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# Dust Dynamics in Protoplanetary Discs after Stellar Flybys

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## Introduction

- We study the dynamical response of protoplanetary discs to encounters with an unbound parabolic stellar companion (i.e. a flyby)
- Flybys could play a significant role in shaping the early evolution of protoplanetary discs (Cuello et al. 2019)
- Can substructures such as spiral arms act as dust traps and favour dust grain growth?

## Numerical simulations

- 3D SPH simulations using PHANTOM (Price et al. 2018)
- We adopted a two-fluid method and used dust particles with St $\geq 1$
- We modelled coplanar prograde flybys around a solar-type star, and one retrograde flyby

| name | $M_2$ [$M_\odot$] | $r_{peri}$ [AU] | inclination |
|---|---|---|---|
| standard_run | 1 | 175 | prograde |
| half | 0.5 | 175 | prograde |
| intermediate | 1 | 263 | prograde |
| far | 1 | 350 | prograde |
| retro | 1 | 175 | retrograde |

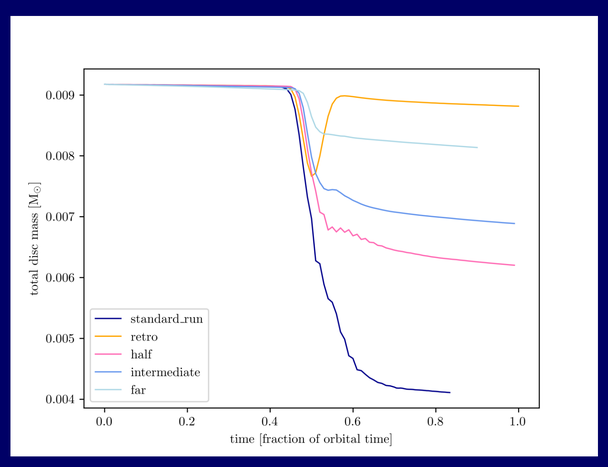


Figure 1: Total mass of primary disc over the course of the flyby.

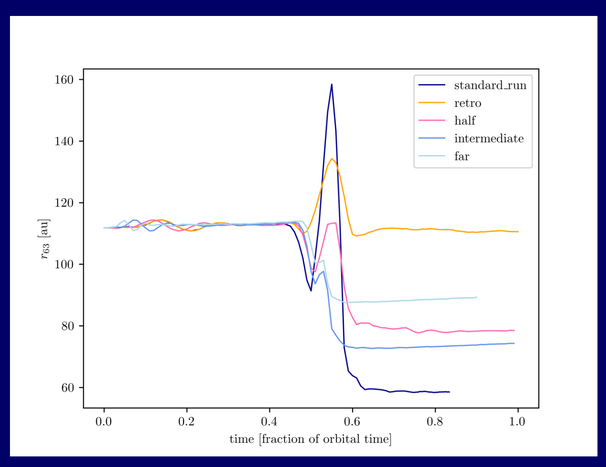


Figure 2: Characteristic radius of the primary disc over the course of the flyby.

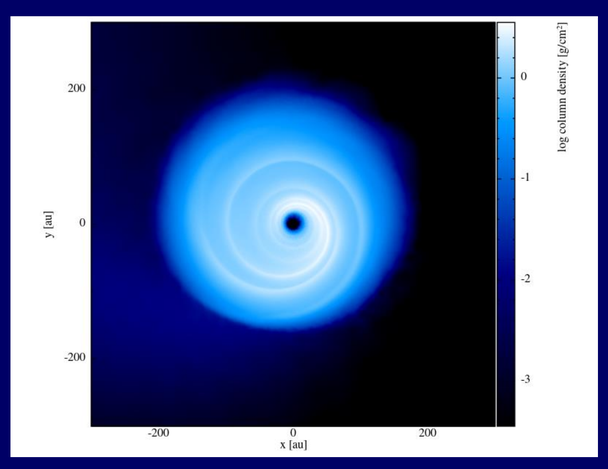


Figure 3: Gas column density at the end of the retrograde encounter.

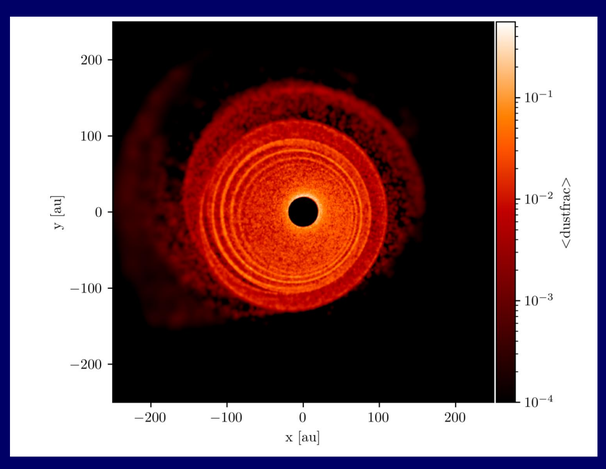


Figure 4: Dust to gas ratio at the end of the retrograde encounter.

## Results and Conclusions

- Material is stripped from the disc by the perturber in all cases, truncating the disc
- We find the most prominent and long-lasting spiral arms for the **retrograde** flyby
- Spirals are associated with corresponding local peaks in the dust to gas ratio – so may act as dust traps
- Next steps are to further investigate the lifetime of spiral arms and whether they act as dust traps
- We will also model some flybys on inclined trajectories

## References


- Cuello N. et al., 2019, MNRAS, 483, 4114.
- Price D. J. et al., 2018, Publ. Astron. Soc. Aust., 35, e031.