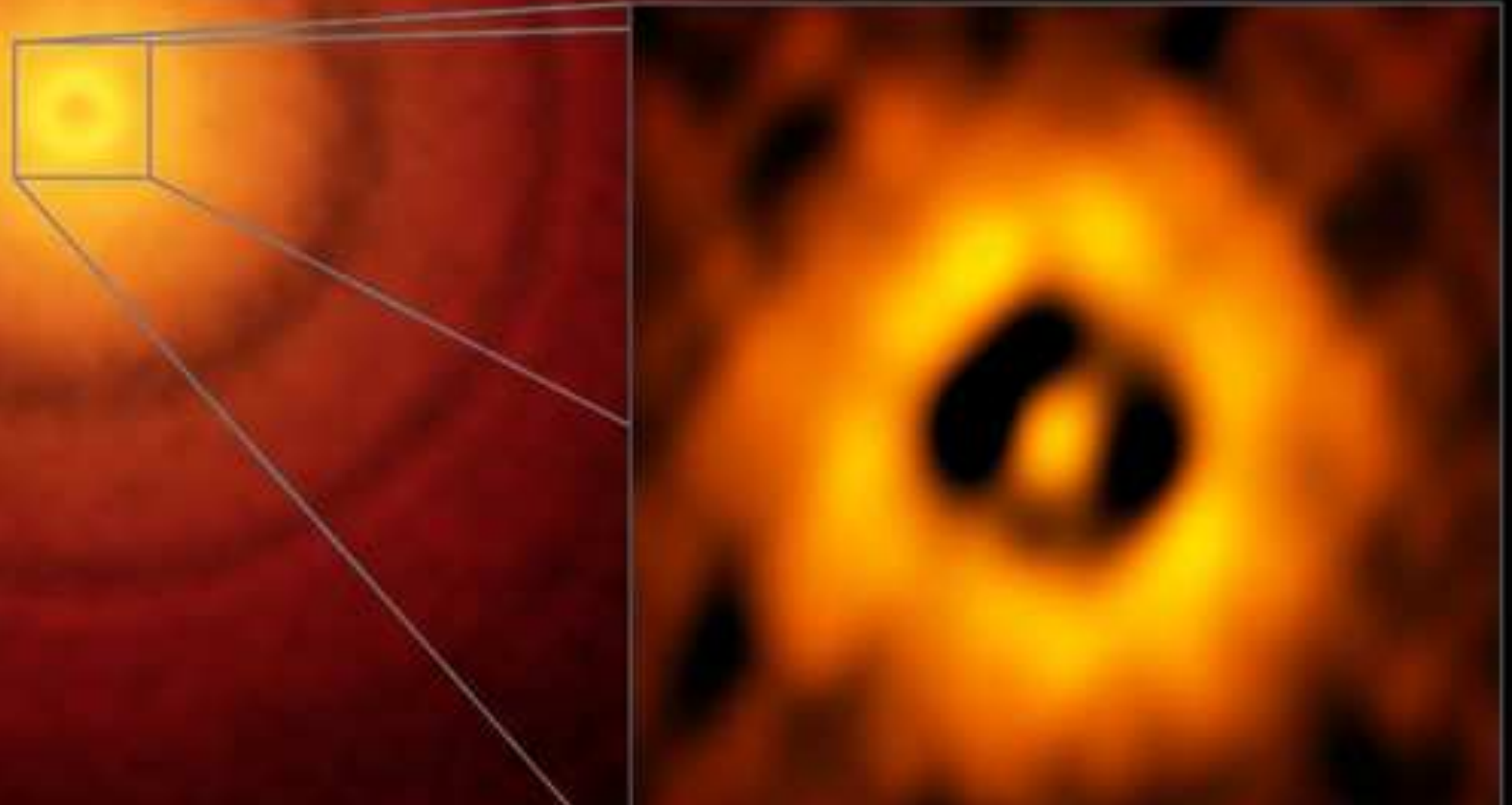
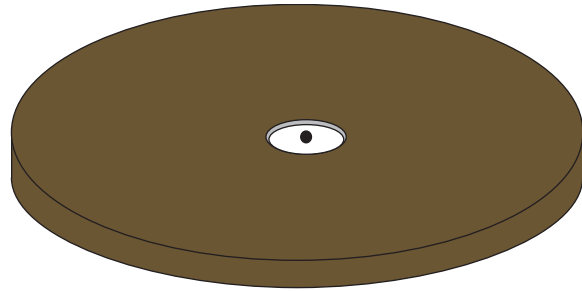


Cavity Opening in Transitional Discs

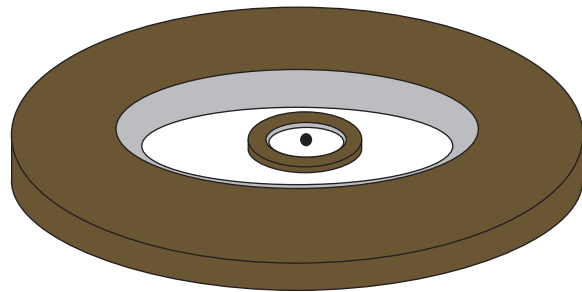
Kieran Hirsh



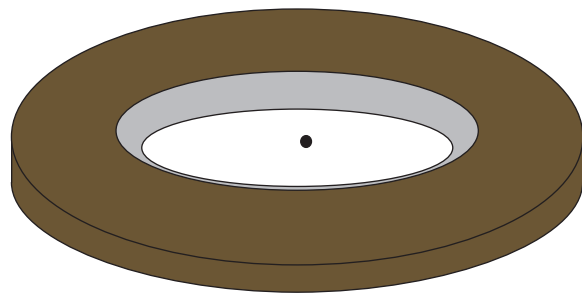
What is a transitional disc?



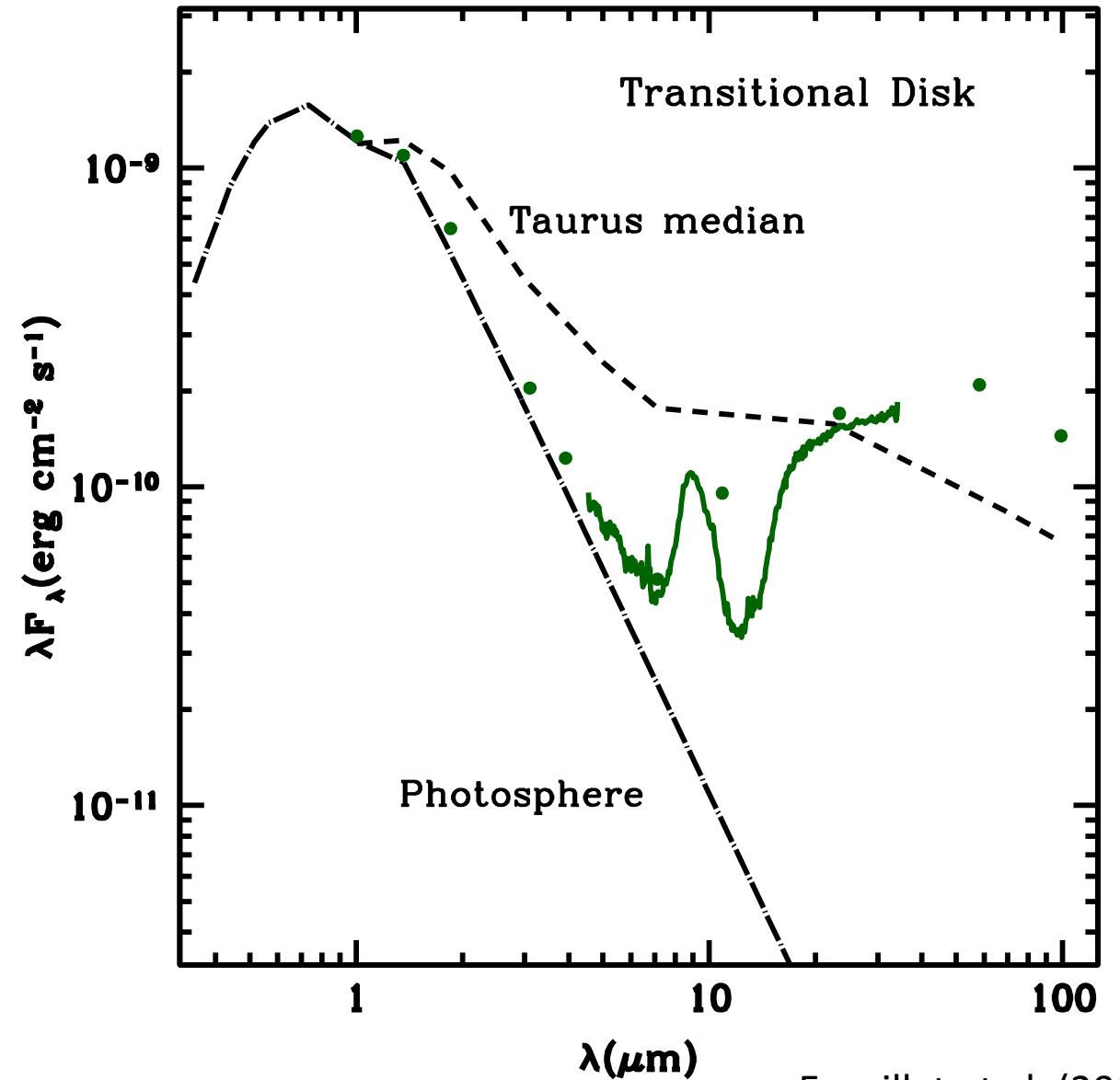
Full Disk



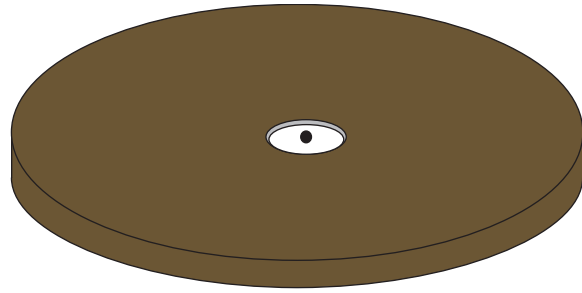
Pre-Transitional Disk



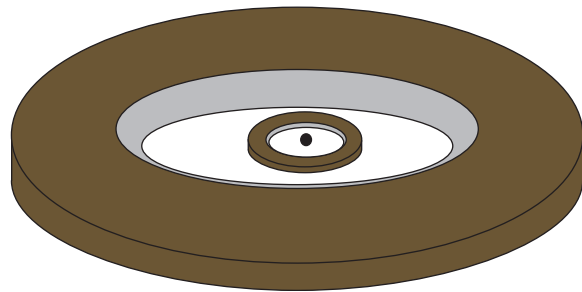
Transitional Disk



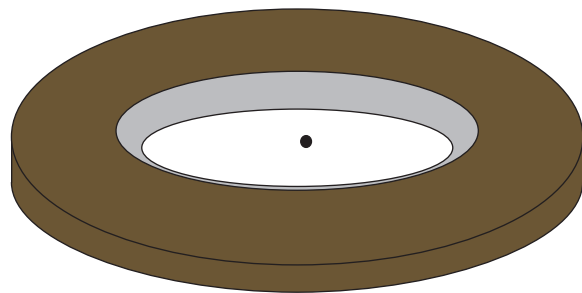
What is a transitional disc?



