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Neutron Radiative Decay

MAYNARD DEWEY, NIST

Beta decay of the neutron into a proton, electron, and electron anti-neutrino is accompanied by the emission of a soft photon. Although neutron decay is generally considered to be the most fundamental beta-decay process and thus may provide sensitive tests of the Standard Model of particle physics, this radiative decay mode had not been observed until 2006. The branching ratio was measured to be $(3.09 \pm 0.32) \times 10^{-3}$ in the energy region between 15 keV and 340 keV and agreed with two distinct theoretical calculations. At this level of precision ($\approx 10\%$), one only had sensitivity to the photon contribution originating from electron bremsstrahlung. An improved measurement below the 0.5% level would approach effects beyond the leading-order contribution, such as the recoil order terms. A new experiment with an upgraded of the detector and apparatus was performed to make a precision measurement of the energy spectrum and the branching ratio near this level. Data from this experiment were collected in 2009. The experimental technique, the status of the analysis, and the outlook for tests of the Standard Model in neutron decay will be discussed.