HD 98800 AaAbBaBb

A benchmark binary for understanding star-disk interaction

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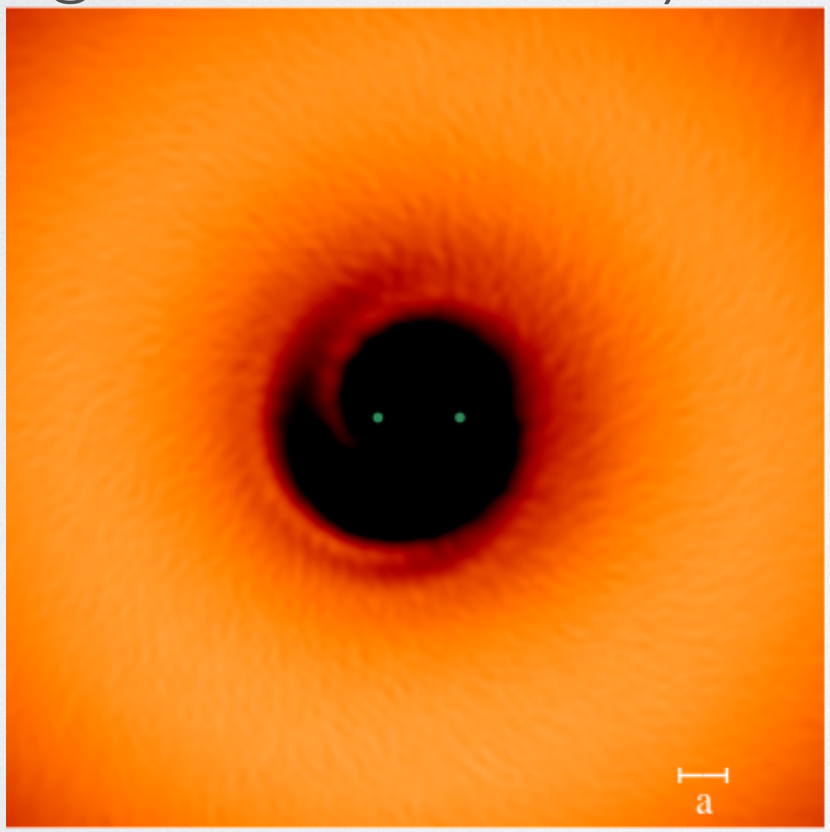
Motivation

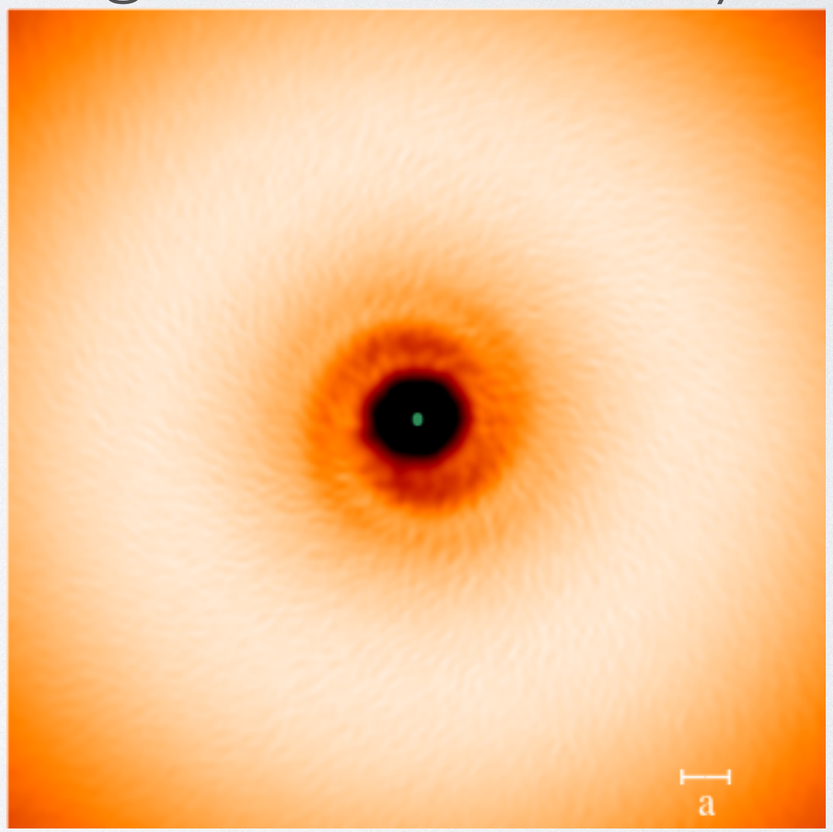
Given a perturbation, theory predicts model-dependent disk structure

