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Seasonal Disappearance of Far-Infrared Haze on Titan

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Abstract

A goal of the *Cassini* mission is the detection and characterization of seasonal changes in Titan's atmosphere. The report by West *et al.* [1] of a distinct drop in altitude near equinox of Titan's detached haze layer prompted us to look for other variations in haze structure. The Composite Infrared Spectrometer (CIRS) has been used to study several types of haze that have signatures in the thermal infrared. A particularly enigmatic emission feature, originally detected by the Infrared Interferometer Spectrometer (IRIS) on *Voyager* 1 appears at 220 cm^{-1} in the far-infrared CIRS spectrum [2, 3]. This emission feature has been detected only at high northern latitudes during the northern winter-to-spring periods covered by *Voyager* and *Cassini*. The composition of the haze material that gives rise to this emission has never been identified, but it is most likely associated with organic gases that are created at high altitude and condense after falling to a height of about 160 km [4].

We report that the emission intensity of the 220 cm^{-1} feature has been steadily decreasing since the arrival of *Cassini* in the Saturn system. Figure 1 shows the changes over 45 Titan flybys between 2004 and 2012. The data shown are the ratios of the peak 220 cm^{-1} emission to the peak of the nearby band of propyne (CH_3CCH) at 325 cm^{-1}. This ratio was key in this study because it allowed us to compensate for the wide variety of viewing geometries among the observations; propyne was relatively unchanged and provided a radiance reference. The 220 cm^{-1} feature diminished in intensity by about a factor of four over Titan's late northern winter and early spring. The weakening was already underway at the beginning of the *Cassini* tour and may reach a minimum in 2014-15. By the end of the *Cassini* mission in 2017 we might see an emergence of this feature in the south. The 220 cm^{-1} time variability is similar to that for gaseous HC_3N in the winter polar region [5]. This could imply that the haze material is composed, at least in part, of nitrile compounds.

[1] West, R. A., Balloch, J., Dumont, P. *et al.*, *Geophys. Res. Lett.*, 38, L06204 (2011).
[2] Coustenis, A., Schmitt, B., Khanna, B., & Trotta, F., *Plan. Space Sci.*, 47, 1305 (1999).
[3] de Kok, R., Irwin, P.G.J., Teanby, N.A. *et al.*, *Icarus*, 191, 223 (2007).
[4] Anderson, C.M., Samuelson, R.E., Bjoraker G.L., & Achterberg, R.K., *Icarus*, 207, 914 (2010).
[5] Vinatier, S., Bézard, B., Nixon, C.A. *et al.*, *Icarus*, 205, 559 (2010).

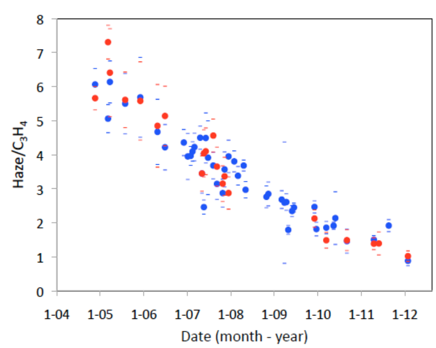

Figure 1: Ratios of the peak radiances of the 220 cm^{-1} haze feature and the C_3H_4 band at 325 cm^{-1} plotted with respect to Titan flyby date. Red data are from limb observations and blue data are from nadir observations.