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The state of CO and the temperature of Triton's surface

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Abstract

High-resolution spectroscopy of Triton, performed in 2009, has provided the first detection of CO in Triton's atmosphere, and the first observation of CH_4 gas since Voyager (Lellouch et al. 2010). Results indicated (i) a CO/N_2 atmospheric abundance consistent with its surface abundance (0.05 %) (ii) a CH_4 column several times larger than measured by Voyager in 1989. Possible interpretations of the CO abundance are that (a) CO is diluted in N_2 ice and its atmospheric abundance is enhanced by the "detailed balancing" effect or that (b) it results from localized CO-rich patches. Although the first hypothesis is thermodynamically more plausible, it has not been confirmed observationally. For methane, the increase since Voyager is best explained if Triton's surface temperature has increased from the 38 K value measured in 1989, but once again, measurements are lacking.

We acquired high-resolution (R= 5000) observations in K band using VLT/SINFONI in September 2010. The idea is (i) to use the precise position of the CO (2-0) ice feature near 2.35 micron as a diagnostic of the pure vs diluted form of CO on Triton's surface (Quirico and Schmitt, 1997) (ii) to use the shape of the N_2 band at 2.15 micron as a surface temperature probe (Tryka et al. 1994). Additional observations with SINFONI were obtained in H band (R=4000) in September 2011, and in H+K band (R=1500) in August 2013. In addition to the above goals, these high-quality spectra will be used to search for additional features and species on Triton's surface.

References

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