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Searching for forming planets embedded in protoplanetary disks with JWST/NIRCam

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Observations in both scattered light (e.g., GPI and SPHERE) and thermal emission (e.g., ALMA) have revealed gaps and spiral structures within circumstellar disks. These disk substructures may be the result of dynamical interactions with massive protoplanets forming within the disks. Direct observations of these protoplanets would allow us to test theories of planet formation by characterizing them in terms of i) temperature, luminosity, and orbital location, ii) nature of any circumplanetary disk and its accretion, and iii) local physical conditions of the circumstellar disk.

As part of the NIRCam GTO program (PID 1179), we aim to search for protoplanets embedded within the circumstellar disks of nearby young stars showing strong evidence of companion-induced morphologies, including spiral arm structures (SAO206462 and MWC758), multiple ringed substructures in both thermal emission and scattered light (TWHya and HLTau), and known protoplanets (PDS70).

Of the five targets, MWC758 and HLTau were recently observed. To attain the necessary inner working angle, these observations were performed in direct imaging mode (sans coronagraph) using the F187N, F200W, F405N, and F410M filters. We will present preliminary results for these two sources, including constraints on potential companions, disk features, discussion on technical challenges, and comparison to pre-flight performance expectations.