→ disks in multiple systems could help calibrate models

aligned circumbinary disk



misaligned circumbinary disk



Franchini et al. 2019

HD 98800 - four stars, one disk

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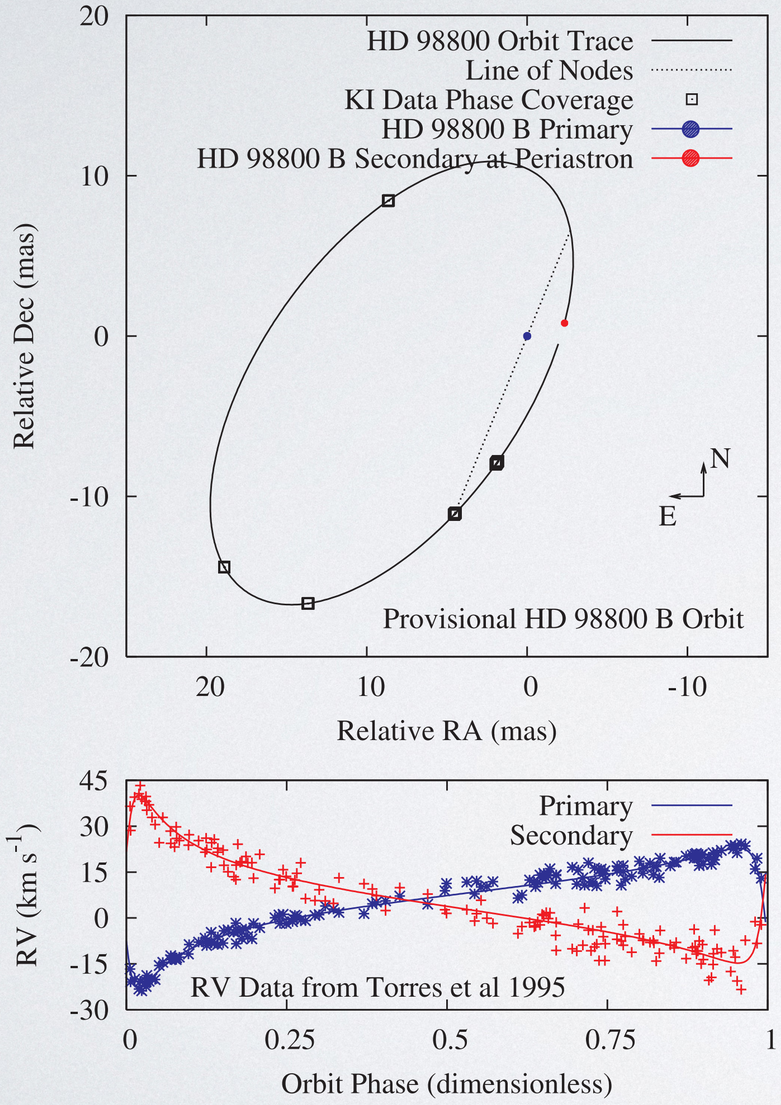
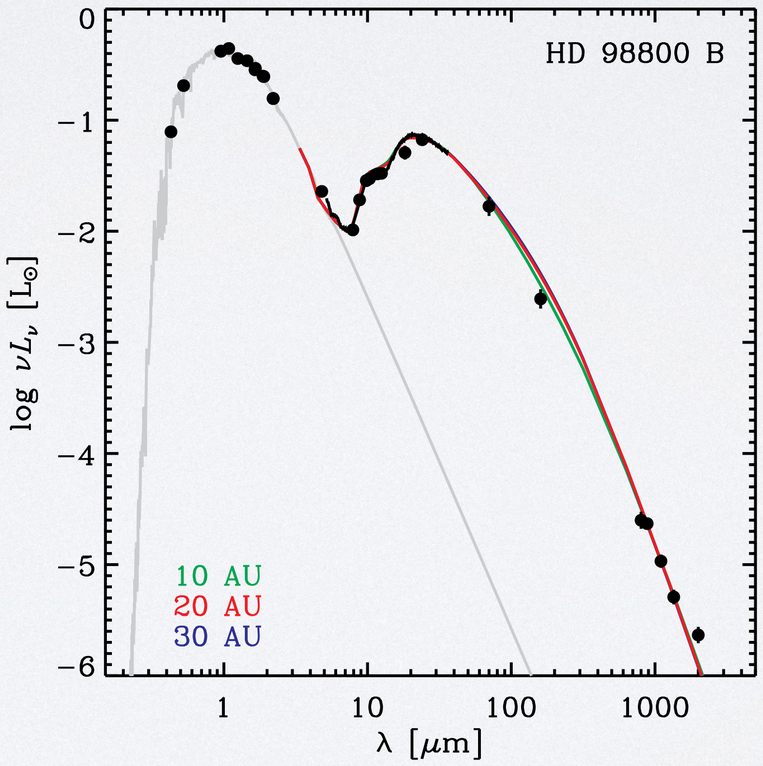
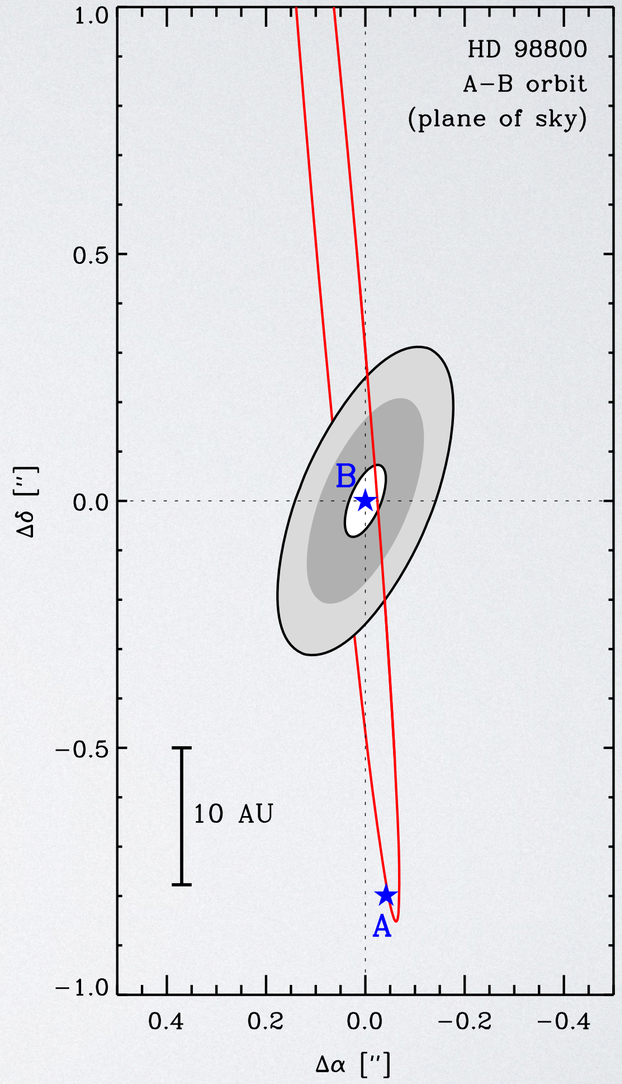
(a.k.a. TWA 4 - 10Myr old)



