

Abstract Submitted  
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**Highly Sensitive Molecular Ion Probe for Variation of the Proton-to-Electron Mass Ratio**<sup>1</sup> MARK KOKISH, PATRICK STOLLENWERK, Northwestern University, MASATOSHI KAJITA, National Institute of Information and Communications Technology, BRIAN ODOM, Northwestern University — Rovibrational transitions in molecules provide an unambiguous connection to the proton-to-electron mass ratio ( $\mu$ ). However, difficulties in molecular state preparation, detection and control over systematics have prevented setting new limits on  $\mu$ -variation at the level set by analogous measurements in atoms. We identify a new molecular ion,  $\text{TeH}^+$ , which has unique properties that mitigate these challenges. Its electronic structure leads to highly diagonal Franck-Condon factors, which can be exploited to implement fast optical state preparation. Combined with its deep ground state potential well in the optical domain, statistical averaging for a single  $\text{TeH}^+$  ion leads to a fractional precision comparable to that of single ion atomic clocks. Its  $0^+$  ground state is also relatively insensitive to systematic Zeeman and Stark shifts. These features all together reveal a promising candidate for setting a new limit on  $\mu$ -variation.

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