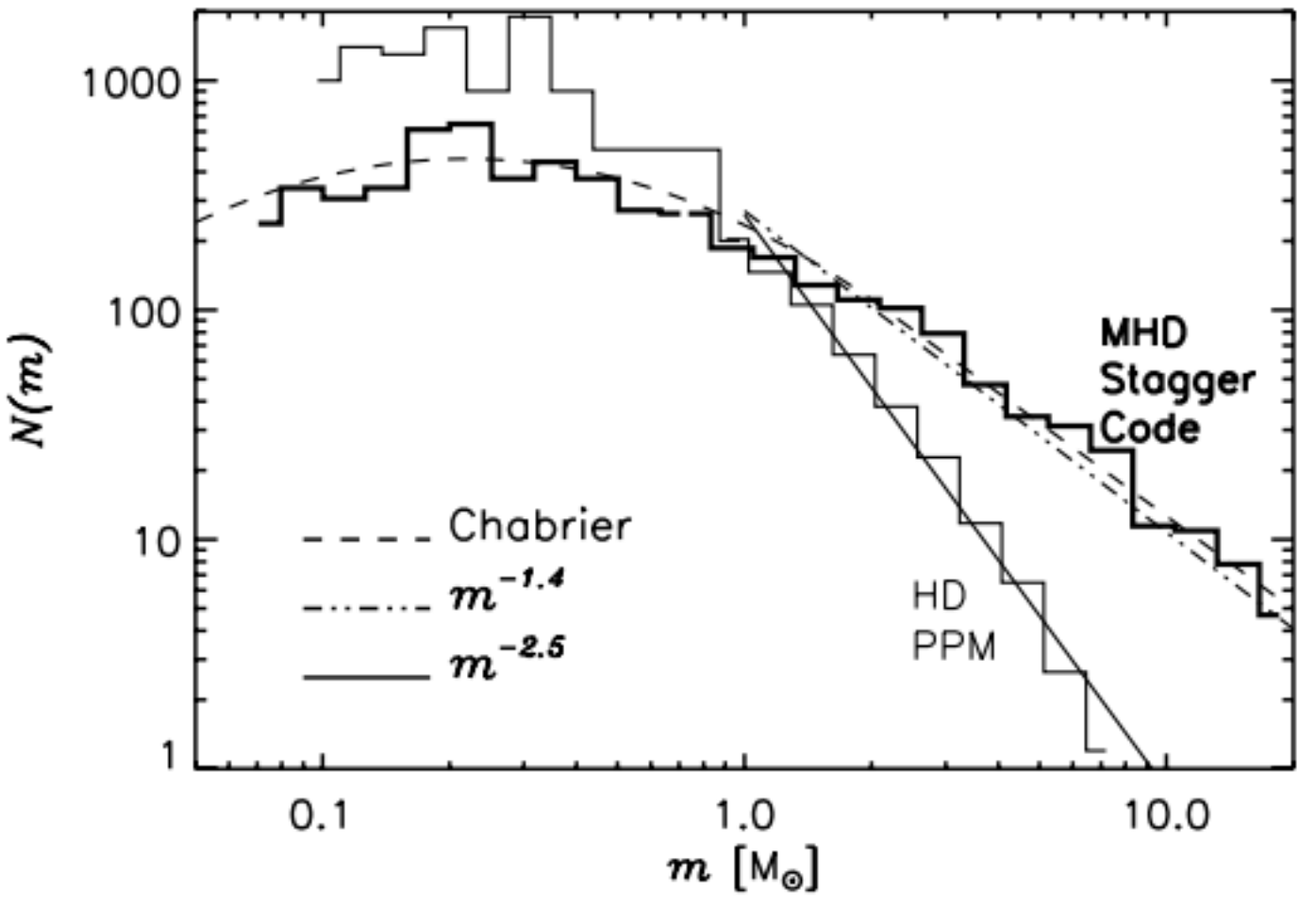
From the CMF to the IMF:

How does it work for massive stars?

In a thought experiment it works, in real life it does not.

