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Limits on oscillating fundamental constants from laser spectroscopy of molecular ensembles

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Oscillations of the fundamental constants are a possible scenario of the effect of quantum fields beyond the Standard Model.

We report about two molecular spectroscopic experiments to search for small oscillations of the nuclear mass. The experiments consist in the comparison of a laser frequency defined by the length of a resonator, or of an unconstrained frequency, with the resonance frequency of an electronic molecular transition.

As such, the experiments are sensitive to modulation of the fine-structure constant, of the electron mass, and of the nuclear mass. The latter sensitivity originates from the vibrational contribution to the electronic transition frequency and is of particular interest here.

We use molecular iodine (I_2), interrogated by lasers at 532 nm and 725 nm. Saturation absorption spectroscopy is used to search for modulation in the frequency range 0.1 - 100 kHz, whereas absorption spectroscopy is employed to cover the range 100 kHz - 100 MHz.

The results of a first data run and the ensuing bounds on the amplitude of modulation of fundamental constants will be presented.

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