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Updated constraints on light mediators from CEvNS data

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The observation of coherent elastic neutrino-nucleus scattering (CEvNS) performed at the COHERENT experiment with a cesium iodide detector and with a liquid argon detector, represents an innovative and powerful tool to study many physical phenomena.
In particular, CEvNS represents a sensitive probe for interactions that are not included in the Standard Model, as for instance interactions mediated by yet-to-be-discovered light-neutral vector bosons.
We present the constraints on the parameters of several light boson mediator models, considering a variety of vector boson mediator models: the so-called universal, the B–L and other anomaly-free U(1)′ gauge models with direct couplings of the new vector boson with neutrinos and quarks, and the anomaly-free Le–Lμ, Le–Lτ, and Lμ–Lτ gauge models where the coupling of the new vector boson with the quarks is generated by kinetic mixing with the photon at the one-loop level. We also consider a model with a new light scalar boson mediator that is assumed, for simplicity, to have universal coupling with quarks and leptons. We compare these constraints with the limits obtained by other experiments and with the values that can explain the muon g−2 anomaly. We show that the COHERENT data allow us to put stringent limits on the light vector mediator mass and coupling parameter space. Finally, we discuss the impact of future CEvNS experiments on these searches, highlighting the importance of complementary approaches.

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