



Contribution ID: 737

Type: **Contributed Poster Presentation**

Anti-neutrino nuclear responses studied by Ordinary Muon Captures on Krypton-82 and Molybdenum-100

Studies of Ordinary Muon Capture (OMC) provide crucial insights into nuclear matrix elements (NMEs) that play a crucial role for neutrino (ν) mass studies by double beta decay (DBD) and astro- ν nuclear interactions. OMC on a nucleus A_ZX , with A and Z being the mass and atomic numbers, proceeds via a proton-neutron conversion, leading to the nuclear excitation around 0-50 MeV and the subsequent emission of a number (m) of neutrons. Then one finally gets the residual nucleus ${}^{A-m}_{Z-1}X$. If it is a radioactive isotope (RI), it is identified by measuring delayed gamma rays following the beta decay of RI. Since the energy and momentum transfers involved in OMC are similar to those for anti- ν response in DBD and astro- ν reaction, OMC provides one with useful information on the anti- ν response associated with DBD and astro- ν interaction. They are used to refine theoretical models for the DBD and astro- ν NMEs. Measurement of delayed gamma rays from RIs produced by OMCs on Krypton-82 (${}^{82}\text{Kr}$) and Molybdenum-100 (${}^{100}\text{Mo}$) were made to study anti- ν responses associated with DBD of ${}^{82}\text{Se}$ - ${}^{82}\text{Kr}$ and astro-anti ν response on ${}^{100}\text{Mo}$. The absolute life-times for OMCs on ${}^{100}\text{Mo}$ and natural Mo (${}^n\text{Mo}$) were measured to get the N - Z dependence on the anti- ν responses. The present work reports recent results of the anti- ν response studies by OMCs on ${}^{82}\text{Kr}$ and ${}^{100}\text{Mo}$, and also on ongoing experimental efforts at Research Center for Nuclear Physics (RCNP) and the Paul Scherrer Institute (PSI) continue. Recent works on OMCs at RCNP were published in:

- 1) H. Ejiri, J. Suhonen, K. Zuber, (2019) Physics Reports 797 1-102.
- 2) Hashim, I. H., Ejiri, H., Shima, T., Takahisa, K., Sato, A., Kuno, Y., et al. (2018). Phys. Rev. C 97, 014617.
- 3) Hashim I. H. and Ejiri H. (2021) Front. Astron. Space Sci. 8:666383
- 4) Hashim, I. H., Ghani, N. N. A. M. A., Othman, F., Razali, R., Ng, Z. W., Ejiri, H., Shima, T., Tomono, D., Zinatulina, D., Schirchenko, M., Kazartsev, S., Sato, A., Kawashima, Y., Ninomiya, K. and Takahisa, K. (2023) Phys. Rev. C 108 014618.

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Session Classification: Poster Session

Track Classification: Nuclear Reactions