Abstract Submitted
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Enhanced sensitivity to ultralight bosonic dark matter in the spectra of SrOH[1] IVAN KOZYRYEV, Columbia University, ZACK LASNER, JOHN DOYLE, Harvard University — The rich spectra of polyatomic molecules offer the possibility of enhanced sensitivity to variations in fundamental constants such as the proton-to-electron mass ratio, μ, arising from coupling between Standard Model particles and theoretically well-motivated ultralight dark matter (UDM) candidates. Recent extension of direct laser cooling techniques to a few linear triatomic metal hydroxide radicals has potential to enable long measurement coherence times and high spectroscopic precision. We show that in SrOH, a near-degeneracy between rotational states in the $X(200)$ and $X(03^10)$ vibrational manifolds of different character leads to $10^3\times$ enhanced sensitivity to μ: a time-dependent change $\delta\mu$ in μ would lead to a change $\delta\nu$ in the resonance frequency ν according to $\delta\nu/\nu$ $10^3\delta\mu/\mu$. We propose to use laser cooling and trapping of SrOH molecules and an experimental approach to enable measurements of $\delta\mu/\mu$ with as low as 10^{-17} fractional uncertainty [1]. A preliminary investigation of potential systematic errors will be discussed as well as possible implications for UDM searches. [1] Kozyryev et al., arXiv:1805.08185

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