



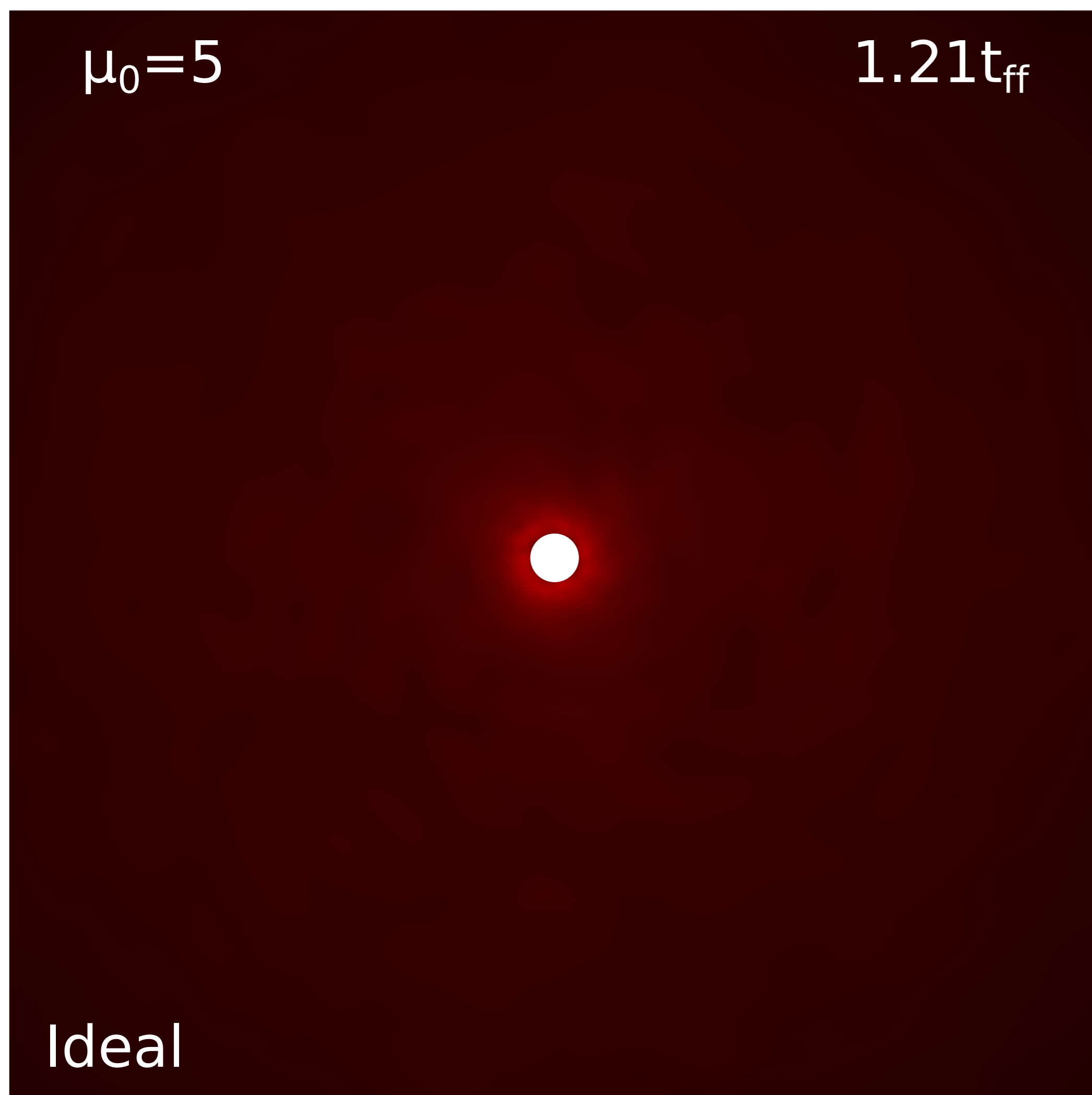
Bring Back the Disc!

