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Deuteron to Proton Mass Ratio from Precision Measurement of the Cyclotron Frequencies of H_2^+ and D^+ with H_2^+ in a Resolved Ro-vibrational State[1] DAVID FINK, EDMUND MYERS, Florida State University — Determination of the deuteron-to-proton mass ratio (m_d/m_p) from precision measurement of the CFR (cyclotron frequency ratio) H_2^+/D^+ benefits from a reduction in systematic error due to the use of ions of similar m/q. However, additional uncertainty results from lack of knowledge of the H_2^+ ro-vibrational state. Following a previous measurement using alternating measurements of cyclotron frequency with ions in large and small cyclotron orbits [1], we are implementing a two-ion simultaneous measurement technique, originally developed at MIT for ions with $m/q \sim 30$, to increase the precision of our measurement of the H_2^+/D^+ CFR. By measuring the cyclotron frequency of the H_2^+ and D^+ ions simultaneously, statistical uncertainty due to magnetic field variation is minimized. With feedback cooling to reduce statistical noise on the cyclotron frequency (due to thermal fluctuations in the cyclotron radius combined with special relativity) this technique may enable us to identify specific ro-vibrational decays, and hence obtain a sub-10^{-11} measurement of m_d/m_p.

[1] D. J. Fink and E. G. Myers, Phys. Rev. Lett. 124, 013001 (2020).

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