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Neutrino electromagnetic interactions in elastic neutrino scattering on nucleons and nuclei

The nonzero neutrino masses open a door for neutrino electromagnetic interactions [1]. We study how these interactions may manifest themselves in elastic neutrino-nucleon and neutrino-nucleus scattering processes. Following our approach developed for the case of elastic neutrino-electron [2] and neutrino-proton [3] collisions, in our formalism we account for possible electromagnetic form factors of massive neutrinos: the charge, magnetic, electric, and anapole form factors of both diagonal and transition types. When treating the nucleon electromagnetic vertex, we take into account not only charge and magnetic form factors of a nucleon, but also its electric and anapole form factors. We examine how the effects of the neutrino electromagnetic properties (in particular, charge radii and magnetic moments) can be disentangled from those of the strange quark contributions to the nucleon's weak neutral current form factors. We also study how the neutrino electromagnetic form factors can manifest themselves in coherent elastic neutrino scattering on spin-0 and spin-1/2 nuclear targets.

[1] C. Giunti, A. Studenikin, Neutrino electromagnetic interactions: A window to new physics, Rev. Mod. Phys. 87, 531 (2015), arXiv:1403.6344.

[2] K. Kouzakov, A. Studenikin, Electromagnetic properties of massive neutrinos in low-energy elastic neutrinoelectron scattering, Phys. Rev. D 96, 099904 (2017), arXiv:1703.00401.

[3] K. Kouzakov, F. Lazarev, A. Studenikin, Electromagnetic neutrino interactions in elastic neutrino-proton scattering, PoS (ICHEP2020) 205.

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Collaboration / Activity

None

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