

Planet formation in polar circumbinary discs

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Question: Why the hell should CBDs become polar?

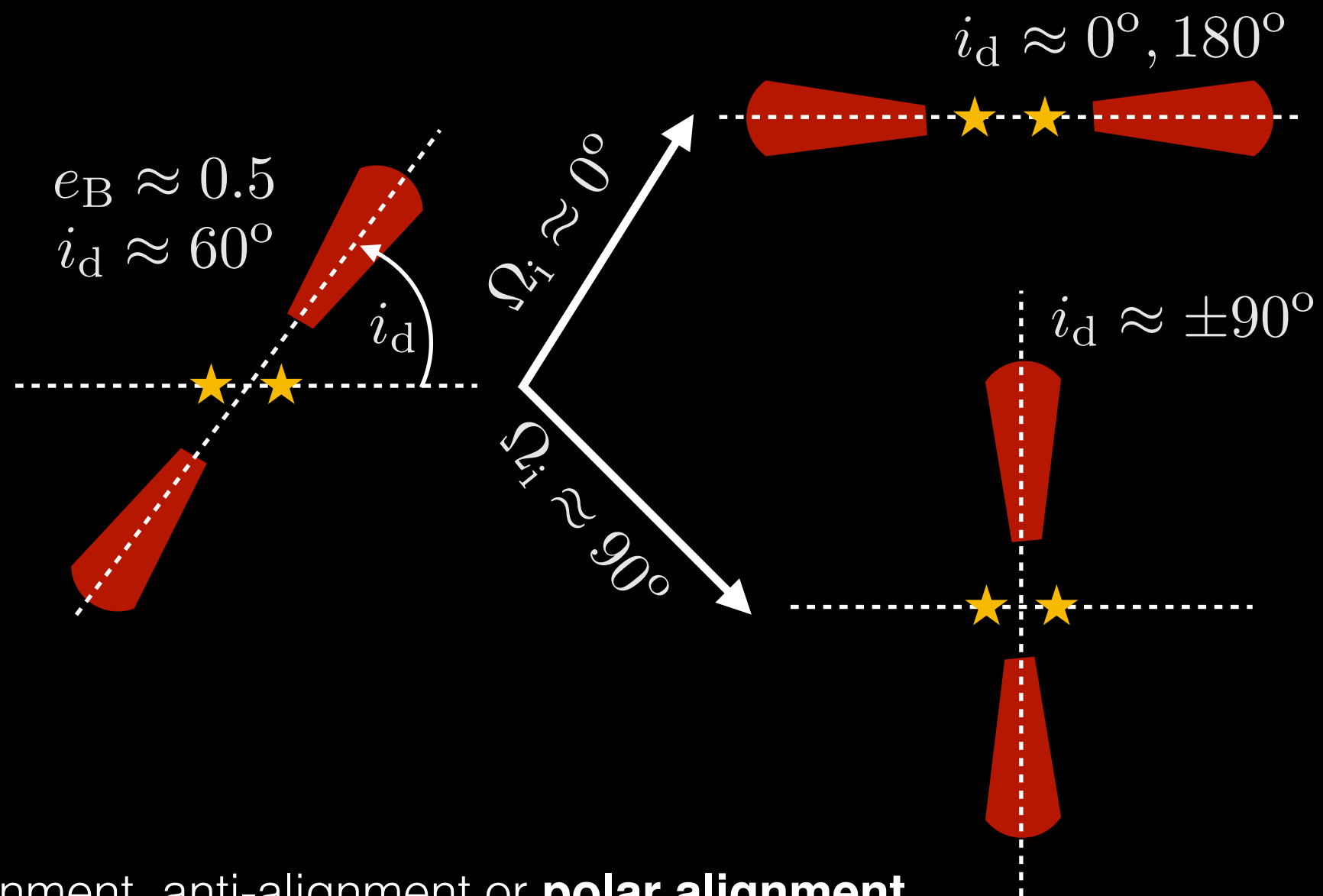
Observational biases:

Kepler observations

Only a few circumbinary planets
Mostly coplanar geometries

Necessary conditions:

