

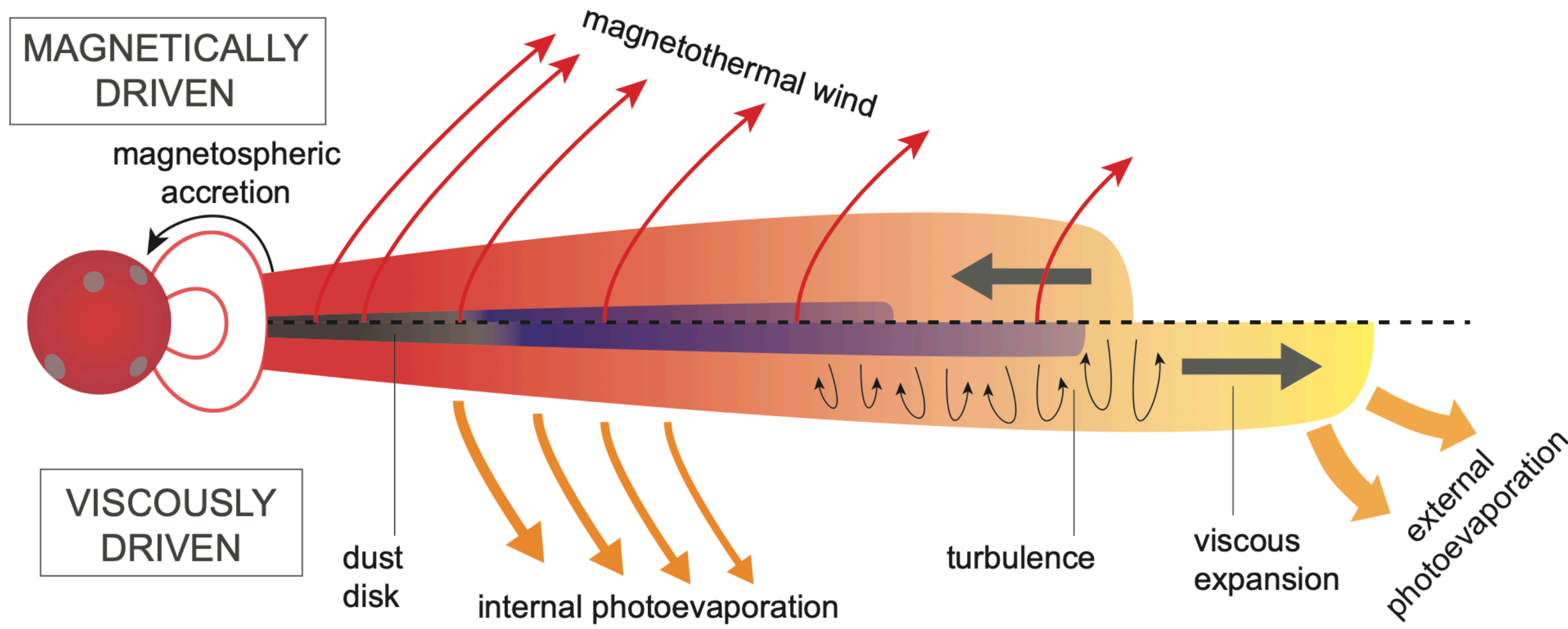
# A WAY TO DISENTANGLE BETWEEN VISCOSITY AND MHD DISC WINDS IN PROTOPLANETARY DISCS



