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The role of the elastic neutrino-electron scattering in constraining the neutrino magnetic moment and millicharge using the LUX-ZEPLIN data

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Elastic neutrino-electron scattering represents a powerful tool to investigate key neutrino properties. In view of the recent results released by the LUX-ZEPLIN Collaboration, we will present a first determination of the limits achievable on the neutrino magnetic moment and neutrino millicharge, whose effect becomes non-negligible in some beyond the Standard Model theories. In particular, we will discuss the impact of different approximations to describe the neutrino interaction with atomic electrons which is of particular importance when including this contribution also in CEvNS analyses. We will show that the new LUX-ZEPLIN data allows us to set a very competitive limit on the neutrino magnetic moment when compared to the other laboratory bounds, namely μeff<1.2×10−11 μB at 90% C.L., which improves by almost a factor three the Borexino Collaboration limit and represents the second best world limit after the recent XENONnT result. Moreover, exploiting the so-called equivalent photon approximation, we obtain the most stringent limit on the neutrino millicharge, namely |qeff|<1.8×10−13 e0 at 90% C.L., which represents a great improvement with respect to the previous laboratory bounds.

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