New Laboratory Measurements of the Microwave Absorption Coefficient of Ammonia and Water Vapor under Jovian Conditions

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Determination of the abundance of water vapor present in the Jovian atmosphere is of extraordinarily high priority to understanding of the evolution of the solar system. Measurement of global H_2O abundances at Jupiter is best accomplished through passive microwave emission measurements, since wavelengths can be chosen that are capable of probing beneath the ammonia and water cloud layers to hundreds of bars of pressure. For these measurements to be accurately interpreted, however, the hydrogen and helium pressure-broadened microwave opacities of H_2O and NH_3 must be well characterized, a task that is very difficult if based solely on theory and limited laboratory measurements. Therefore, laboratory measurements have been taken under a broad range of conditions that mimic those of the Jovian atmosphere. These measurements, performed on an updated high-accuracy system (described in detail in Hanley and Steffes [2007 *Radio Science* in press]), are being used in the creation of models for the microwave opacity of H_2O and NH_3 in an H_2/He atmosphere. These will enable more accurate retrieval of H_2O and NH_3 abundances from future missions to Jupiter and the outer planets, such as the NASA New Frontiers Juno mission scheduled for launch in 2011. This information will enable a greater understanding of the concentration and distribution of H_2O and NH_3 in the Jovian atmosphere, which would reveal much about the planet's dynamics and formation.

New data on the absorption coefficients of H_2O and NH_3 in an H_2/He atmosphere will be presented and compared to presently used models. The data for NH_3 has been taken at temperatures from 183 to 450 K and for H_2O from 350 to 450 K, both at pressures up to 12 bars, and frequencies from 1.5 GHz up to 23 GHz. Because the weighting functions of the 600 and 1200 MHz channels on the Juno Microwave Radiometer will probe deeper into the Jovian atmosphere to higher pressures, a new measurement system capable of measuring up to 100 bars of pressure is under development and is described in an accompanying paper (see Karpowicz and Steffes 2008).