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## MOTIVATION AND GOAL



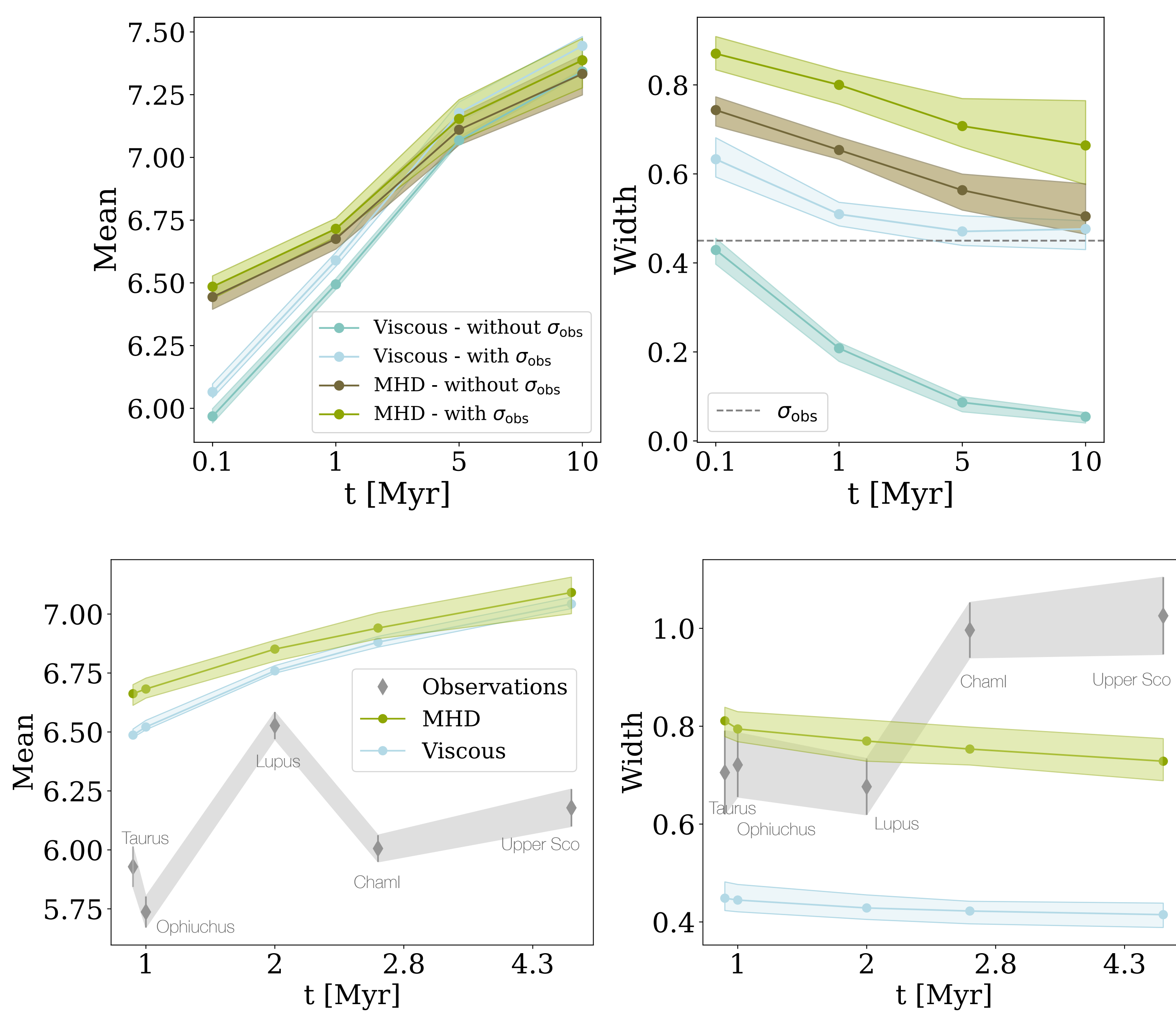
- Protoplanetary disc evolution can be explained by the traditional viscous theory or MHD disc winds
- Which mechanism dominates evolution is still debated

*Is there a characteristic observable signature of evolution that can discriminate between the two scenarios?*

Manara et al. 2022

## RESULTS

Distribution of  $t_{\text{lt}} = M_d/\dot{M}$



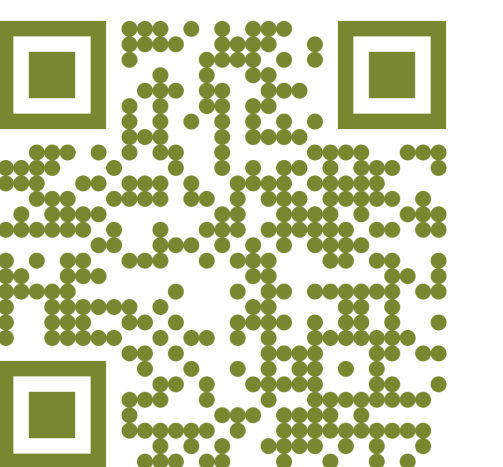
The spread in the distribution of  $t_{\text{lt}} = M_d/\dot{M}$  is a combination of intrinsic and observational spread,  $\sigma_{\text{tot}} = \sqrt{\sigma_{\text{init}}^2 + \sigma_{\text{obs}}^2}$

- The mean  $t_{\text{lt}}$  for evolved populations is indistinguishable for the two scenarios; the skewness of its distribution is in principle a good proxy, but adding  $\sigma_{\text{obs}}$  smooths out the differences between the two models
- The width of the  $t_{\text{lt}}$  distribution is significantly model-dependent and is not influenced by the observational uncertainties