Boden et al. 2005

Probably gas-rich, disk misaligned with at least one orbit

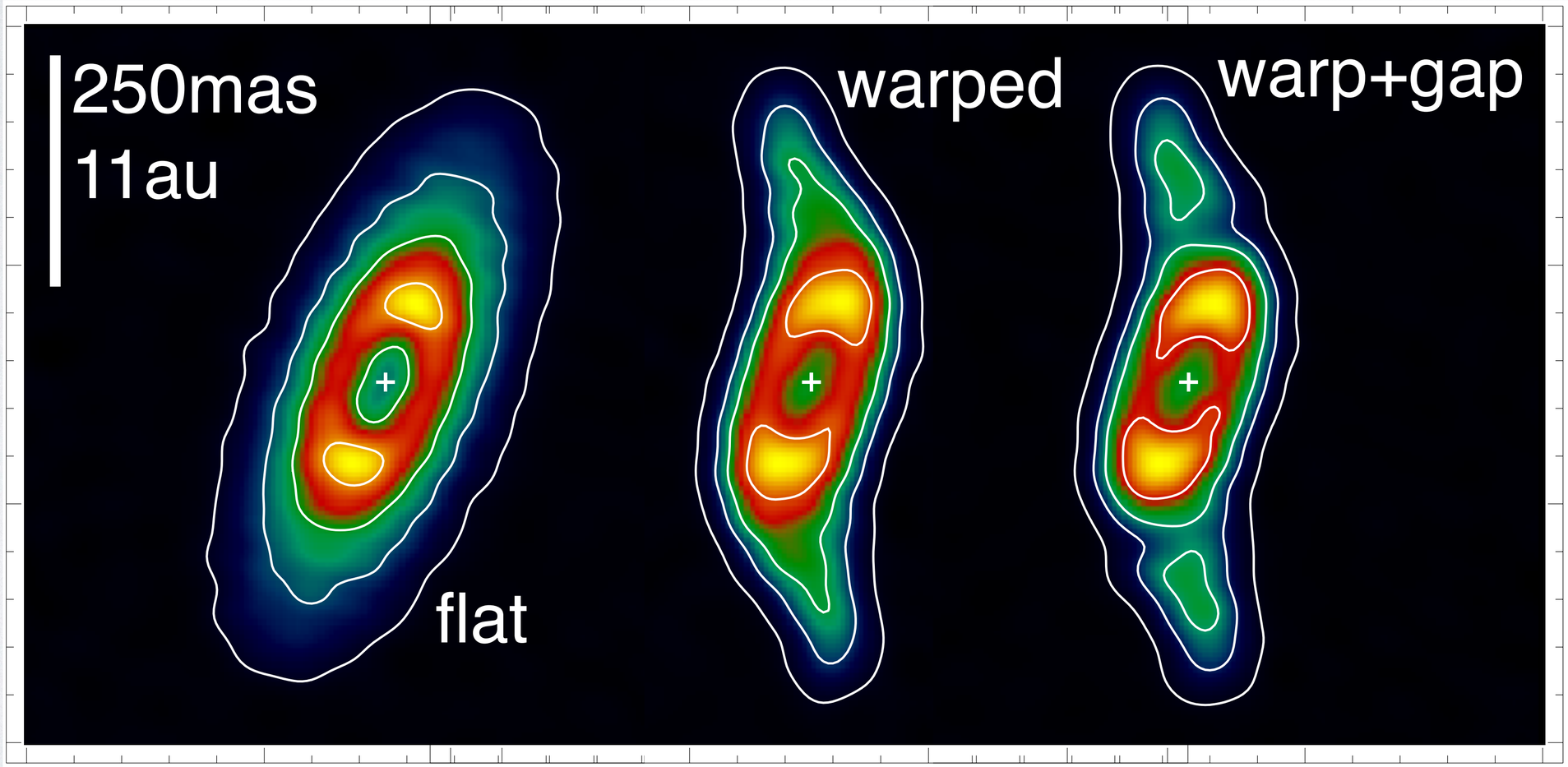




Andrews et al. 2010

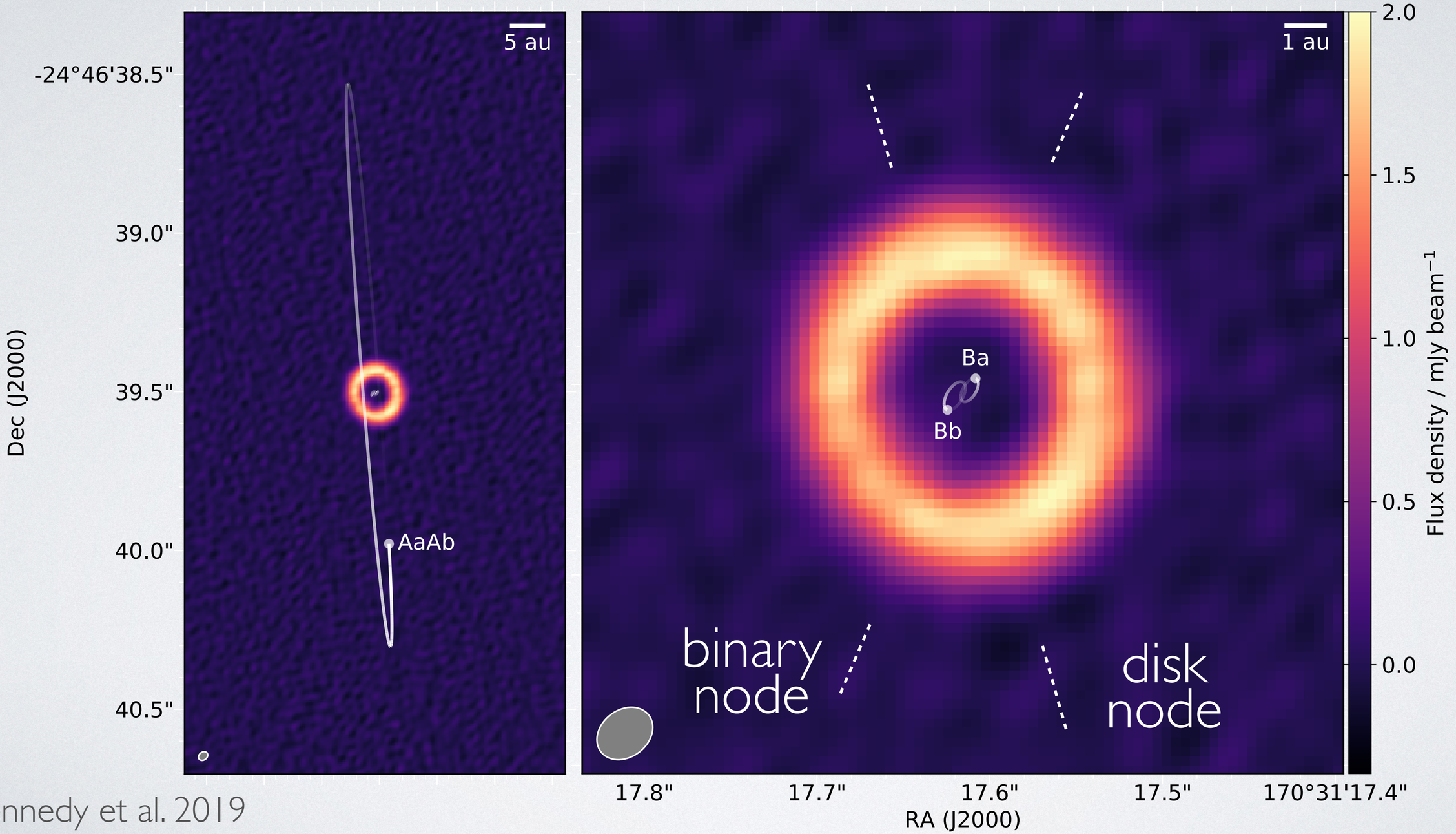
HD 98800 - four stars, one disk

predictions: coplanarity at inner and outer disk edges, gap if gas-poor
(warp expected as B reddened more than A)



misaligned!

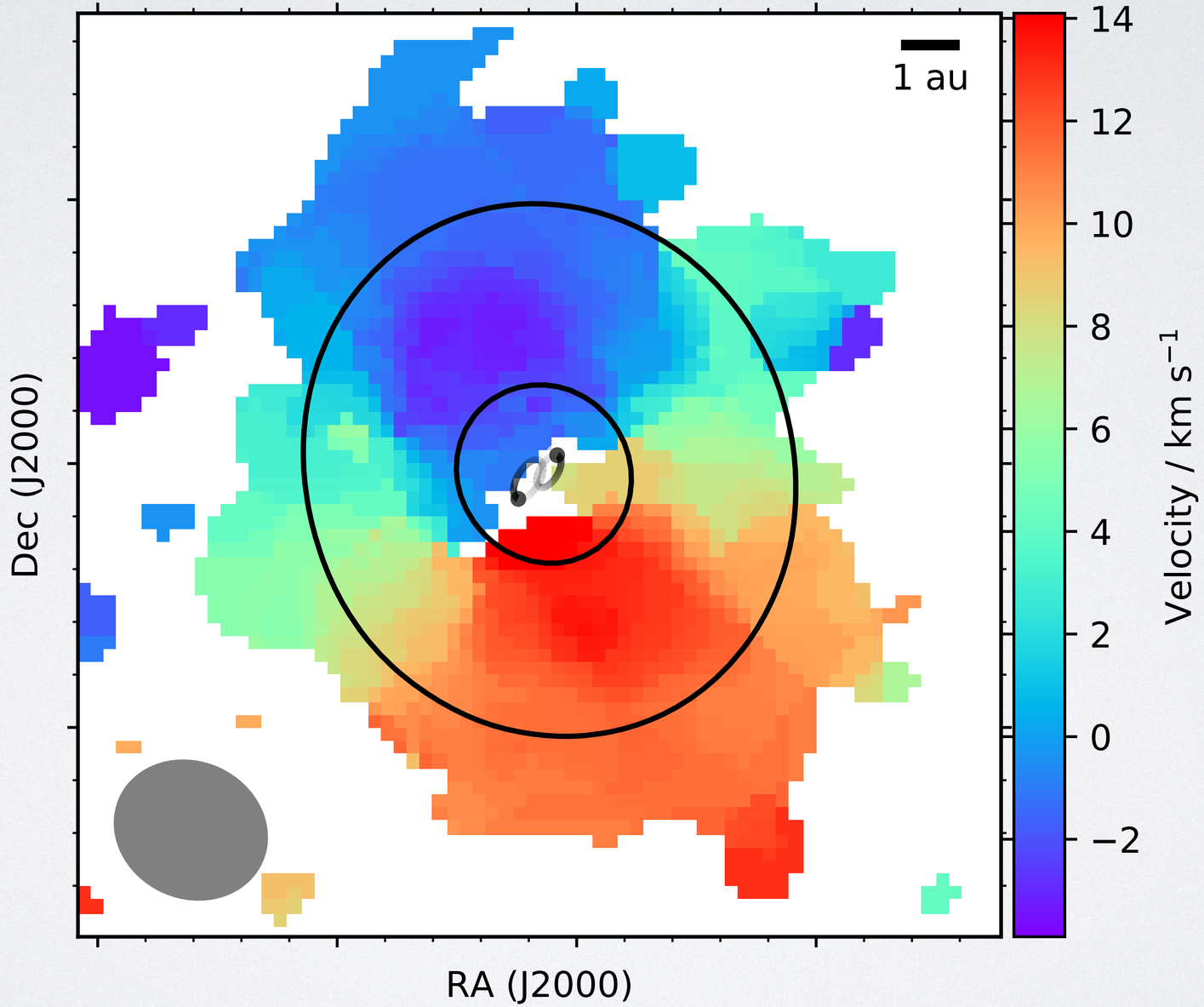
disk is polar or moderately misaligned w.r.t. inner binary orbit



