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Chemical composition and optical constants of Pluto aerosol analogues

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Pluto's tenuous atmosphere is mainly composed of molecular nitrogen N2 and methane CH4, with 515 ± 40 ppm of carbon monoxide CO (Lellouch *et al.*, 2017, Young *et al.*, 2018). This atmosphere is the place of a complex photochemistry producing aerosols that surround Pluto as several thin haze layers extending at more than 350 km of altitude (Cheng *et al.*, 2017, Gladstone *et al.*, 2016, Stern *et al.*, 2015, Young *et al.*, 2018). These aerosols can deeply affect Pluto's atmospheric chemistry and climate. For instance, the aerosols can deplete from the atmosphere small hydrocarbons to form more complex molecules (Luspay-Kuti *et al.*, 2017). They can also serve as cloud condensation nuclei (Lavvas *et al.*, 2016, Luspay-Kuti *et al.*, 2017) or cool the atmosphere by absorbing solar radiations (Zhang *et al.*, 2017).
Laboratory simulation is one way to support these hypotheses and constraint the formation pathways, the chemical composition or the physical properties of Pluto's aerosols. Thus, we produced analogues of Pluto' s aerosols, using the PAMPRE experimental setup (Szopa *et al.*, 2006) developed at LATMOS (Guyancourt, France). As the CH4 mixing ratio strongly varies all along the atmospheric column (Young *et al.*, 2018), different types of analogues were synthesized, in variable proportions of N2 and CH4, with 500 ppm of CO; the idea being to mimic aerosols formed at different altitudes in Pluto's atmosphere.
The chemical composition of these analogues was inferred from infrared spectroscopy, high-resolution mass spectrometry and elemental composition analyses. Their optical constants (refractive indices and absorption coefficients) were determined by spectroscopic ellipsometry.

Field

Planetology (incuding small bodies and exoplanets)

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