ALMA results on a case-study transition disk

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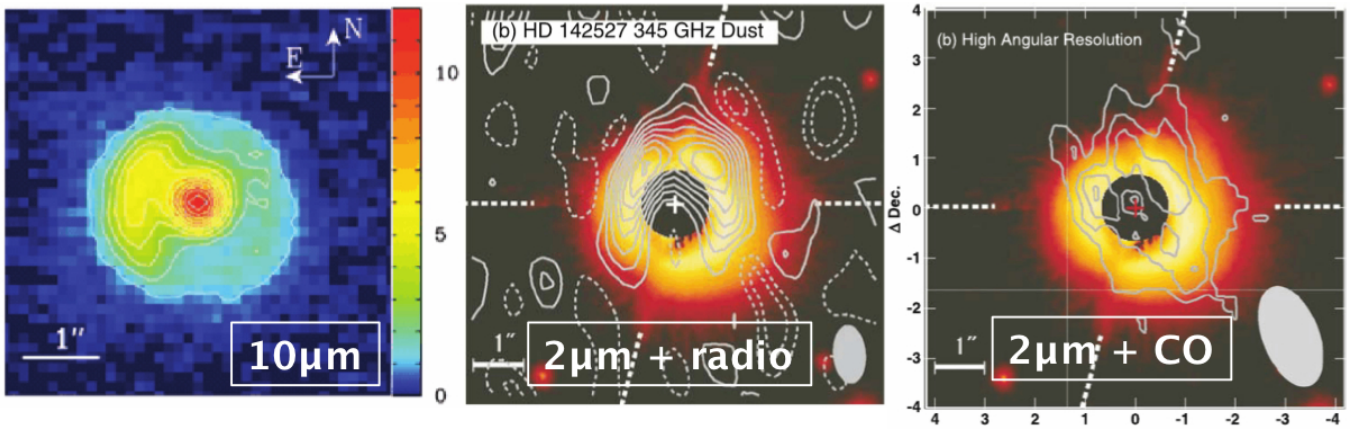
2 **Millenium nucleus for ALMA research in Disks**

Postdoc positions available!

Outline

A large cavity in a face-on transition disk



Subaru images (Fukagawa et al. 2006, Fujiwara et al. 2006) & SMA contours (Ohashi 2010).