Kennedy et al. 2019

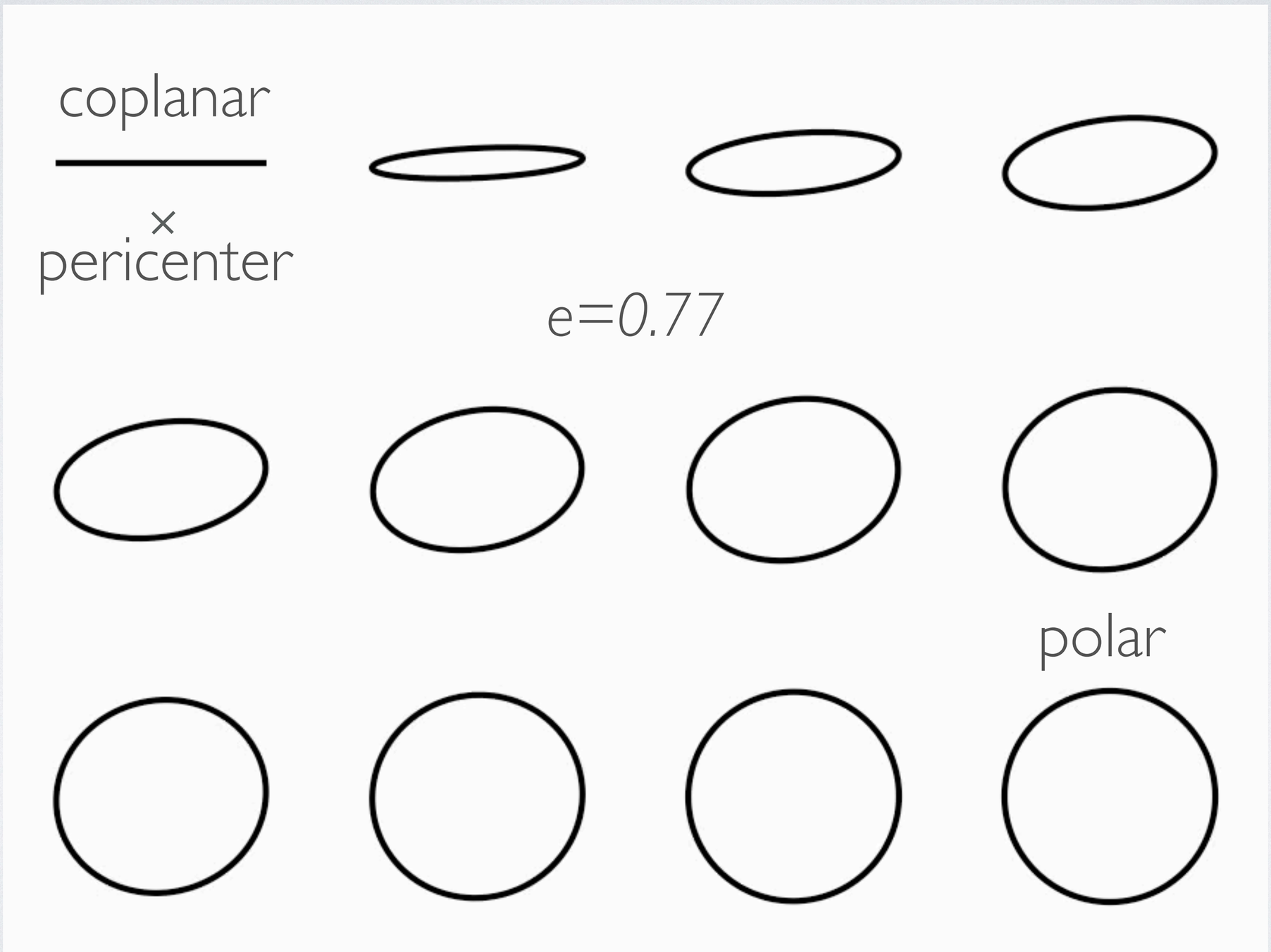
CO detected from 1.6-6.4au

dust 2.5-4.6au, i.e. dust trap



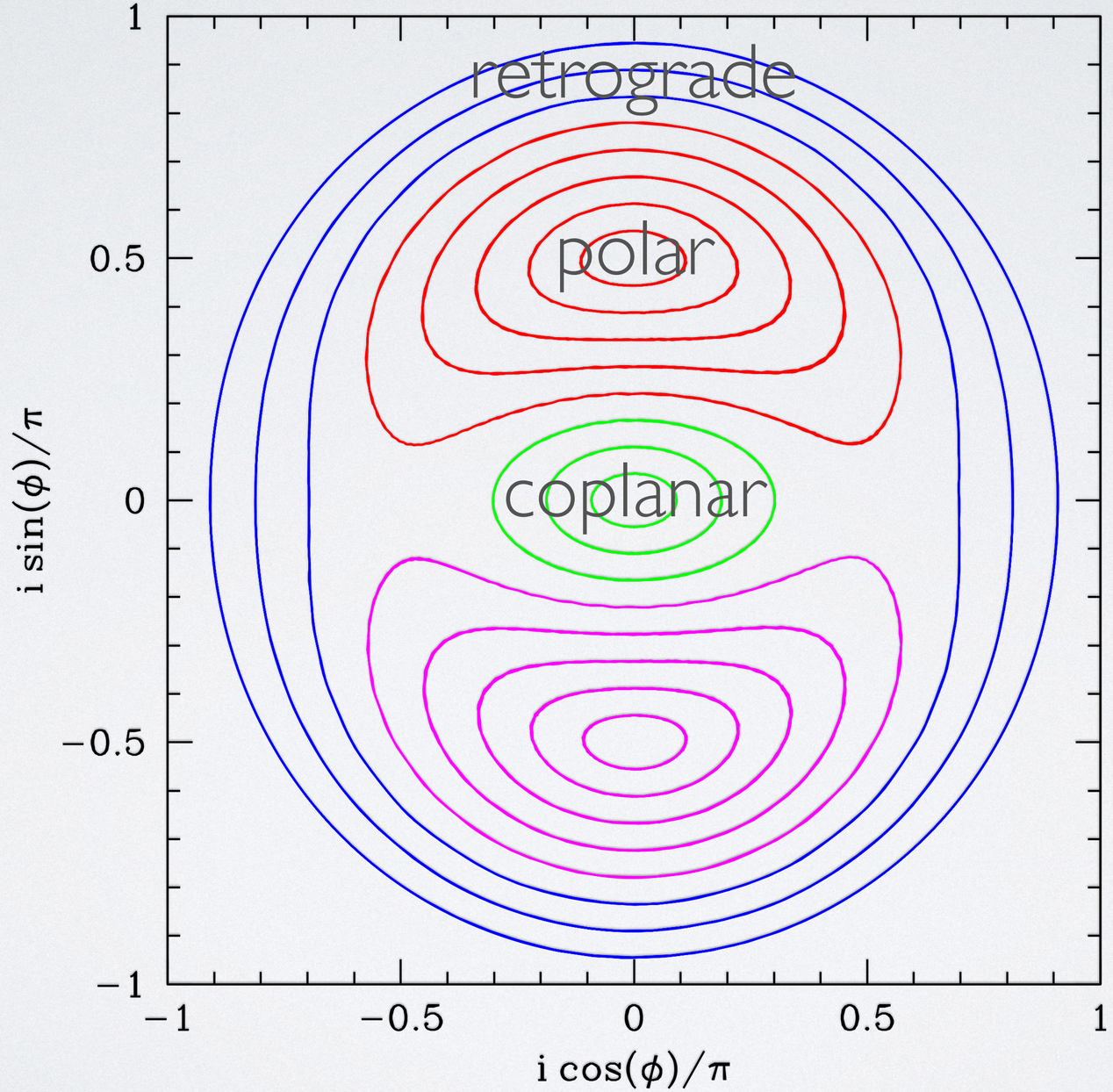
Kennedy et al. 2019

Circumbinary dynamics - an example



Circumbinary dynamics

(non-interacting test particles)