My Padoan et al. 2007 thought experiment:
supersonic turbulence without self-gravity

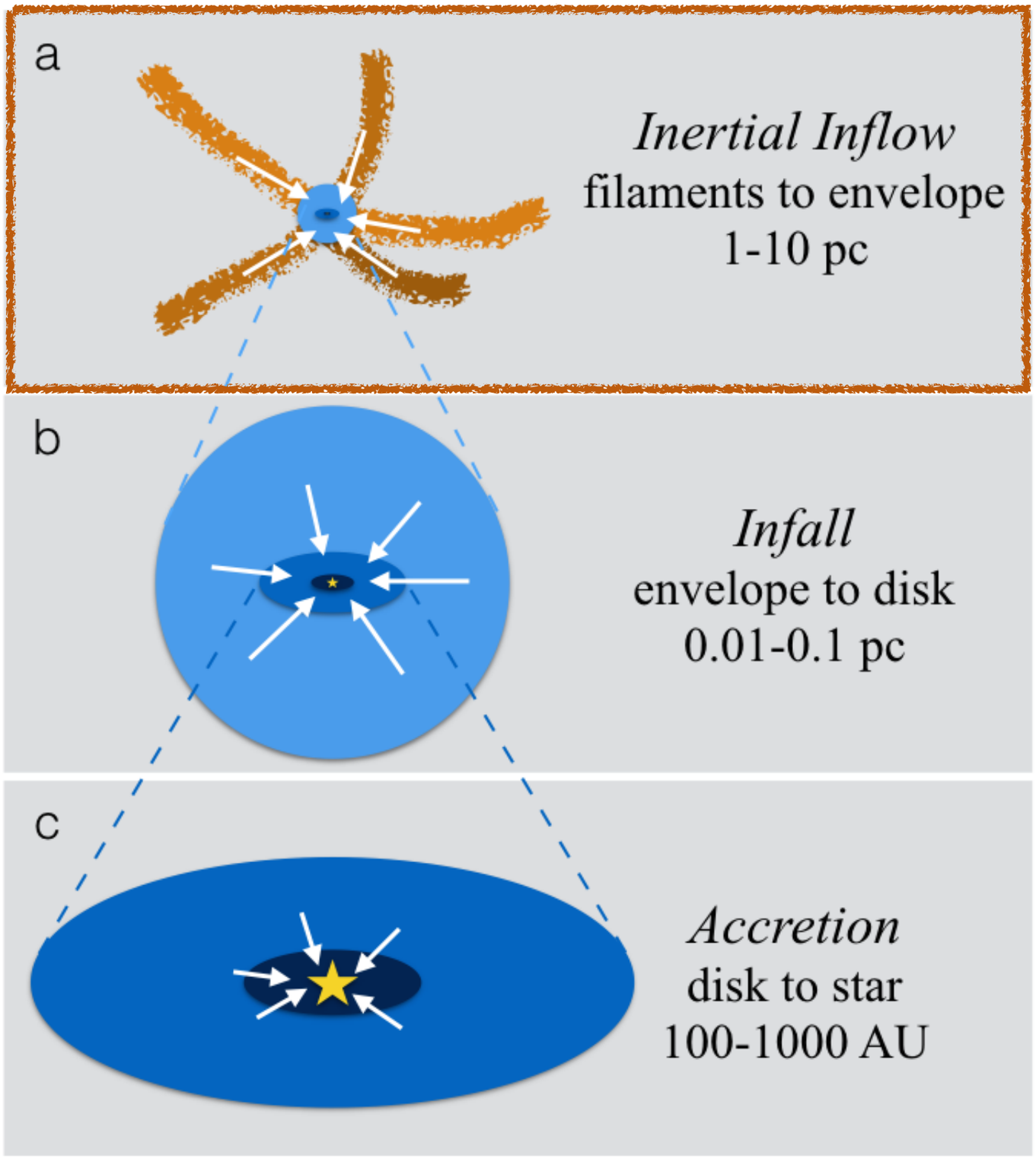


Supersonic MHD turbulence gives you a nice mass function of "gravitationally unstable cores".

Should we see it in real life? Perhaps up to ~1-10 $M_\odot$.

