Hydrogen molecular ions and fundamental constants

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High-precision spectroscopy of hydrogen molecular ions has been proposed more than four decades ago as a way to determine the proton-to-electron mass ratio m_p/m_e [1]. This idea has not lost its relevance today [2], even considering the precision achieved in recent measurements of the electron and proton masses [3], but needs to be reanalyzed in the light of the current debate on the proton radius [4].

We have shown [5] that combined measurements in H_2^+ and HD^+ could be used to cross-check the proton/deuteron radii and Rydberg constant. To that end the theoretical accuracy should be improved to a few 10^{-12}; recent progress in the calculation of $m\alpha^8$-order QED corrections [6] has brought us closer to this goal. The most appropriate ro-vibrational transitions, experimental methods by which they can be measured, and experimental status will be discussed. Finally, the prospects of using hydrogen molecular ions as probes of a possible time variation of m_p/m_e will be reviewed [7].

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