

Overview of physics results with coherent elastic neutrino-nucleus scattering data

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The detection of Coherent Elastic Neutrino-Nucleus Scattering (CEvNS) performed in 2017 and 2021 with cesium iodide and in 2020 with liquid argon by the COHERENT collaboration has paved the way for precision phenomenological measurements of many diverse physical phenomena.

CEvNS is a neutral current process induced by the exchange of a Z boson that permits putting interesting constraints on nuclear physics, beyond the standard model (SM) neutrino electromagnetic properties but it also represents a sensitive probe for non-standard interactions (NSI) that are not included in the SM, induced by yet to be discovered neutral vector and scalar bosons.

Recently, CEvNS has also been observed for the first time using antineutrinos from reactors at the Dresden-II site with a germanium detector called NCC-1701, allowing to obtain more stringent and complementary constraints.

In this talk, I will present a summary of the physics reach of CEvNS, presenting, in particular, the state-of-the-art constraints on neutrino charge radii, milli-charges, and magnetic moments [1] (putting emphasis on the role of elastic neutrino electron scattering in Dark Matter experiments like LZ and XENONnT [2]) as well as new limits on different new physics models involving light vector Z' mediators [3]. The complementarity of CEvNS constraints with nuclear physics with the recent PREX and CREX neutron-skin determinations will also be discussed [4], highlighting the interplay with the weak-mixing angle determination [5].

Finally, I will provide prospects for the future, given the large amount of CEvNS experiments that are currently being proposed or under construction [5].

[1] M. Corona et al. JHEP 09 (2022) 164, Arxiv: 2205.09484

[2] M. Corona et al. Phys. Rev. D 107 (2023) 5, 053001, Arxiv: 2207.05036

[3] M. Corona et al. JHEP 05 (2022) 109, Arxiv: 2202.11002

[4] M. Corona et al. Phys. Rev. C 105 (2022) 5, 055503, Arxiv:2112.09717

[5] M. Corona et al. Arxiv:2303.09360 (2023)

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