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Precision Atomic Tests of Physics Beyond the Standard Model

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We will give an overview of atomic precision measurements as tests of physics beyond the Standard Model, such as searches for "fifth forces", tests of fundamental symmetries with clocks, and searches for an electric dipole moment of the electron. In particular, measurements of the fine structure constant α use methods from across sub-fields and are thus powerful tests of the consistency of theory and experiment in physics. Using the recoil frequency of cesium-133 atoms in a matter-wave interferometer, we report the most accurate measurement, $\alpha = 1/137.035999046(27)$, at 2.0×10^{-10} accuracy. Comparison with Penning-trap measurements of the electron gyromagnetic anomaly $g - 2$ via the Standard Model is now limited by the uncertainty in $g - 2$; a 2.5-sigma tension has implications for dark sector candidates and electron substructure may be a sign of physics beyond the Standard Model that warrants further investigation.

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