Photoassociation and photoionization in a two-species Rb-Hg MOT

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We present the detection of near-threshold bound states of excited heteronuclear Rb*Hg molecules through photoassociation spectroscopy [1] near the 795 nm Rb D1 line. The necessary ultracold mixture of Rb and Hg atomic gases was produced using a two-species magneto-optical trap (MOT) [2]. The interaction properties of the RbHg system as well as the prospects for photoassociation near Rb resonance lines and the production of RbHg molecules in their rovibrational ground state were recently analysed *ab initio* [3]. These theoretical predictions helped find and identify the photoassociation resonances.

Ground state molecules composed of an alkali-metal and a closed-shell atom, like RbYb [4] or RbHg, offer both permanent magnetic-dipole and electric-dipole moments thanks to their unpaired valence electron. Recently, magnetic Feshbach resonances were observed in such systems [5] providing a valuable tool for efficient control of atomic collisions. On the other hand, Hg is applicable in fundamental research with optical atomic clocks [6]. Dimers containing Hg were also proposed as good candidate species in the search for the electron electric dipole moment [7].

We also measure photoionization cross sections of the $5S_{1/2}$ and $5P_{3/2}$ states of ^{87}Rb in the Rb-Hg MOT using the Hg cooling laser operating at 254 nm. Since the 254 nm laser ionizes both the $5S_{1/2}$ and $5P_{3/2}$ states, we calibrate the latter state fraction by measuring the photoionization rate induced by an additional 401.5 nm laser. The photoionization cross section for the Rb $5P_{3/2}$ state at 401.5 nm agrees quantitatively with previous determinations [8].

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