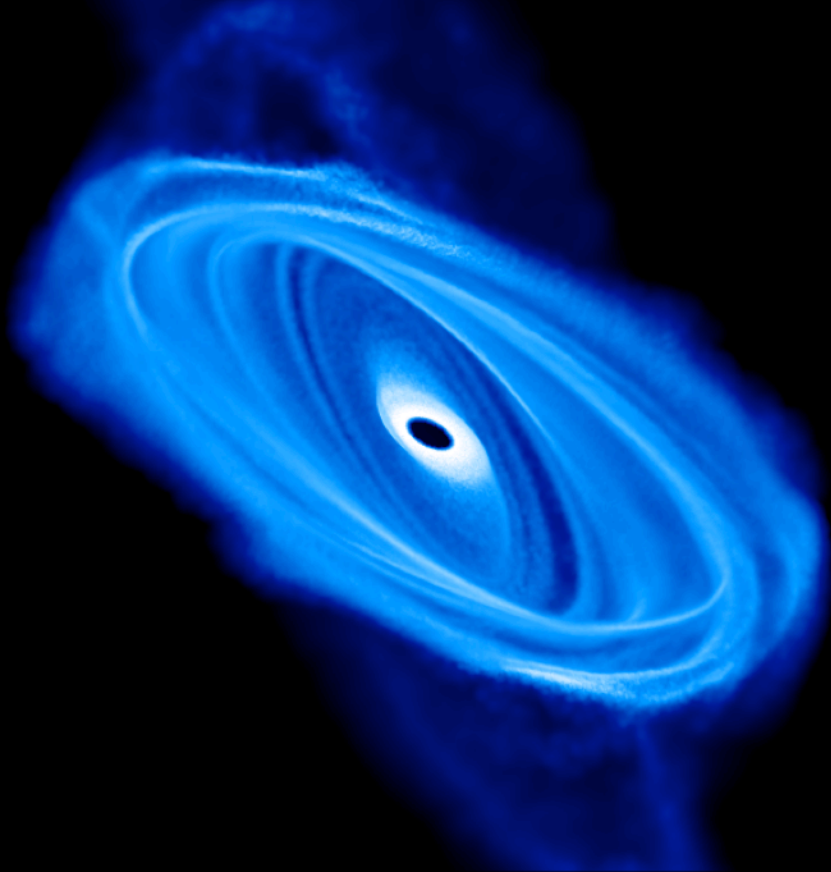


Overlapping Inflows: Catalysts for AGN and Not Only that.



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AGN 11 – Where Black
Holes and Galaxies Meet

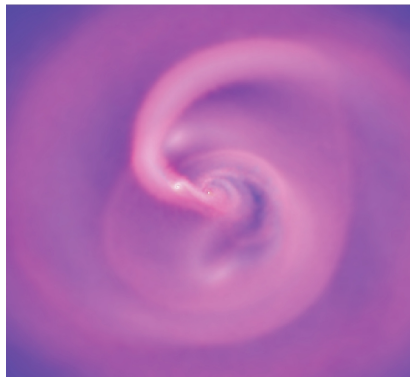
24 – Sep – 2014

Gas inflow at different scales (e.g. Shlosman et al. 1989, Jogee 2006, Hopkins and Quataert 2010, 2011).

~ 10 kpc – Galactic scales: Non-axisymmetric potential.



~ 1 kpc - 100 pc – Galactic Bulge: “Bars within bars”.



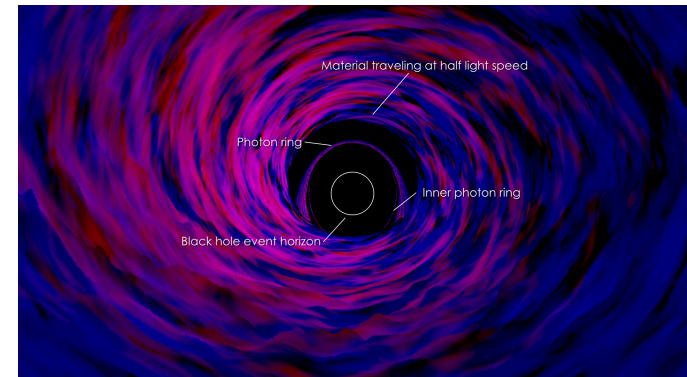
~ 10 pc – BH Sphere of Influence:

