Physique du milieu interstellaire à l'ère de JWST

JWST will provide a unique opportunity to study the interstellar medium, with an unprecedented spatial resolution, sensitivity and combining different wavelengths. We expect to detect and spatially resolve a large number of lines, i.e. fine-structure lines of several ions and atoms (e.g., [Fe II], [Fe I], [Ar III], [Ar II], [S IV], [S II], [S I], [P III], [Ne III], [Ne II], ...), fluorescent lines (O, N), recombination lines (H, He, C), pure rotational and ro-vibrational transitions of H2 and its isotopologue HD (both collisionaly excited or radiatively pumped), ro-vibrational transitions of (non-)polar molecules (CH4, C2H2, CO2, C6H6), and highly excited pure rotational and ro-vibrational transitions of CO, H2O, HDO, and OH. Observations of these species, each of which provides a diagnostic of a specific physical environment or chemical reaction, at unprecedented high spatial resolution (up to 0.1'' or 40 AU at 400 pc) have so far been out of reach. Only JWST will spatially resolve at near and mid-IR wavelengths dust emission and scattering simultaneously with the gas lines. The important role of dust properties (e.g., size distribution) will be much constrained.

In this talk, I will focus on highlight science objectives such as the evolution of the physical and chemical conditions at the critical HII/HI/H2 transition zones. JWST ERS and GTO observations will perform a tomography of several irradiated molecular cloud edges, revealing the individual IR spectral signatures in the key transition zones. I will present new near-infrared adaptive optics (AO) images showing a spectacular level of detail over a quite large area, and presage what JWST should achieve when it becomes operational.
Near-infrared AO images reveal unexpected structures within this classic irradiated molecular cloud and how the JWST will complement the highest-resolution ALMA maps of molecular cloud.