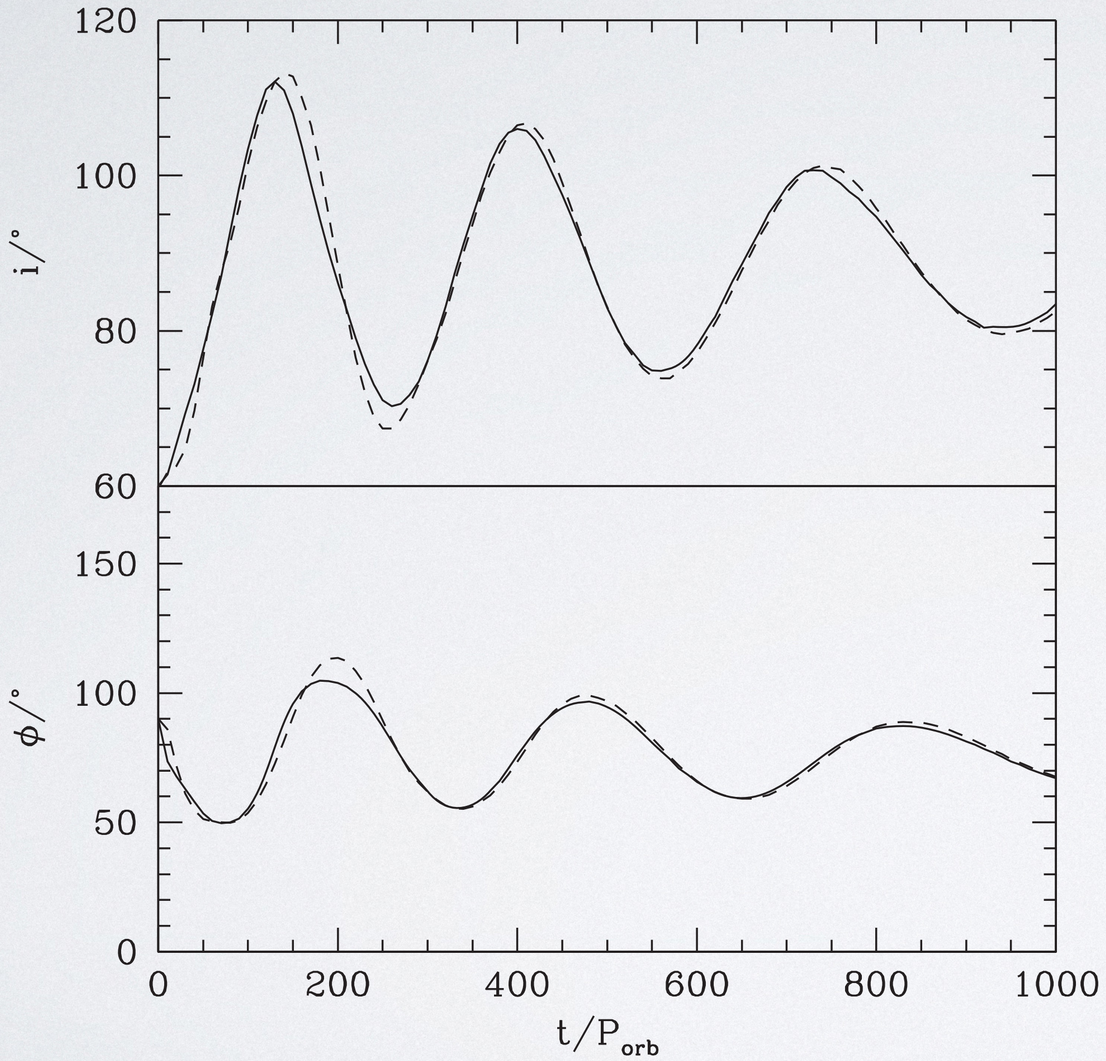


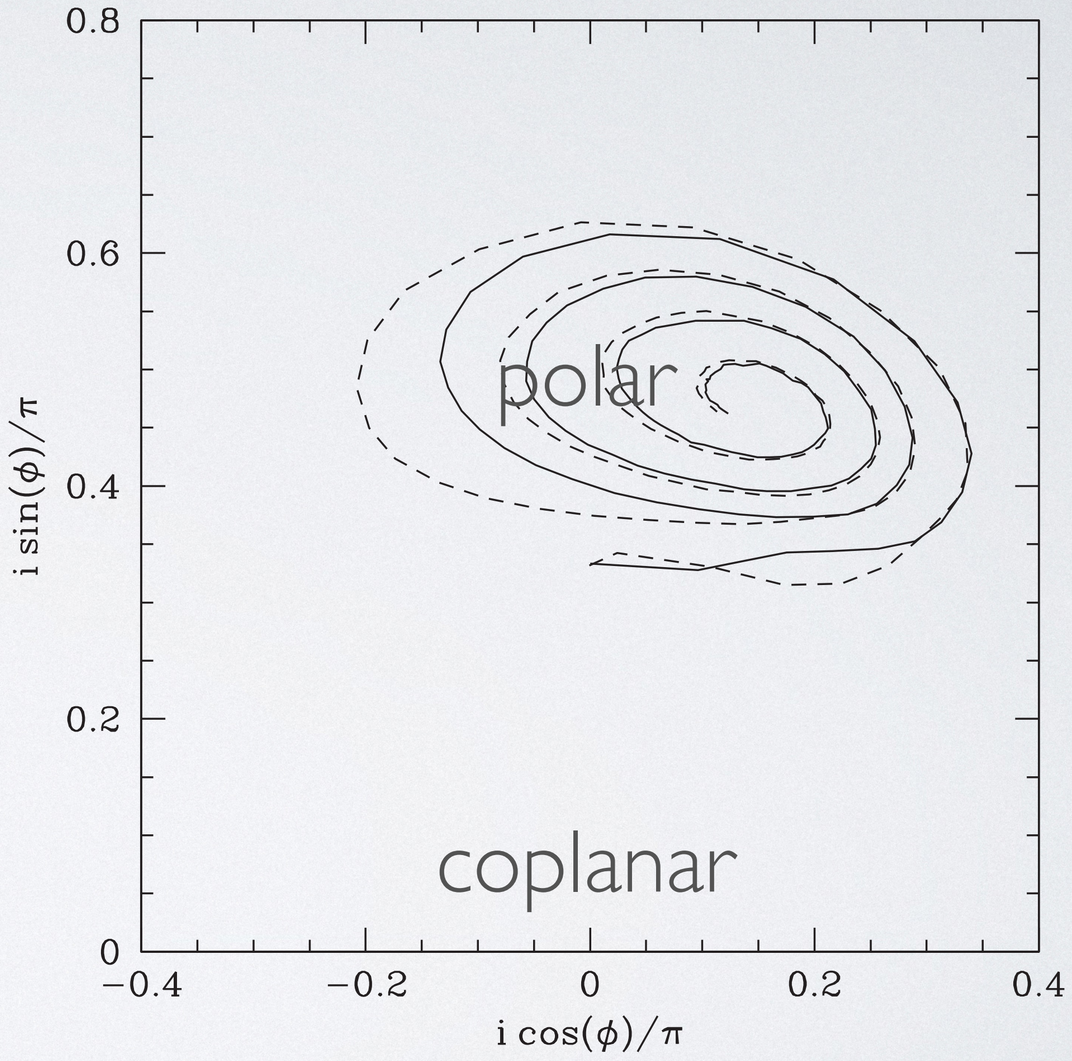
r = inclination
phi = node

Martin & Lubow 2017

Circumbinary dynamics - protoplanetary

damping to either coplanar or polar configurations



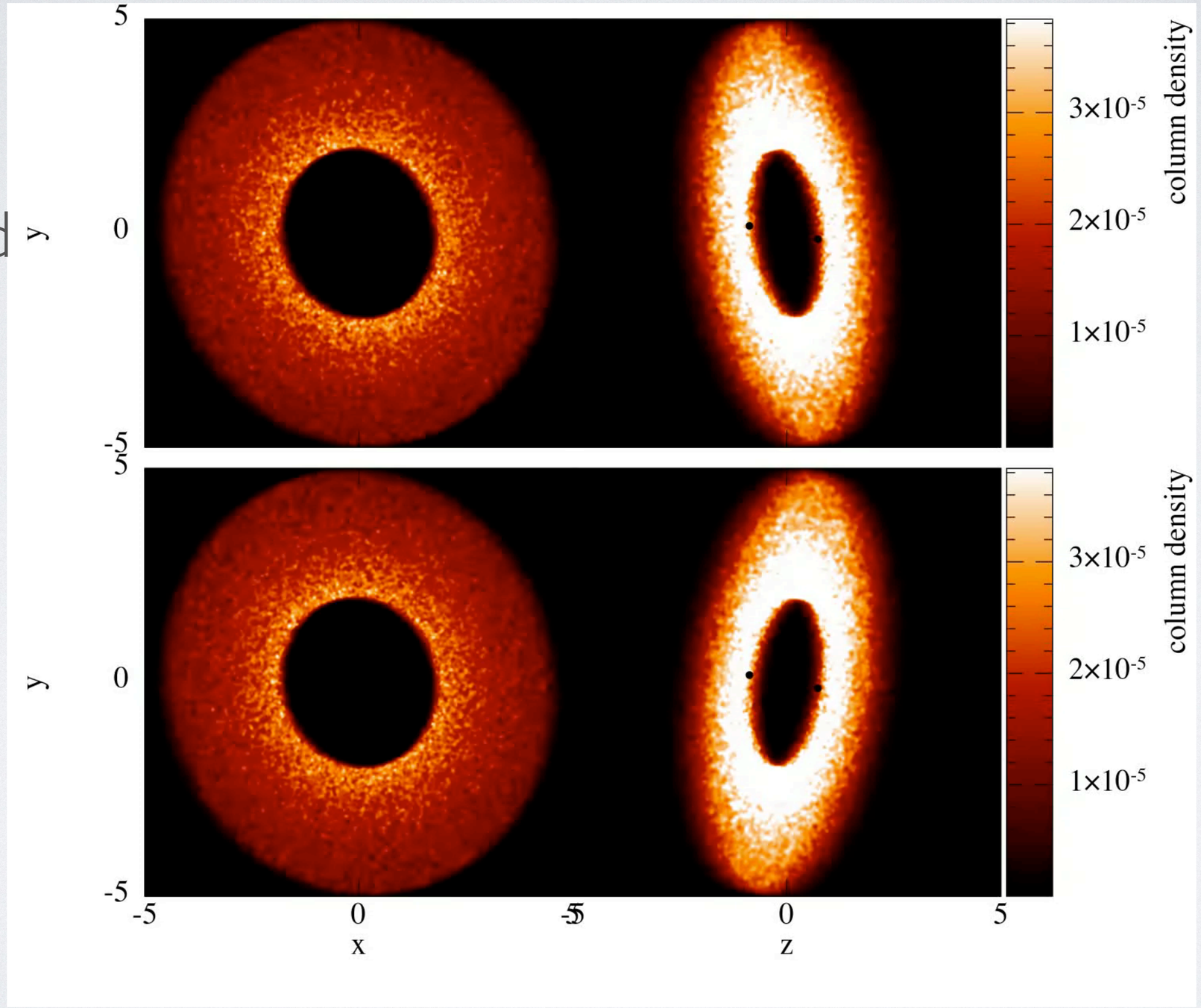


Martin & Lubow 2017

Inclination ambiguity - polar or misaligned?

