A kinematically detected planet candidate in a transition disk

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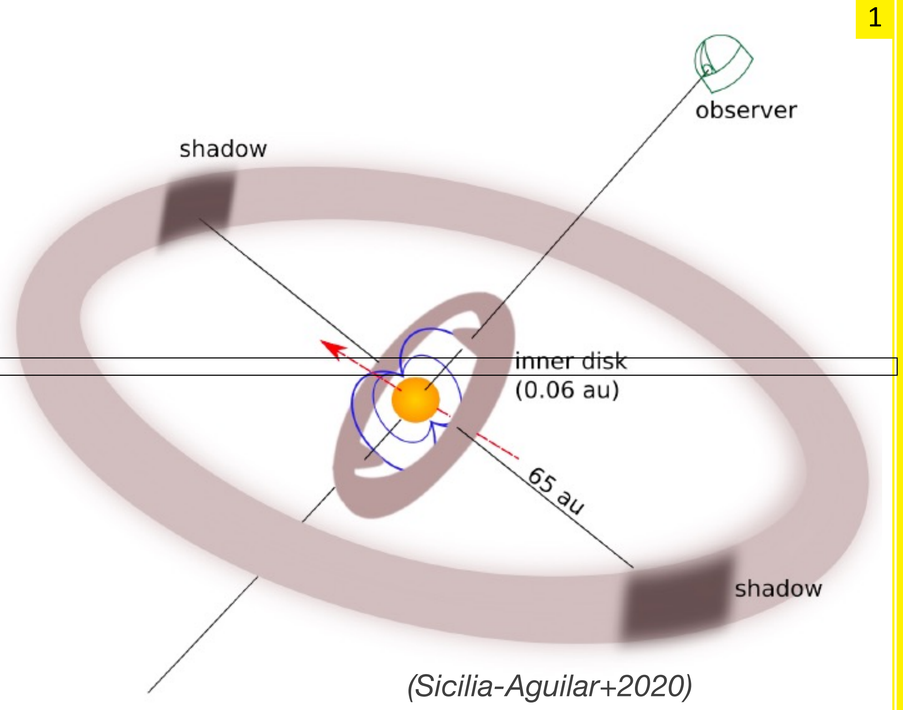
INTRODUCTION & METHODS

- Transition disks are protoplanetary disks with inner cavities possibly cleared by massive companions
- High resolution observations are ideal to map their velocity structure and to investigate the origin of cavities
- In the Letter we focus on RX**J1604**.3-2130 A, one of the brightest transition disks in UpperSco in the millimeter[1]
- Infrared scattered light observations of J1604 show the presence of two variable and nearly symmetric shadows[2], cast by a highly misaligned inner disk onto the outer face-on (i ~ 6°) disk[3, 4] (see sketch)
- We present ALMA Band 6 dust and ^{12}CO (2-1) gas observations of J1604
- Analyzed the channel and velocity maps with a Keplerian model using the code *discminer*[5] fitting the channel-by-channel line emission



(Sicilia-Aguilar+2020)

