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Oxygenated Planetary Hazes In Our Backyard: Triton and Carbon Monoxide S. E. Moran¹ S. M. Hörst², C. He², M. J. Radke², J. A. Sebree³, N. R. Izenberg⁴, V. Vuitton, L. Flandinet, F.-R. Orthous-Daunay, C. Wolters

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Abstract:

Triton is the largest moon of the Neptune system and possesses a thin nitrogen atmosphere with trace amounts of carbon monoxide and methane, making it of similar composition to that of the dwarf planet Pluto. Like Pluto and Saturn's moon Titan, Triton has a haze layer thought to be composed of organics formed through photochemistry.

Here, we perform atmospheric chamber experiments of 0.5% CO and 0.2% CH₄ in N₂ at 90 K and 1 mbar to generate Triton haze analogues. We then characterize the physical and chemical properties of these particles. We measure the haze production rate, the bulk composition with combustion analysis, their molecular composition with very high resolution mass spectrometry, and their transmission and reflectance from the optical to the near-infrared with Fourier Transform Infrared (FTIR) Spectroscopy. We compare these properties to existing measurements of Triton's tenuous atmosphere and surface, as well as contextualize these results in view of all the small, hazy, nitrogen-rich worlds of our solar system.

We find that carbon monoxide present at greater mixing ratios than methane in the atmosphere can lead to significantly oxygen- and nitrogen-rich haze materials. These Triton haze analogues have clear observable signatures in their near-infrared spectra, which may help us differentiate the mechanisms behind haze formation processes across diverse solar system bodies. Additionally, these results have implications for the spectral signatures of more oxygen-rich hazes made in some exoplanet atmospheres.

References:

- [1] Moran, S. E., et al. (2022) *JGR – Planets*, 127, 1.