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Contribution of Penning trap mass spectrometry to neutrino physics

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Penning traps provide nowadays highest sensitivity, precision and accuracy for atomic mass spectrometry [1]. In the combined strong magnetic field and weak electric field of a Penning trap a charged particle can be stored and observed for long time thus frequency comparisons well below ppb can be performed. Different techniques such as non-destructive detection with single ion sensitivity or destructive time-of-flight resonance techniques are available to measure with high resolution the motional frequencies in the trap, yielding the free space cyclotron frequency which is inversely proportional to the charged particles mass.

References
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2. Sz. Nagy et al., Europhys. Lett. 74, 404?410 (2006)
3 G. Douysset et al., Phys. Rev. Lett. 86, 4259 - 4262 (2001)
4. M. Suhonen et al., JINST 2, P06003 (2007)
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A number of important mass measurements with remarkable precision have been performed for applications in neutrino physics experiments studying beta-decay or searching for neutrinoless double-beta-decay (0nBB) or radiative neutrinoless double electron capture (0n2EC) processes, where the atomic mass of the initial and final state nuclei or the mass difference are a much needed input.

The mass measurement principle will be introduced and the different detection techniques will be compared. The latest advances shall be summarized, new ideas and upcoming experiments will be presented. The talk will cover some of the recent highlights such as the measurement of the 3H-3He mass difference giving the endpoint of the tritium beta-decay with 1.2 eV precision [2], the 76Ge-76Se Q-value of 2039.006(50) keV [3,4] and the 136Xe-136Ba Q-value 2457.83(37) [5].

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