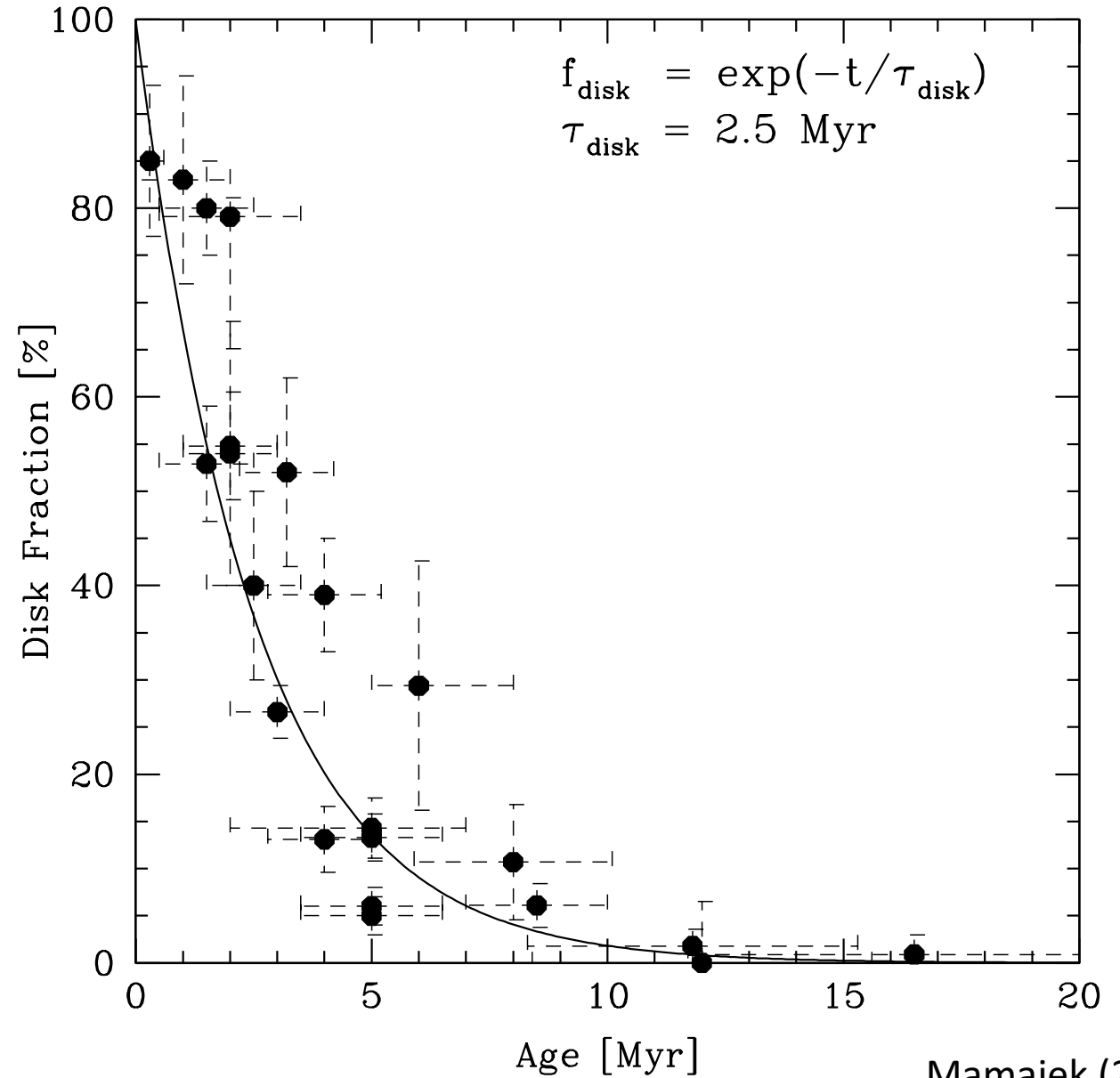
Full Disk



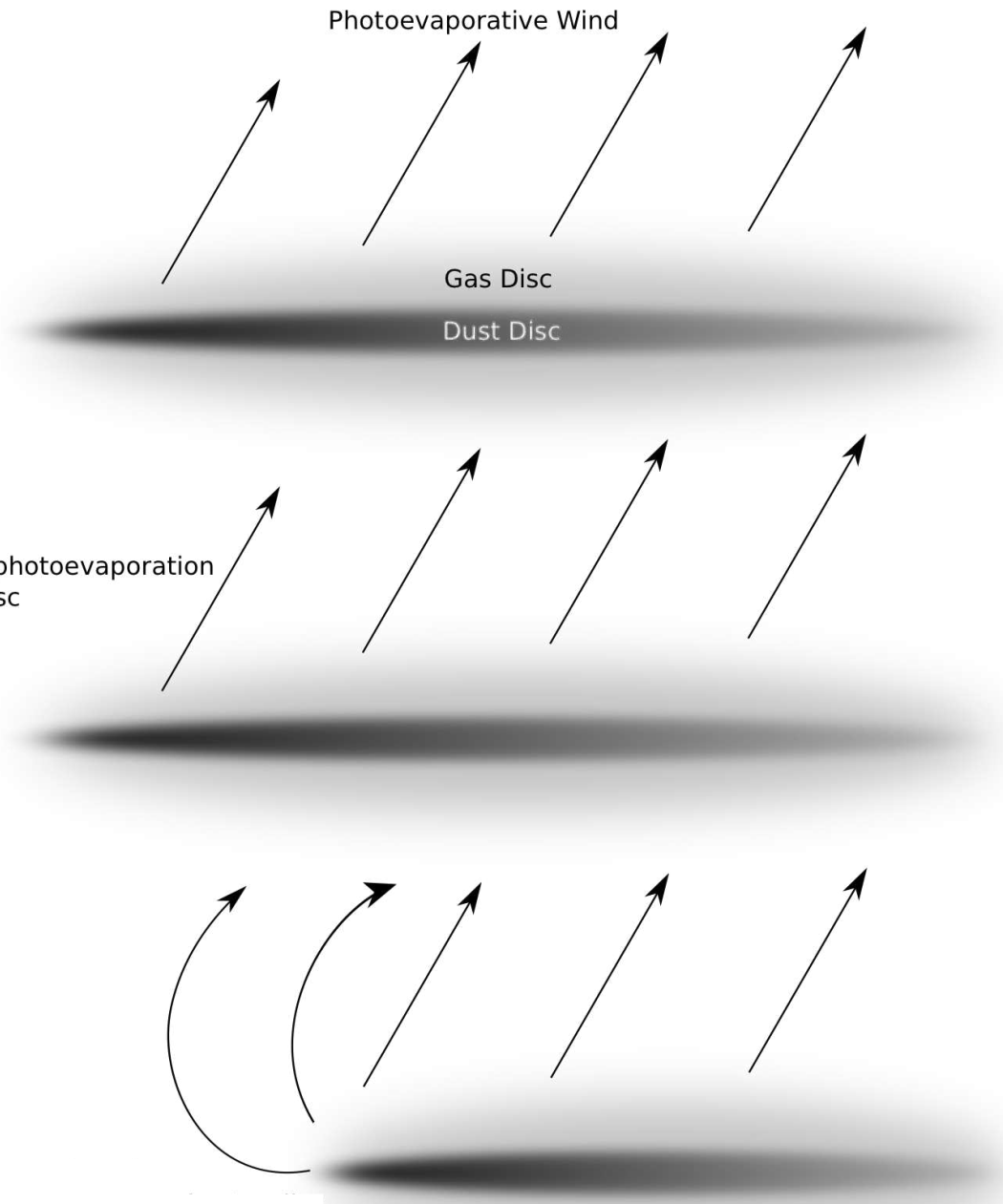
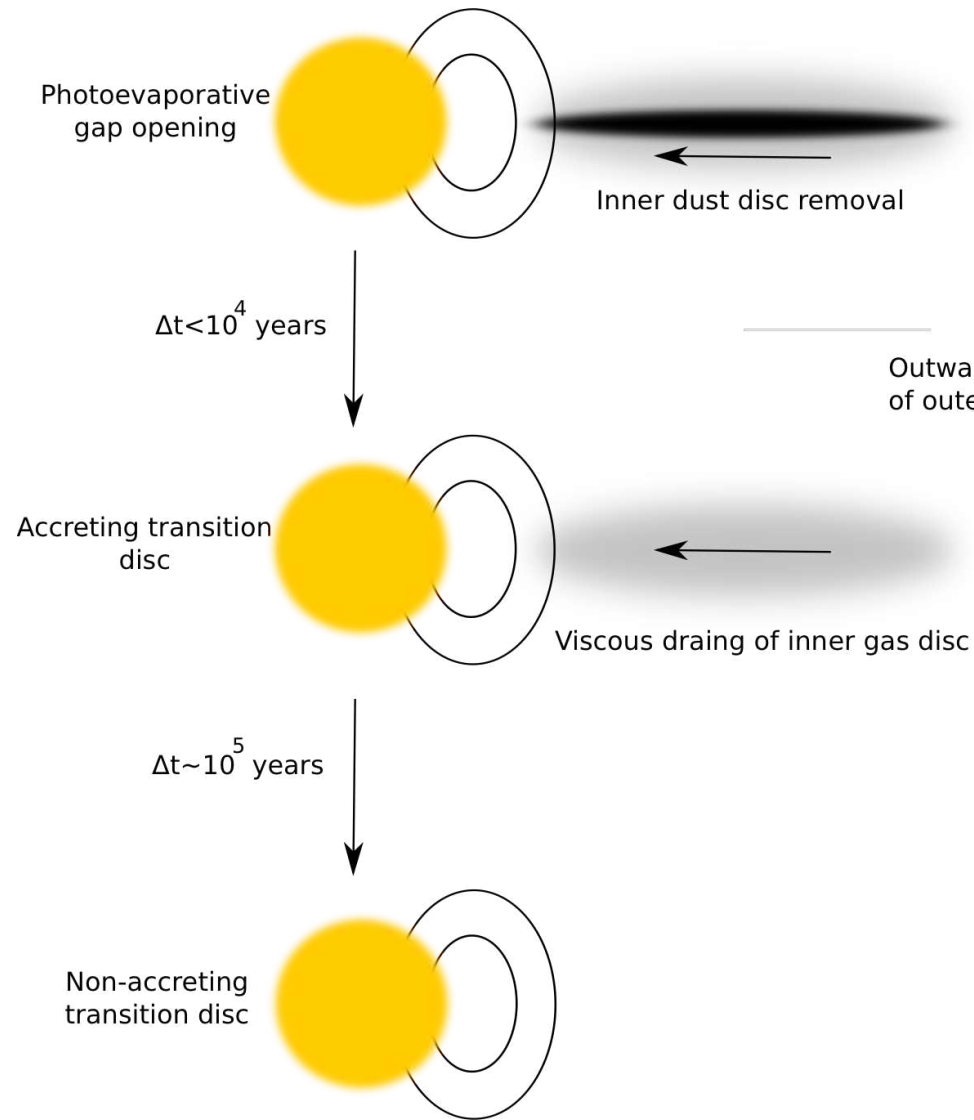
Pre-Transitional Disk



