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Spectrally Dominant Aromatic Hydrocarbon Compounds on Titan (*Invited*)

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The surface composition of Titan is still shrouded in mystery. While some compounds have been identified and mapped on Titan's surface, like liquid ethane + methane lakes, and benzene, the compounds responsible for the main spectral properties have remained elusive (Clark et al, 2010, JGR in press). Titan's surface is seen in the near
infrared in only a few spectral windows, near 0.94, 1.1, 1.3, 1.6, 2.0, 2.68-2.78, and 4.9-5.1 microns in the Cassini Visual and Infrared Mapping Spectrometer (VIMS) spectral range. The apparent reflectance in these windows generally decreases with increasing wavelength except the 2.7 and 5-micron windows which are similar in level. The decrease has led researchers to infer a number of compounds, responsible for the observed decreasing spectral shape; the most common being water ice. But ice is incompatible with the 2.78/2.68 micron I/F ratio. Many organic compounds have absorptions not seen on Titan, eliminating them as possible major components at the surface. In a broad survey of the reflectance properties of organic compounds we have found that the closest spectral matches to the Titan spectrum is best explained by abundant aromatic hydrocarbons
Aromatic hydrocarbons are compatible with all the ratios of reflectances observed through the atmospheric windows, including the 2.68 and 2.78 micron windows. Clark et al. (2010) found a 5.01-micron absorption in some Titan spectra but could not identify a compound. We find that the polycyclic aromatic hydrocarbon (PAH) coronene, consisting of 6 benzene rings matches that feature. Coronene is also a naturally occurring mineral on Earth, known as karpatite. Combinations of PAHs such as coronene, phenanthene ($C_{14}H_{12}$), pentacene ($C_{22}H_{14}$) and other aromatic hydrocarbons like indole (C_8H_7N) match the overall spectral structure
of Titan spectra, Further, subtle changes in spectral diversity shown by Clark et al. in the 5-micron window can be explained by variations in the relative abundances of the aromatic hydrocarbons. Indole has a 1.5 micron band that can explain the feature observed in DISR spectra of Titan's surface. Titan's surface seems dominated by aromatic
hydrocarbon.

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