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Electromagnetic effects in elastic neutrino scattering on nucleons and nuclei

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Electromagnetic properties of neutrinos can be a manifestation of new physics [1]. We study the electromagnetic contribution to 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 the 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 reveal themselves in coherent elastic neutrino-nucleus scattering. For illustration, we present our results in the case of the 40Ar nuclear target and neutrino energies typical for the COHERENT experiment.

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