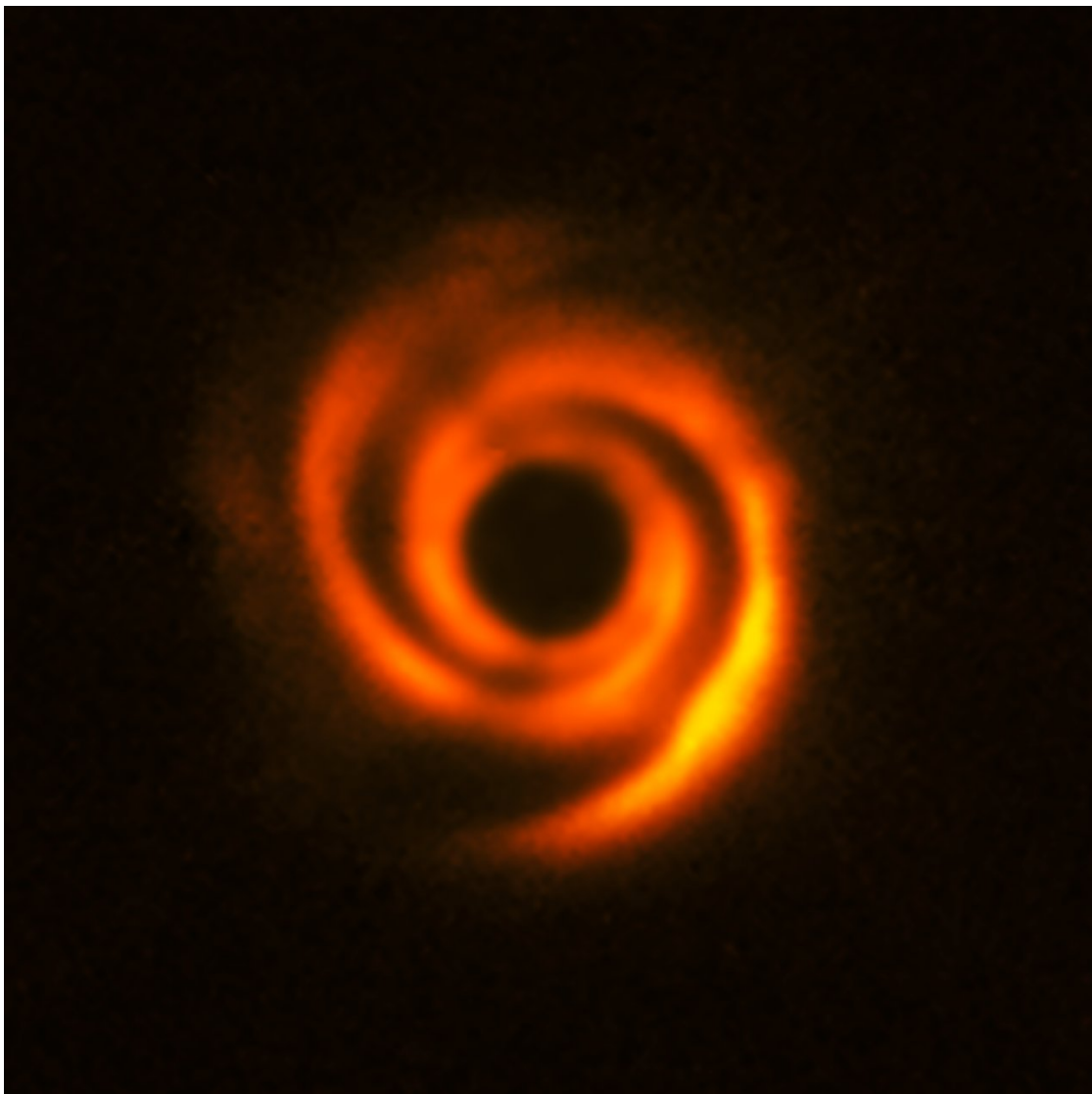
Transitional Disk



Photoevaporation

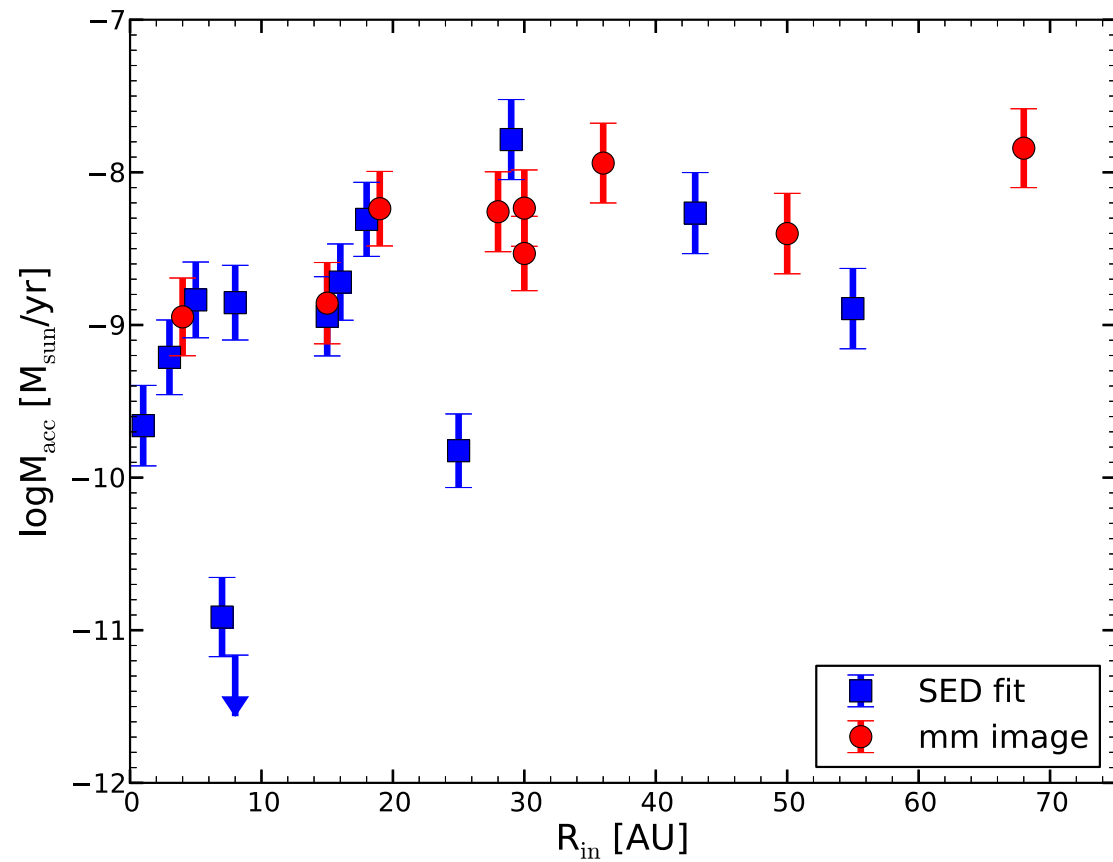


Photoevaporation?



HD 135344B

ESO, Stoler et al. (2017)



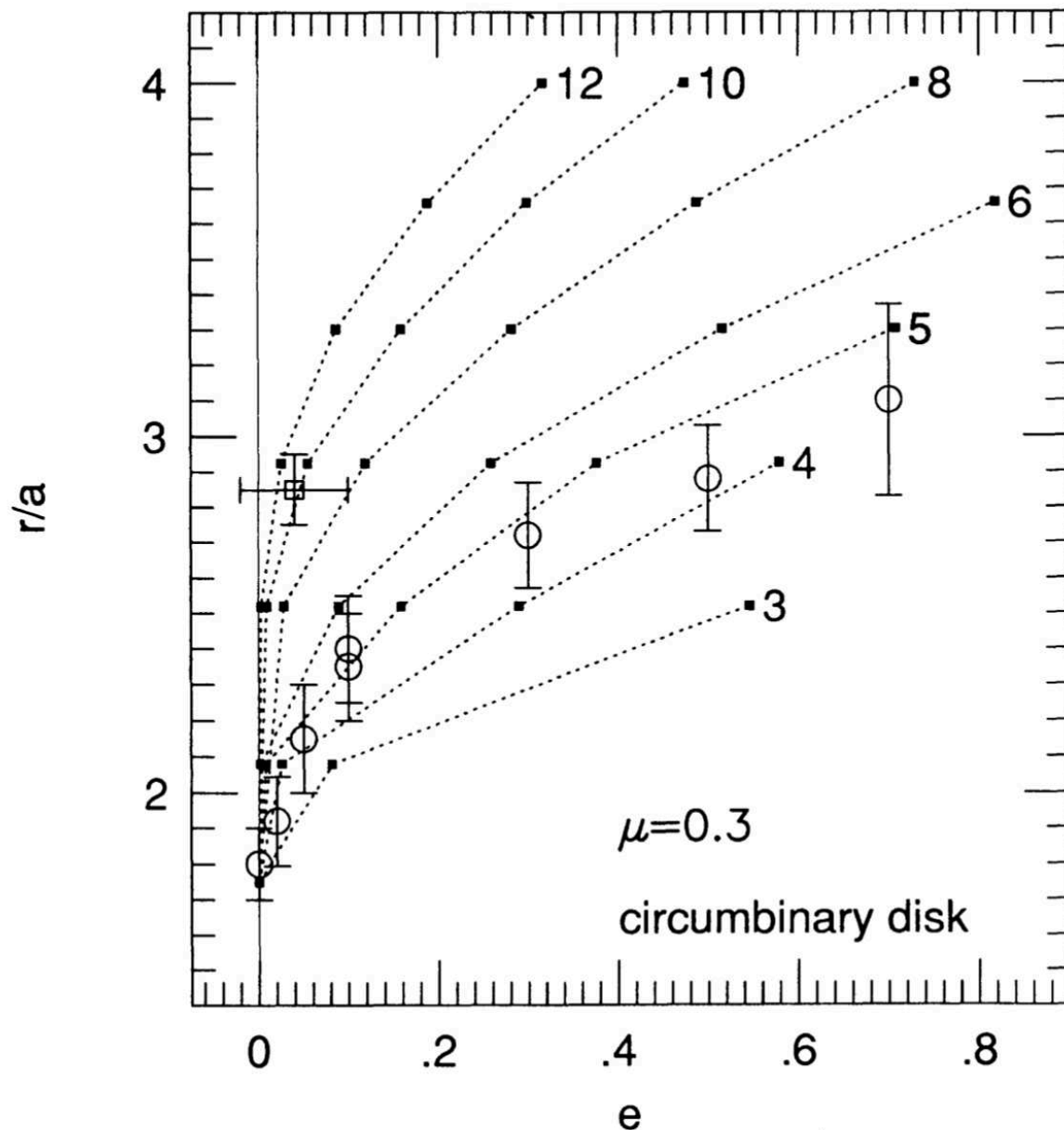
Manara et al. (2014)

Binaries

$$-m\pi^2 \left[\Sigma \left(\frac{dD}{d \ln r} \right)^{-1} |\Psi_{m,N}|^2 \right] \gtrsim 3\pi\alpha h^2 \Sigma \Omega^2 r^4$$

