



Contribution ID: 27

Type: Oral

Q-value measurements of rare weak beta decays with JYFLTRAP

Tuesday, 25 February 2020 15:00 (20 minutes)

Rare weak beta decays can be potentially used in searches for the neutrino mass. These are, e.g., decays between nuclear ground states and excited states in daughter nuclei that have very small (< 1 keV) decay energy (Q -value). The beta decay of ^{115}In $9/2^+$ ground state to $3/2^+$ state in ^{115}Sn currently has the smallest measured Q -value (0.155(24) keV [1,2]) of any beta decay.

There are several more nuclei that potentially possess similarly low Q -values [3]. Those are optimal for experimental neutrino mass determination through distortions in the beta endpoint spectrum. First, before any attempt to measure the endpoint spectrum, it is necessary to confirm whether the Q -value of the decay is positive. The ground-state-to-ground state Q -value can be measured with mass spectrometry while the excitation energy of the excited state in the daughter can be deduced from gamma-ray spectroscopy.

Using the JYFLTRAP Penning trap setup [4,5] at the Accelerator Laboratory of the University of Jyväskylä, we have measured Q -values of several such cases. One of those is the ^{135}Cs decay to ^{135}Ba , which was measured with a precision at the 100-eV level. Along with this Q -value measurement I'll give an overview of the used Phase-Imaging Ion-Cyclotron mass measurement technique [6].

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Session Classification: Contributed Talks