Abstract Submitted
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Searching for Scalar Dark Matter via Coupling to Fundamental Constants with Photonic, Atomic and Mechanical Oscillators[1] WILLIAM CAMPBELL, BEN MCALLISTER, MAXIM GORYACHEV, EUGENE IVANOV, MICHAEL TOBAR, Univ of Western Australia — We present a way to search for light scalar dark matter (DM), seeking to exploit putative coupling between dark matter scalar fields and fundamental constants, by searching for frequency modulations in direct comparisons between frequency stable oscillators. Specifically we compare a Cryogenic Sapphire Oscillator (CSO), Hydrogen Maser (HM) atomic oscillator and a bulk acoustic wave quartz oscillator (OCXO). This work demonstrates the use of bulk acoustic wave resonators as sensitive tools for dark matter detection. Results are presented based on 16 days of data in comparisons between the HM and OCXO, and 2 days of comparison between the OCXO and CSO. No evidence of oscillating fundamental constants consistent with a coupling to scalar dark matter is found, and instead limits on the strength of these couplings as a function of the dark matter mass are determined. We constrain the dimensionless coupling constant d_e and combination $|d_{m_e} - d_g|$ across a finite sub-eV mass band. Notably, these limits do not rely on maximum reach analysis, instead employing the more general coefficient separation technique. This experiment paves the way for future, highly sensitive experiments based on state-of-the-art acoustic oscillators.

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