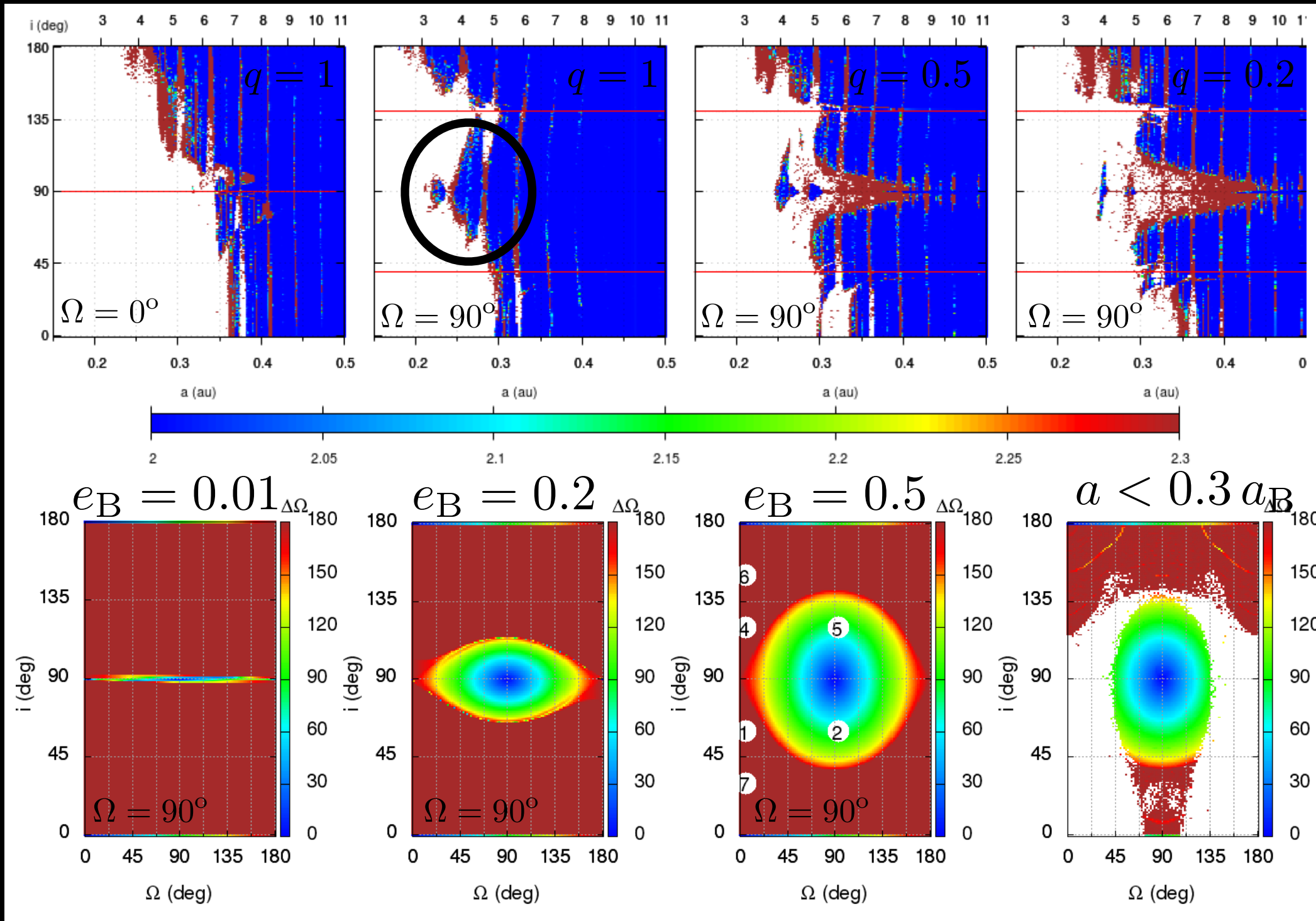
inner binary with $a < 1$ au
warp = tilt i_d + twist Ω_i
flybys can do the job!
~~Kozai-Lidov~~ osc.