$$r_{\text{inf}} \sim \frac{GM_{\text{BH}}}{\sigma^2}$$



*Keplerian Potential
→ Centrifugal barrier!*

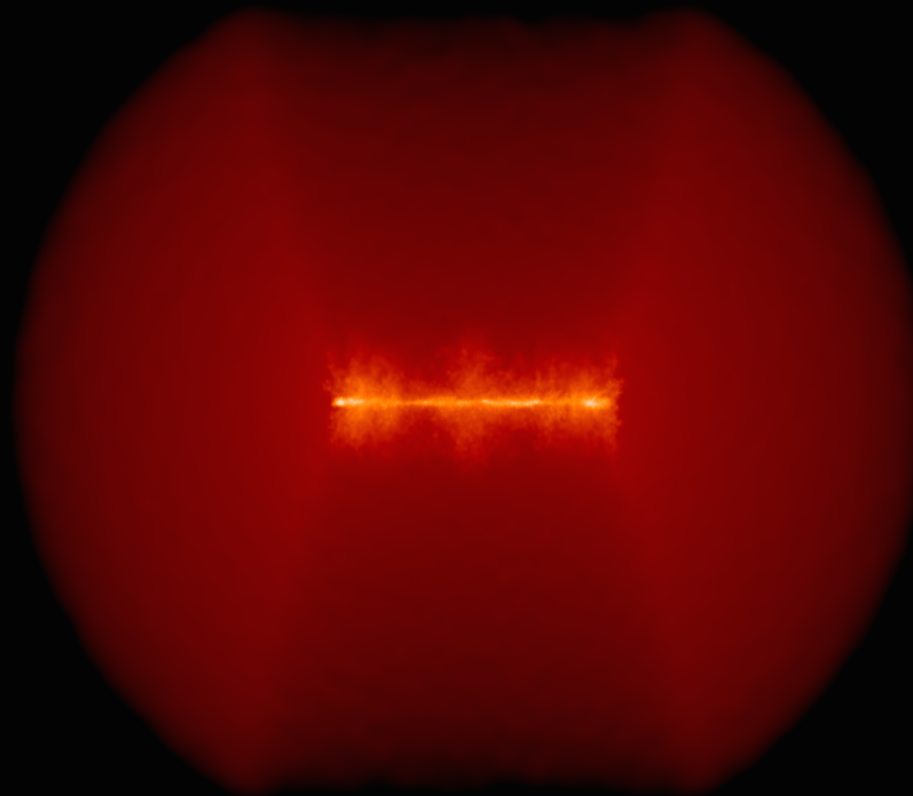
~ 0.01 pc down – Accretion Disc: Shakura Sunyaev alpha disc.



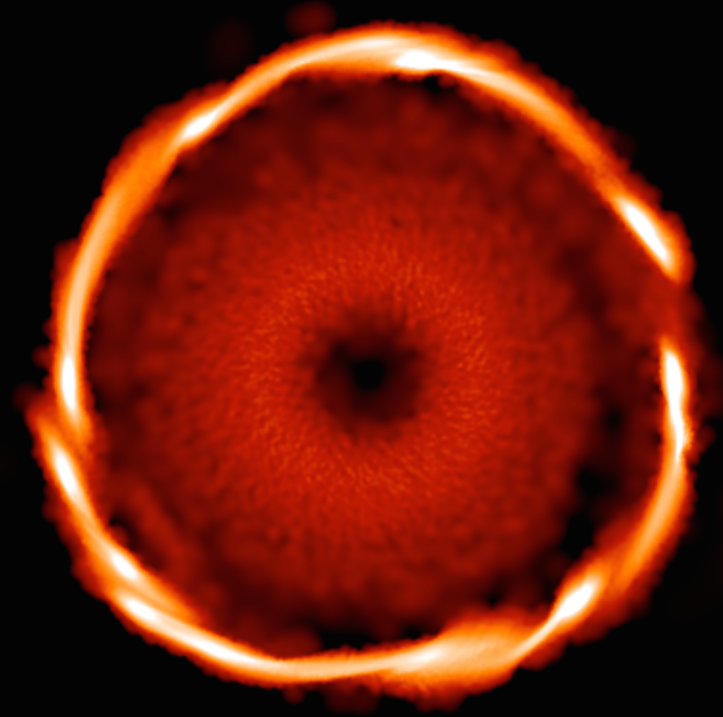
Disc Formation.