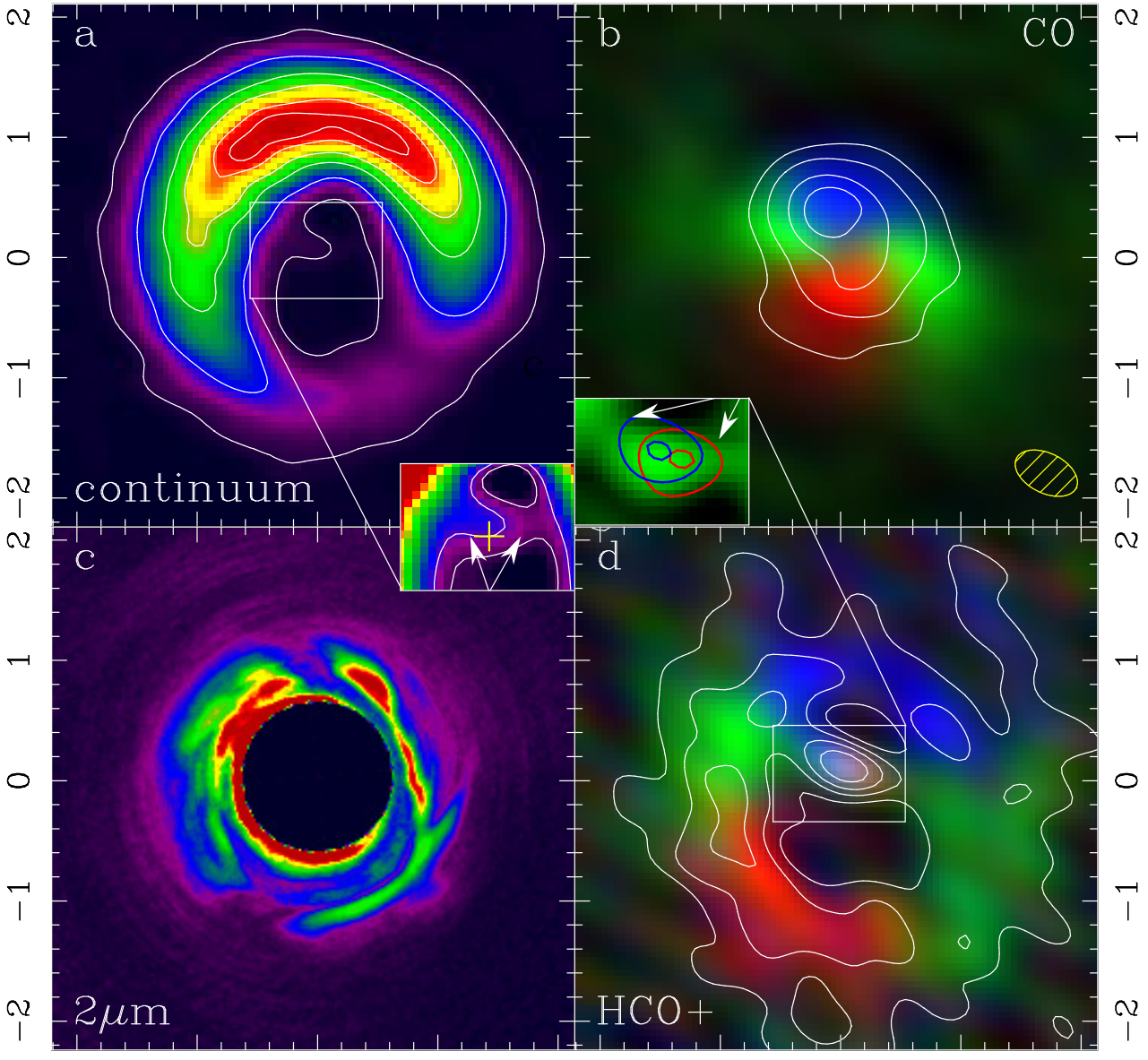
Crystalline inner disk ($r < 0.1''$, van Boekel et al. 2004) with dust mass $\sim 10^{-9}\ M_\odot$ (Verhoeff et al. 2011).

$M_\star \sim 2.2\ M_\odot$, $\dot{M}_\star \sim 10^{-7}\ M_\odot\ yr^{-1}$, $A_V \sim 0.6$, $D \sim 145$ pc,

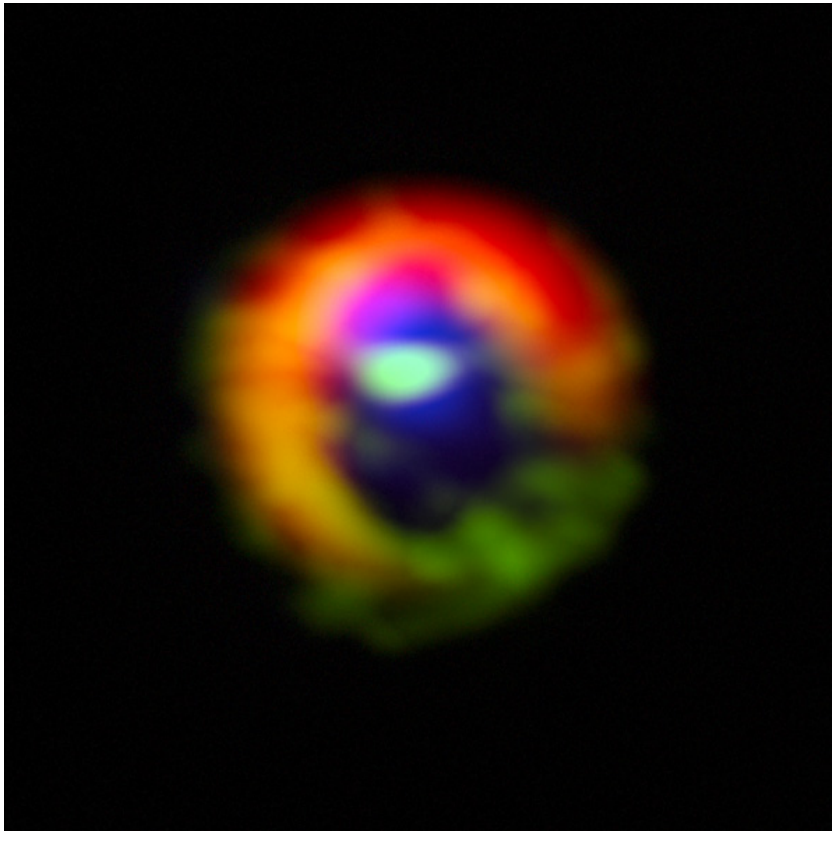
Mm-continuum disk mass $\sim 0.1\ M_\odot$ (Oberg et al. 2011),

