**HST Images of Protostellar Disks and Envelopes in Orion**

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**Introduction**

We present near-infrared HST NICMOS+WFC3 images of 244 protostars, tracing with better than 70 AU spatial resolution the scattered light from the protostellar envelopes and in some cases, the absorption and shadowing by protostellar disks. Orion is home to half the young stellar objects in the nearest 500 pc and is a largely unexplored ground for scattered-light studies of protostellar envelopes and disks. This region is the focus of HOPS, the Herschel Orion Protostar Survey, a multi-observatory study of protostars using Herschel, Spitzer, Hubble, and APEX. Scattered light images allow us to break degeneracies in fitting the 1–870 micron spectral energy distributions (see posters by E. Furlan and W. Fischer), in particular by constraining the inclination of the source and the opening angle of the envelope cavity.

We also present a grid of 2900 models of the scattered light images to show how the nebulousity depends on cavity shape and inclination. For edge-on protostars, the comparison of the HST images to models allows us to determine the properties of protostellar disks by their shape in absorption against the scattered light and by the shadows they cast in the envelope.

Here we show a subsample of 15 edge-on sources. We then present a detailed analysis of HOPS 136 (Fischer et al. in prep.), where we have used the NICMOS data to provide strong constraints on the disk radius, mass, and structure.

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**Sample**

- The Orion Molecular Clouds contain the largest sample of protostars within 500 pc
- 488 protostellar candidates were identified by Megeath et al (2012) using Spitzer 3-24 μm
- 330 were observed in far-infrared in the Herschel Orion Protostellar Survey (HOPS)
- Imaging and photometry from 1.6-870 μm was obtained for constructing SEDs.
- NICMOS imaging at 1.6 and 2.05 μm was obtained for 89 sources.
- After the failure of NICMOS, 197 more sources were imaged with WFC3 at 1.6 μm

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**HOPS 136: Determining the Properties of an Edge-On Protostellar Disk**

- Edge-on protostar in southern end of L1641
- Bolometric temperature of 180 K, matching with a Class I source (Chen et al. 1995)
- Light scattered in the envelope is apparent in NICMOS F160W and F205W images.
- The following disk properties are constrained by fits to radiative transfer models (Fischer et al. in prep):
  - Disk radius: 450 ± 20 AU
  - Mass of disk: 0.003 ± 0.001 M☉
  - Disk scale height at 100 AU: 22 ± 4 AU
  - Radial density exponent: 2.20 ± 0.05
  - Disk flaring exponent: 1.20 ± 0.05
- We have an ALMA observation in a high priority queue for cycle 1 to observe the angular momentum distribution of this and 3 other edge-on sources

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