misaligned

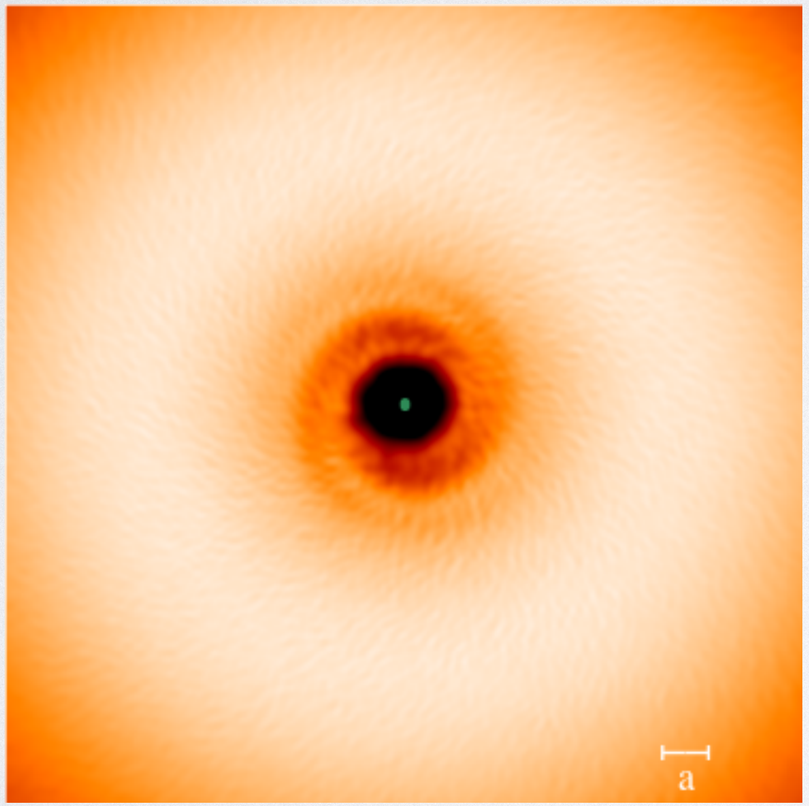
polar

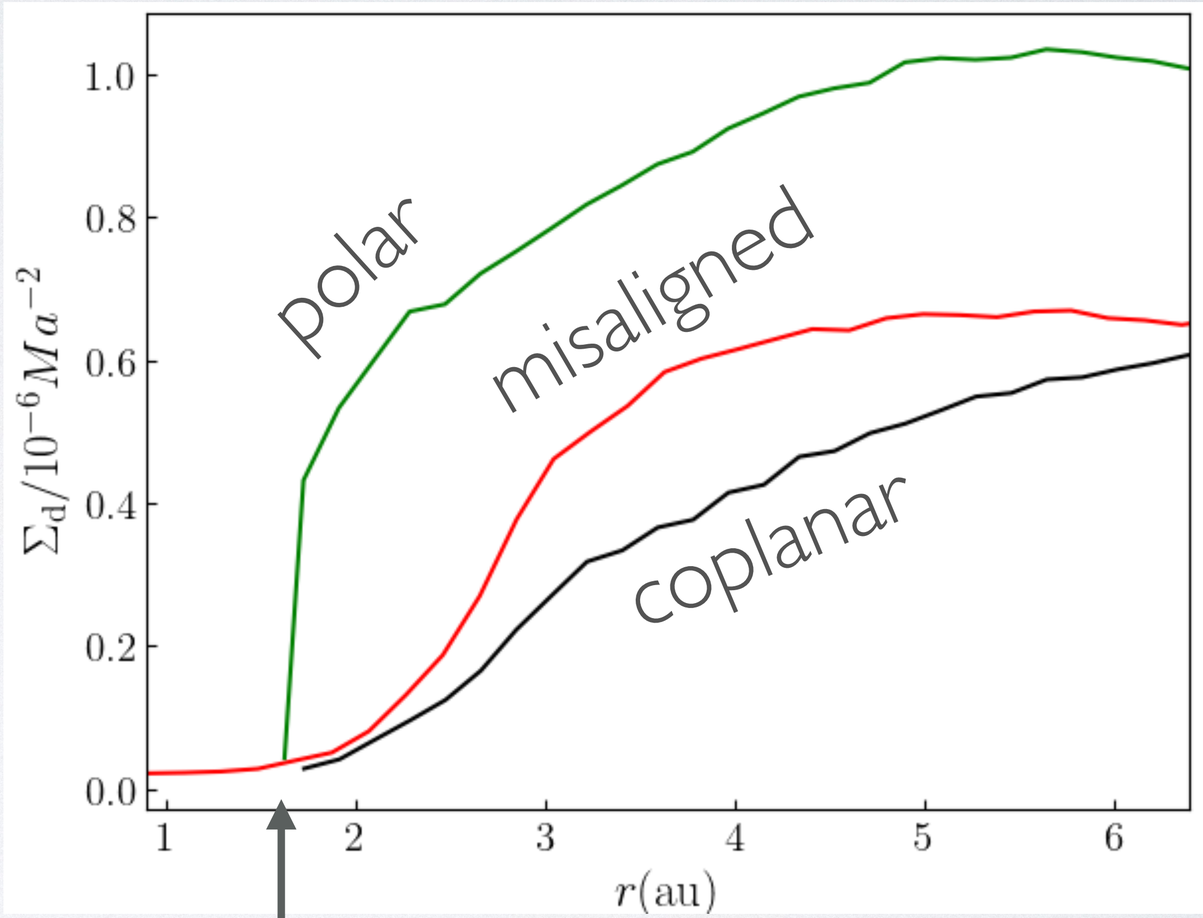


Applications - disk dynamics

Given known perturbation, observation should constrain model

"most viscous case possible"

