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Probing the two-neutrino exchange force using atomic parity violation

The exchange of two neutrinos at one loop leads to a long-range parity-violating force between fermions. We explore the two-neutrino force in the backdrop of atomic physics. We point out that this is the largest parity-violating long-range force in the Standard Model and calculate the effect of this force in experiments that probe atomic parity violation by measuring optical rotation of light as it passes through a sample of vaporized atoms. We perform explicit calculations for the hydrogen atom to demonstrate this effect. Although we find that the effect is too small to be observed in hydrogen in the foreseeable future, our approach may be applied to other setups where long-range parity violation is large enough to be probed experimentally.

Mini-abstract

2-neutrino exchange force as the longest range parity violating force in atomic hydrogen

Experiment/Collaboration

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