The CMF must drop steeply above 10 $M_\odot$

The Inertial-Inflow Scenario



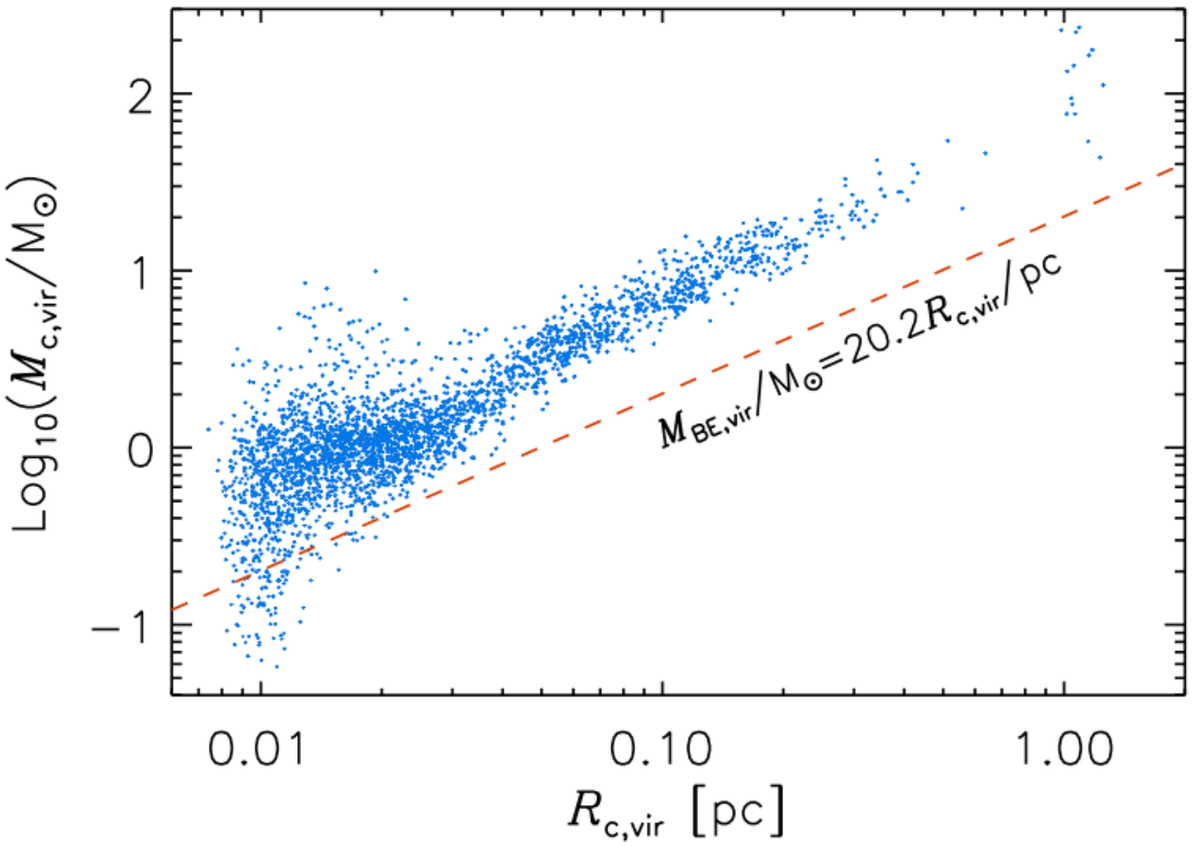
	core formation	**core collapse**	**inflow+infall**
mass	$0 - M_{BE}$	M_{BE}	$M_{BE} - M_{star}$
		~0.1-1 $M_\odot$	~1-100 $M_\odot$
time	$t_{formation}$	$t_{free\text{-}fall}$	t_{inflow}
	~10^5 yr	~10^4 yr	~10^6 **f(M_{star})** yr
physics:	turbulence	gravity	turbulence+gravity

Strong evidence for this in every simulation of supersonic turbulence.

This particular simulation is set up to provide a huge sample of MCs and massive stars and realistic driving of the turbulence:

L=250 pc dx=0.007 pc ~30 Myr evolution with self-gravity and 1000s of sinks.

