Application of Laboratory UV Measurements of CO and C_2H_2 Absorption Coefficients to Hubble Space Telescope Observations of Neptune

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The Faint Object Spectrograph aboard the HST has observed both Uranus and Neptune from 1700 to 3300Å. The data have previously been analyzed by Courtin *et al.* (1996). Their goal was to determine the CO abundance on Neptune, using the Cameron (0,0) band at 2060Å. CO is known to be present there from millimeter wavelength observations, but it is not in chemical equilibrium in that environment. It therefore requires that there be a source of CO to maintain its presence as observed. Courtin *et al.* were motivated by the potential of the UV observations to clarify the vertical distribution of CO in the upper atmosphere. If one could determine the abundance gradient, with vertical resolution made possible by the multi-spectral data set from submicro- to millimeters, it would then be possible to distinguish between an internal and an external source for the CO. There would be significant implications for the origin and internal structure of the entire planet. Here, we re-analyze the data, with a number of differences from the procedures used by them, the most important being:

1) our inclusion of the effects of C_2H_2 (Chen *et al.* (1991), which are significant,

2) our use of *ab initio* calculations and supporting low-temperature laboratory observations of UV absorption coefficients CO (White *et al.* (1993) , and

3) a more rigorous analysis of errors, which shows that the true errors are significantly less than claimed by Courtin *et al.*.

We do, however, retain one important feature that was developed by Courtin *et al.*. Because the albedos of Uranus and Neptune are very similar, and because CO has not been found at millimeter wavelengths on Uranus, they ratioed Neptune to Uranus, instead of to the Sun, to form a UV quasi-albedo spectrum with reduced spectrographic signatures.

We report a UV non-detection of CO on Neptune, with an upper limit of 5×10^{-6} in the pressure range 0.4-200 mbar, as opposed to the marginal detection $2.7 \pm 1.8 \times 10^{-6}$ found by Courtin *et al.*. A major factor in this contradiction is the different abundances of C_2H_2 on Neptune and Uranus, which mask the true abundance of CO on Neptune.

References:

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