Frontiers in Gamma Ray Spectroscopy FIG18

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Search for Double Beta Decay in 94Zr

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Content :

Double beta decay (DBD) is a rare second-order weak nuclear transition, first suggested by Maria Goeppert-Mayer in 1935 [1]. Generally, in the case of a beta unstable parent nucleus it is extremely difficult to distinguish the rare DBD from an intensive single beta decay background. There are 35 even-even nuclides with single beta decay either energy forbidden or spin suppressed, which makes it possible to search for the DBD transformation in these nuclides. In the two-neutrino double beta decay (2$\nu\beta\beta$) mode, two neutrons simultaneously undergo beta decay producing two protons, two electrons and two anti-neutrinos in the final state. The 2$\nu\beta\beta$ process has been experimentally observed in 12 nuclei so far with a half-life range of T1/2~ 10^18-10^24 y [2]. Neutrinoless Double Beta Decay is a phenomenon of fundamental interest for particle physics. For a number of nuclei, double beta decays to excited states in their daughter nuclei are also energetically possible and can provide supplementary information for the calculation of NTME for the process. These processes can be probed at low background facilities and limits of the order of T1/2~ 10^18-10^25 y have been reached using different experimental techniques for some nuclei.

In the present work, double beta decay of 94Zr to the 2+ excited state of 94Mo at 871.1 keV is studied using TIFR low background counting setup. No evidence of this decay was found with a 232 g.y exposure of natural Zirconium. The lower half-life limit for the double beta decay is significantly improved over the existing experimental limit [3]. Challenges in the measurement and results will be discussed in this talk.

References:

[1] M. Goeppert-Mayer, Phys. Rev. 48 (1935) 512.
[2] R. Saakyan, Annu. Rev. Nucl. Part. Sci. 63 (2013) 503.
[3] N. Dokania et al. Eur. Phys. J. A 53, 74 (2017)

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