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Detecting Dark Matter Coherent Scattering via a Novel Torsion Balance Experiment

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Dark matter with mass in the crossover range between wave dark matter and particle dark matter, around $(10^{-3}, 10^{3})$ eV, remains relatively unexplored by terrestrial experiments. In this mass regime, dark matter scatters coherently with macroscopic objects. The effect of the coherent scattering greatly enhances the accelerations of the targets that the dark matter collisions cause by a factor of $\sim 10^{23}$. We propose a novel torsion balance experiment with test bodies of different geometric sizes to detect such dark matter-induced acceleration. This method provides the strongest constraints on the scattering cross-section between the dark matter and a nucleon in the mass range $(10^{-5}, 10^{3})$ eV.

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