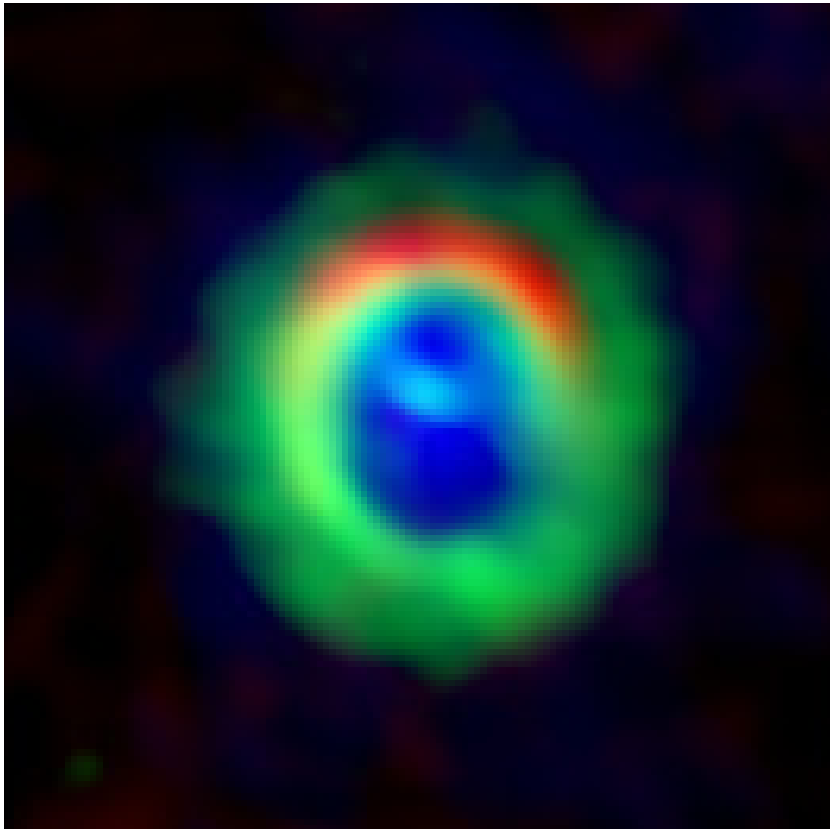
$\Rightarrow$ Inner disk is a steady state feature of accretion

ALMA band 7 data + NICI ADI



Summary RGB figs



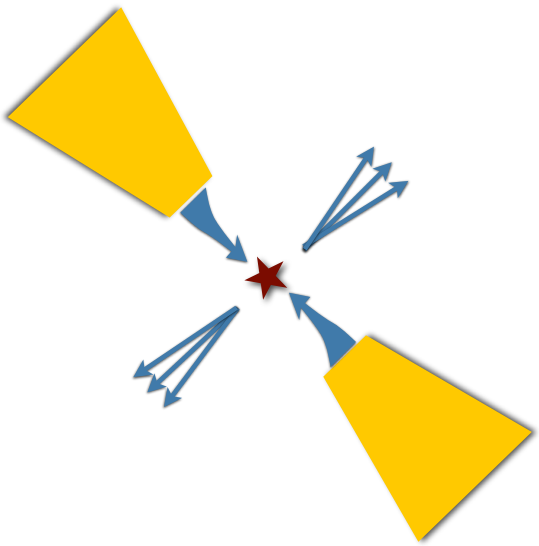


ESO press release

In-house MEM models

345 GHz, **HCO(4-3)$^+$**, **CO(3-2)**

Inflow or outflow?

