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Searching for New Physics using hydrogen molecular ions (and more)

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Spectroscopy of the HD^+ molecular ion has made a ''quantum" leap in recent years, reaching part-per-trillion precision by use of techniques for Doppler-free excitation. The theoretical precision has also been improved, both in the spin-averaged transition frequencies and in hyperfine structure.

Under the assumption that the Standard Model correctly describes the physics of HD^+, comparison between theory and experiment can be used to improve the determination of the proton-electron mass ratio. I will briefly describe a recent reanalysis of experimental data in the perspective of the adjustment of fundamental constants.

Using independent values of the particle masses deduced from Penning trap measurements, one can exploit HD^+ spectroscopy to constrain hypothetical interactions beyond the standard model. Here, a global approach to combine different types of spectroscopic data is desirable, keeping in mind that the vlaues of fundamental constants themselves could be affected by the New Physics being tested. I will present a self-consistent solution to this problem, and results of a first implementation of this method.

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