Masatoshi Koshiba

Nobel laureate Masatoshi Koshiba, professor emeritus at the University of Tokyo, died on 12 November 2020 in Tokyo.

Koshiba was born in Toyohashi City in central Japan on 19 September 1926. Two years after getting his BS in physics from the University of Tokyo in 1951, Koshiba enrolled in the graduate program at the University of Rochester. He received his PhD in 1955 under the supervision of Morton Kaplon, with a thesis entitled "High energy electron–proton cascade in cosmic radiation."

For the next three years, Koshiba worked as a research associate at the University of Chicago. After returning to Japan and spending a year as an associate professor at the University of Tokyo's Institute for Nuclear Study, he went back to Chicago, where he was the principal investigator of a balloon-borne cosmic-ray experiment using emulsions. In 1962 Koshiba again returned to the University of Tokyo as an associate professor of physics. After retiring in 1987, he taught at Tokai University for 10 years.

Koshiba recognized the potential of conducting experiments with high-energy electron–positron colliders. In the early 1970s, his collaboration with Gersh Budker, a particle-accelerator pioneer in the Soviet Union, was cut short, so Koshiba looked to Europe to find new partners. He connected with Erich Lohrmann, a good friend from Chicago who was director of research at the German Electron Synchrotron (DESY). Koshiba and his University of Tokyo group worked on the DORIS e^+e^- storage ring at DESY as part of the DASP experiment.

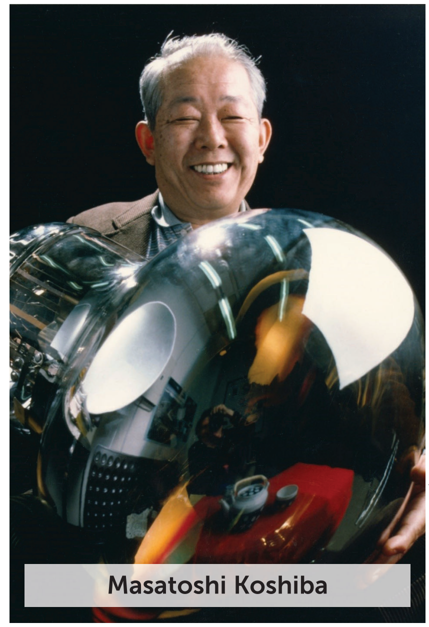
In 1974 in the US, researchers at Brookhaven National Laboratory and at SLAC independently discovered the J/ψ resonance. That detection led DESY scientists to build PETRA, a higher-energy e^+e^- collider. Koshiba joined with others from Japan, Germany, and the UK to form the JADE collaboration. In 1979 JADE and other experiments at PETRA discovered the gluon.

Koshiba founded the Laboratory for International Collaboration on Elementary Particle Physics (now the International Center for Elementary Particle Physics) at the University of Tokyo in 1977. In the 1980s Koshiba and his team worked on the OPAL collaboration at CERN's Large Electron–Positron Collider. Additionally, he dedicated his time to promoting the construction of the International Linear Collider.

In 1978 Koshiba got a phone call from theoretical physicist Hirotaka Sugawara, who asked him to devise a proton-decay experiment and present it at a KEK workshop. Koshiba immediately recalled an idea he had during his time in the US and designed an experiment with a large amount of water and photomultiplier tubes (PMTs). Soon after, Koshiba heard that a similar but potentially larger experiment, later known as IMB (Irvine-Michigan-Brookhaven), was being planned in the US. He revisited his original design and came up with the idea to develop PMTs with a 50 cm diameter. He thought that even if the IMB experiment discovered proton decays, his experiment could study the branching ratio of the proton decays that result from high photon-detection efficiency. In the end, his experiment, eventually named Kamiokande, brought many important results.

The Kamiokande experiment was constructed 1000 m underground at the Mozumi mine in Kamioka. It started in July 1983, but no convincing proton decay signal was observed. Koshiba noted, however, that the 50 cm PMTs performed superbly. In the fall of 1983, Koshiba proposed improving the Kamiokande detector so it could observe solar neutrinos. At that time, the Homestake experiment in South Dakota was the only one to have successfully detected solar neutrinos, but the observed number of events was only about 30% of the expectation.

After undergoing several years of improvements, the Kamiokande experiment restarted at the beginning of 1987 with a lower energy threshold to observe solar neutrinos. Then, on 23 February 1987, a supernova explosion was detected in the Large Magellanic Cloud. Kamiokande recorded a neutrino burst that beautifully confirmed the basic mechanism of the supernova explosion. In addition, Kamiokande detected solar neutrinos and confirmed the solar neutrino deficit in 1989. Koshiba was a corecipient of the 2002 Nobel Prize in Physics "for pioneering contributions to astrophysics, in particular for the detection of cosmic neutrinos."



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In 1983 Koshiba came up with the Super-Kamiokande experiment. When he originally proposed that Kamiokande should observe solar neutrinos, he realized that the event rate would be low because of the detector's limited mass. He thought that a much larger and higher-sensitivity detector was necessary to advance "neutrino astronomy." The 50-kiloton Super-Kamiokande has also been successful in obtaining many important neutrino-physics and astrophysics results, including the discovery of neutrino oscillations.

Koshiba was a great physicist who was able to feel the direction of physics. He told his younger colleagues that they should always have several "eggs" of research ideas because some of them could hatch in the future.

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