Abstract Submitted
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Searching for Dark Matter with Atomic Clocks and Laser Interferometry YEVGENY STADNIK, VICTOR FLAMBAUM, University of New South Wales — We propose new schemes for the direct detection of low-mass bosonic dark matter, which forms a coherently oscillating classical field and resides in the observed galactic dark matter haloes, using atomic clock, atomic spectroscopy and laser interferometry measurements in the laboratory. We have recently shown that such dark matter can produce both a 'slow' cosmological evolution and oscillating variations in the fundamental constants [Stadnik and Flambaum, PRL 115, 201301 (2015); PRL 113, 151301 (2014)]. Using recent atomic dysprosium spectroscopy measurements in [Van Tilburg et al., PRL 115, 011802 (2015)], we have derived limits on the quadratic interactions of scalar dark matter with ordinary matter that improve on existing constraints by up to 15 orders of magnitude [Stadnik and Flambaum, PRL 115, 201301 (2015)]. We have also proposed the use of laser and maser interferometry as novel high-precision platforms to search for dark matter, with effects due to the variation of the electromagnetic fine-structure constant on alterations in the accumulated phase enhanced by up to 14 orders of magnitude [Stadnik and Flambaum, PRL 114, 161301 (2015); arXiv:1511.00447]. Other possibilities include the use of highly-charged ions, molecules and nuclear clocks.

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