Chemical composition of inner disks with JWST

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Despite the tremendous number of exoplanets detected, planet-forming scenarios are not yet able to fully explain the large diversity of planets. The elemental composition of planetary atmospheres is expected to give valuable insight about their formation, since it is known to vary spatially and temporally due to physical (ex: pebble drift) and chemical (chemical reactions, sublimation) processes, like the C/O ratio.

However, the chemical composition of planet-forming regions of disks is still poorly constrained, making it difficult to link exoplanetary atmospheres and planet formation history. In this context, the James Webb Space Telescope opens an unprecedented observation window on the inner disks (<10 au). The MIRI Guaranteed Time Observation of planet-forming disks MINDS (PI: Th. Henning) observed more than 50 disks, and revealed an active chemistry in these inner regions by detecting plenty of new molecules, especially hydrocarbons.

I will present the surprising diversity of JWST spectra, and I will highlight important results from the MINDS collaboration, such as the link between the molecular composition of inner disks and the stellar mass (Grant et al. 2025). Detailed thermochemical modelling showed that this diversity could be explained by a variation in elemental abundances (Arabhavi et al. 2026, Estève et al. subm), and suggesting that the C/O is below 1 in T Tauri disks (Estève et al. subm). Interestingly, transport models predict a change in elemental content as the disk evolves (Mah et al. 2023, Sellek & van Dishoeck 2025), which leads to consider the leakiness of gaps as the main process behind this diversity (Tabone et al. subm). Statistical studies on larger samples and future ELT observations are needed to confirm this scenario and broaden our knowledge on disk evolution.