The fundamental structure and physical conditions of the Orion Bar as seen by JWST and ALMA

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The infrared emission from Photodissociation Regions (PDRs) dominates the spectra of galaxies as they reprocess a significant fraction of the radiation output of massive stars. The intense stellar far-ultraviolet (FUV) radiation incident upon PDRs plays a dominant role in the physics and chemistry of gas and dust. The study of these regions is therefore essential for a better understanding of star formation, stellar feedback and the evolution of interstellar matter. In this context, the Orion Bar, a prototypical PDR, acts as an interesting interstellar laboratory.

In this contribution, I will present an overview of the main results obtained with the spectro-imaging data, acquired with the *James Webb Space Telescope* (JWST) (PDRs4All program) as well as with ALMA, of the Orion Bar. I will present how we derived strong constraints on physical conditions (temperature, density, warm chemistry…) using the many tracers observed with these instruments (H_2, HD, CH^+, HCN, CN). I will show that we observe a high density and thermal pressure gradient near the dissociation front. I will present the spatial morphology of HCN and CN emission observed with ALMA, well-known tracers of density due to their high critical densities. Comparing observations with PDR and radiative transfer models, I will show that we derive high densities after the dissociation front but that we do not find major density variation, contrary to what is expected in a small-scale clumpiness scenario. We argue that the structure observed in HCN emission rather originated from the propagation of a UV-driven shock compressing the gas. Finally, I will show that in the extreme conditions found in the Orion Bar (high UV field intensity and gas density), we observe a very active UV-induced chemistry driven by high-temperature with reactions with H_2 and FUV-pumped H_2.