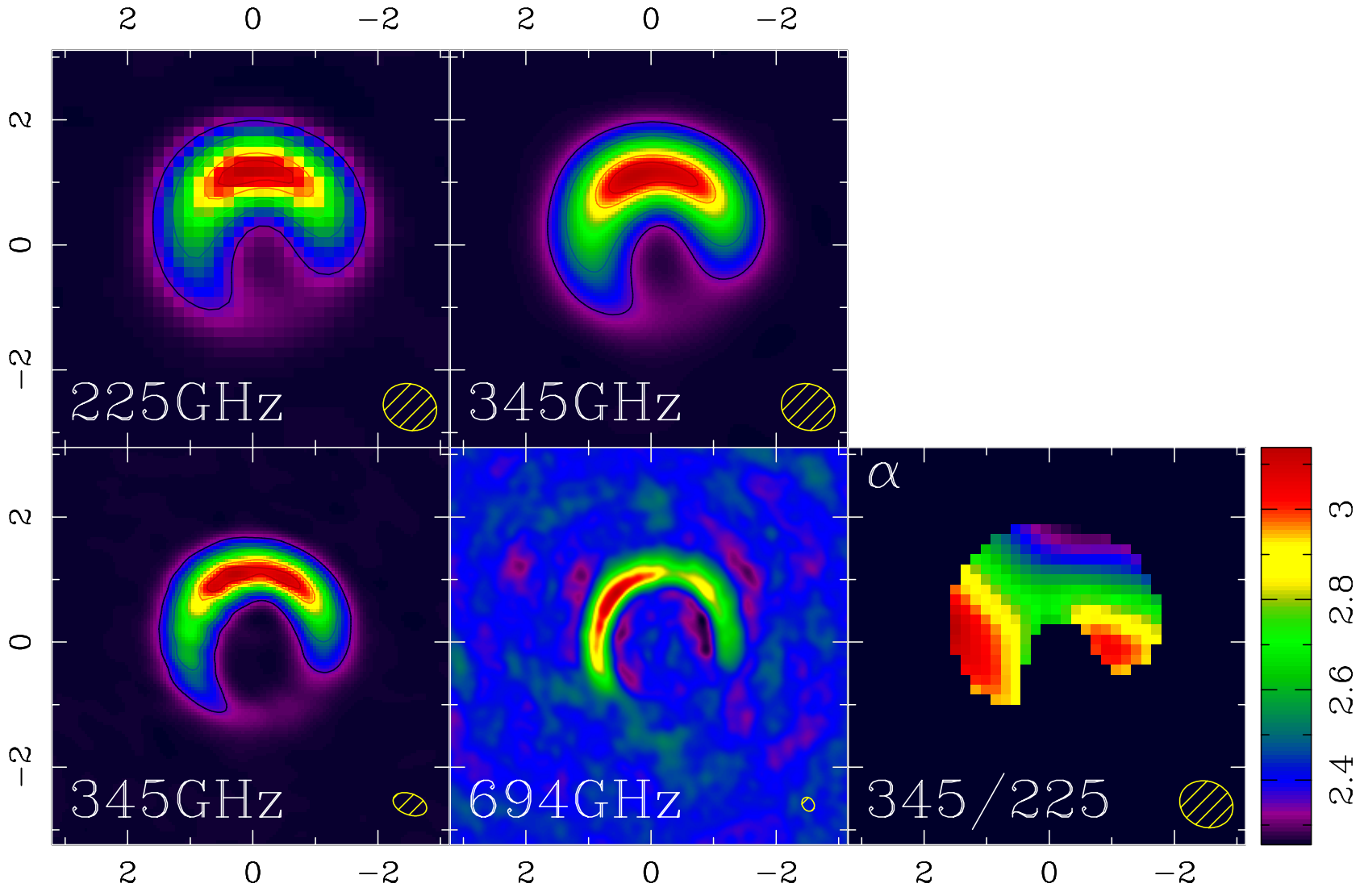


- Inflow interpretation assumes east is far.
- Approx. perpendicular alignment of flow axis with disk, but apparent obtuse ‘v’ shape with star at vertex.
- Systemic velocity filament connect with the ring $\Rightarrow$ zero-velocity terminal speed?
- $7\ 10^{-9} < \dot{M}/\ M_\odot\ \mathrm{yr}^{-1} < 2\ 10^{-7}$ $\Rightarrow$ close to stellar accretion rate $7\ 10^{-8}\ M_\odot\ \mathrm{yr}^{-1}$.