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The Magnetic Braking Catastrophe:

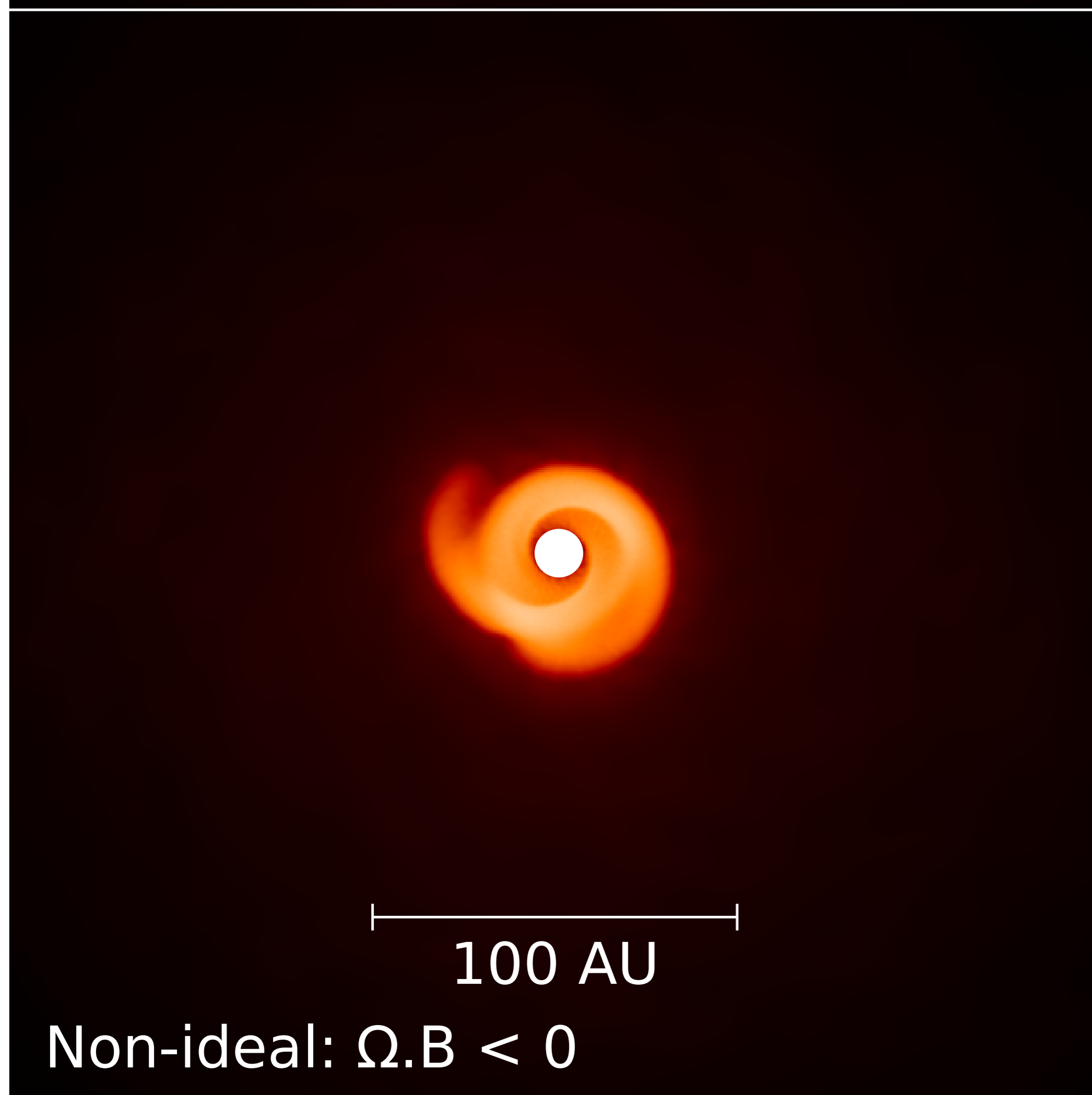
Numerical simulations cannot form discs in the presence of strong, ideal magnetic fields. This contradicts observations.