$$T_{m,N}^{LR} \gtrsim T_\nu$$

$$\frac{r_{LR}}{a} = \left(\frac{m+1}{N} \right)^{\frac{2}{3}}$$

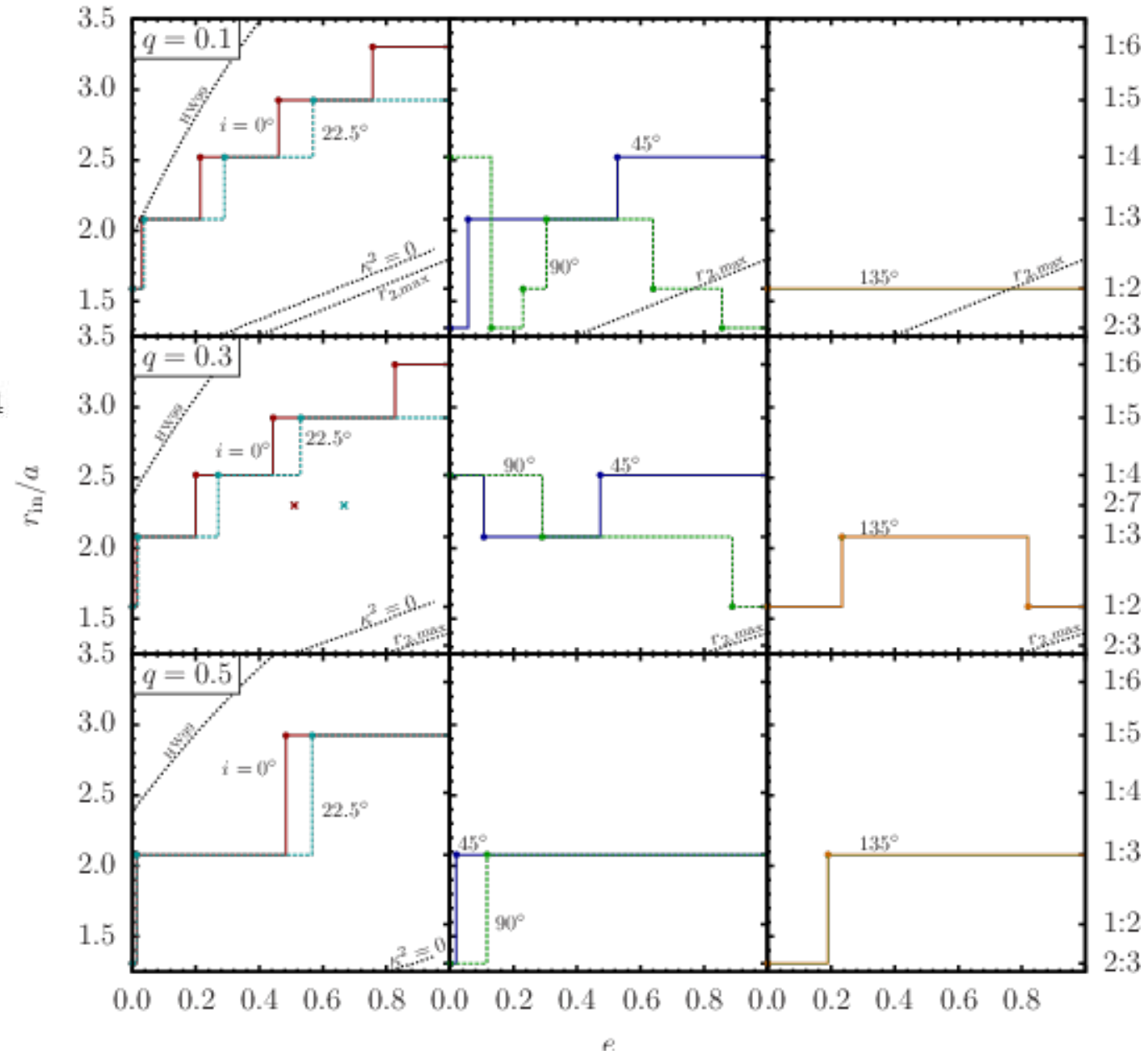


Binaries

$$T_{m,N}^{LR} \gtrsim T_\nu$$

$$-m\pi^2 \left[\Sigma \left(\frac{dD}{d \ln r} \right)^{-1} |\Psi_{m,N}|^2 \right] \gtrsim 3\pi\alpha h^2 \Sigma \Omega^2 r^4$$

$$\frac{r_{LR}}{a} = \left(\frac{m+1}{N} \right)^{\frac{2}{3}}$$



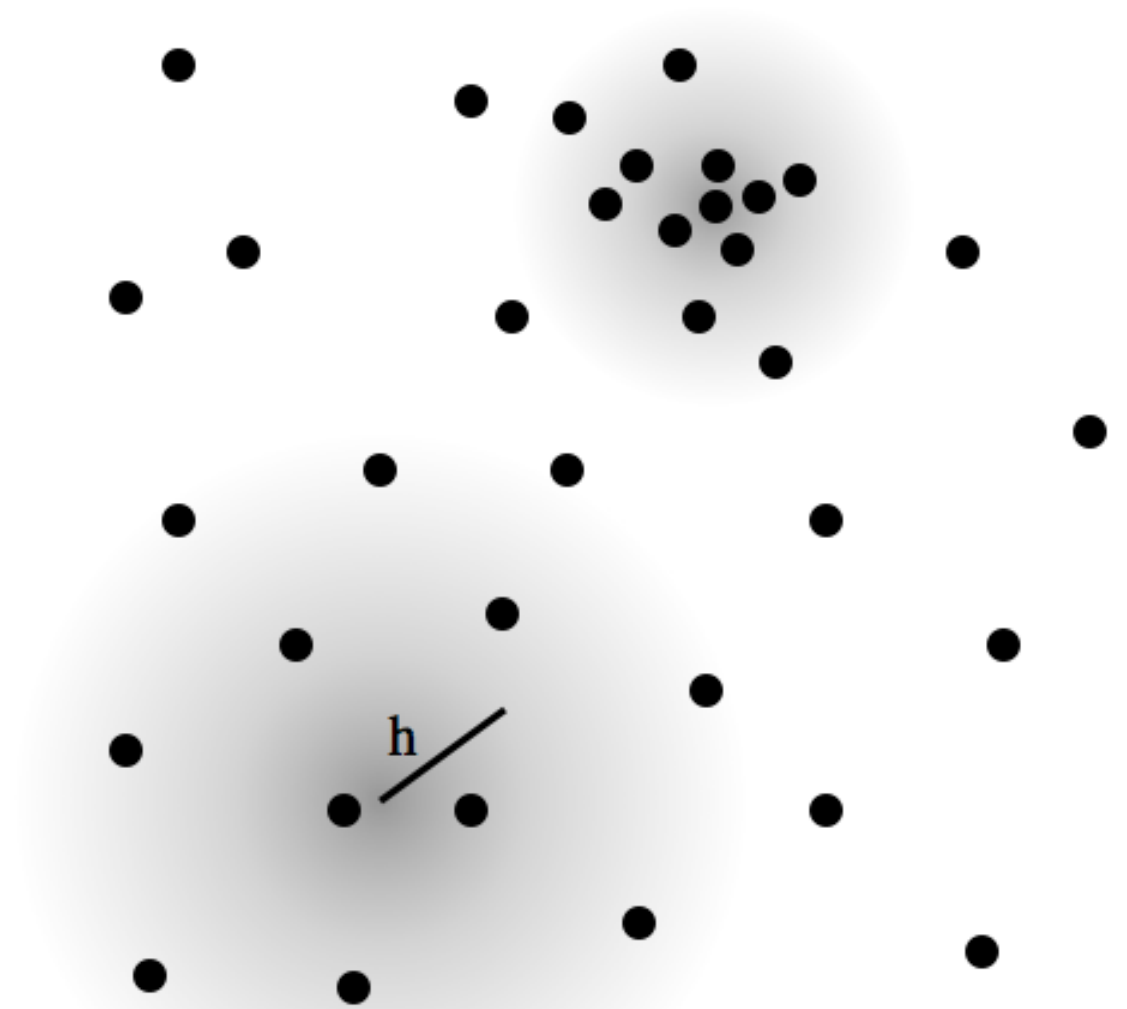
Smoothed Particle Hydrodynamics (SPH)

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{v}) = 0$$

$$\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla_{\mathbf{x}} = \frac{-\nabla P}{\rho} - \nabla \Phi$$

$$\Phi = \frac{-GM_1}{|\mathbf{r} - \mathbf{r}_1|} - \frac{GM_2}{|\mathbf{r} - \mathbf{r}_2|}$$

$$P = c_s^2(r) \rho$$



Smoothed Particle Hydrodynamics (SPH)

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{v}) = 0$$

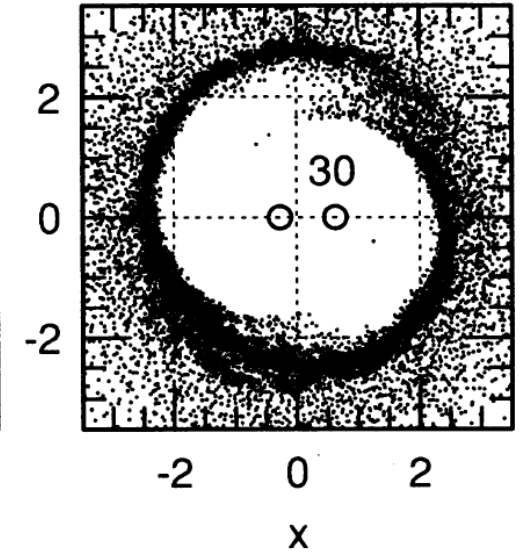
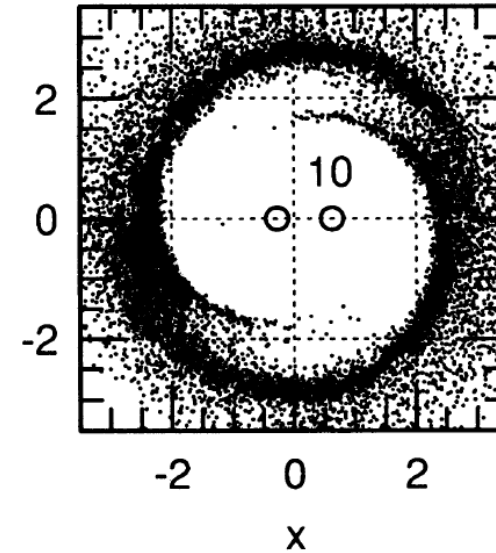
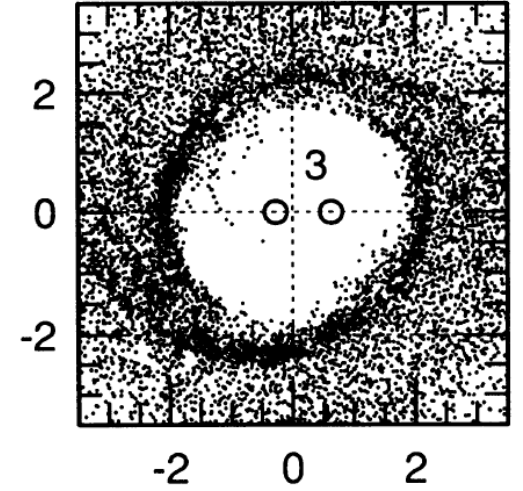
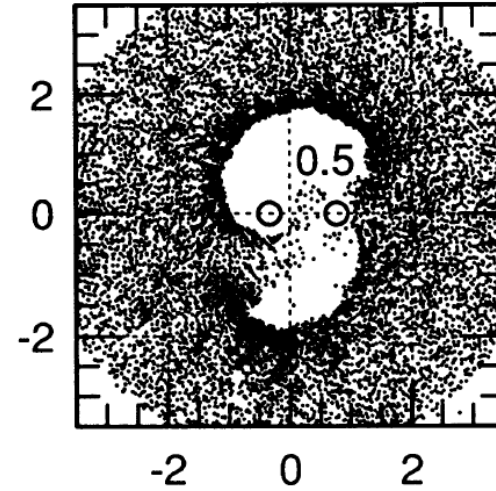
$$\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla_{\mathbf{x}} = \frac{-\nabla P}{\rho} - \nabla \Phi$$

$$\Phi = \frac{-GM_1}{|\mathbf{r} - \mathbf{r}_1|} - \frac{GM_2}{|\mathbf{r} - \mathbf{r}_2|}$$