1st Inflow event, gaseous shell: $v_{\text{rot}} = 0.3$

[Hobbs et al. 2011]



10 pc



10 pc

$$r_{\text{shell}} = 100\text{pc}$$

$$\vec{v}_{\text{shell}} = v_{\text{rot}} \hat{e}_{\varphi}$$

$$r_{\text{disc}} = r_{\text{circ}} \simeq 15 - 20\text{pc}$$

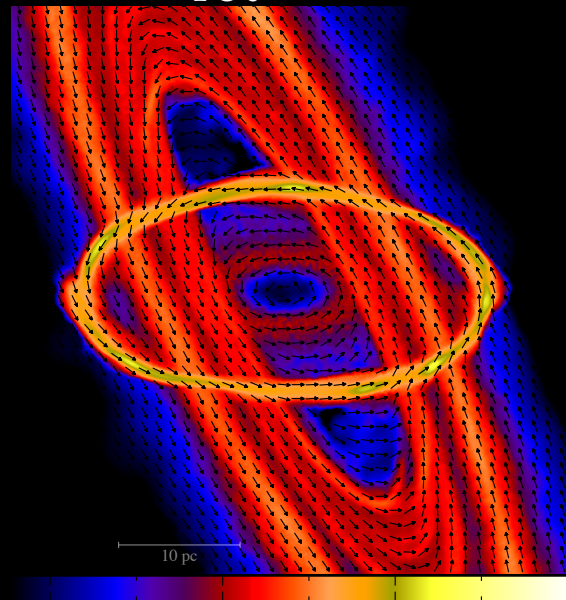
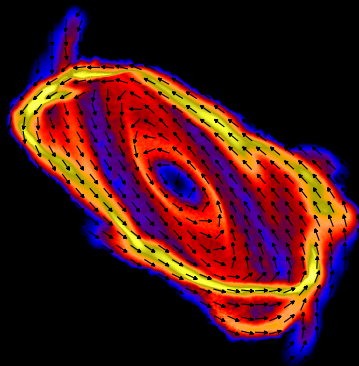
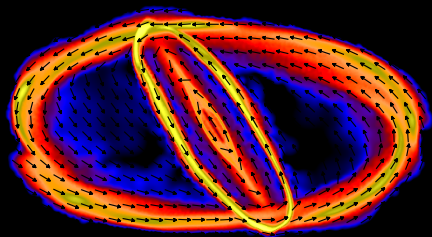
$$v_{\text{disc}} \sim r^{-1/2}$$

$v_{\text{rot}} = 0.2$

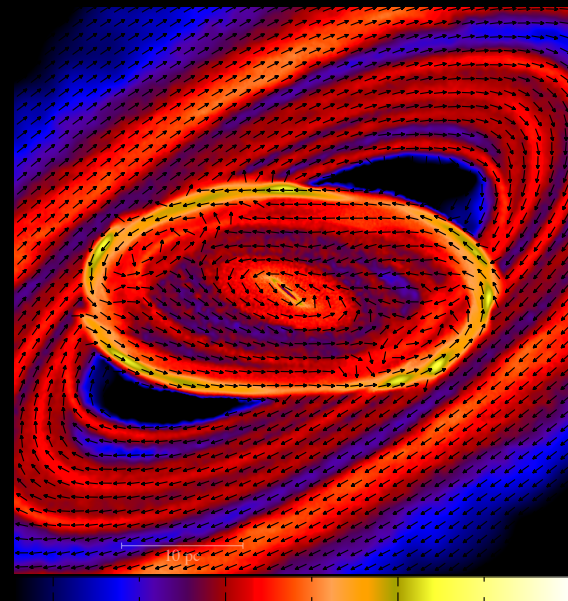
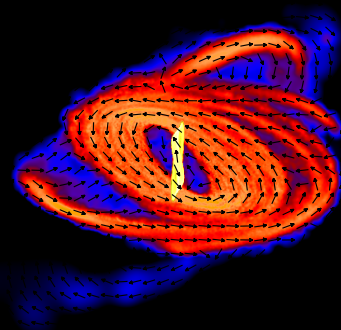
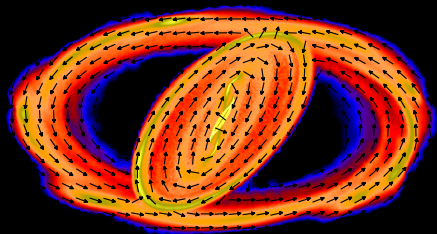
$v_{\text{rot}} = 0.3$

