The new NASA Ames infrared optical constant facility. Determinations for Titan aerosol-, and exoplanet and brown dwarf cloud particle analogs

Ella Sciamma-O'Brien[1], Ted Roush[1], David Dubois[1,2], Caroline Morley[3], Mark Marley[1], Farid Salama[1]
[1]NASA Ames Research Center, Moffett Field, CA, USA
[2]Bay Area Environmental Research Institute, Moffett Field, CA, USA
[3]University of Texas at Austin, TX, USA

Here we present a new optical constant facility developed at NASA Ames that will allow the determination of optical constants in the infrared of various materials, analogs of hazes and cloud particles in (exo)planet atmospheres and brown dwarfs. Our facility is composed of a Fourier Transform Infrared (FTIR) spectrometer continuously covering the Near-IR, mid-IR and Far-IR range (from 0.74 to 200 μm), coupled to variable angle transmittance and reflectance accessories that allow the characterization of the scattering properties of nonhomogeneous samples (laboratory planetary aerosol analogs, films, slabs of material, crystals, powders…) over a wide incidence and emittance angle range (0-90 degrees). This permits the angular light distribution in both transmission and reflection measurements to be characterized, enabling the determination of the complex indices of refraction, n and k, over the full NIR-FIR range via modeling of the laboratory observations. The resulting refractive indices are critical input parameters in radiative transfer models, exoplanet and brown dwarf cloud models, protoplanetary disk simulations and other models used for the interpretation of observational data from past, current and future (exo)planetary NASA missions. We will present preliminary data obtained on Titan aerosol analogs produced in the Titan Haze Simulation (THS) experiment on COSmIC, a unique experimental platform developed at NASA Ames that allows the simulation of Titan's complex atmospheric chemistry at Titan-like temperature (200 K). We will also introduce a new study of the optical properties of ammonium-bearing phosphates, potential cloud particles forming in temperate exoplanets and brown dwarfs.

Acknowledgements: The authors acknowledge the technical support of Emmett Quigley.