Exploring the nature of a non-axisymetric disk around HD142527

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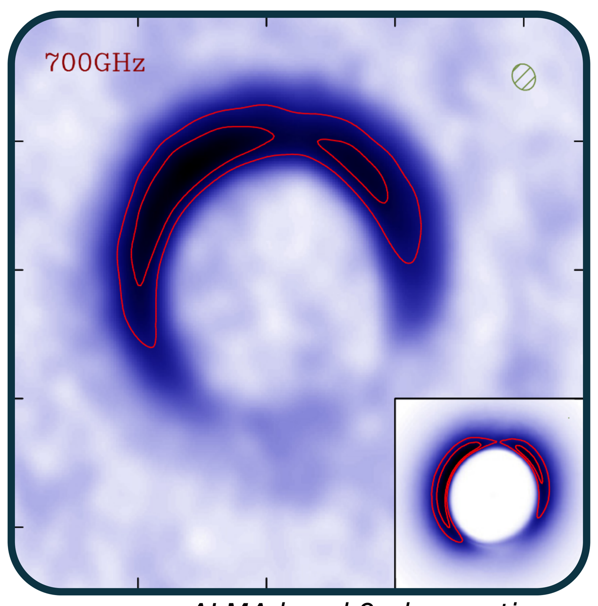
> Intro

Each forming star is born surrounded by a disk-shaped cloud, called a proto-planetary disk. (Hydro)dynamical mechanisms that could lead to planet formation have been a subject of concern and debate. Recent discoveries of crecent-shaped large scale features in ppds, seen at mm wavelenght, have unearthed the idea that planets may be born in the eye of a dust-accumulating vortex *(Barge & Sommeria 1995)*. By means of hydro simulations and using radiative transfer as well as chemistry codes as post-processing, we explore the consequences and look for observational signatures of a particular kind of vortex-forming scenario (namely through the **Rossby-Wave Instablity**). We produce synthetic images for direct comparison with observations, and predict the depletion in CO-lines emission in a vortex as a consequence of the enhanced opacity.



ALMA band 9 observations from Casassus et al. 2015

② Radiative transfer

We use a Monte-Carlo ray-tracing approach to compute the 3D temperature map, using the **MCFOST** code (*Pinte et al. 2006*). The vertical scale of the disk is a free parameter in the 2D->3D extrapolation. Dust concentration in the vortex leads to a higher opacity. In turn, the local temperature is decreased and allows for CO to stick more efficiently to grains, **preventing CO-lines emission**.

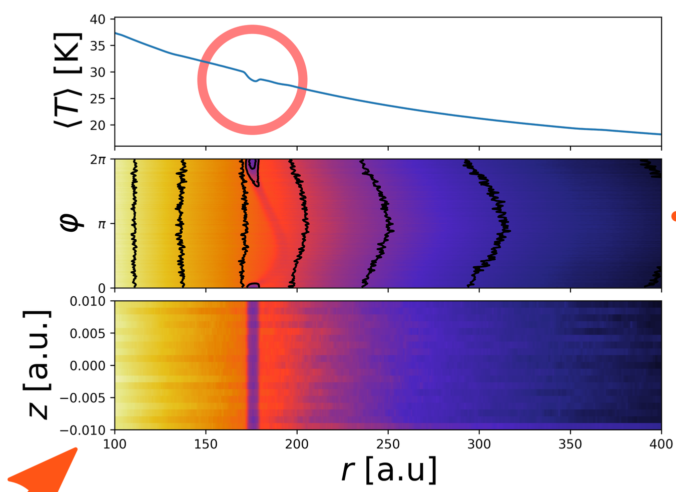
Images production <

We generate synthetic images from our models with **MCFOST**. Those first images do not contain artefacts expected from imaging with a physical instrument (beam convolution, noise...). Similar alterations need to be added in order to allow direct comparison with actual observational data.

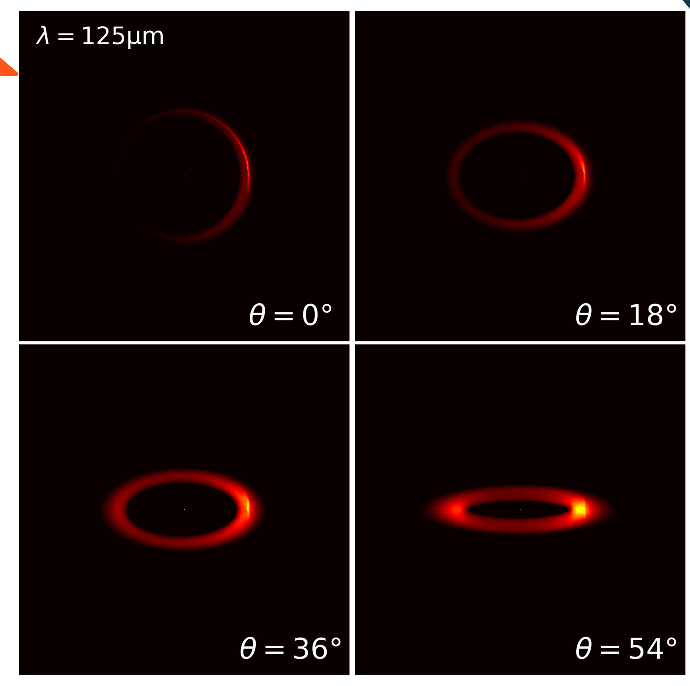
① Hydro simulations/model

We use a grid-based, **multi-fluid hydro-code AMRVAC 2.0** *(Xia et al. 2018)* to build and run fully coupled {gas+dust} disk models. Heating and cooling processes are neglected and we assume a barotropic equation of state. First simulations are done in razor-thin 2D disk models. We assume realistic, observationally contrained, initial conditions prone to the vortex-forming, **Rossby-Wave instability** *(Lovelace et al. 1999)*, spontaneously evolving into a dust-concentrating crescent-shape feature in the gas component.

