Early results of the GTO-MIRI MINDS programme on planet-forming disks Unveiling the composition of inner disks with JWST

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Planets form, migrate, and obtain their elemental composition in disks orbiting young stars (a few Myrs). The elemental composition of gas and solids in disks is expected to vary with time and distance to the star due various processes such as the radial drift of icy-pebbles, chemical reactions, and sublimation of ices. With its extensive spectroscopic capabilities in the near- and mid-IR, JWST is now providing unique access to the composition of planet-forming regions in disks (~<10 au).

In this contribution, I will present the first results of the MIRI Guaranteed Time Observations of planet-forming disks (PI: Th. Henning). This programme extensively surveys the chemical composition of gas and solids in a large sample of disks around stars of various stellar types. I will highlight three early results that demonstrate the unique potential of JWST, namely :

1) The discovery of an extremely rich hydrocarbon chemistry (benzene, C_2H_2, C_4H_2) in a disk around a very low-mass star, hinting at the destruction of refractory carbon within 0.033au (Tabone+ accepted Nat. Astro.). This process could lead to the formation of carbon-poor rocky planets and carbon-rich gaseous planets, depending on their migration patterns.
2) The study of the GW Lup disk showing a particularly high CO_2/H_2O ratio, likely related to the formation of an ice trap between the CO_2 and the H_2O snowlines (Grant+2023., arXiv:2212.08047).
3) The first detection of H_2O in the inner disk of the PDS70 planet-hosting disk (Perotti+ submitted), highlighting the impact of forming giant planets on the composition of inner disk.

Along with these first results, I will present the modelling approaches we are developing to retrieve the composition of the gas and dust from JWST spectra. This talk will highlight the need for a synergy with spectroscopists and laboratory data.