MODELING PLANETARY OPACITIES WITH HITRAN AND HAPI: TEST CASE OF AMMONIA MICROWAVE ABSORPTION SPECTRA UNDER JOVIAN CONDITION

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The HITRAN (high-resolution transmission molecular spectroscopic database) is an international standard for reference molecular spectroscopy, particularly in simulating planetary and terrestrial atmospheric spectra [1]. HITRAN recently added new broadening parameters that are relevant to planetary atmospheres for many chemical species in the database. For NH_3, new broadening parameters include H_2, He, CO_2 [2] and H_2O [3]. These additional broadening parameters for NH_3 allowed for validations of HITRAN data with the HITRAN Application Programming Interface (HAPI) [4] against the NH_3 opacity models and laboratory data utilized by the Juno Mission. The Juno spacecraft carries with it a microwave radiometer which probes the atmospheric composition of Jupiter in the microwave range (0.02-0.73 cm^{-1}) [5,6]. At these frequencies, Jupiter's atmospheric spectra is dominated by the inversion of NH_3 and is broadened by H_2, He, and H_2O. This work required three new line shapes to be incorporated into HAPI in order to accurately compare to available laboratory data and standard NH_3 opacity models (the Ben-Reuven [7], Gross [8] and Van Vleck and Weisskopf [9] line shapes). The results of this work demonstrate that HAPI can be used with HITRAN data, to model NH_3 opacities under Jovian conditions in the microwave region. It also shows great promise to produce opacities for other species of interest to the planetary community.

References

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