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Titan's Far-Infrared 220 cm-1 Cloud Seen for the First Time in the South

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ABSTRACT

In 2012 an emission feature at 220 cm-1 in Titan's far-infrared spectrum was seen for the first time in the south [1]. Attributed to a stratosphere ice cloud formed at the winter pole, the 220 cm-1 emission had previously been seen only at high northern latitudes where it had been decreasing since the arrival of Cassini in 2004 [2]. Our far-infrared observations were performed with the Composite Infrared Spectrometer (CIRS) on Cassini [3]. Although it had been expected that the 220 cm-1 emission would eventually appear in the south, the emission appeared rather suddenly, increasing by a factor of at least four between February (when it was not detected) and July 2012. At the time of our observations, one Titan month after equinox, the 220 cm-1feature was present in both the north and south and showed a trend of continued slow decrease in the north and steep increase in the south. As has been the case in the north, the emission in the south was confined to high latitudes associated with winter polar shadowing. Our spectroscopic detection of the southern 220 cm-1 ice cloud coincided with the rapid formation in 2012 of a haze hood and vortex at the south pole as seen in Cassini images [4]. The 220 cm-1 feature was first observed by the Infrared Interferometer Spectrometer (IRIS) on Voyager 1 [5, 6] and has been extensively studied in the north by CIRS [7-10]. Until now the 220 cm-1 emission, like the polar hood, has been associated solely with the north, owing to the fact that Voyager and Cassini have viewed Titan only during winter-spring. In 2012 we witnessed the start of a seasonal shift of this pattern to the south. The 220 cm-1 emission arises from altitudes of 80-150 km and peaks sharply near 140 km. The material responsible for the spectral feature is not known, but indirect evidence hints at a condensate arising from complex nitriles, which also tend to be present only at high winter latitudes.

References: [1] Jennings, D. E., et al., ApJ, 761, L15, 2012. [2] Jennings, D. E., et al., ApJ, 754, L3, 2012. [3] Flasar, F. M., et al., Space Sci. Rev., 115, 169, 2004. [4] West, R. A., et al., DPS, paper 300.04, 2012. [5] Kunde et al. 1981, [6] Coustenis et al., 1999. [7] de Kok et al., Icarus, 191, 223, 2007. [8] de Kok et al., Icarus, 197, 572, 2008. [9] Samuelson et al., Icarus, 189, 63, 2007. [10] Anderson, et al., presented at workshop "Titan Through Time 2", 2012.