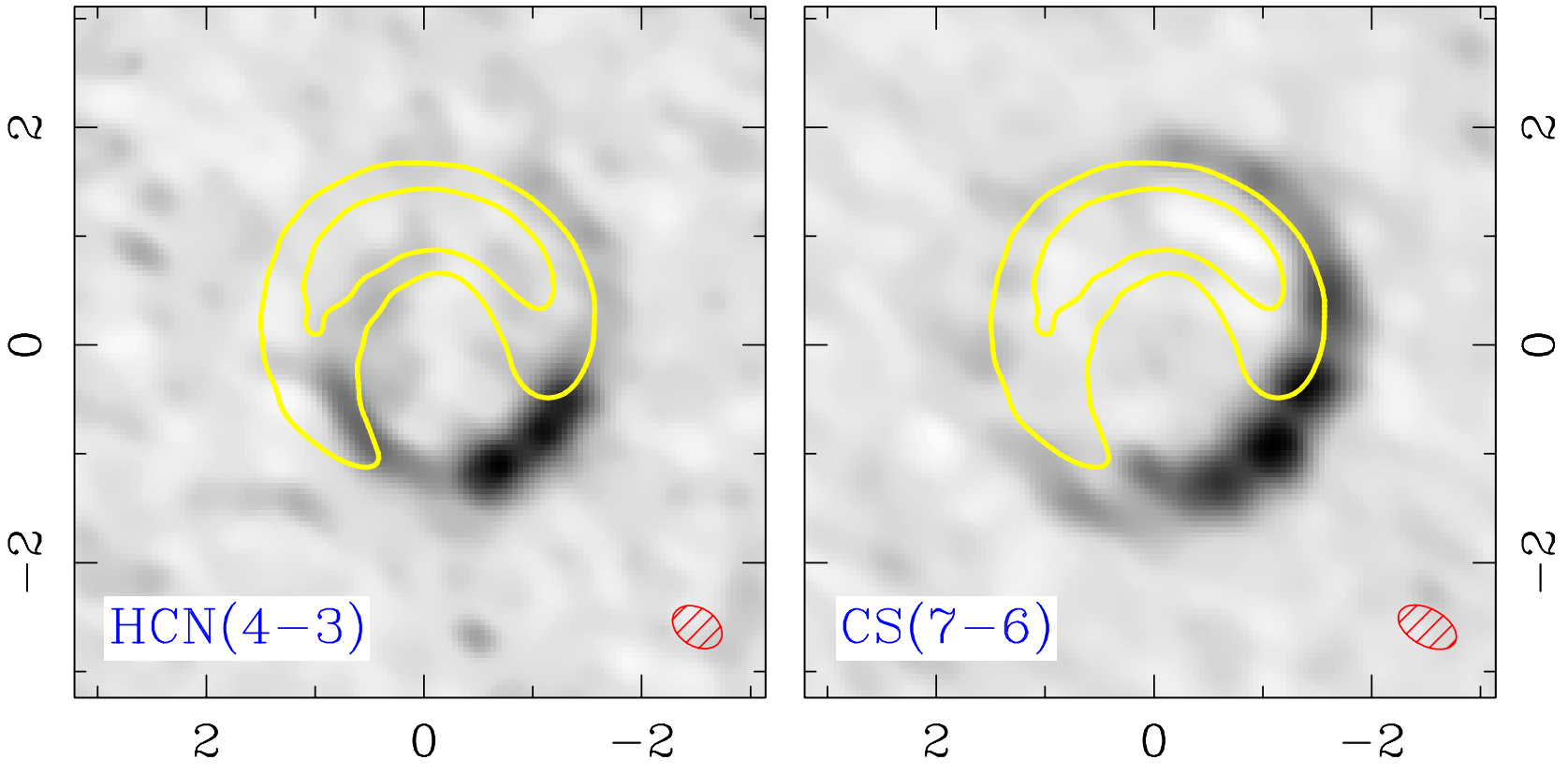
The data on HCO^+

Credit: Seba Perez

Azimuthal variations