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Optical properties of aerosol haze analogs : implications for future observations with the James Webb Space Telescope

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Photochemical hazes are solid organic particles produced by photochemistry in planetary atmospheres. Their scattering-induced opacity strongly impacts observations of exoplanet atmospheres as it mutes gaseous signatures in the near-infrared [1]. The process of haze formation and the composition of the particles are largely unknown, their optical properties are therefore retrieved on laboratory analogs.

The measurement of optical properties on laboratory haze analogs started four decades ago in order to characterize Titan's aerosols [2]. These data are still used in the context of exoplanet atmospheres despite the different atmospheric compositions expected. Recent work revealed an increased absorbing power for hazes produced in more oxidizing conditions [3]. More data is thus required to accurately constrain the optical properties of hazes in retrieval models.

We produced haze analogs using the PAMPRE plasma reactor at LATMOS and measured their optical constants (refractive index and extinction coefficient) from 0.3 to 30 microns to cover the operating range of the James Webb Space Telescope (JWST). In our study, we provide new data and compare them to the seminal work of [2]. We discuss the impact of the atmospheric composition on the optical properties and implications for future observations with the JWST.

[1] Gao, Wakeford, Moran & Parmentier (2021), JGR : planets 126

[2] Khare, Sagan, Arakawa, Suits, Callcott & Williams (1984), Icarus 60

[3] Gavilan, Carrasco, Hoffmann, Jones & Mason (2018), ApJ 861