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PDRs with JWST: Probes of dust formation and evolution

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Photodissociation regions (PDRs) are predominantly neutral regions of the ISM in which the heating and chemistry are mainly regulated by far ultraviolet photons emitted from one or more nearby young stars. They are extended regions at the interface between the ionizing sources and molecular clouds, and contain dense structures and clumps of dust and gas immersed in a more diffuse medium. Dust at the PDR interface experiences extreme physical conditions, with temperatures and densities varying by orders of magnitude over very small spatial scales, of order a few hundred AU. Hence the PDR interface provides a unique opportunity to study (1) dust formation as a function of environment, from the ionized region in front of the PDR to the dense regions behind the PDR (2) the destruction and evolution of grain mantles/clusters in the transition region, (3) the role of dust in regulating molecular chemistry (e.g. H2 formation on grain surfaces), and (4) the potential identification of grain composition via excitation studies.
In light of the potential impact PDRs have on our understanding of dust properties and their interdependence with the gaseous and molecular phase, the JWST NIRCam and MIRI GTO teams have proposed a joint GTO program to study two nearby PDRs, NGC 7023 and the Horsehead nebula, using a suite of instruments and modes on JWST. These emblematic PDRs have different excitation conditions and relatively simple geometries and are ideal targets to take full advantage of the high spatial resolution and sensitivity of JWST. In this poster, we describe the observing strategy for our GTO program and briefly describe several of the science goals of the team.

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Yes

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