

from which he determined the first good limit for the ν_e mass. In the early 1970s Raymond Davis started using the Cl-Ar technique to detect solar neutrinos.

At the end of his Chalk River period (1943-48) Pontecorvo investigated the decay of cosmic-ray muons and concluded that the muon decays into an electron without photon emission. In 1947 he noted that the interactions responsible for the capture of electrons and muons by nuclei have the same strength, and he advanced the prophetic hypothesis of a universal weak interaction for electrons and muons. That universality, applying to leptons as well as quarks, is one of the cornerstones of our present understanding of elementary-particle physics.

In 1950 Pontecorvo, just after having been appointed as James Chadwick's successor at the University of Liverpool, secretly departed with his entire family to the USSR. From then on he worked in Dubna, at the institute that in 1956 became the Joint Institute of Nuclear Research, the Soviet analog of CERN. There, besides his theoretical work on neutrinos, he performed pion and muon experiments. In the early 1950s he formulated, independently of Abraham Pais, the law of associated production of strange particles in strong interactions.

In 1957 Pontecorvo launched the idea (which he developed further with Vladimir Gribov and Samoil Bilenky) of "neutrino oscillations," in which neutrinos could change their type while flying through vacuum. Thus ν_e 's emitted by the Sun might arrive at the Earth as ν_μ 's, which could explain the solar neutrino deficit—the fact that the flux of electron neutrinos measured at four different detectors is somewhat smaller than expected. Such oscillations are impossible for massless neutrinos. On the other hand, they would allow one to measure extremely small differences between the masses of neutrinos of different types (e , μ , τ). In 1959 Pontecorvo noticed that emission of neutrino pairs by electrons is very important at certain stages of stellar evolution. He was the first to discuss, in a 1961 paper written jointly with Yakov Smorodinsky, the "sea" of relic neutrinos.

In 1959 at the Rochester Conference held in Kiev, Pontecorvo suggested an accelerator experiment to identify muon neutrinos. An experiment of this kind was successfully performed in 1962 at Brookhaven and led to the awarding of the 1988 Nobel Prize in Physics to Leon Lederman,

Melvin Schwartz and Jack Steinberger. This work opened the road to a series of fundamental high-energy neutrino experiments.

Pontecorvo received great recognition in the Soviet Union. From 1959 on, he was allowed to travel to countries friendly to the USSR. It was, however, only in September 1978, when he visited Rome for a week, that he was permitted to cross the iron curtain. In the 38 years that I knew him, we had many discussions and wrote three papers together—but he never talked about his 1950 flight.

Bruno Maximovitch, as he was called in Russia, was greatly respected by all who came into contact with him. While never losing a strong Italian accent, he understood all the subtleties of the Russian language. His talks and his comments at the talks of others were extremely clear and inspiring. He championed reliability in experiments and was suspicious of "psychologically motivated systematic errors" stemming from wishful thinking or the urge to make discoveries. Brilliant as a teacher (he was a professor at Moscow State University), he inspired several generations to serve science.

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Georgianne Robertson Caughlan

Georgianne Robertson Caughlan, professor emerita of physics at Montana State University, died on 3 January 1994, at the age of 77.

Caughlan, known as Jan to her relatives and friends, obtained a BS in physics from the University of Washington in 1939 but delayed graduate school until her children were in school. She received her PhD in physics from that same school in 1964. Her dissertation concerned hydrogen burning in stars. She joined the faculty of Montana State University in Bozeman in 1961 and became emerita professor there in 1984.

Jan began her study of thermonuclear reactions in stars and supernovae in 1962, when she came to the Kellogg Radiation Laboratory at Caltech to work with me and my collaborators. We developed a standard format for presenting the reaction rates of protons, deuterons and α particles with nuclei having atomic numbers from 1 to 14.

An avid reader, Jan searched the literature for articles on the rates of

nuclear reactions of relevance in stars and supernovae and scrutinized those rates for accuracy and reliability. In a few cases we argued at length over her conclusions, but she usually won out.

In our studies of the structure of stars and the nuclear processes in supernovae, Jan matched my performance and led me to a better understanding of them. I am much indebted to Jan Caughlan for her role in the theoretical part of the studies of reactions important in nucleosynthesis for which I received the 1983 Nobel Prize in Physics.

Jan was always interested in promoting women in physics. She served as a role model to show that despite the difficulties of raising a family and entering a male-dominated field, it is possible for a woman to make significant contributions.

WILLIAM A. FOWLER

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John Miller

John Miller, president emeritus of the Florida Institute of Technology, in Melbourne, died on 14 December 1993.

Born in McKeesport, Pennsylvania, on 9 December 1921, Miller received his BS in mathematics from Randolph-Macon College in 1948 after serving from 1942 to 1946 with the Army Combat Engineers in Europe in World War II. He changed fields from math to experimental physics for his graduate work at the University of Virginia, where he earned his MS in 1950 and his PhD in 1952 under Jesse Beams. He then joined the faculty at Clemson University. He remained at Clemson, except for a year as an NSF senior fellow at Stanford in 1962-63, until 1966, when he became vice president for academic affairs at the young Florida Institute of Technology. In 1975 his duties at Florida Tech were expanded to include those of executive vice president, and in 1986-87 he served as president. He became Distinguished Professor of Physics at Florida Tech four years before retiring in 1991.

In characteristic manner, in his final illness John showed great strength, courage and determination to keep going until the end. It was a privilege to know him and to count him as a colleague and friend.

J. D. PATTERSON

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