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Spin-Dependent Sub-Millimeter Fifth Force Search Using Ferrimagnetic Test Masses

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Macroscopic forces of nature beyond gravity and electromagnetism arise in many frameworks attempting to unify General Relativity and the Standard Model. We describe an experimental search for spin-dependent fifth forces in the sub-millimeter range. The experiment uses planar mechanical oscillators as test masses, which have been augmented with polarized rare earth iron garnets. These materials exhibit orbital compensation of the magnetism associated with the electron spins, substantially reducing the magnetic backgrounds. We describe the essential properties of the test masses and the progress of the apparatus developed to make optimal use of them, including a radiative cooling system, and discuss the experimental sensitivity.

Summary

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