in spectral index



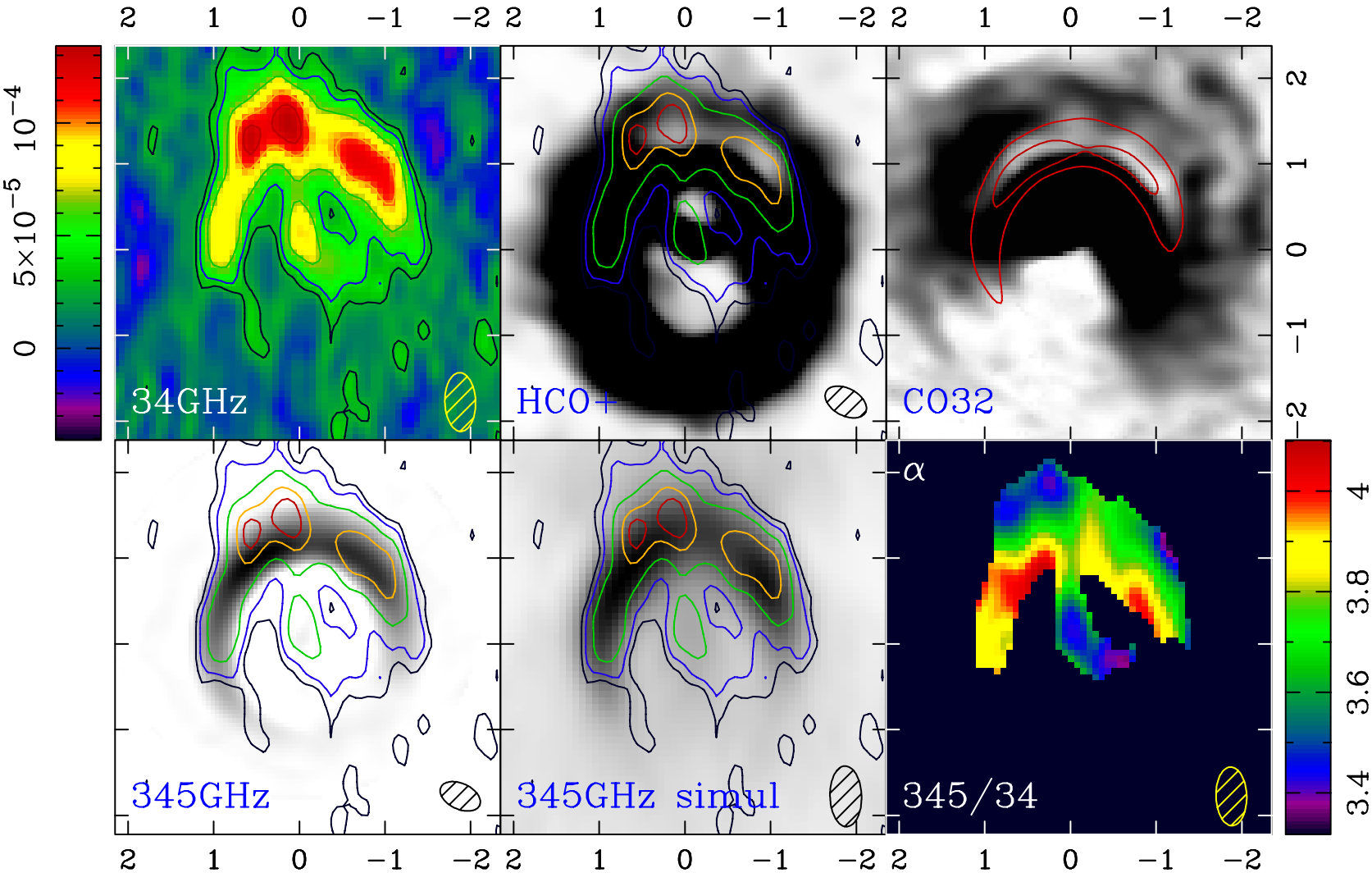
Azimuthal asimmetries in the gas.