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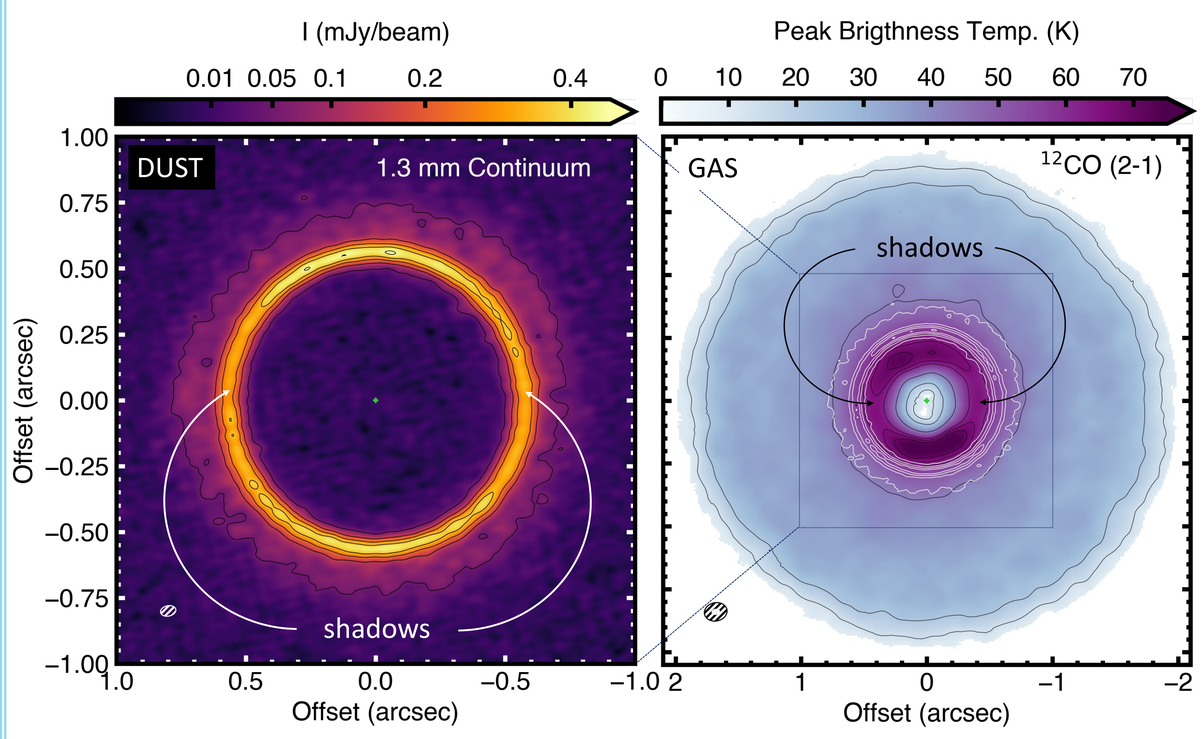
RESULTS



Observations of dust continuum and ^{12}CO (2-1) molecular line, both show brightness variations to the west and east, that are broadly aligned with shadows observed in scattered light.

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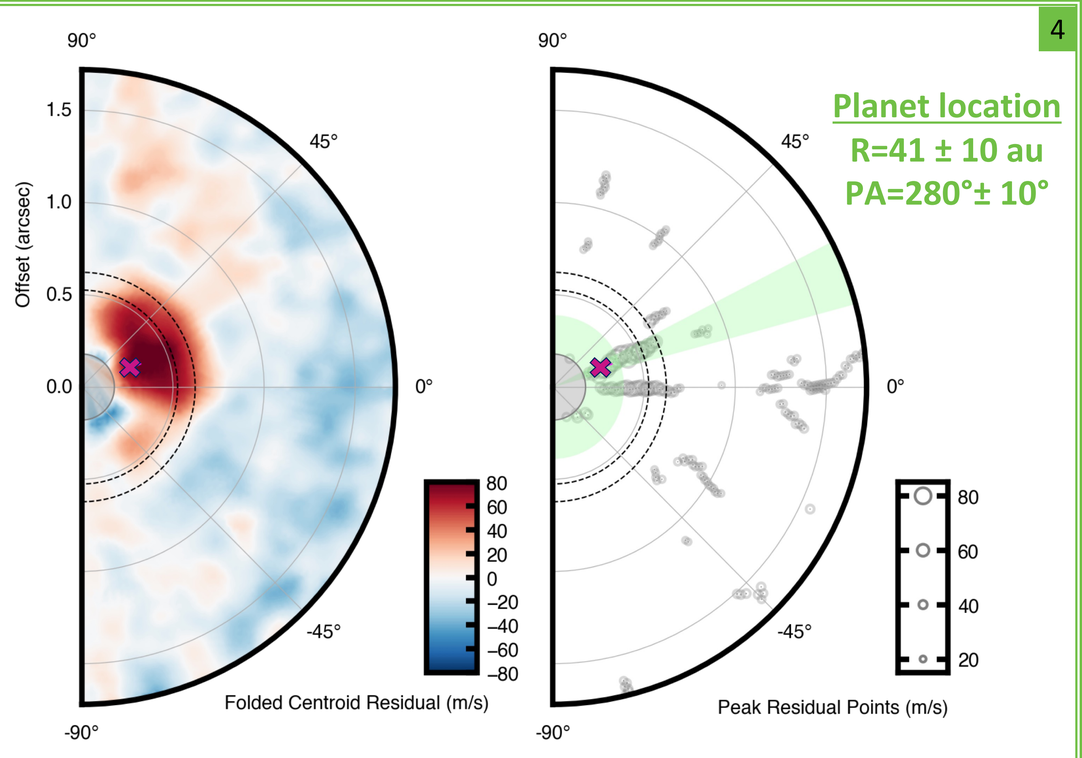

Folded velocity residuals (left) and detected clusters of peak velocities (right) in the disk reference frame. The green wedges in the right plot mark the significant clusters in radius and azimuth.

