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Precision proton-deuteron mass ratio from cyclotron frequency measurements of H_2^+ and D^+ with H_2^+ in the vibrational ground-state[1]
DAVID J FINK, EDMUND G MYERS, Florida State University — Precision measurements of the CFR (cyclotron frequency ratio) of H_2^+ to D^+ provide an effective means to determine the mass ratio of the proton and deuteron m_p/m_d. Comparison of ions of nearly equal mass results in a large reduction in systematic errors. When the H_2^+ is produced by electron-impact ionization of H_2 this process is made more complicated because the H_2^+ can be formed in one of 20 vibrational levels, which significantly affects its mass. For instance, the energy difference between $v = 1$ and $v = 0$ ($J = 0$) corresponds to a fractional change in mass of 1.45 x 10^{-10}. However, since our CFR resolution is sufficient to resolve this difference, we can identify the ground vibrational level. In addition, we can accelerate the decay from excited vibrational levels to the ground level by means of Stark-quenching, by placing the H_2^+ in a large cyclotron orbit. The status of our measurements and study of systematics will be presented.

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