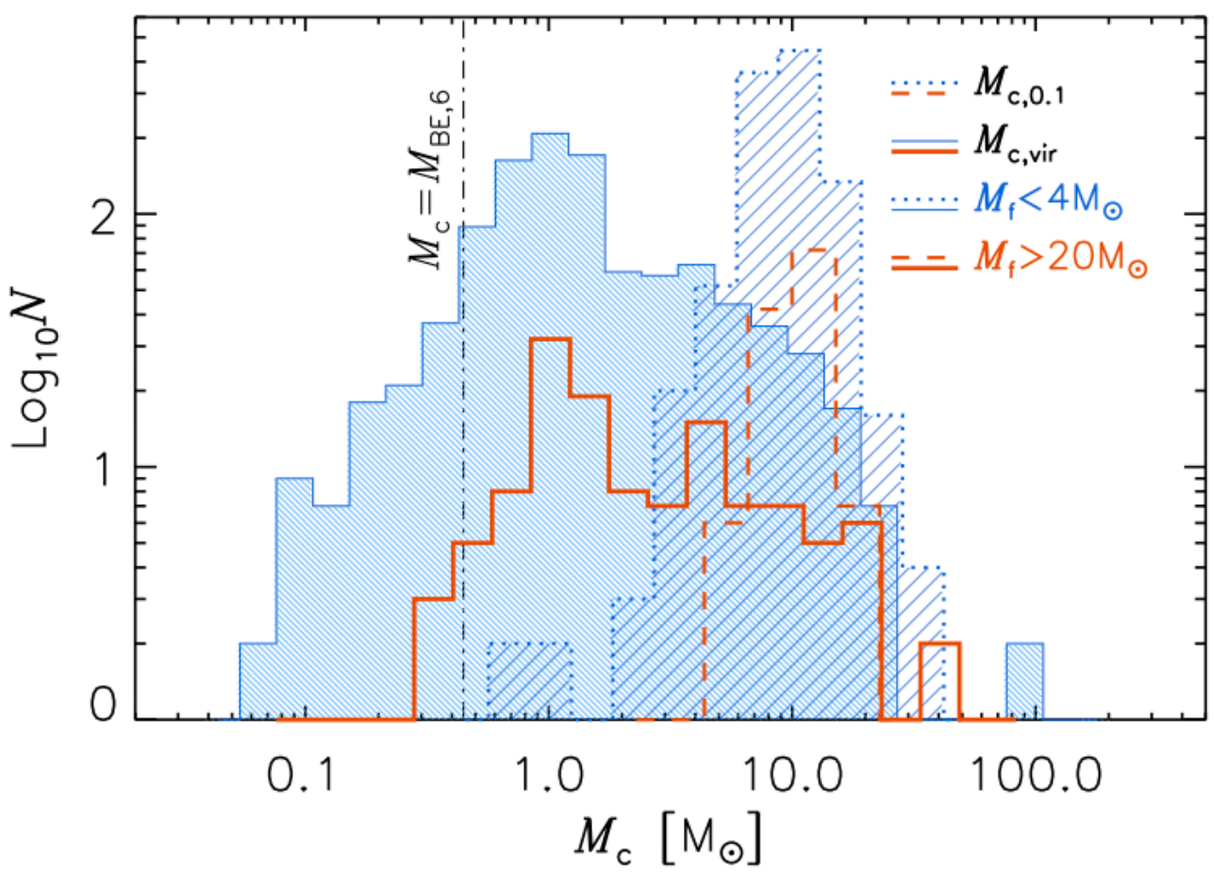
Prestellar cores at the moment they become unstable



The prestellar core mass is of the order of the critical Bonnor-Ebert mass.

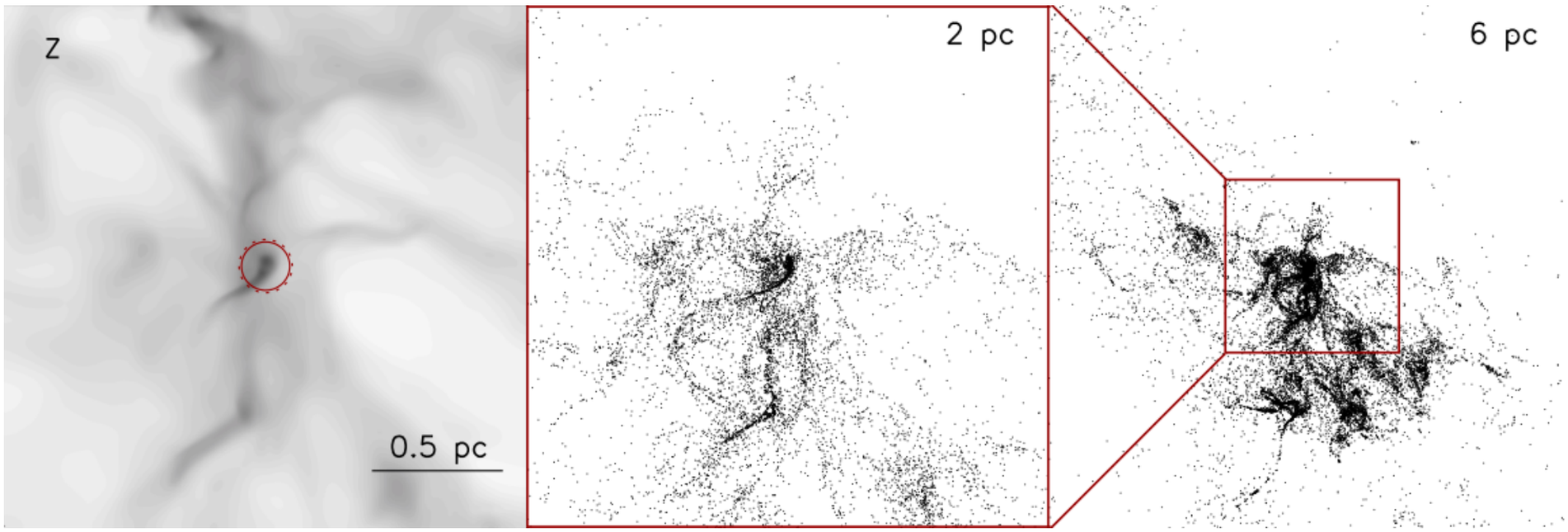
No evidence that turbulence or magnetic fields can support very massive prestellar cores.

