HIGH PRECISION UV MEASUREMENTS IN CO, TOWARDS A LABORATORY TEST OF THE TIME-INVARIANCE OF μ.

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The metastable $a^3\Pi$ state of CO has favourable properties for testing the time-invariance of physical constants[a]. Due to an incidental near-degeneracy between the $\Omega = 0, J = 8$ and the $\Omega = 0, J = 6$ the 2-photon microwave transition connecting these two states is highly sensitive to a possible time variation of physical constants, with a sensitivity coefficient ranging from ≈ -300 to $\approx +150$ for different isotopes. We are planning a molecular beam experiment to measure these transitions.

As a first step, spectroscopic measurements have been performed on the $X^1\Sigma^+ \rightarrow a^3\Pi$ transition around 206 nm. We have recorded a total of 40 optical transitions in the six most abundant isotopes. For these measurements, we have used the fourth harmonic of an injection-seeded titanium:sapphire pulsed oscillator. A frequency comb laser referenced to a Rb-clock was used for the absolute calibration of the seed laser. An absolute accuracy of a few MHz was reached.

The optical data for $^{12}C^{16}O$, together with published RF and MW data, was fitted to an effective Hamiltonian. The precision of a number of molecular parameters was significantly increased. The obtained parameters were isotope scaled to calculate the optical transition frequencies in other isotopes. These frequencies typically agree with the measurements within 10 MHz. These calculations confirm the high sensitivity of the near degeneracies to variations of μ.

[a] H.L. Bethlem and W. Ubachs, Faraday Discussions **142**, 25-36 (2009)