Outcomes: alignment, anti-alignment or **polar alignment**

More info \rightarrow poster by Antoine Rocher

How stable are these polar orbits?



$$\Omega = 0^\circ$$

vs.

$$\Omega = 90^\circ$$

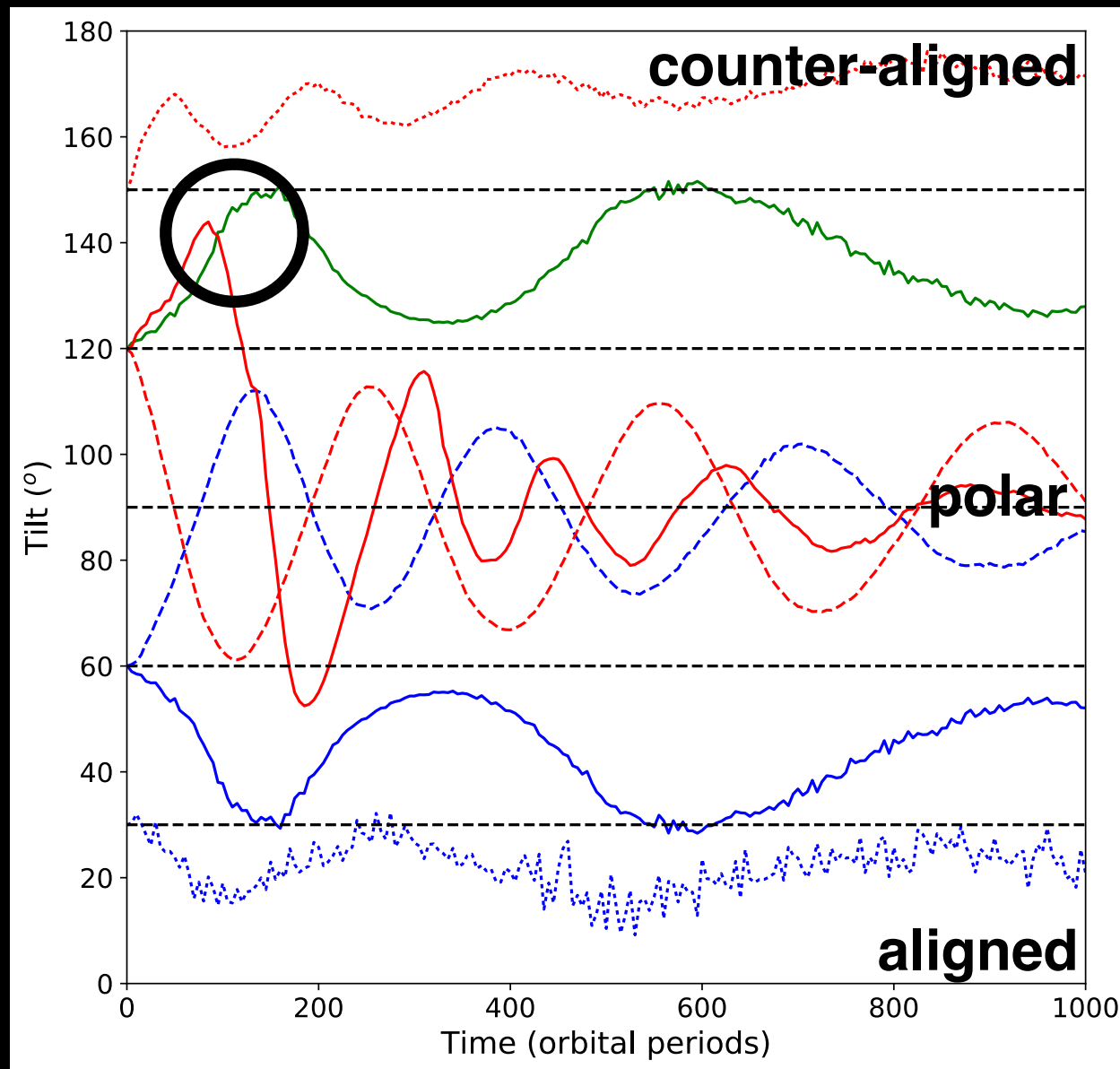
Polar orbits
are stable !!!
(if $q=M2/M1=1$)

Ideal conditions
High eccentricity
High to moderate
disc inclinations
 $\Omega = 90^\circ$

NB: eccentric equal-mass binaries and large semi-major axis are favored
Island of stability for polar orbits if $\Omega = 90^\circ \rightarrow$ polar Tatooine nurseries ?

Exploring polar alignment with hydro simulations

PHANTOM simulations (Price+2018)



For the “right” initial conditions,
polar alignment !

Symmetry breaking between
prograde and retrograde orbits
—> disk breaking !

NB: we confirm the theory.
But, unexpected results
likely due to the size of the cavity

Future: explore dust dynamics
& polar planet formation



- We should expect a large population of polar planets
- Polar planets are hard to detect (geometry & time)
- The habitability of these planets is rather different...

More soon: Cuello & Giuppone (in prep.)