The masses of prestellar cores are much smaller than the final mass of massive stars.



Tracer particles at the beginning of the collapse

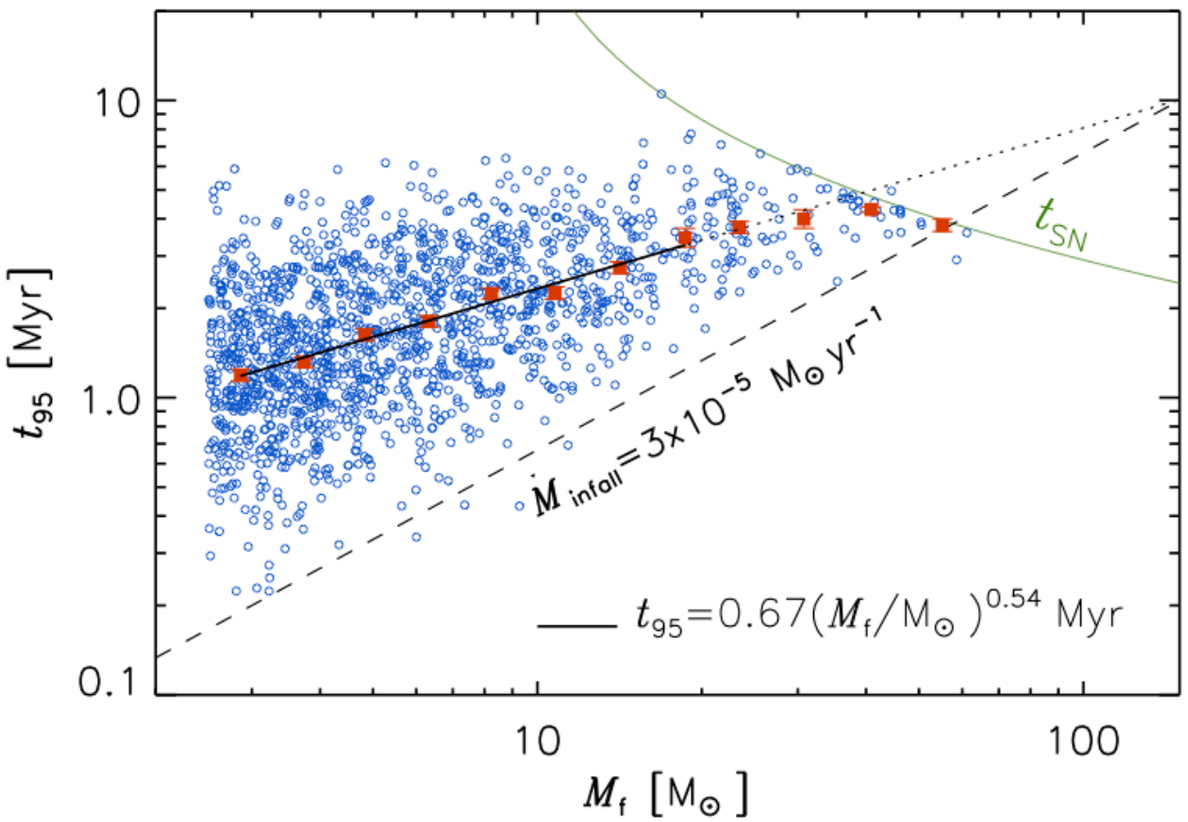
Projected gas density: Projected tracer particles at two different scales:



The tracer particles that will form the stars come from a large region, where the gas is not gravitationally bound.