From those clusters we can infer the position of a statistically significant and localized velocity perturbation[5] (magenta cross) which is possibly related to a massive planet at 41 au and 280°.

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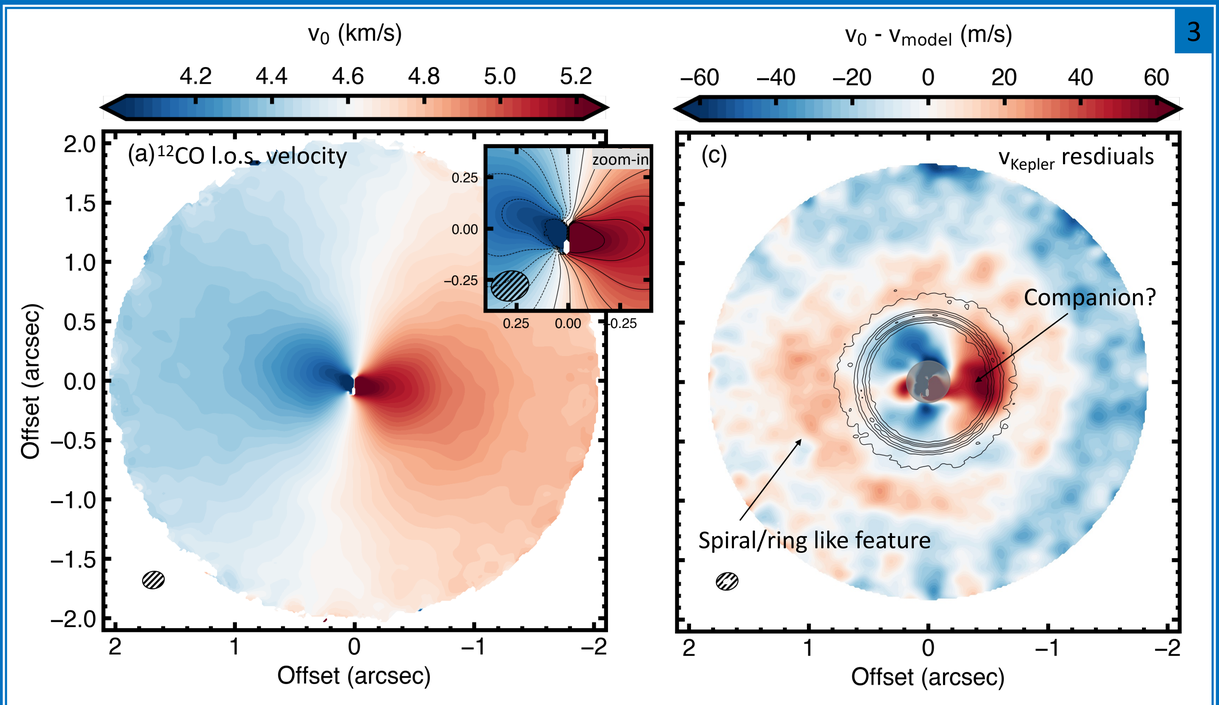

We detect a strong localized non-Keplerian feature within the continuum ring and a tightly wound spiral that extends over 300° in azimuth possibly connected to the former. A bending of the iso-velocity contours in the cavity indicates a highly perturbed inner region, probably related to the misaligned inner disk.

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CONCLUSIONS

- The localized non-Keplerian feature cannot solely be due to changes in temperature, even though aligned with the shadows
- Instead, we interpret this feature as tracing a massive companion located at the edge of the dust continuum ring
- We speculate that the observed spiral is caused by buoyancy resonances driven by planet-disk interactions[6]
- However, the potential planet candidate at ~41 au cannot explain the gas-depleted cavity, the low stellar accretion rate and the misaligned inner disk[4], which suggests the presence of another companion closer in

REFERENCES

(1) Barenfeld+2016, (2) Pinilla+2018, (3) Ansdell+2020,
(4) Sicilia-Aguilar+2020, (5) Izquierdo+2021, (6) Bae+2021

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