3D temperature map
w/ MCFOST

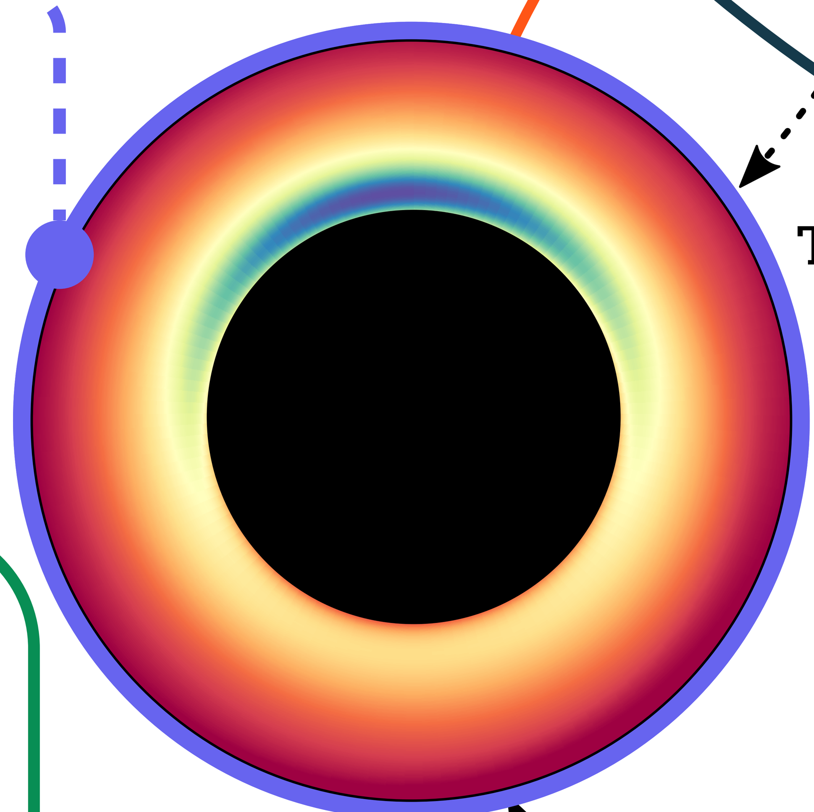


synthetic images #1
w/ MCFOST



T feedback

2D hydro simulation
surface density
w/ AMRVAC



T feedback

new temperature maps
& images w/ MCFOST

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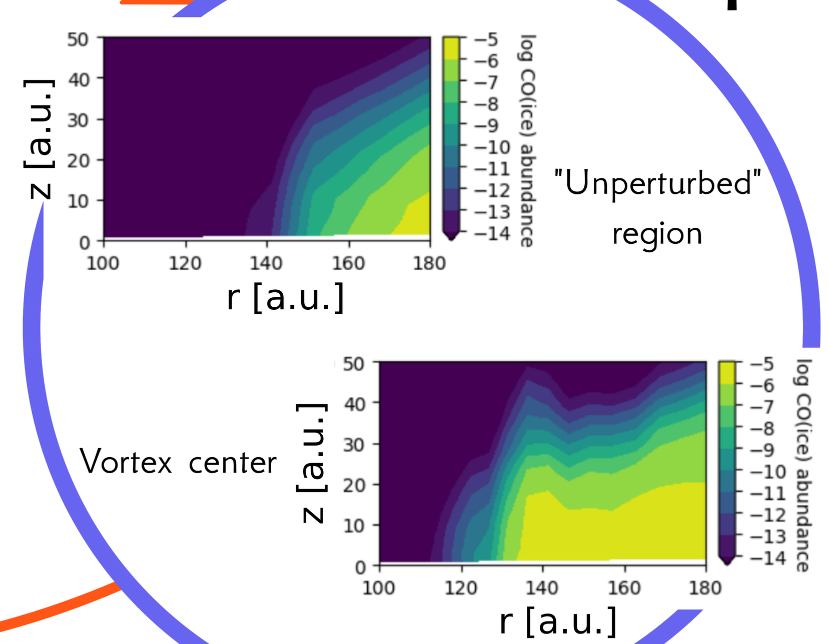

CO ice abundance
w/ Astrochem

> Perspectives

- Full 3D hydro models in preparation. This will allow us to study the Doppler-shifting in molecular lines caused by vertical circulation in a vortex.
- * : results from a preliminary study by C. Mibord, F. Ménard and S. Maret
- dashed arrows indicate future backward interfacing (radiative transfer to hydro).

> References

Barge & Sommeria 1995, A&A
Lovelace et al. 1999, *ApJ, DOI: 10.1086/306900*
Pinte et al. 2006, A&A, DOI: 10.1051/0004-6361:20053275
Casassus et al. 2015, ApJ, DOI: 10.1088/0004-637X/812/2/126
Xia et al. 2017, ApJ Suppl. Ser., DOI: 10.3847/1538-4365/aaa6c8

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