Directed Neutrino Beam with Electron Capture Beta Decay

VLADIMIR TSIFRINOVICH, LORCAN FOLAN, CHRISTINA DEANGELIS, Department of Applied Physics, Polytechnic Institute of NYU — We suggest generation of directed neutrino beams using electron capture beta decay sources. The basic idea is the following. Consider a Gamov-Teller transition with a decrease of nuclear spin I of one unit: $I \rightarrow I - 1$. Assume that the nuclear spins are highly polarized by a magnetic field at low temperature. In this case the z-component of the total angular momentum before decay is $F_z = I$. The electron capture beta decay produces an unpaired electron with spin $S = \frac{1}{2}$ and a neutrino with spin $V = \frac{1}{2}$. From conservation of the z-component of the angular momentum we obtain after the decay $I_z = I - 1, S_z = \frac{1}{2}, V_z = \frac{1}{2}$. From the helicity requirement, the emitted neutrino momentum is opposite to the direction of its spin. Thus, the considered source generates a directed neutrino beam propagating in the negative z-direction. We show an opportunity for experimental detection of the average recoil force produced by the neutrino emission with a conventional technique of atomic force microscopy.