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Pluto's Atmospheric Haze

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Abstract

Haze in Pluto's atmosphere was detected by New Horizons approach and departure imaging and by the UV solar occultation experiments. Layered haze was detected from the surface up to altitudes above 200 km in the visible at solar phase angles from ~20° to ~169°, and it was detected up to 300 km altitude in the UV occultation. The haze is strongly forward scattering in the visible, and a microphysical model of haze reproduces the visible phase function just above the surface with 0.5 µm spherical particles, but also invokes fractal aggregate particles to fit the visible phase function at 45 km altitude and to account for UV extinction. The visible phase function at the bottom of the atmosphere has a back scatter lobe which is absent from the phase function measured 45 km above the surface, making the latter phase function similar to that for haze in Titan's upper atmosphere. Pluto's haze may form by similar processes to those responsible for the detached haze layer in the upper atmosphere of Titan. It is suggested that haze particles form fractal aggregates which grow larger and more spherical as they settle downwards through the bottom 15 km of the atmosphere. Haze particles settle onto Pluto's surface, at a rate sufficient to alter surface optical properties on seasonal (hundred-year) time scales. However, if this picture applies to Pluto's atmosphere throughout the Pluto year, then haze particles would rapidly accumulate to an optically thick surface layer within thousands of years. If the compositions of deposited haze particles are regionally uniform across Pluto, the striking albedo and color contrasts on Pluto, with very bright and dark regions, would be difficult to understand. Pluto's regional scale albedo contrasts may be preserved by atmospheric collapse [1].

Acknowledgements

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References

[1] Cheng A. F. et al. (2017) Haze in Pluto's Atmosphere. Icarus, 290: 112-133.