## TAKE HOME MESSAGE

The width of the distribution of disc lifetimes can disentangle between the viscous and MHD evolutionary prescriptions. Observational data support the latter

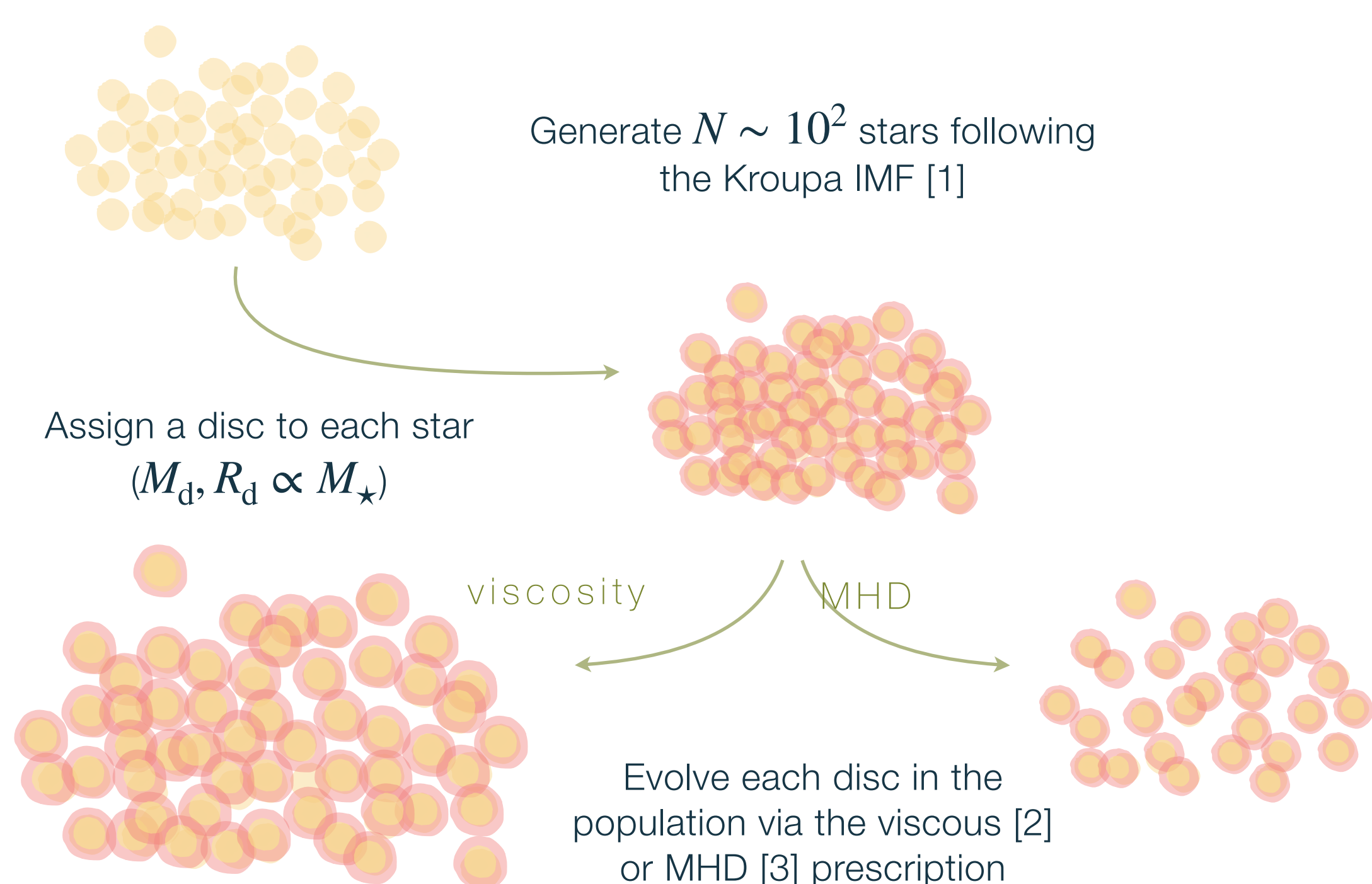
More details:



