Dust Evolution in the Orion Bar: New insights from the JWST

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The interstellar medium (ISM) is a complex and dynamic environment that plays a crucial role in the formation of stars and planets. Dust is a fundamental component of the ISM, and its properties, including composition, size distribution, abundance, and optical properties, evolve in response to changes in the local environment, such as radiation field and density. In this study, we use data from the JWST program "PDRs4All" to explore the evolution of dust properties in the Orion Bar, a strongly FUV-irradiated photon-dominated region (PDR) at the interface between cold, dense molecular clouds and hot, ionized regions.

We model the dust emission in the Orion Bar in seven photometric bands using THEMIS dust model and SOC, a 3D radiative transfer code that takes into account variations in the local physical conditions: geometry, density, and irradiation.

The JWST allows us for the first time to spatially resolve the steep density gradient at the illuminated edge of the PDR. By considering carbonaceous nanograins and aggregates across the PDR, we derive unprecedented constraints on the properties of the dust grains across the Orion bar.

This study provides new insights into the evolution of dust properties in PDRs and demonstrates the power of JWST observations to spatially resolve these regions.

References:

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