

Revealing new processes with superfluid liquid helium detectors: The coherent elastic neutrino-atom scattering

Friday, July 31, 2020 1:42 PM (3 minutes)

The particle physics community is studying and developing new technologies to measure processes never detected before. Among these, strong efforts are put into studying innovative He detectors based on the quantum evaporation phenomenon. The main outcome of such detectors is the possibility to detect light dark matter particles. However, they also might have a great potential for exploring neutrino properties. Indeed, we propose an experimental setup to observe coherent elastic neutrino-atom scattering (CEvAS) [1] using electron antineutrinos from tritium decay and a liquid helium target. In this neutrino scattering process with the whole atom, that has not been observed so far, the electrons tend to screen the weak charge of the nucleus as seen by the electron antineutrino probe. In addition to this discovery, it may be possible to measure fundamental weak interaction parameters at very low energy scale, never reached before, and achieve an unprecedented sensitivity to electromagnetic properties of neutrinos [2], for example, such as the neutrino magnetic moments.

[1] M. Cadeddu, F. Dordei, C. Giunti, K. A. Kouzakov, E. Picciau, and A. I. Studenikin, Phys. Rev. D 100, 073014 (2019), arXiv:1907.03302.

[2] C. Giunti and A. Studenikin, Rev. Mod. Phys. 87, 531 (2015), arXiv:1403.6344.

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Secondary track (number)

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Session Classification: Neutrino Physics - Posters

Track Classification: 02. Neutrino Physics