It is NOT competitive accretion (stellar gravity is not driving the large inflow motion).

The star-formation timescale



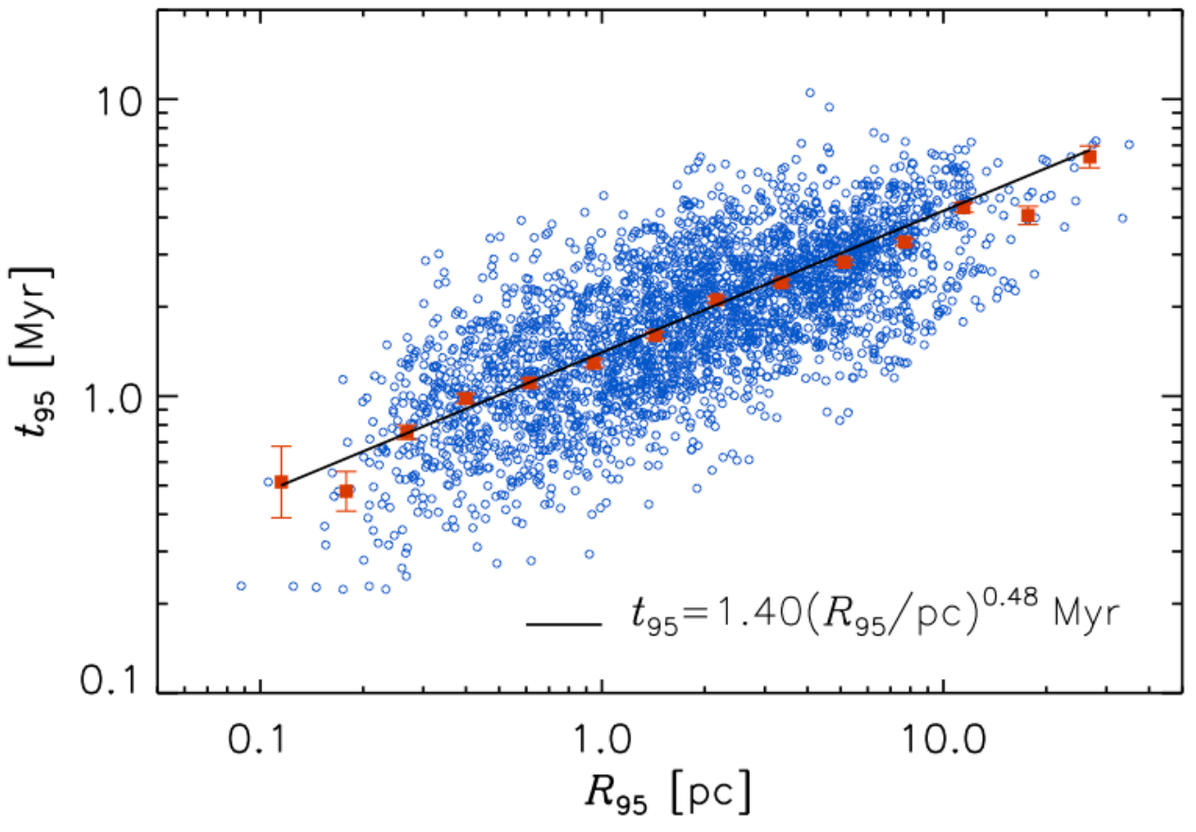
Time to accumulate 95% of the final stellar mass versus final stellar mass.

It take ~ 1 Myr to form a massive star, but very large scatter.

Time to accumulate 95% of the final stellar mass versus “initial” size of the region that contains 95% of the tracer particles.

Consistent with velocity-size relation !!

The star-formation timescale is the dynamical time of the turbulence.



Conclusions / Predictions

1. It takes time to build the power-law tail of the IMF (~1 Myr).

2. The prestellar CMF > 10 $M_\odot$ is much steeper than the IMF.

Question

Can you kill these two predictions with the observational data?