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Towards precision spectroscopy of molecular hydrogen ions

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The molecular hydrogen ion is a promising candidate for the metrology of fundamental constants, as its rovibrational transition frequencies can be calculated to the few-10^{-12} accuracy level [1]. Measuring the transition frequencies between the levels with similar precision will provide an independent determination of the proton to electron mass ratio m_p/m_e and possibly of the proton radius. I will present our recent progress towards this goal. In particular, I will show experimental results of state-selective preparation of molecular hydrogen ions in the $v = 0$ and $v = 1$ states and a demonstration of our detection mechanism via photodissociation of the excited state. Very recently, we have embedded sympathetically cooled, state-selected H_2^+ ions in a cloud of laser cooled Be^+ ions and will soon attempt to observe the two-photon vibrational transition at 9.17μm [2].

[1] V.I. Korobov et al., PRL 118, 233001 (2017)
[2] F. Bielsa et al., Opt. Lett. 32, 1641 (2007)

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