$v_{\text{rot}} = 0.7$

$\theta_{\text{tilt}} = 60$



$\theta_{\text{tilt}} = 150$



Accretion rates:

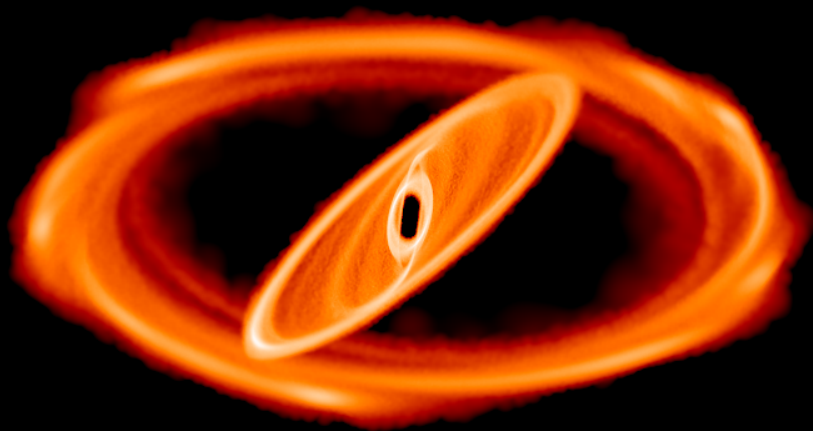
Strongly dependent on angular momentum difference.

(+ G. Murante, P. Monaco, P. Barai)

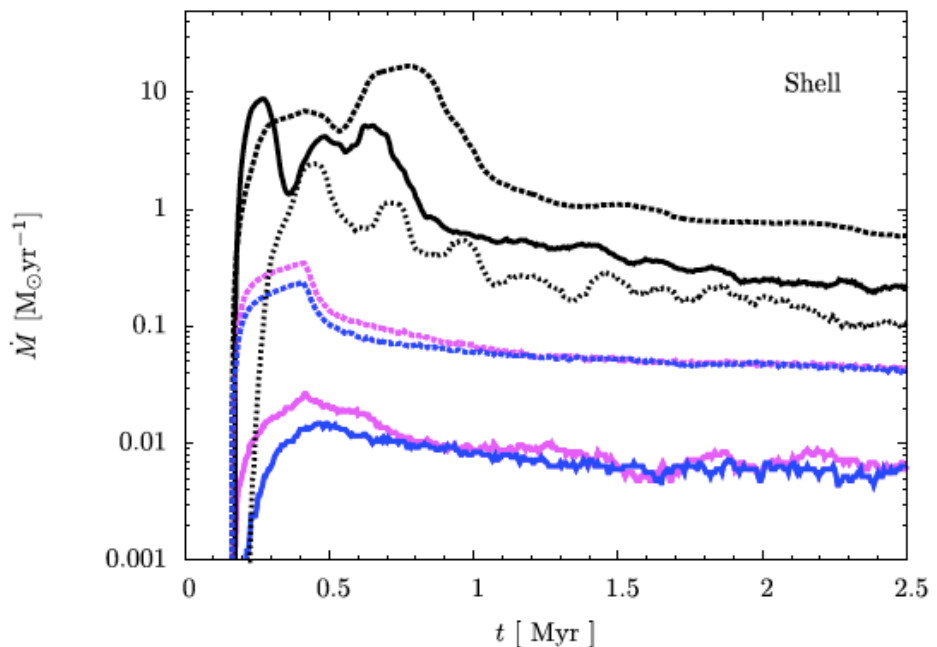
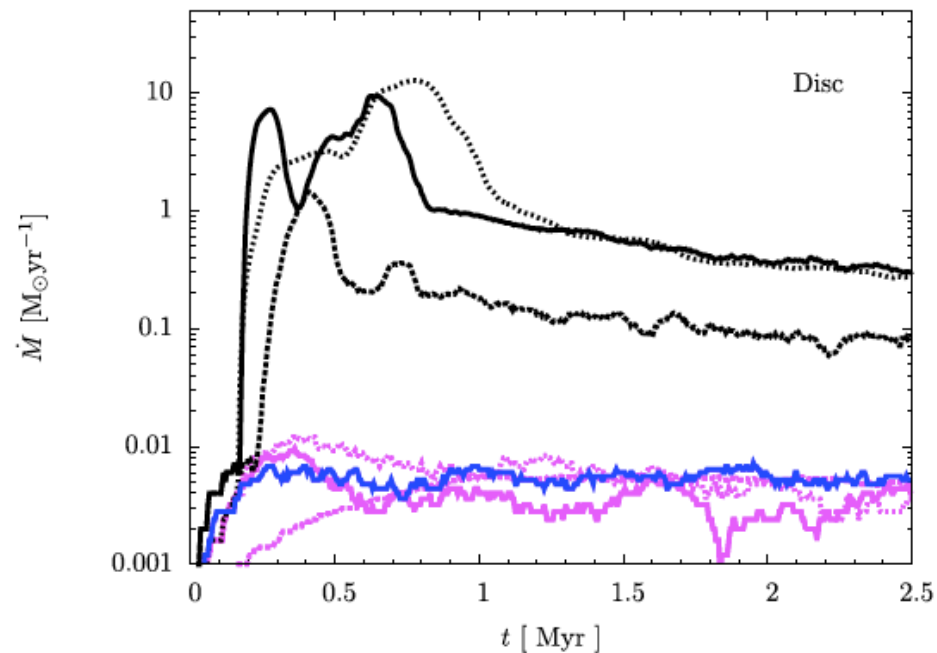
Disc Morphologies:

