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Search for Lorentz invariance violation through short-range gravity experiments

General relativity offers an impressive description of gravity at the classical level. A key ingredient in its construction is local Lorentz invariance, which insures rotation and boost symmetry in a freely falling frame. However, achieving a consistent unification of gravity with quantum physics may require modifications of the foundations of general relativity. These modifications could induce observable violations of Lorentz invariance. With the analysis of testing gravitational inverse-square law at millimeter ranges carried in our laboratory, we studied the limits on putative Lorentz invariance violation coefficients in the pure gravity sector. This study showed that the Lorentz violating signal is suppressed in the planar test mass geometry employed in the experiment, based on which we further proposed a periodic, striped test mass geometry design of a short-range torsion pendulum experiment to enhanced sensitivity to possible Lorentz violating signals.

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