$$P = c_s^2(r) \rho$$

y

y



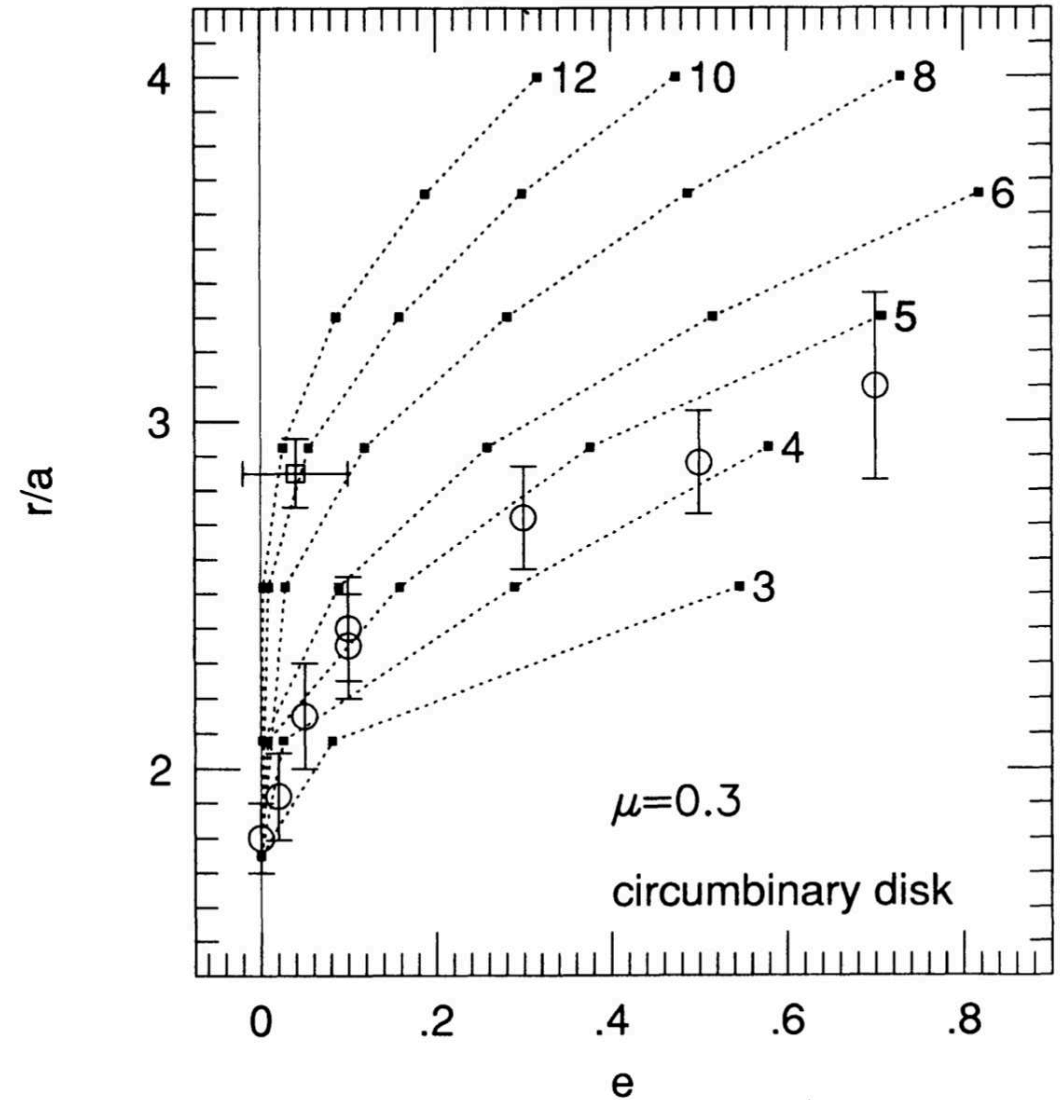
Smoothed Particle Hydrodynamics (SPH)

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{v}) = 0$$

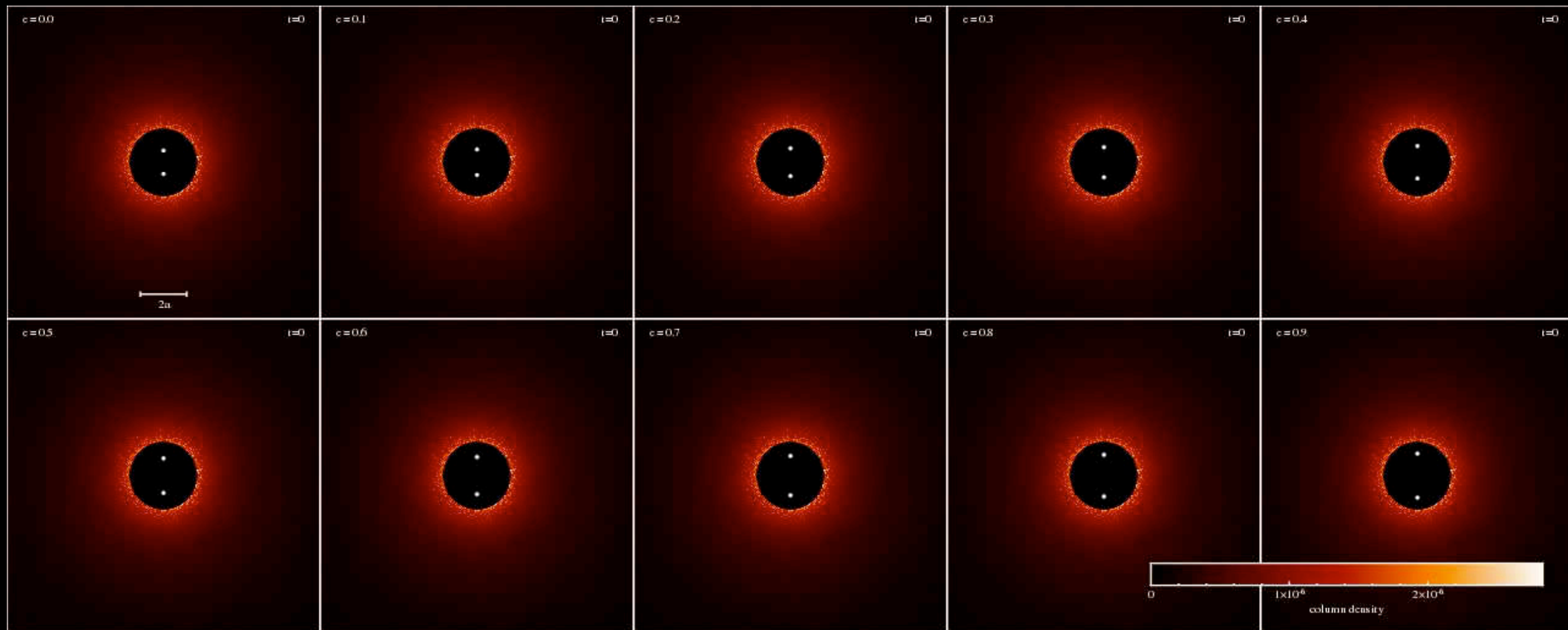
$$\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla_{\mathbf{x}} = \frac{-\nabla P}{\rho} - \nabla \Phi$$

$$\Phi = \frac{-GM_1}{|\mathbf{r} - \mathbf{r}_1|} - \frac{GM_2}{|\mathbf{r} - \mathbf{r}_2|}$$

