ROTATIONAL SPECTROSCOPY OF UREA UP TO 500 GHZ: THE GROUND STATE AND EIGHT EXCITED VIBRATIONAL STATES

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Urea has an important role in the nitrogen cycle of organisms and is produced at large scales industrially for food production among other uses. Its significance in the formation of complex prebiotic molecules has made it an appealing target for astronomers searching for precursors to life in space [1]. Some of the data presented here has enabled definitive detection of urea in the interstellar medium with modern submillimeter telescopes [2]. Assignment of the ground and eight lowest vibrational states of urea, $(\mathrm{NH_2})_2\mathrm{CO}$, was performed over a spectral range between 210-500 GHz [3]. Intensities of the excited state lines were calibrated by means of a global fit of the ground state and excited state intensities to determine relative vibrational energies. The lowest of these states was found to be $61\ \mathrm{cm}^{-1}$above the ground state which is consistent with previously determined values and could potentially aid in the determination of the temperature urea spectra. The next two lowest vibrational states we found to be significantly coupled and were treated with a Coriolis coupling model. Other higher vibrational states also demonstrated significant coupling. Combined, the vibrational symmetries along with the relative energies provide insight into the structure of urea vibrational energies.

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[2] A. Belloche et al., "Re-exploring Molecular Complexity with ALMA (ReMoCA): interstellar detection of urea," *Astron & Astrophys*, vol. 628, 2019, . Available: https://doi.org/10.1051/0004-6361/201935428

[3] D. J. Tyree, T. W. Chapman, I. R. Medvedev, and Z. Kisiel, "Rotational spectroscopy of urea up to 500 GHz: The ground and eight excited vibrational states," *J Mol Spectrosc*, vol. 390, p. 111706, 2022, doi: https://doi.org/10.1016/j.jms.2022.111706.