Application of Laboratory UV Measurements of NH_3 and C_2H_2 Absorption Coefficients to Hubble Space Telescope Observations of Jupiter

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Spectrographs aboard the HST have observed Jupiter at the center of the disk and at the limb. Local air masses at the two equatorial positions are 1.0 and 2.5 respectively. The central spectrum includes GHRS G200M and FOS G190H and G270H data, from 1700 to 3300Å. The limb spectrum includes only FOS G190H data, up to 2300Å. The spectra were obtained during consecutive HST Earth-orbits, such that the G190H data at each location measure the same parcel of Jovian air, that planet having rotated in the interim between HST observations. The respective G190H observations contain essentially all of the information on Jovian NH_3 and C_2H_2 in the current data set.

HST UV imaging shows significant UV limb-brightening at the location of the limb spectrum. It is necessary to invoke a thin, high-altitude, strongly back-scattering haze layer to reconcile the central and limb continuum albedos near 2300Å wavelength. With that constraint satisfied, it is then possible to explain both spectra of Jupiter well with a simple model consisting of 15 km-am of clear H_2, which exhibits both Rayleigh and Raman scattering, and minor amounts of NH_3 and C_2H_2. These minor gases are distributed nonuniformly with altitude, with the C_2H_2 being concentrated toward the top and NH_3 toward the bottom. NH_3 and C_2H_2 absorption coefficients used in this work have been described further by Wu *et al.* (this volume). Additional trace amounts of other molecules, including polyacetylenes, are compatible with, but not compelled by, these data.

While the reality of NH3 absorption on Jupiter is beyond doubt, a comparison of laboratory observations (Wu *et al.*) and HST spectra reveals detailed differences for some individual subband structures. In particular, the (0,0) and (1,0) bands on Jupiter, at 2157 and 2166Å respectively, are much narrower than those in the laboratory data of Wu *et al.*, obtained at 175K. The Jovian bandwidths are more consistent with the data of Ziegler (JCP 82(1985)664) obtained at 25K. The (2,0) and (3,0) NH3 bands are expected to resemble the (0,0) and (1,0) bands, as opposed to the (4,0) and higher bands, because the (0,0) to (3,0) bands are not subject to pre-dissociation but (4,0) and higher bands are. However, the HST data indicate that the (2,0) and (3,0) bands are as wide as the (4,0) and higher bands.

Future modelling will investigate the influence of PH_3 on the continuum albedo of Jupiter near 2000Å. Future laboratory studies of very low temperature NH_3 spectra will require open cell techniques, as described by Wu *et al.*.

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