## METHODS

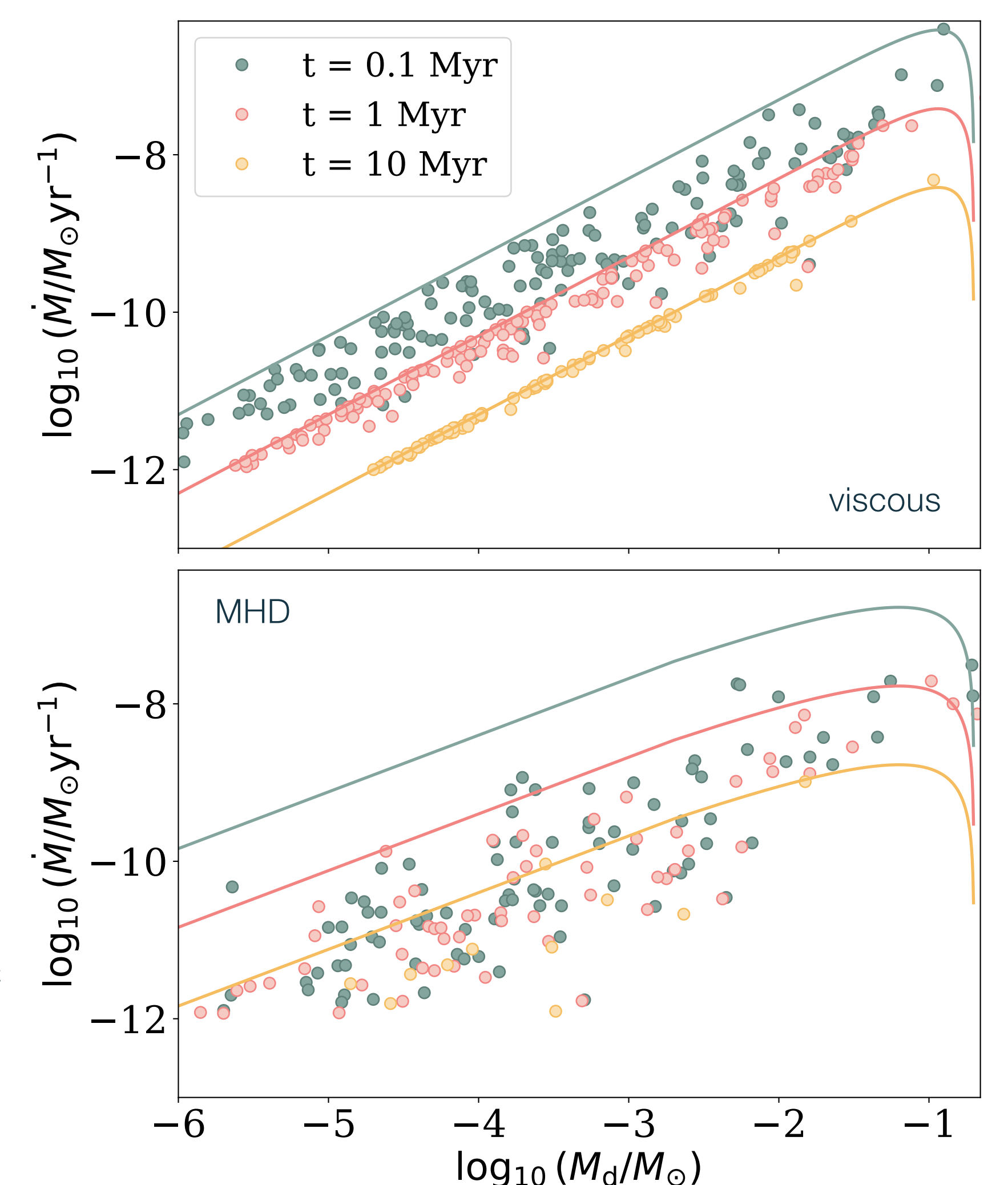
Population synthesis approach: generating and evolving a synthetic population of discs through our code **Diskpop** (Somigliana et al. in prep)

### Diskpop workflow



- The distribution of  $t_{\text{lt}} = M_d/\dot{M}$  is expected to evolve for viscous populations [4]
- For an MHD population with an exponential distribution of initial accretion timescales,  $t_{\text{lt}}$  is expected to be constant [5]

We assume a log-normal distribution, which still reproduces the observed disc fraction and leads to an evolving distribution of  $t_{\text{lt}}$



References: [1] Kroupa P., 2001, MNRAS, 322, 231 [2] Lynden-Bell D., Pringle J. E., 1974, MNRAS, 168, 603 [3] Tabone B. Et al., 2022a, MNRAS, 512, 2290 [4] Lodato G. Et al., 2017, MNRAS, 472, 4700 [5] Tabone B. et al, 2022b, MNRAS, 512, L74



Questions? Let's chat!  
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