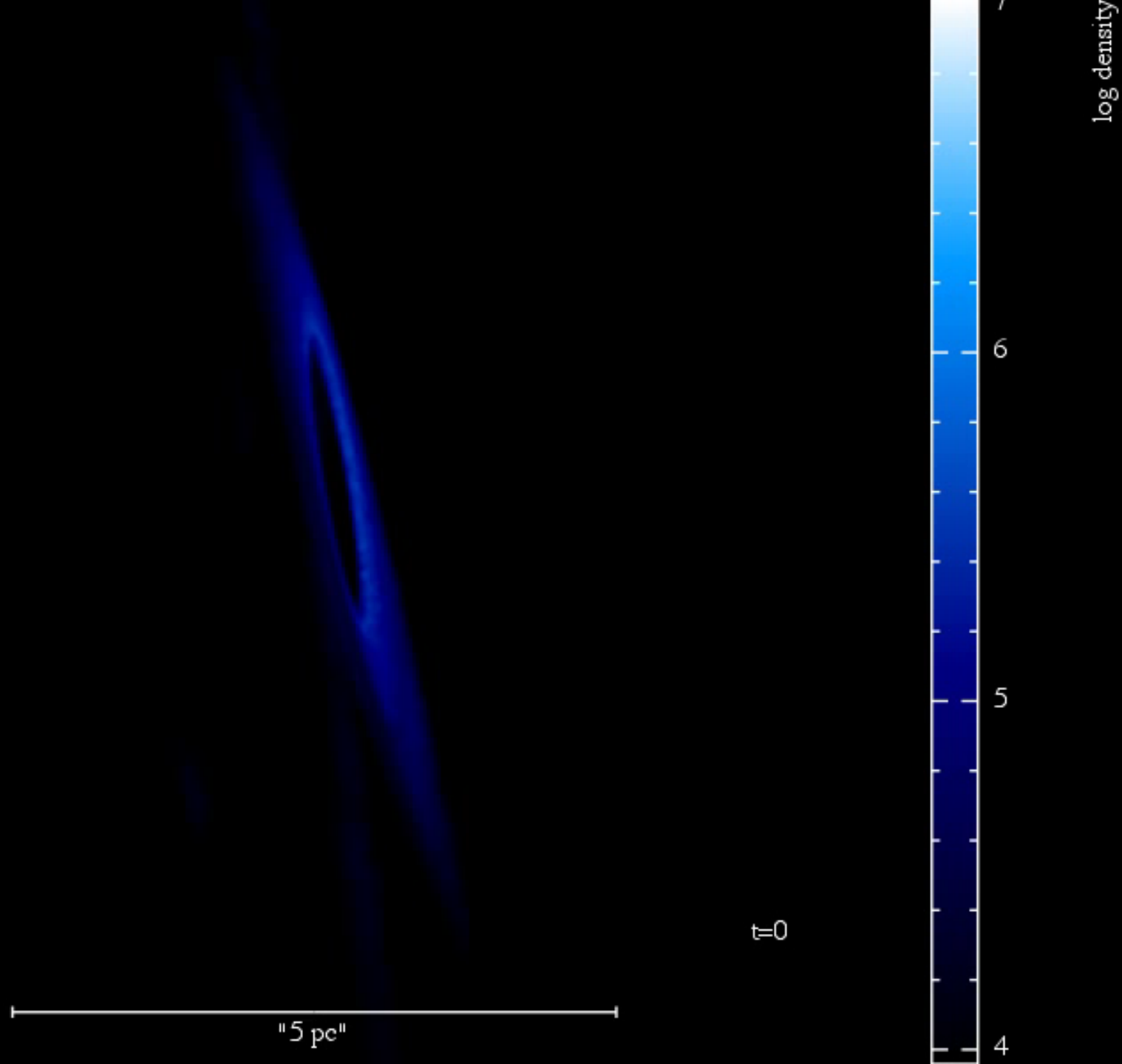
Nested discs? WARPS?

