Synthetic Observations of a Circumbinary Disc Transit

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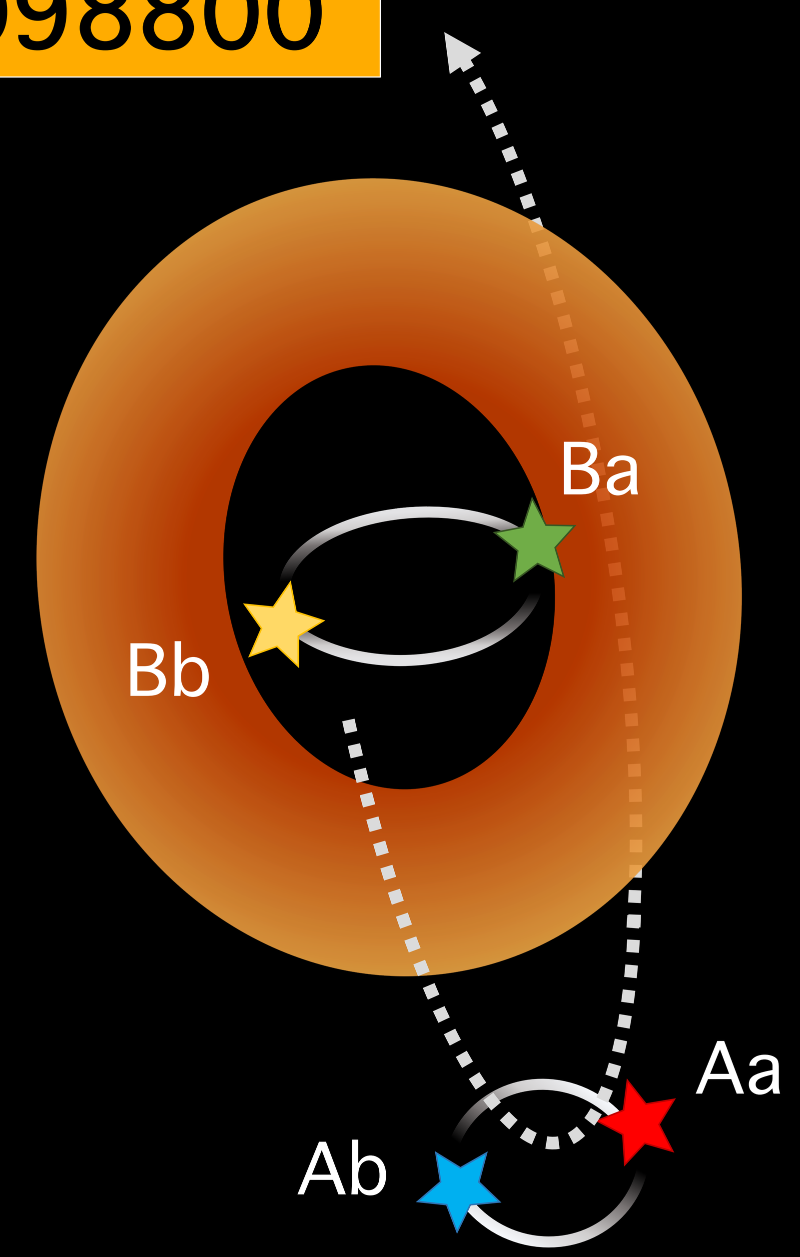
① OUTLINE & OBJECTIVES

- Build a set of hydrodynamical models of HD98800 with different disc parameters.
- Create a synthetic light curve of the transit for each model.
- Compare – what effect do disc properties have on the light curve? How can these be constrained? How should we observe the transit?

HD98800



Protoplanetary disc aligned ~92° to binary

Disc expected to eclipse AaAb in a few years[1,2]

What can observations of the transit tell us about the disc?