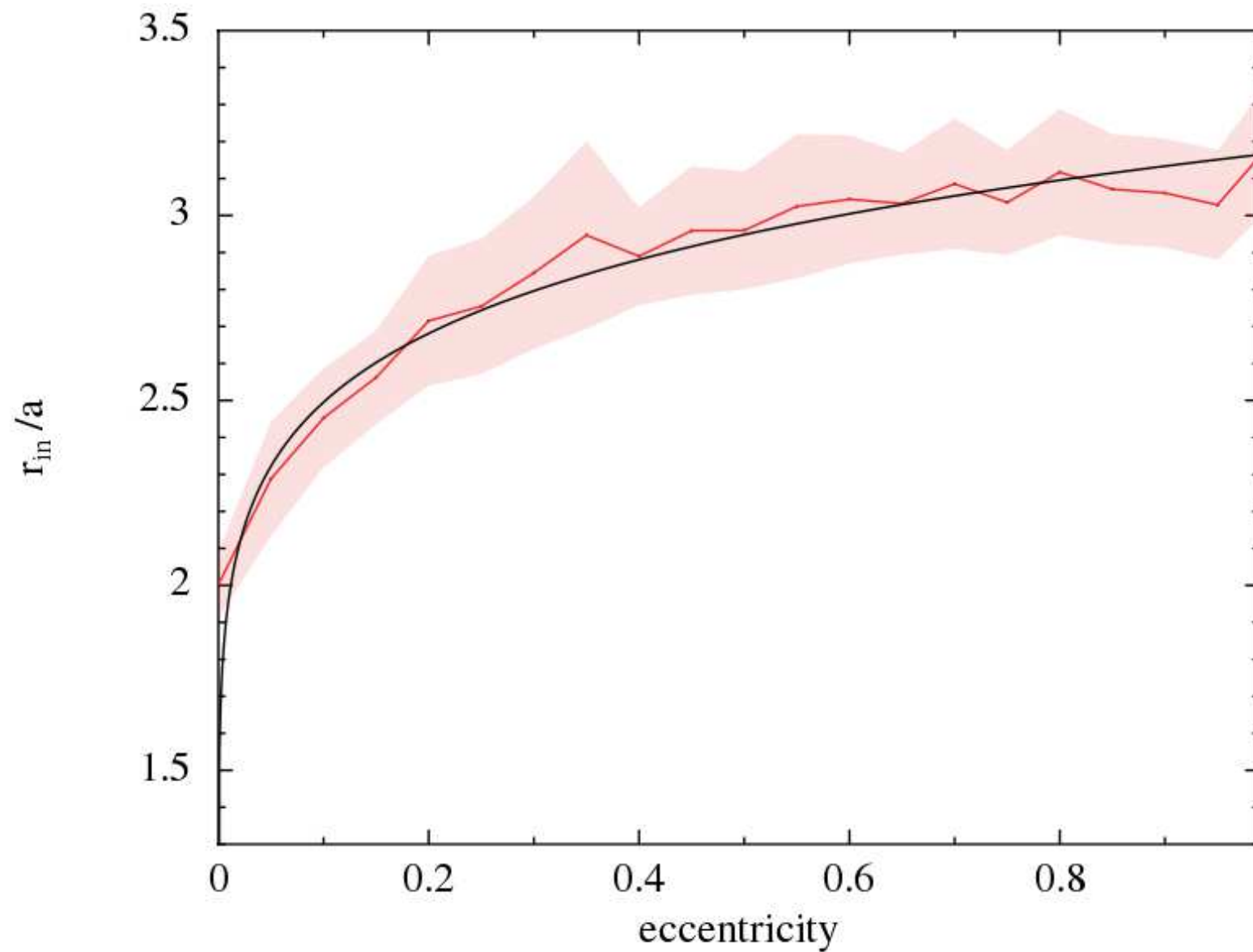
$$P = c_s^2(r) \rho$$



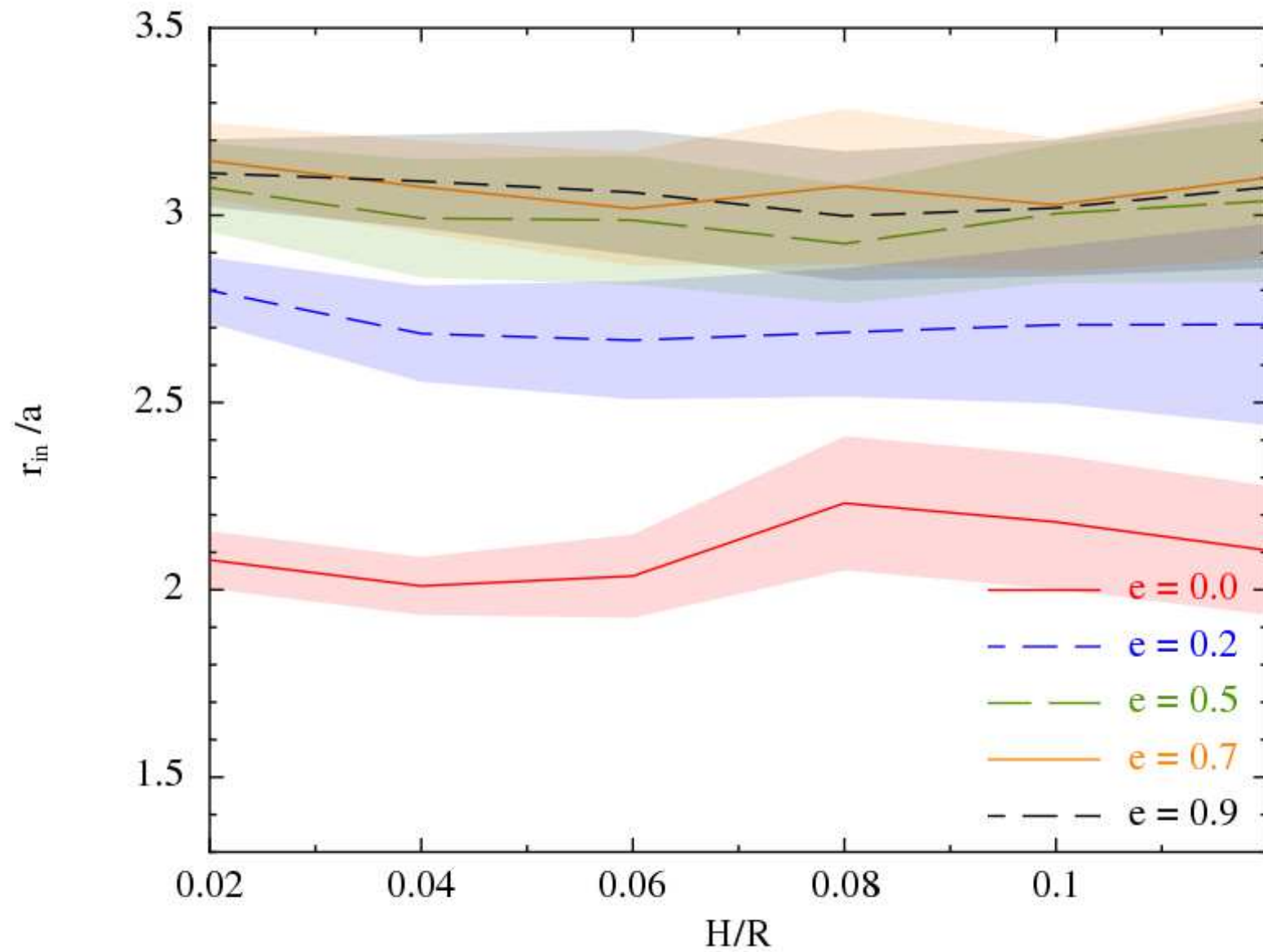
Coplanar Disc



Coplanar Disc

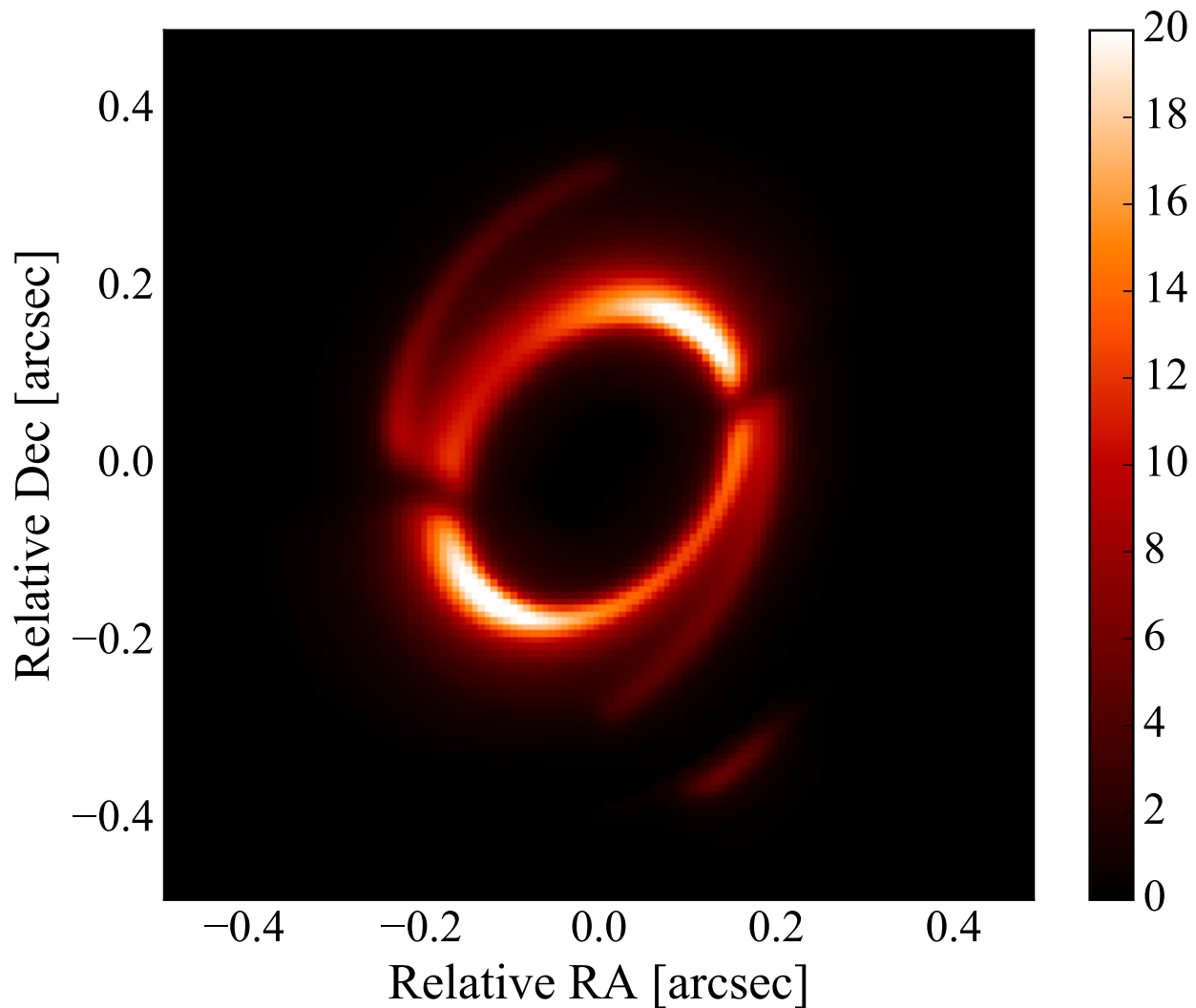


Scale Height

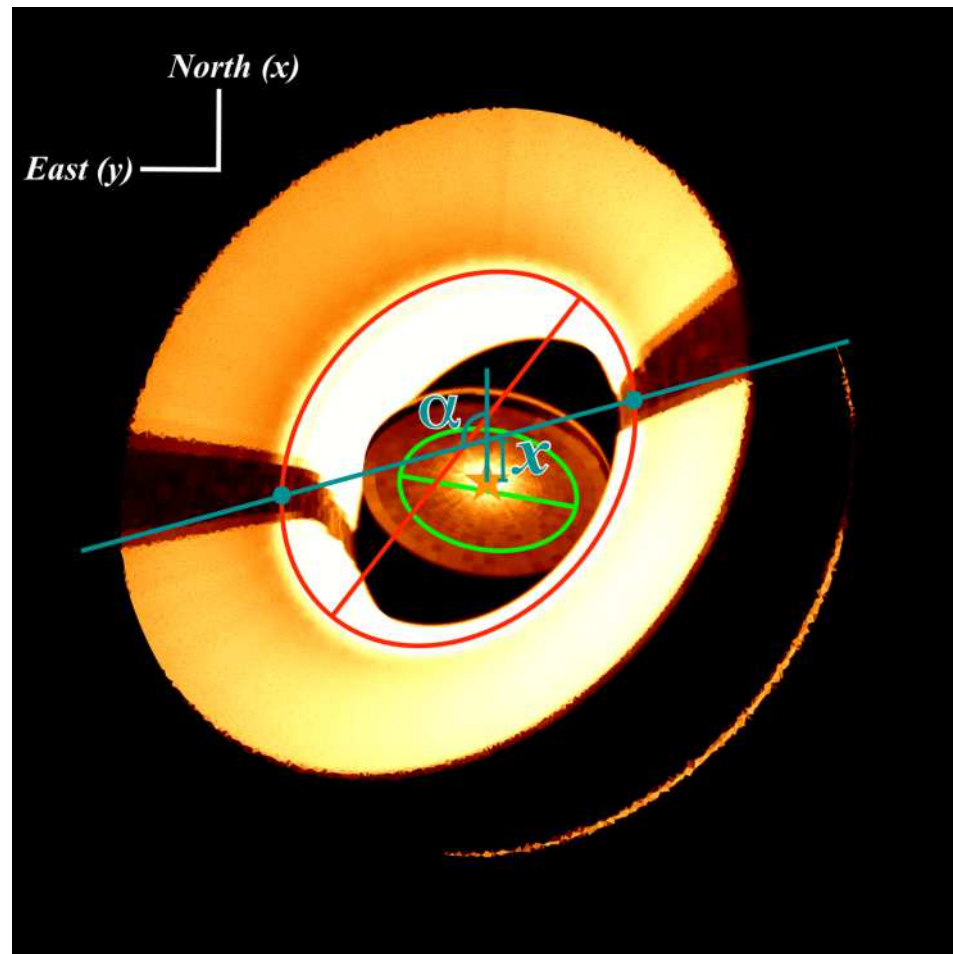


Inclination

HD 1004553

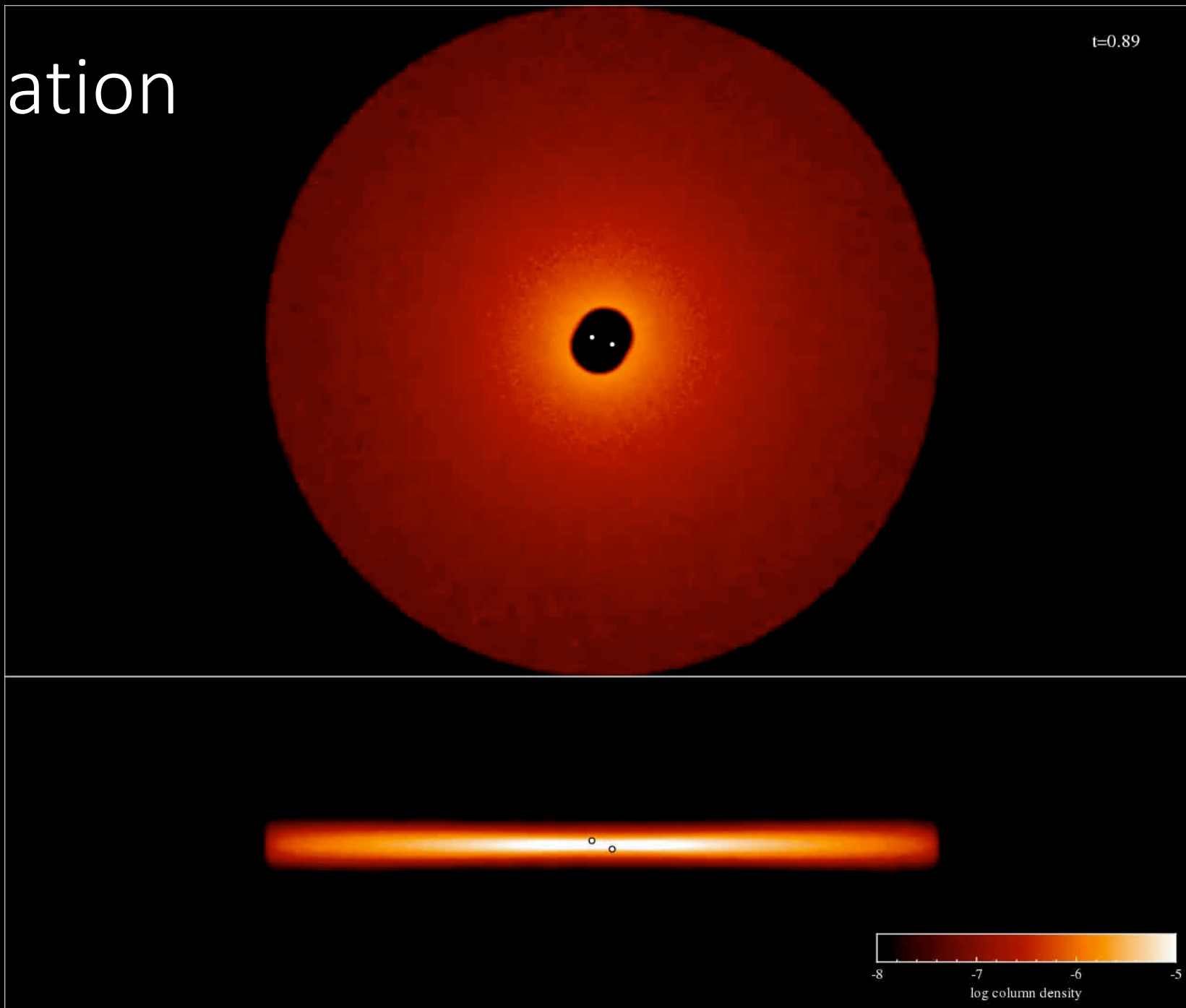


Benisty et al. (2016)