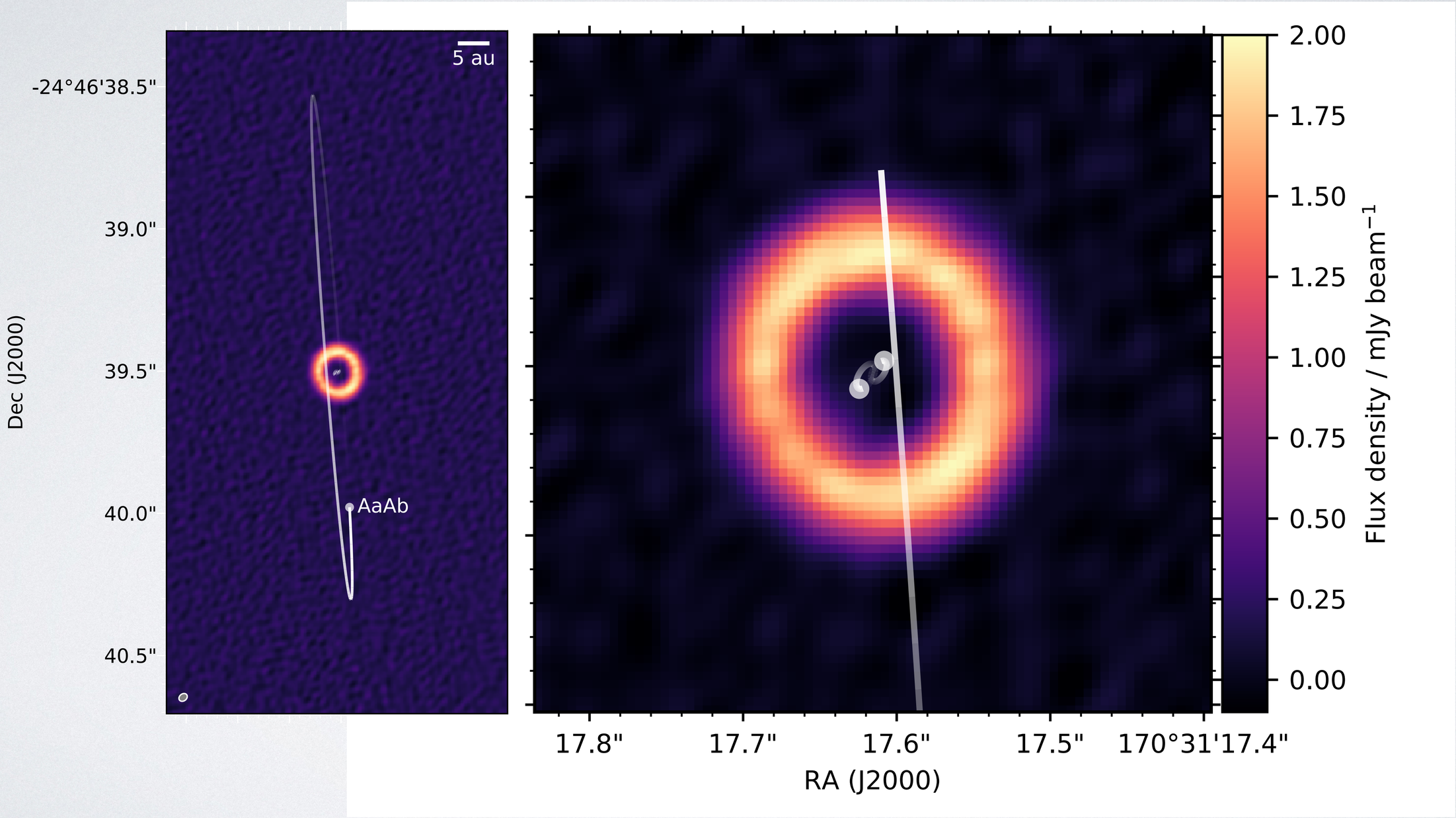




observed inner edge

Franchini et al. 2019

Applications - optical depth structure



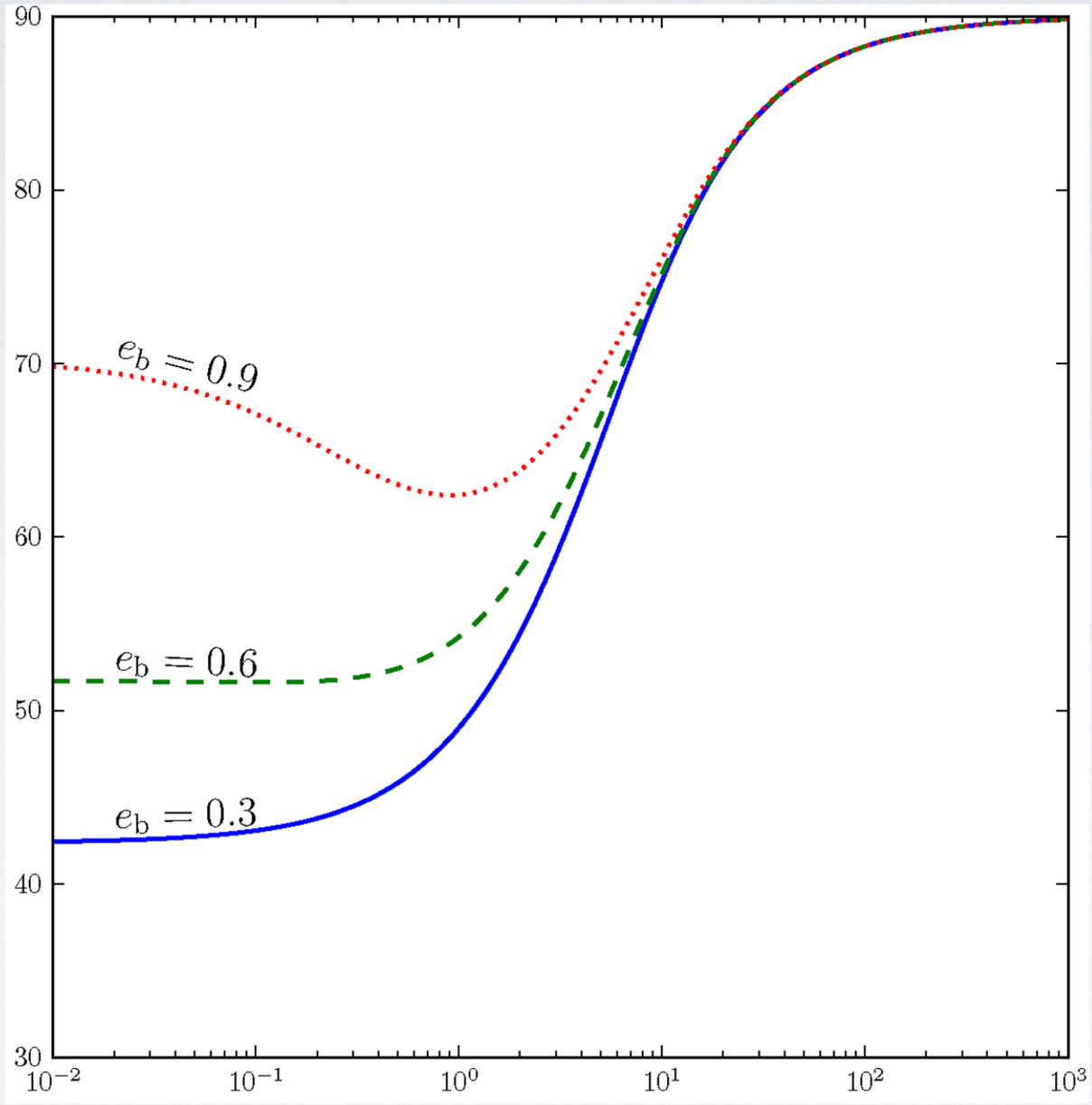
Alternative disk mass measurement?

polar

disk inclination

60deg

30deg



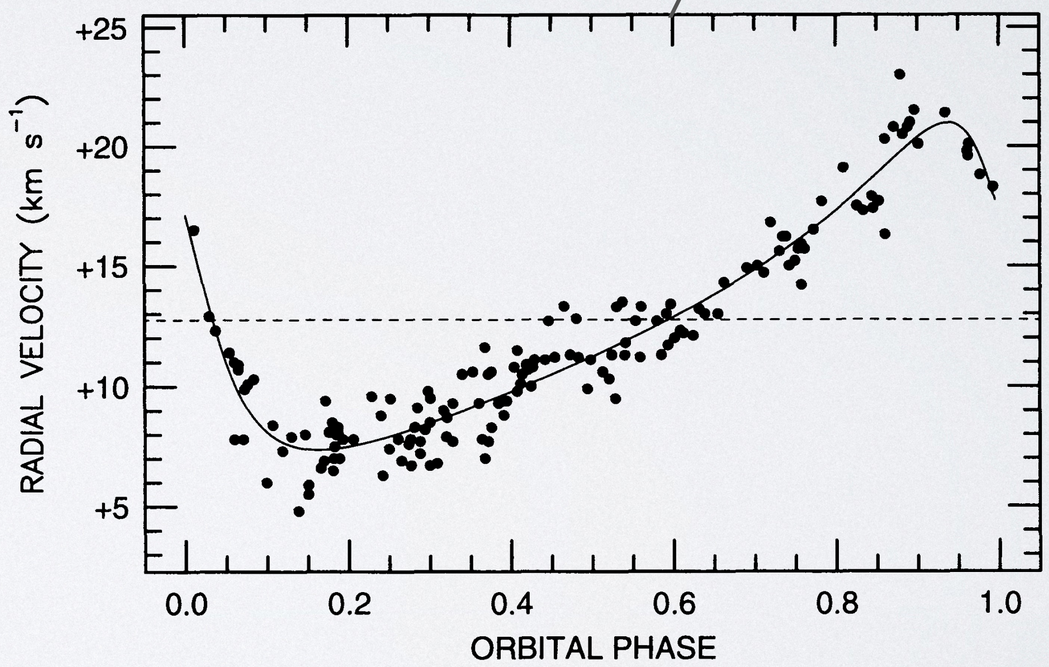
high L Disk L low L

Zanazzi & Lai 2018

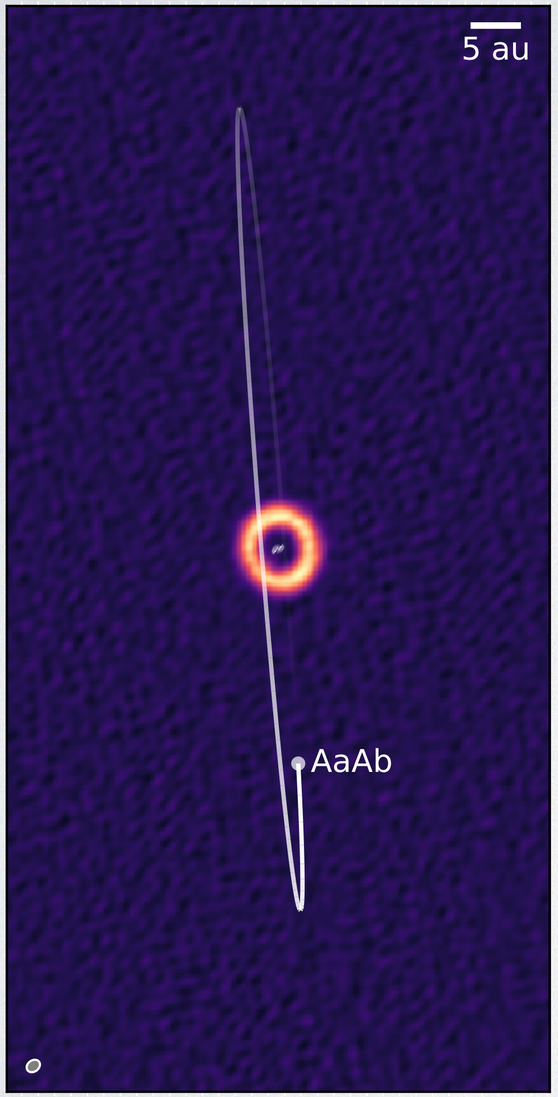
Refining orbits with VLTI

Seba Zuniga-Fernandez in prep. (BaBb), and proposal accepted (AaAb)

RV curve for AaAb,
no astrometry to date



Summary



- HD 98800 - mostly known-orbit binary
- Quantify interior *and* exterior perturbations
- May help constrain disk physics…
- …viscosity, dust trapping, disk mass?
- Orbital refinement/characterisation ongoing
- AaAb occultation to come…