Parameter Space	
Disc Parameter	**Values Tested**
Dust mass	0.033, 0.33, 3.3$M_\oplus$
Gas mass	3.3, 33, 330$M_\oplus$
α (viscosity)	0.005, 0.01, 0.05
Radius (outer binary effects)	2.5 – 4.6 AU[2] 2.5 – 6.0 AU

② METHODS

1. Phantom[3] (SPH) simulations – Model system with different input gas masses, disc radii, α viscosities.
2. MCFOST[4] radiative transfer models – Calculate optical depth τ for different dust masses (gas-dust ratios).
3. Generate a light curve – Calculate flux from AaAb using $F = F_0 exp(-\tau)$

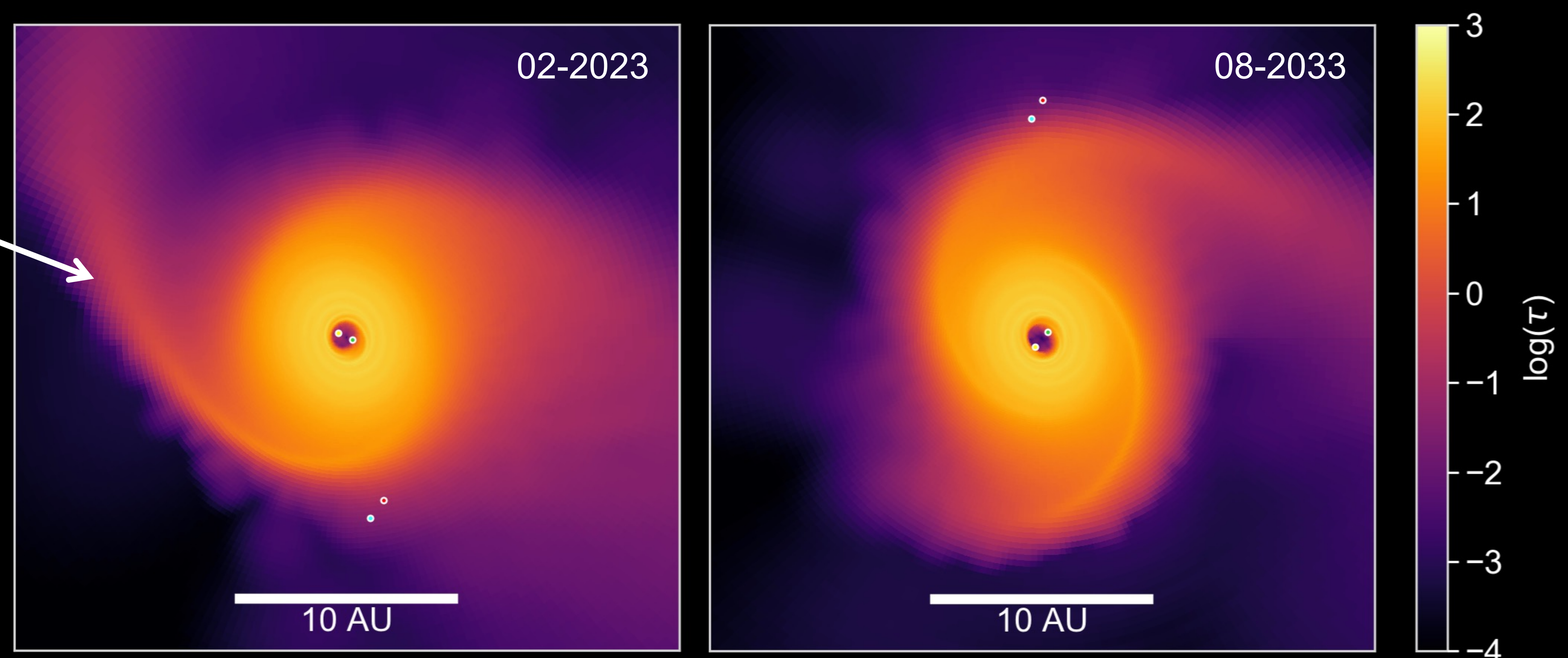
③ RESULTS

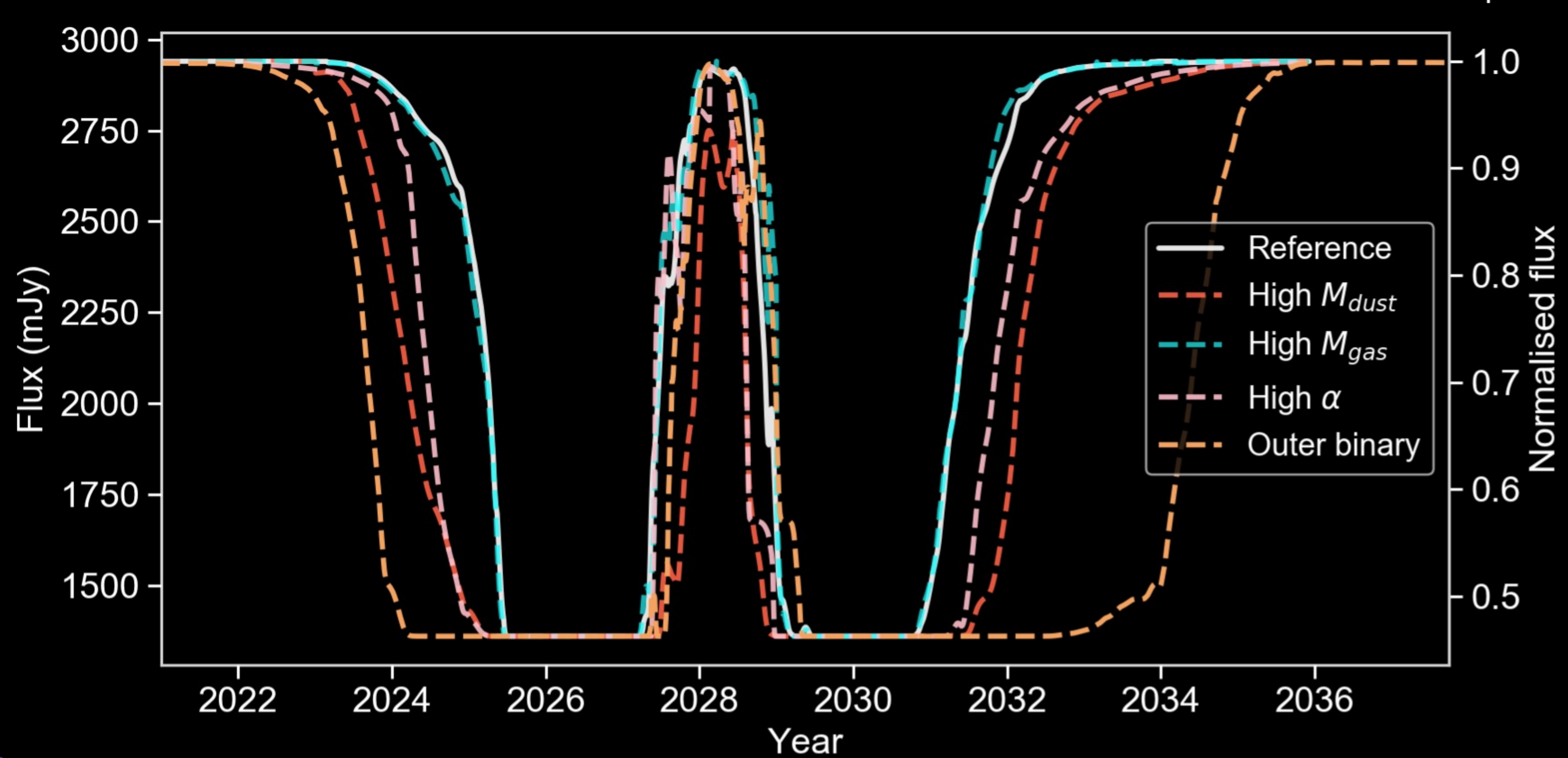
OUTER BINARY INTERACTIONS
Spiral arm excitations, asymmetric light curve

HIGH DUST MASS
Widens dips, prolongs transit, higher optical depth inside cavity

HIGH GAS MASS
No measurable effect

HIGH VISCOSITY
Disc spreads at outer edges, minimal change to cavity





References
1. Zúñiga-Fernández S. et al., 2021. A&A
2. Kennedy G.M. et al., 2019. Nature Astronomy
3. Price D.J. et al., 2018. PASA
4. Pinte C. et al., 2006, 2009. A&A