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Measurement of the fine-structure constant as a test of the Standard Model

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Measuring the fine-structure constant α allows testing the consistency of theory and experiment across physics. Using the recoil frequency of cesium-133 atoms in a matter-wave interferometer, we recorded the most accurate measurement of the fine-structure constant to date: $\alpha = 1/137.035999046(27)$ at 2.0×10^{-10} accuracy. Comparison with Penning trap measurements of the electron gyromagnetic anomaly $g_e - 2$ via the Standard Model of particle physics is now limited by the uncertainty in $g_e - 2$. Implications for dark-sector candidates and electron substructure may be a sign of physics beyond the Standard Model that warrants further investigation.