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Title: Sr lattice clock with 10^{-16} inaccuracy: characterization of fermionic collisions and future prospects.

Abstract:

We present the current status of the JILA strontium optical lattice clock. Ultracold fermionic ^{87}Sr atoms are held in a one dimensional magic wavelength lattice allowing the clock transition to be probed in the Lamb-Dicke regime. The quantum projection noise limit of this system has yet to be reached due to Dick effect-limited clock operation, highlighting the potential gains due to near-term improvements in ultrastable laser technology. With a fractional inaccuracy of less than 1.5×10^{-16}, the Sr lattice clock has surpassed the best microwave standards in fractional uncertainty, while profiting from the improved short-term stability afforded by operating at optical frequencies. The largest contributions to the uncertainty are the density-dependent and black-body radiation shifts. We present recent work characterizing the density-dependent effect, resulting in new understanding of how otherwise identical ultra-cold fermionic atoms are allowed to weakly interact due to inhomogeneous excitation. Possible further steps towards characterizing and reducing the black-body radiation shift are also discussed.