

## VIBRATIONAL SPECTROSCOPY OF SYMPATHETICALLY COOLED $\text{CaH}^+$ MOLECULAR IONS

NCAMISO B. KHANYILE, JAMES E. GOEDERS and KENNETH R. BROWN, *Department of Chemistry, Georgia Institute of Technology, Atlanta, GA 30332.*

The search for time variation in the fundamental constants of nature such as the fine structure constant( $\alpha$ ) and the proton/electron mass ratio( $\mu$ ), is an area of active research<sup>a</sup>. Comparing the vibrational overtones of  $\text{CaH}^+$  with electronic transitions in atoms has been proposed as a means to detect possible time variation of  $\mu$ <sup>b</sup>. Before these precision measurements can be realized, the survey spectroscopy needs to be performed. We describe our experiments using a Coulomb crystal of sympathetically cooled  $\text{CaH}^+$  and laser-cooled  $\text{Ca}^+$  ions to measure the vibrational overtones by resonance-enhanced multiphoton photo-dissociation (REMPD) in a linear Paul trap. The dissociation of  $\text{CaH}^+$  is detected by observing the change in the crystal composition by monitoring the  $\text{Ca}^+$  fluorescence. Future single ion experiments for the precision measurement are also discussed.

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<sup>a</sup>J. Uzan, Rev. Mod. Phys. 75, 403 (2003).

<sup>b</sup>M. Kajita and Y. Moriwaki, J. Phys. B: At. Mol. Opt. Phys. 42, 154022(2009).