

Titan's Ammonia Feature

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Abstract

NH₃ has long been considered an important component in the formation and evolution of the outer planet satellites. NH₃ is particularly important for Titan, since it may serve as the reservoir for atmospheric nitrogen. A brightening seen on Titan starting in 2004 may arise from a transient low-lying fog or surface coating of ammonia. The spectral shape suggests the ammonia is anhydrous, a molecule that hydrates quickly in the presence of water.

1. Introduction

NH₃ has long been considered an important component in the formation and evolution of the outer planet satellites. NH₃ is seen in clouds in the atmospheres of giant planets, but has yet to be detected on any of the satellites. This may be because all forms of NH₃ are unstable in the ambient

conditions of the satellite's surfaces or that its spectral features are altered by other components of the surface, and have not been identified. NH₃ has been suggested as a possible source for sustaining Titan's thick nitrogen-dominated atmosphere.

2. Surface brightening on Titan

It has been demonstrated [1] that brightening occurs on Titan that is transient on the timescale of months. Figure 1 shows the size and shape of the brightening event on Titan and figure 2 demonstrates that the event is both transitory and recurrent. Figure 3 shows the spectral behaviour of the brightening (for various pass bands of the Titan atmosphere) contrasted with laboratory spectra of several frosts. The spectral shape of the brightening is consistent with that of the transient apparition of a pure ammonia frost, but not of ammonia monohydrate or ammonia dihydrate frost.

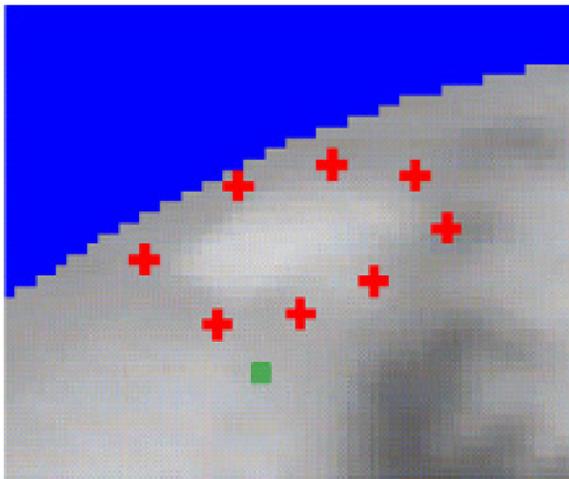


Figure 1 The brightening observed on Titan recurs in same locale, has a short lifetime and low altitude and is consistent with a surface coating that rapidly either evaporates, is covered, or is converted to a composition that is not bright in the wavelength range of VIMS.

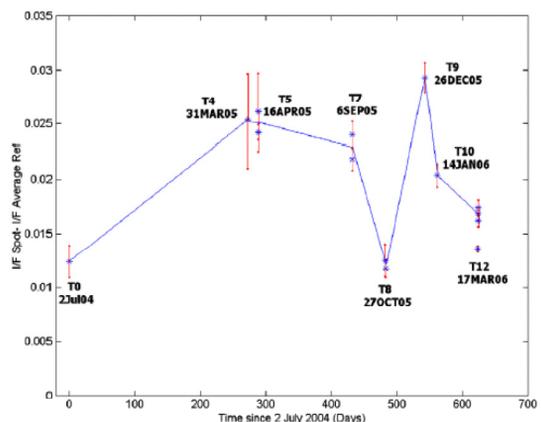


Figure 2 The apparent brightness of the feature varies over time, suggesting both an active source and a rapid sink or covering of the brightened area.

