Unveiling the chemical and physical structure of planet-forming disks with future infrared facilites: the case of oxygen chemistry

Benoit Tabone*[1], Ewine Van Dishoeck , John Black , and Marc Van Hemert

[1]Leiden Observatory [Leiden] – Netherlands

Abstract

Planets form, migrate, and obtain their elemental composition in disks orbiting young stars (a few Myrs). The upcoming JWST observations, together with ground-based infrared observatories (ELT, ELT) will give unique access to the planet-forming regions of disks (_˜< 20 au). Combined with the constraints on the populations of exoplanets (architecture of the systems, elemental composition of the gas giants), these data will be key for our understanding of planet formation.

In this context, the challenges for the PCMI community are to leverage the capabilities of the next infrared instruments and develop detailed modelling tools to interpret the observations of the molecular lines and dust emission.

In this contribution, I will present our ongoing effort to develop state-of-the-art models, combining thermochemistry and radiative transfer to interpret the near- and mid-infrared emission of the gas located in the inner disks (_˜< 20au). I will focus on oxygen chemistry that is traced by vibrational and ro-vibrational lines on H2O and OH. In particular, I will discuss how " state-to-state " chemical modelling of OH can allow us to constrain the UV radiation field in the disk surface layers from OH mid-IR lines. Synthetic predictions will illustrate the capabilities of JWST and demonstrate the need ELT-METIS observations. I will also stress the need for collaborations will chemists to provide us with data on state-to-state chemistry and on collisional rate coefficients.

*Speaker