'A Major Asymmetric Dust Trap in a Transition Disk' published in *Science*, June 2013

Planet formation in action

Resolved gas and dust images of a transitional disk and its cavity

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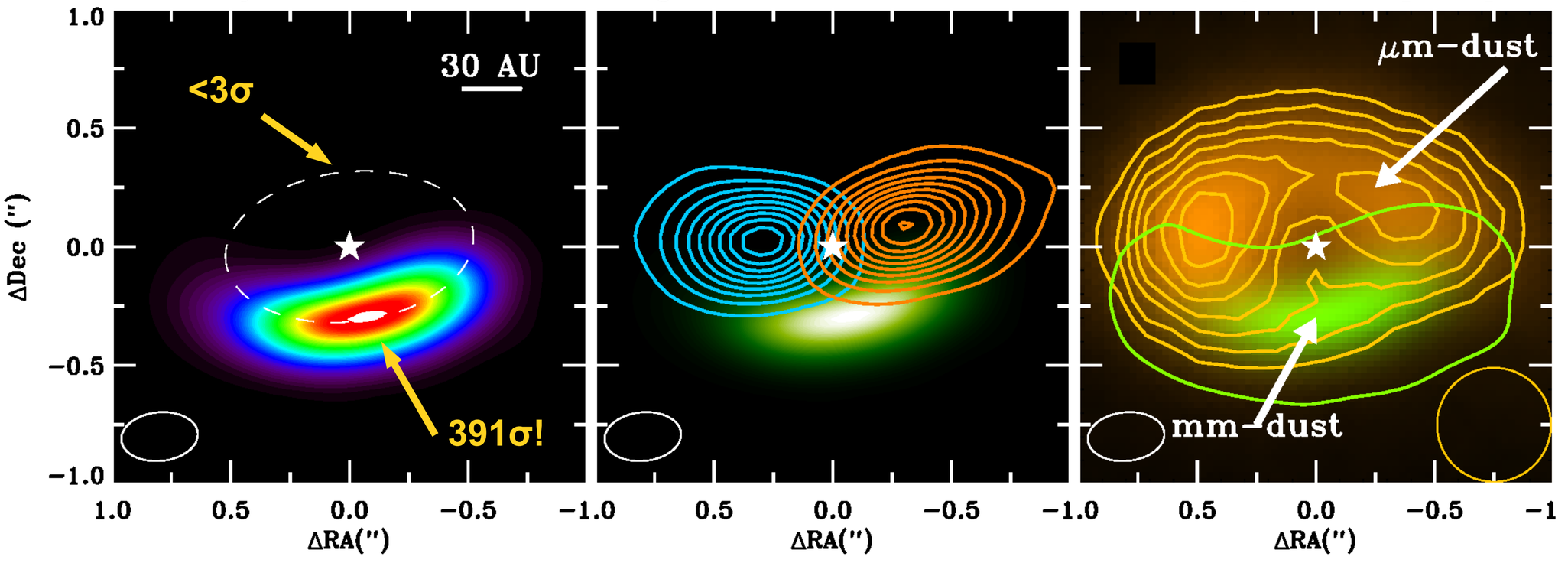
Introduction

- Transitional disks with inner dust holes are the best systems for studying planet formation.
- Both gas and dust observations are needed to understand the origin of the hole.

ALMA Cycle 0 observations of the gas and dust distribution in A0 star Oph IRS 48 [2,3,6]



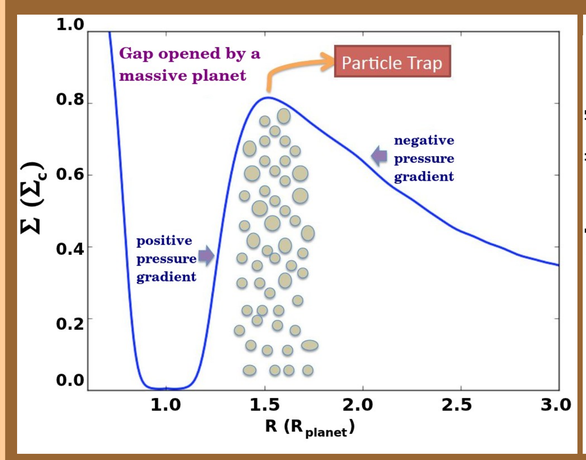
Highly asymmetric crescent in the 0.44 mm dust continuum

Keplerian disk with a 20 AU gas hole in integrated ^{12}CO 6–5 map.