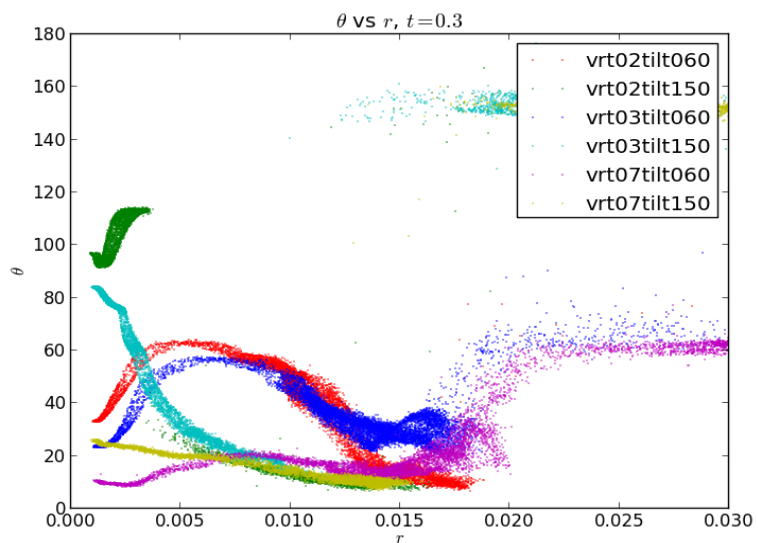
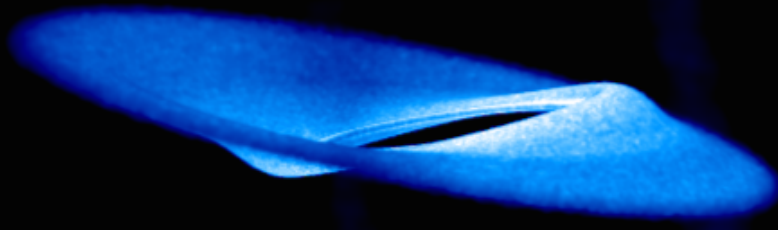
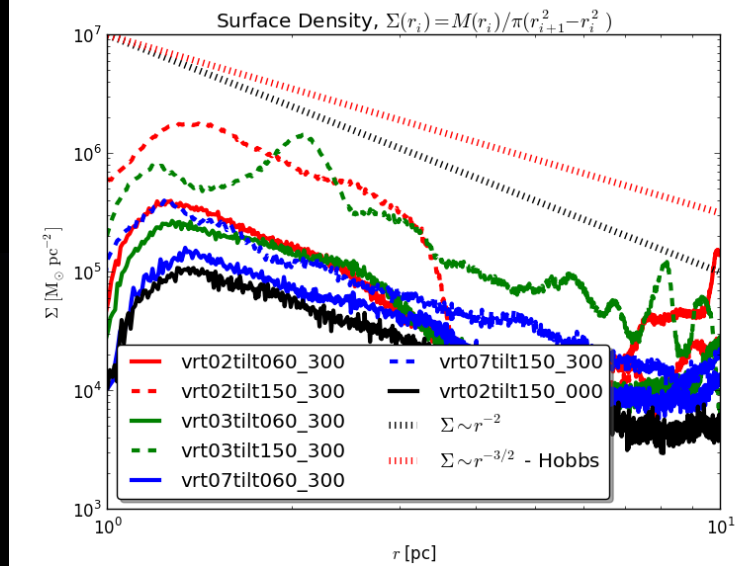
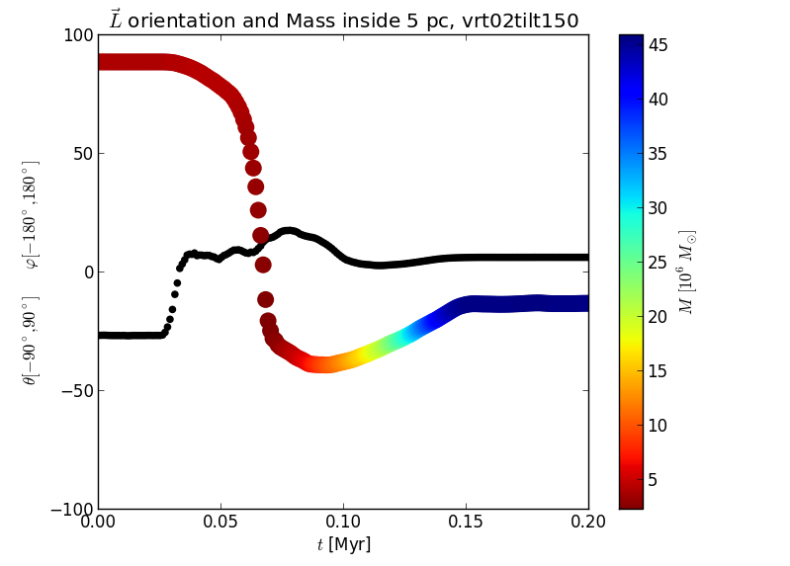
(+M. Colpi, M. Dotti, R. Valdarnini)