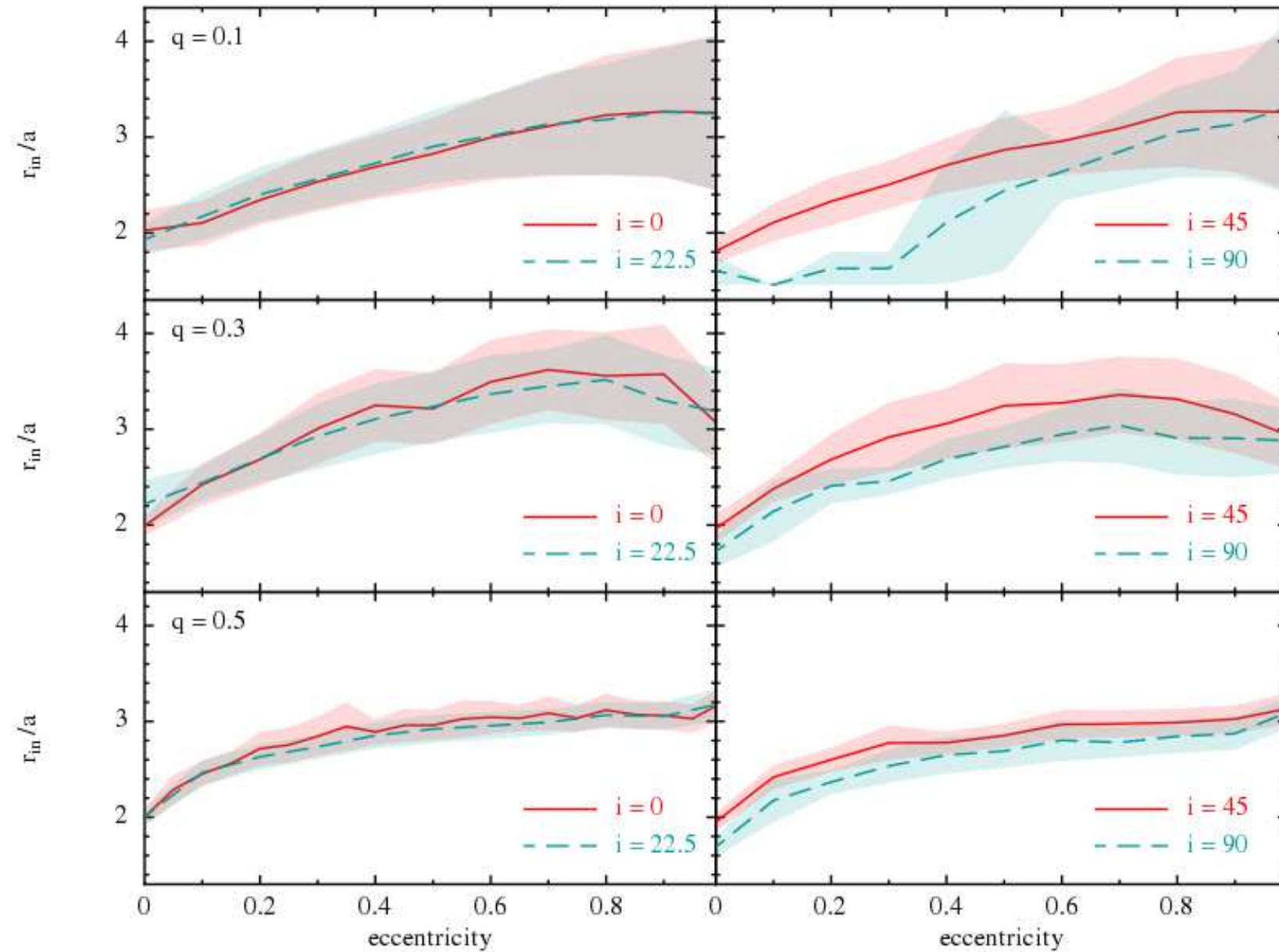


Min et al. (2017)