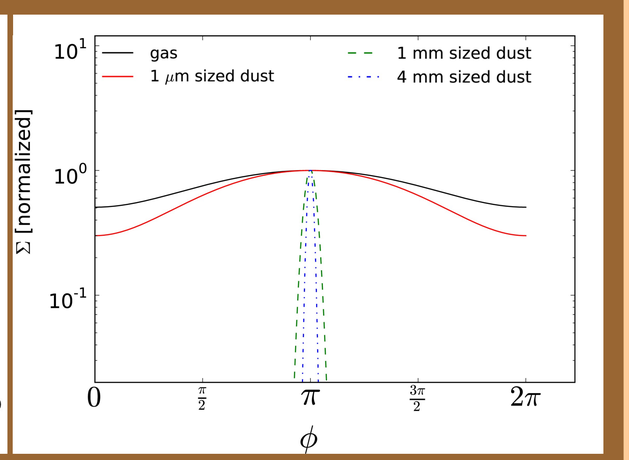
Asymmetric mm-dust vs a full ring of μm-dust (VISIR, [3]).

Separation between large dust and gas/small dust is evidence for dust trapping in a vortex.

Dust trapping

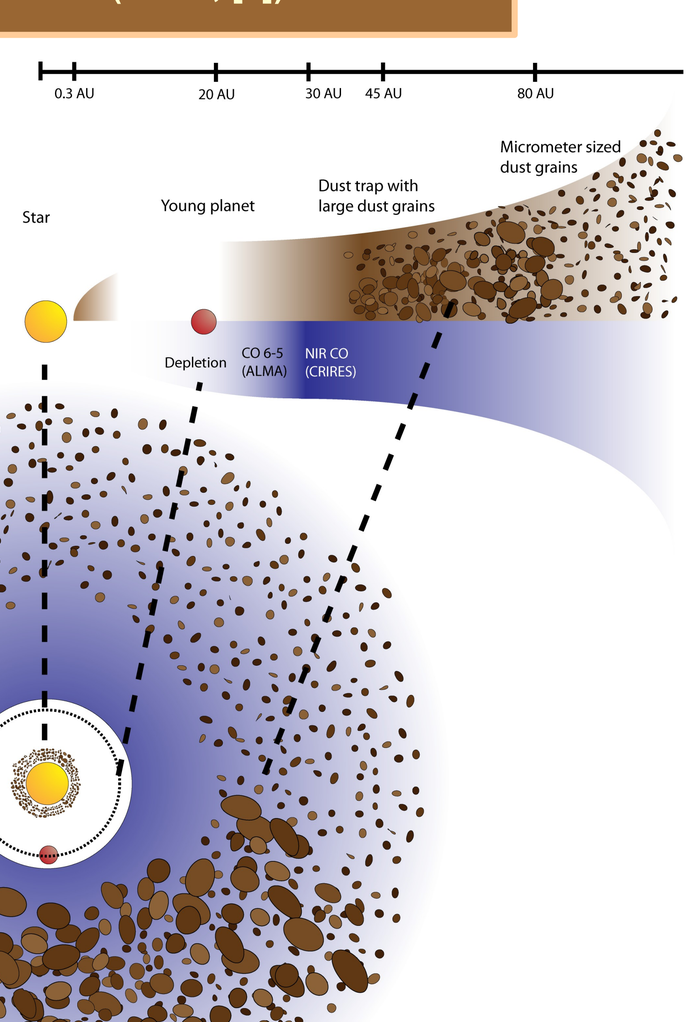


Radial dust trapping



Azimuthal dust trapping

- Gas hole: clearing by a companion.
- At edge of such hole originates a radial pressure bump: large dust particles get trapped [4,5]
- Dust trap proposed as solution for the 'radial drift barrier' [7]: further dust growth.
- Rossby instability of radial pressure bump: vortex as azimuthal dust trap [1].
- Small overdensity in the gas ↔ Large density contrast in dust



Implications

- Modeling prediction: 10 M_{Jup} companion at 20 AU,
- Dust trap as 'comet factory', analogous to a planet factory
- Is dust trapping a common phenomenon in transition disks?
  => Stay tuned for more ALMA observations!

Contact

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References

[1] Birnstiel et al. 2013, A&A, 550, L8, [2] Brown et al. 2012, ApJ, 744, 116, [3] Geers et al. 2007, A&A, 469, L35, [4] Klahr & Henning 1997, Icarus, 128,213, [5] Pinilla et al. 2012, A&A, 545, A81, [6] Van der Marel et al. 2013, Science, 340, 1199, [7] Whipple 1972, From Plasma to Planet. Credits images: ESO/L. Calcada & NRAO/C. Padilla