THE ABUNDANCES OF ETHANE TO ACETYLENE IN THE ATMOSPHERES OF JUPITER AND SATURN

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The presentation by Noll *et al.* is largely contained in a paper which appears in the special issue of *Icarus* (1986; 65, 257-263). The abstract of that paper is reproduced here.

Infrared spectra near 780 cm^{-1} of Jupiter and Saturn have been obtained to determine the stratospheric abundances of ethane (C_2H_6) and acetylene (C_2H_2). Atmospheric models using Voyager thermal profiles and density profiles with constant mixing ratios result in the mixing ratios, $X(C_2H_2) = 1.0(\pm0.3) \times 10^{-7}$ and $X(C_2H_6) = 5.5(\pm1.5) \times 10^{-6}$ for Jupiter. The results for Saturn are $X(C_2H_2) = 3.0(\pm1.0) \times 10^{-7}$ and $X(C_2H_6) = 7.0(\pm1.5) \times 10^{-6}$. The ratio of ethane to acetylene, $n[C_2H_6]/n[C_2H_2]$, is found to be insensitive to model atmosphere assumptions. The ratio is 55 ± 31 for Jupiter and 23 ± 12 for Saturn from models with uniform mixing ratios. Atmospheric models with density profiles adapted from theoretical photochemical models also result in a higher ratio of ethane to acetylene (by a factor of 2 at the 1 mbar level) on Jupiter. The lower abundance of acetylene on Jupiter suggests that the rate of vertical transport in the stratosphere may be more rapid on Saturn than on Jupiter.