$n^{\rm crit}_{\rm HCN(4-3)} \sim 1.3\ 10^8\ {\rm cm}^{-3}$

$n^{\rm crit}_{\rm CS(7-6)} \sim 2\ 10^7\ {\rm cm}^{-3}$

34GHz clumps vs. CO(3-2), HCO^+(4-3) decrements



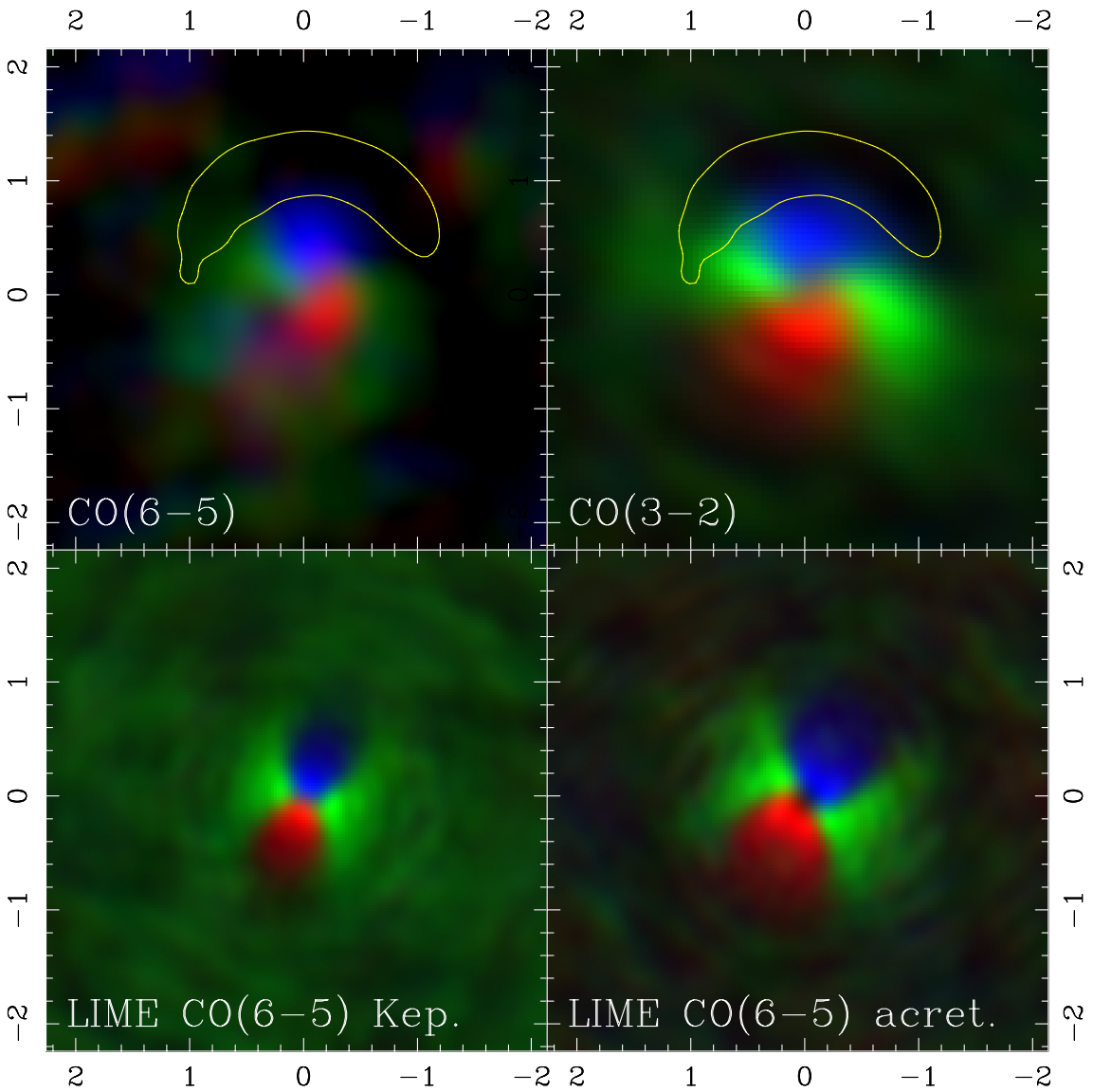
34 GHz data from C. Wright. New ATCA run scheduled for July.

Conclusions - work in progress

The ALMA data in HD142527 indicate

- Residual CO gas inside cavity, ^{13}CO(2-1) gives $M_{\rm H2} \sim 10^{-5}\ M_\odot$ (see poster by S. Perez).
- Gap-crossing HCO^+ flows, probably inflows.
- Confirmation of horse-shoe reported by Ohashi (2008) + azimuthal spectral index variations under horse-shoe.
- Possible azimuthal gas surface density variations, as hinted by CS(6-5) and HCN(4-3), with peak under hoseshoe.
- CO, HCO^+ decrements right outside horse-shoe, along with 34 GHz clumps
  $\rightarrow$ shadowing from a massive horse-shoe?

Non-Keplerian flows in CO?



Simulations obtained with the LIME package (Brinch et al.)