Molecular Hydrogen in Titan's Atmosphere: Implications of the Measured Tropopsheric and Thermospheric Mole Fractions

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The third most abundant species in Titan's atmosphere is molecular hydrogen with a tropospheric/lower stratospheric mole fraction of 0.001 derived from Voyager and Cassini infrared measurements. In this talk the globally averaged thermospheric profile of the H_2 mole fraction from the Cassini Ion Neutral Mass Spectrometer (INMS) measurements is shown to be inconsistent with the IR inferred value. Although there is only a small positive gradient in the H_2 mixing ratio inferred from the tropopause region to the lower thermosphere (~ 950-1000 km), it drives a downward H_2 flux into Titan's surface comparable to the H_2 escape flux out of the atmosphere and requires larger photochemical production rates of H_2 than obtained by previous photochemical models. From detailed model calculations based on known photochemistry with eddy, molecular, and thermal diffusion, the tropospheric and thermospheric H_2 mole fractions are incompatible by a factor of ~2.

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