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Improved bounds on Lorentz violation from long-coherence Ramsey spectroscopy in Yb⁺

High precision spectroscopic measurements in trapped cold ions, have enabled various sensitive searches for new physics beyond the Standard Model [1]. Local Lorentz invariance (LLI) is suggested to be violated in extensions of the Standard Model that include quantum-gravity [2]. We here report on a stringent test of local Lorentz invariance (LLI) in the electron-photon sector based on a novel radiofrequency (rf) composite pulse Ramsey method in the meta-stable $2F_{7/2}$ manifold of the Yb⁺ ion [2]. The method extends the coherence time to several seconds and uses the most sensitive magnetic sub-levels of the F state to Lorentz violation [4]. As a result, improved bounds on Lorentz violation were extracted in ten times less averaging time. As an outlook, we will discuss the progress in extending this method to multiple ions and elaborate on plans to further explore entangled decoherence-free states for various searches for new physics.

References:

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