TOWARDS A HYDROGEN MOLECULAR ION CLOCK

M. BEYER, *Department of Physics and Astronomy, VU Amsterdam, Amsterdam, The Netherlands.*

The molecular hydrogen ion is the simplest of all molecules and as such is an important system for the development of molecular quantum mechanics. The rovibrational energy-level structure of this one-electron system can be calculated extremely precisely by quantum-chemical methods which include the determination of relativistic and QED effects. By comparison with the results of precision measurements of rovibronic intervals, fundamental constants, such as the proton-to-electron mass ratio, can be determined.

I will give an overview of our work towards building a novel molecular clock based on weakly bound states of the molecular hydrogen ion. Various laser sources in the visible and (vacuum) ultraviolet wavelength range are used to selectively produce H_2^+ in the desired weakly bound states, and to precisely measure its 'clock' frequency in the microwave range.

Together, the theoretical framework and results of the clock measurements form a unique system that will shed light on several intriguing pending issues in physics, ranging from the (still not understood) role of nuclear-spin-induced symmetry breaking within the framework of quantum electrodynamics, to the possible existence of time-varying fundamental constants and hypothesized spin-dependent fifth forces.

p-number: p253 **Submitted on Tue, 27 Jun 2023 21:34:32 +0200**