European Nuclear Physics Conference 2025

Contribution ID: **220** Type: **Oral Presentation**

Ultra-low Q$_\beta$ value for the allowed decay of ^{110}Ag^m confirmed via mass measurements

The existence of the three flavours of neutrinos, electron, muon and tau neutrino, predicted by the Standard Model of particle physics has been experimentally proven decades ago. Contrary to the Standard Model however, neutrino oscillation experiments [1] have shown that they are massive particles, making neutrino mass measurements a gateway to physics beyond the Standard Model. As these experiments can only determine the squared mass difference of the flavours, the absolute mass has to be determined through other means, such as studying the kinematics of β-decay reaction products. As per $E = mc^2$, some energy released in the decay (Q-value) is transformed into the (anti-)neutrino created in the decay, and thus the mass of the neutrino can be determined from the difference between the energy left with the other decay products and the Q-value of the decay, as the neutrino is unlikely to interact with the detector. Since the mass is expected to be minuscule, the difference is easier to observe in a decay with ultra-low Q-value ($<$ 1 keV).

In our work [2], we have determined the Q-value of the β^- decay of the 117.59 keV isomer of ^{110}Ag into the excited state at 3008.41 keV in ^{110}Cd. This determination was done by combining our precise Penning trap measurement of the mass difference of ^{110}Cd and ^{109}Ag with previously published measurements of ^{109}Ag(n,γ)^{110}Ag [3] and the excitation energies [4]. The obtained Q-value of 405(135) eV is notable. It is the lowest measured Q value for an allowed transition and, as such, is an excellent candidate for an experiment searching for the neutrino mass. In addition, the partial half-life and the branching ratio of this transition were calculated. In my contribution, I will present the JYFLTRAP double Penning trap [5] measurement setup at the IGISOL facility [6] at the University of Jyväskylä, and the results of our measurement.

[1] SNO Collaboration, Phys. Rev. Lett. 89, 011301 (2002)

[2] J. Ruotsalainen et al. arXiv:2409.11203 (2025), accepted for publication in Phys. Rev. Lett.

[3] M. Bogdanovic et al. Kernforschungsanlage Jülich Institut für Kernphysik, JUL-Spez-99, p76 (1981)

[4] G. Gürdal et al. Nuclear Data Sheets 113, 1315 (2012)

[5] T. Eronen et al. Eur. Phys. J. A. 48 46 (2012)

[6] I. Moore et al. Nucl. Instrum. Methods Phys. Res. B 317 208 (2013)

Author: RUOTSALAINEN, Jouni (University of Jyväskylä)

Co-authors: KANKAINEN, Anu (University of Jyväskylä); Prof. SUHONEN, Jouni (University of Jyväskylä); Dr STRYJCZYK, Marek (University of Jyväskylä); Dr RAMALHO, Marlom (University of York); ERONEN, Tommi (University of Jyväskylä)

Presenter: RUOTSALAINEN, Jouni (University of Jyväskylä)

Session Classification: Parallel session

Track Classification: Fundamental Symmetries and Interactions