

## SUB-DOPPLER SPECTROSCOPY OF $\text{ND}_3\text{H}^+$ ION IN THE NH STRETCHING MODE

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Despite early successes with velocity modulation spectroscopy<sup>a,b</sup> of ammonium ( $\text{NH}_4^+$ ) and perdeuteroammonium ( $\text{ND}_4^+$ ) cation, corresponding studies of any of the mixed H/D isotopomers ( $\text{NH}_m\text{D}_{4-m}^+$ ) have proven elusive. In this talk, we present first high resolution results on the lone NH stretch fundamental mode for the jet cooled  $\text{ND}_3\text{H}^+$  ion, based on tunable IR difference frequency absorption spectroscopy in a slit jet, sub-Doppler resolution infrared spectrometer. Supersonically cooled  $\text{ND}_3\text{H}^+$  ions are generated by modulated (50 KHz) discharges (650V, 500 mA) in  $\text{ND}_3$  doped  $\text{H}_2/\text{Ne}$  slit jet expansions, monitored by time-gated, lock-in detection methods and with absorption sensitivities near the quantum shot noise limit. Jet cooled (30 K) *P*, *Q*, and *R* branch rovibrational progressions in the *a*-type NH stretch band are observed and unambiguously assigned by four line ground state combination differences, with additional confirmation by nuclear spin statistical weights for the 3 identical D atoms ( $I = 1$ ). Least squares fits to this parallel band yield precision rotational constants and an NH stretch vibrational band origin at  $3316.8347(19) \text{ cm}^{-1}$ . These high resolution spectroscopic results prove to be in generally excellent agreement with high level *ab initio* theoretical predictions by Martin and Lee<sup>c</sup>.

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<sup>a</sup>Mark.W. Crofton, Takeshi. Oka, J. Chem. Phys. 86, 5983, (1987).

<sup>b</sup>E. Schafer, M. H. Begemann, C. S. Gudeman, R. J. Saykally, J. Chem. Phys. 79, 3159, (1983).

<sup>c</sup>Jan. M. L. Martin, Timothy J. Lee, Chem. Phys. Lett. 258, 129 (1996)