Inclination

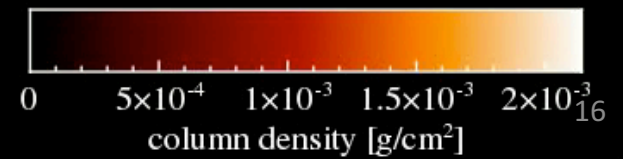


Inclination

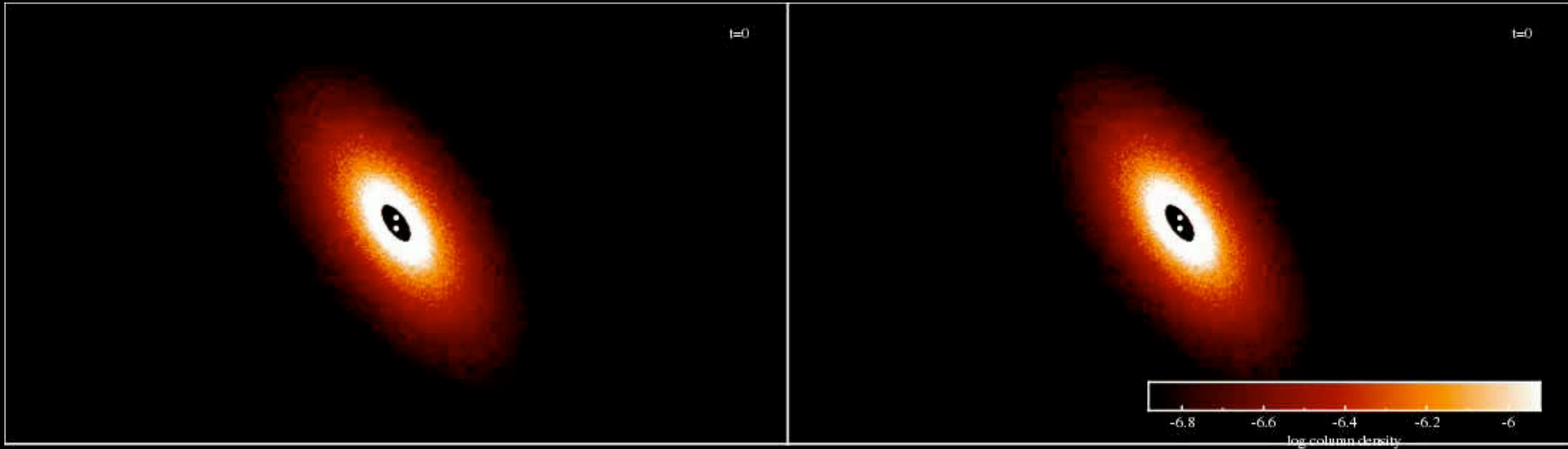


Polar Orbit

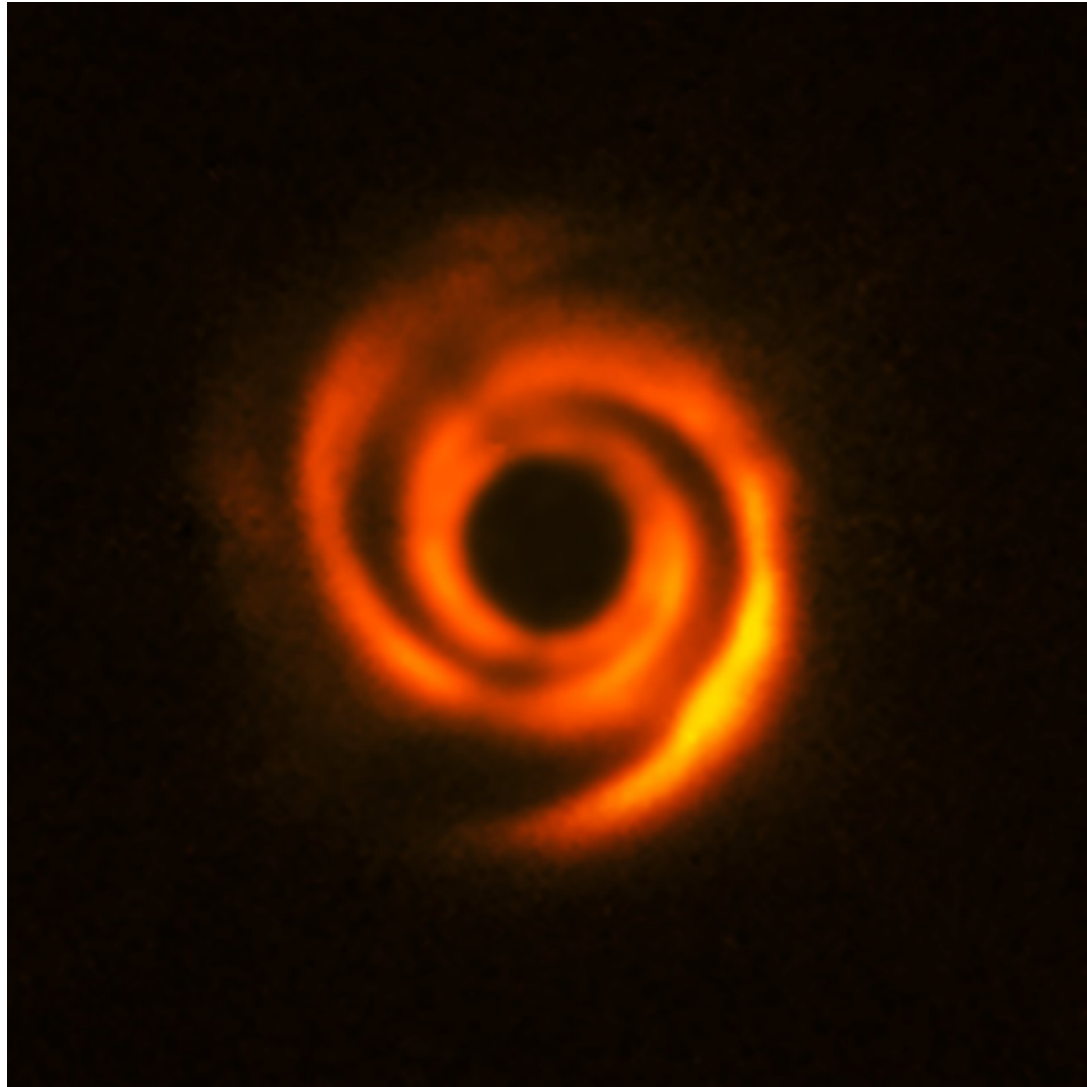
t=0 yrs



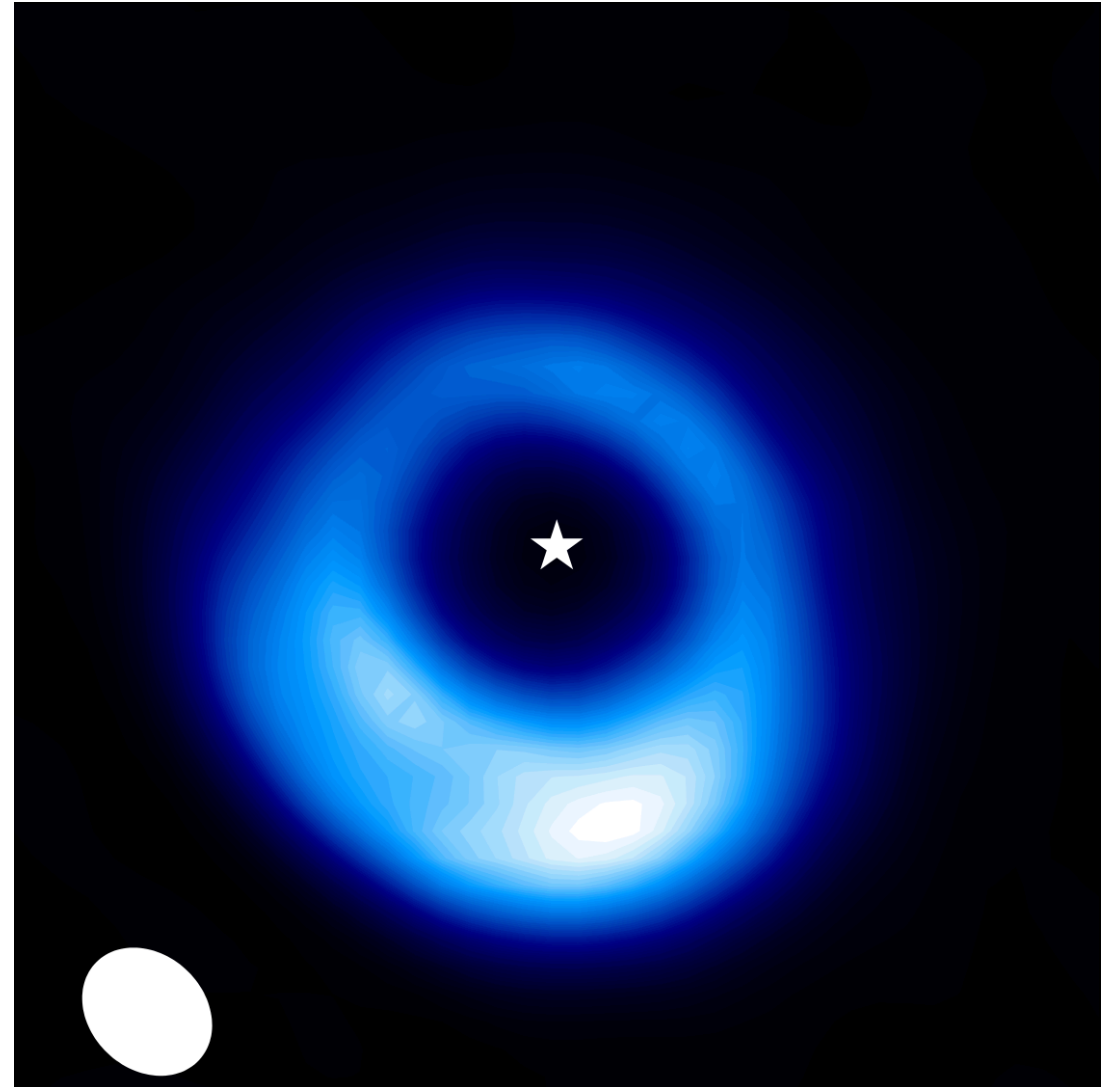
Inclined and Retrograde



Dust



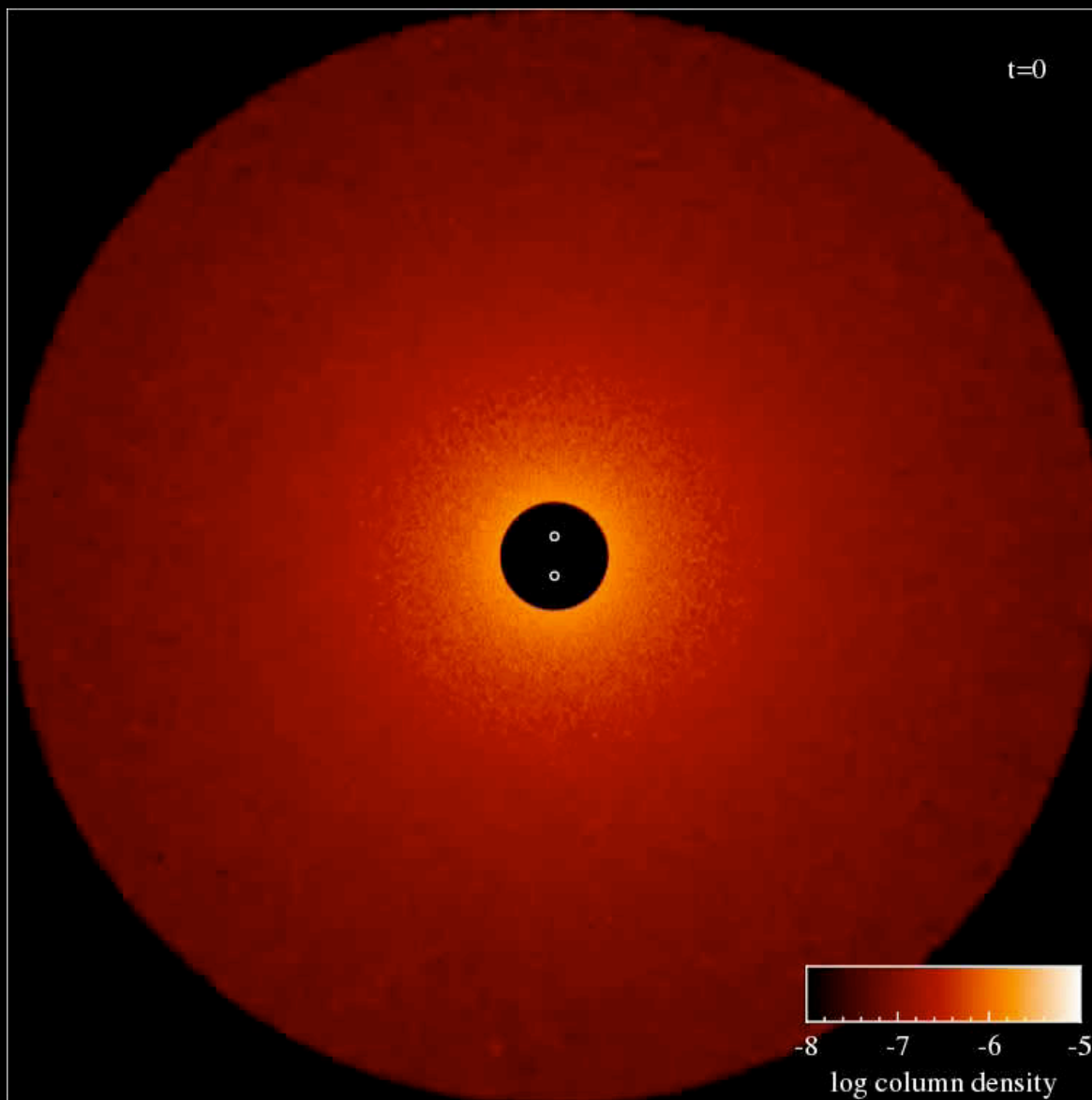
ESO, Stoler et al. (2017)



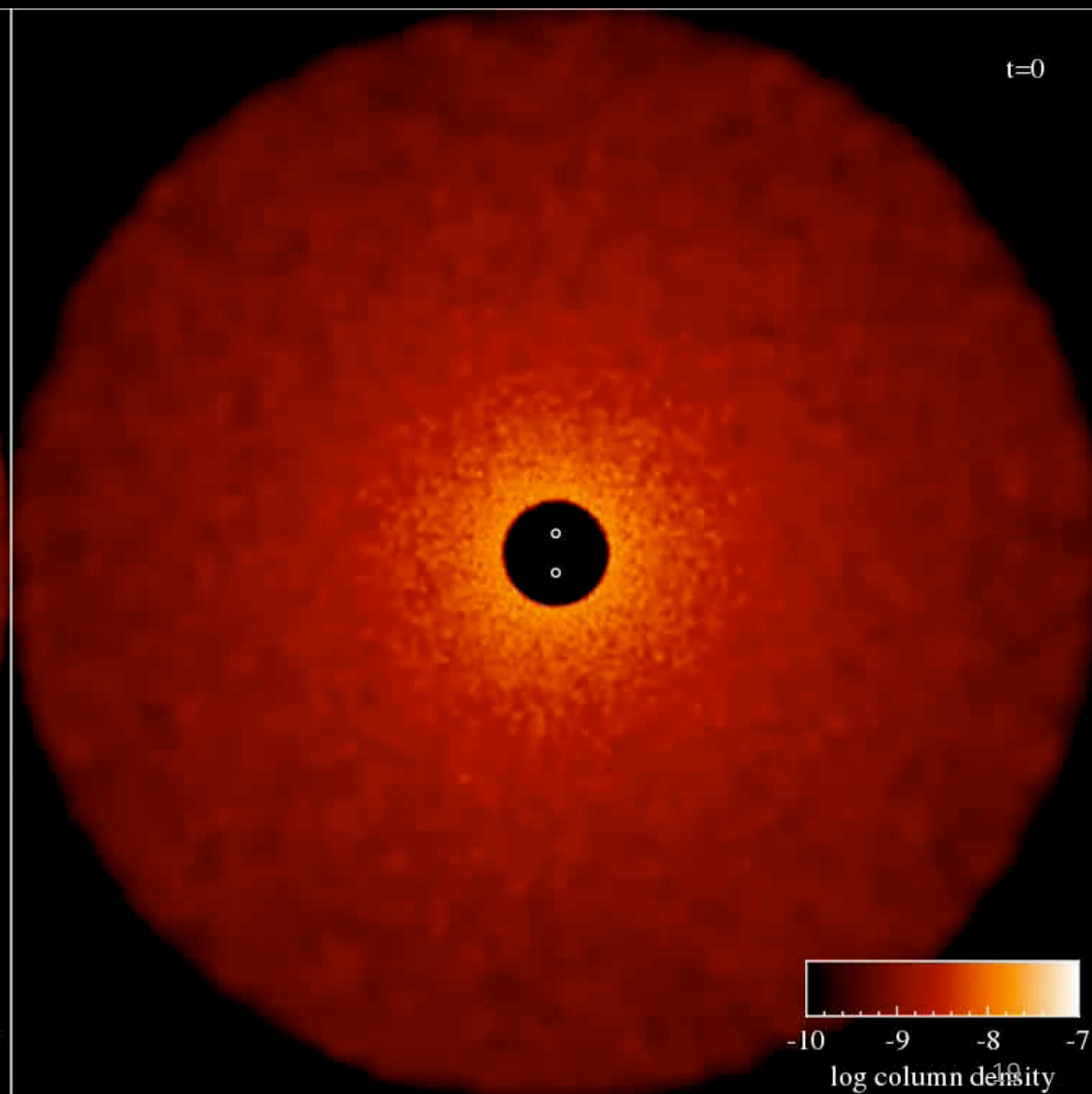
HD 135344B

Van der Marel¹⁸ (2015)

Gas



Dust



Summary

