an advisory board member for the Central California Korean Historical Society. He almost single-handedly created two alternating biweekly electronic SKAS newsletters—the *Korean-American Science and Technology News* and the *Information Exchange for Korean-American Scholars*. As the *IEKAS* editor-in-chief for almost 20 years, he made sure that each issue could be read in a few minutes; it would contain two or three concise articles of contemporary interest—from politics to history and, yes, to sciences. Those of us on his mailing list would eagerly anticipate the next *IEKAS*, delivered via email. For his contributions to the Korean American community, the Council on Korean Studies at Michigan State University bestowed on Moo-Young the 1998 Global Korea Award.

Moo-Young enjoyed spending time with his family. He and Chang Ki (Kay) Han, his wife of 57 years, spent their golden years exploring many mountainous destinations, from the Sierra Nevada in California to the White Mountains of New Hampshire. We will sorely miss hearing his boasts of discovering great food places that specialize in local cuisine, which he found by chance while journeying extensively on the interstate highway systems.

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