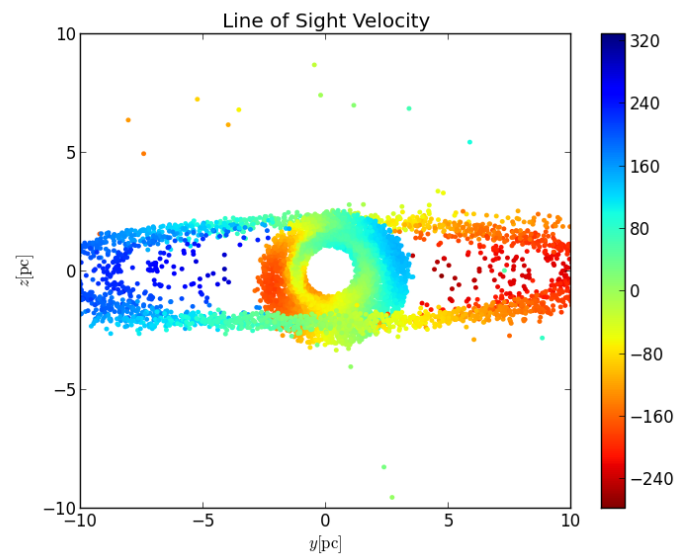
10 pc







"5 pc"



Conclusions:

- *Overlapping inflows are good candidates for explaining: i) Black Hole Feeding, ii) Reservoir Growing, iii) Warp Formation.*
- *The degree of misalignment between overlapping inflows has a strong impact on the inflow rate.*
- *Massive warped discs and misaligned gas streams are a general outcome of overlapping inflows.*

[Carmona-Loaiza et al. (2014) & Carmona Loaiza et al. (in preparation)]

Future and Ongoing work:

(+ M. Colpi, M. Dotti, G. Murante, P. Monaco, P. Barai, R. Valdarnini)

- *How is the **inflow** rate linked to the **angular momentum** of the gas? – Sub-grid recipe for AGN feedback in large scale simulations.*
- ***Star Formation**: Are this kind of interactions responsible for the warped disc observed around **Sgr A***?*
- *More **realistic** environments: How likely is it to have these kind of events?*
- *Would overlapping inflows impact the evolution of a **binary BH**?*