Isotope shift spectroscopy in hot mercury vapors

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Accurate measurements of isotope shifts are of paramount importance in atomic physics since they offer crucial insights into nuclear structure, atomic interactions, and, more generally, in fundamental Physics [1]. For heavy atoms, a direct method to investigate new physics scenarios (beyond the Standard Model) involves combining precise measurements of transition frequencies of different isotopes in the so-called King plots and looking for a possible King-plot nonlinearity [2]. We report on absolute center frequency measurements of the mercury intercombination line at 253.7 nm with a combined uncertainty at the level of 10 kHz. More specifically, we performed comb-locked saturated absorption spectroscopy in a 1-mm-long atomic vapor cell using a sensitive wavelength-modulation technique. This technique enabled us to observe a narrow dispersion-like profile in coincidence with the Lamb dip. Following a thorough investigation of the AC Stark shift, we achieved a remarkable precision and accuracy in measuring the absolute line center frequency for both ^{200}Hg and ^{202}Hg isotopes. Consequently, we determined the isotope shift with enhanced accuracy as compared to the past literature [3]. We also report the first results of a double-resonance experiment in an open three-level ladder scheme. This experiment may lead to novel isotope shift data for a transition between excited levels.

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