We model the collapse of a rotating $1M_{\text{sun}}$ gas cloud until the first hydrostatic core is formed. This is done in the presence of a vertical magnetic field with an initial mass-to-flux ratio of 5 times critical.



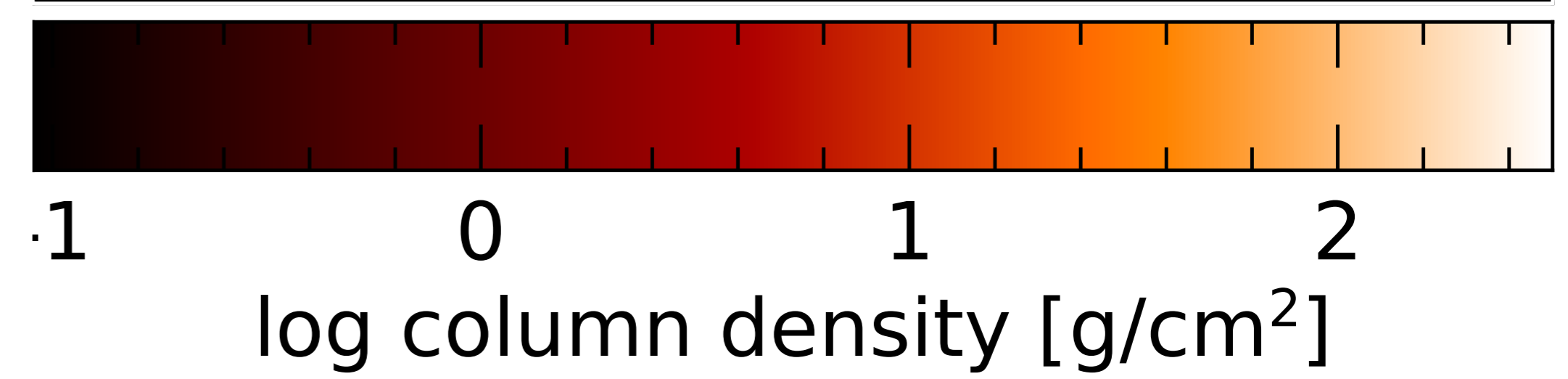
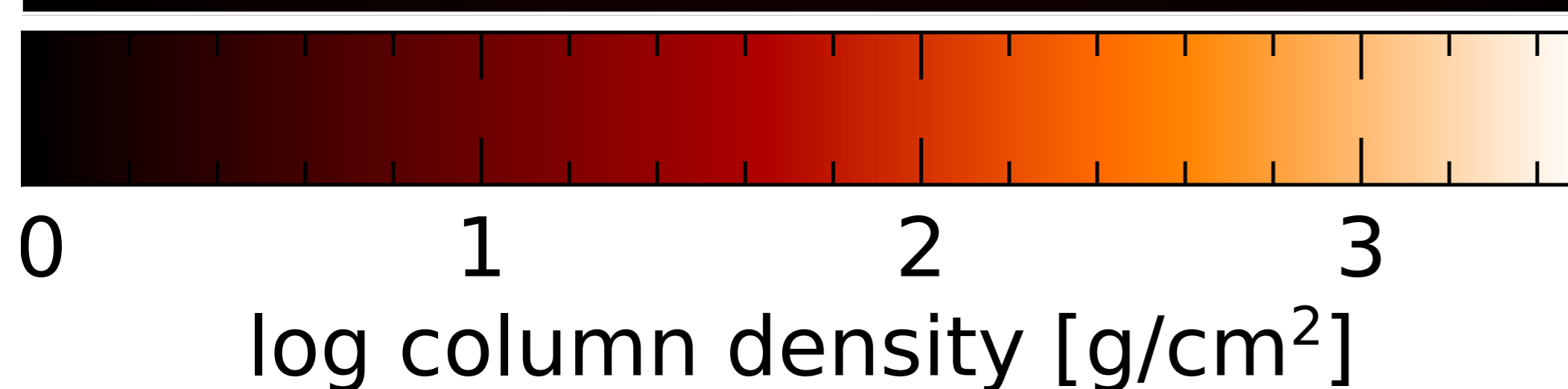
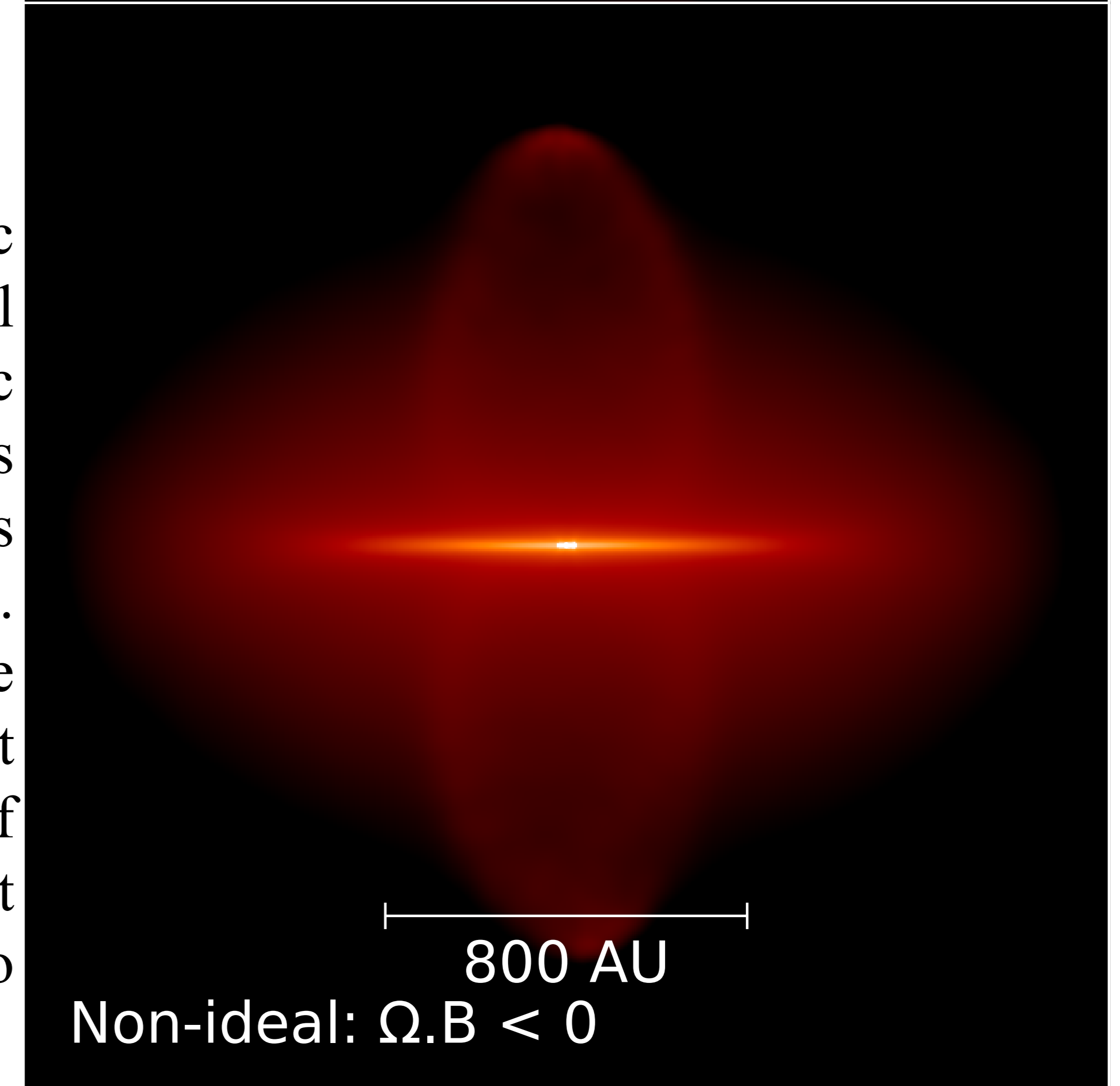
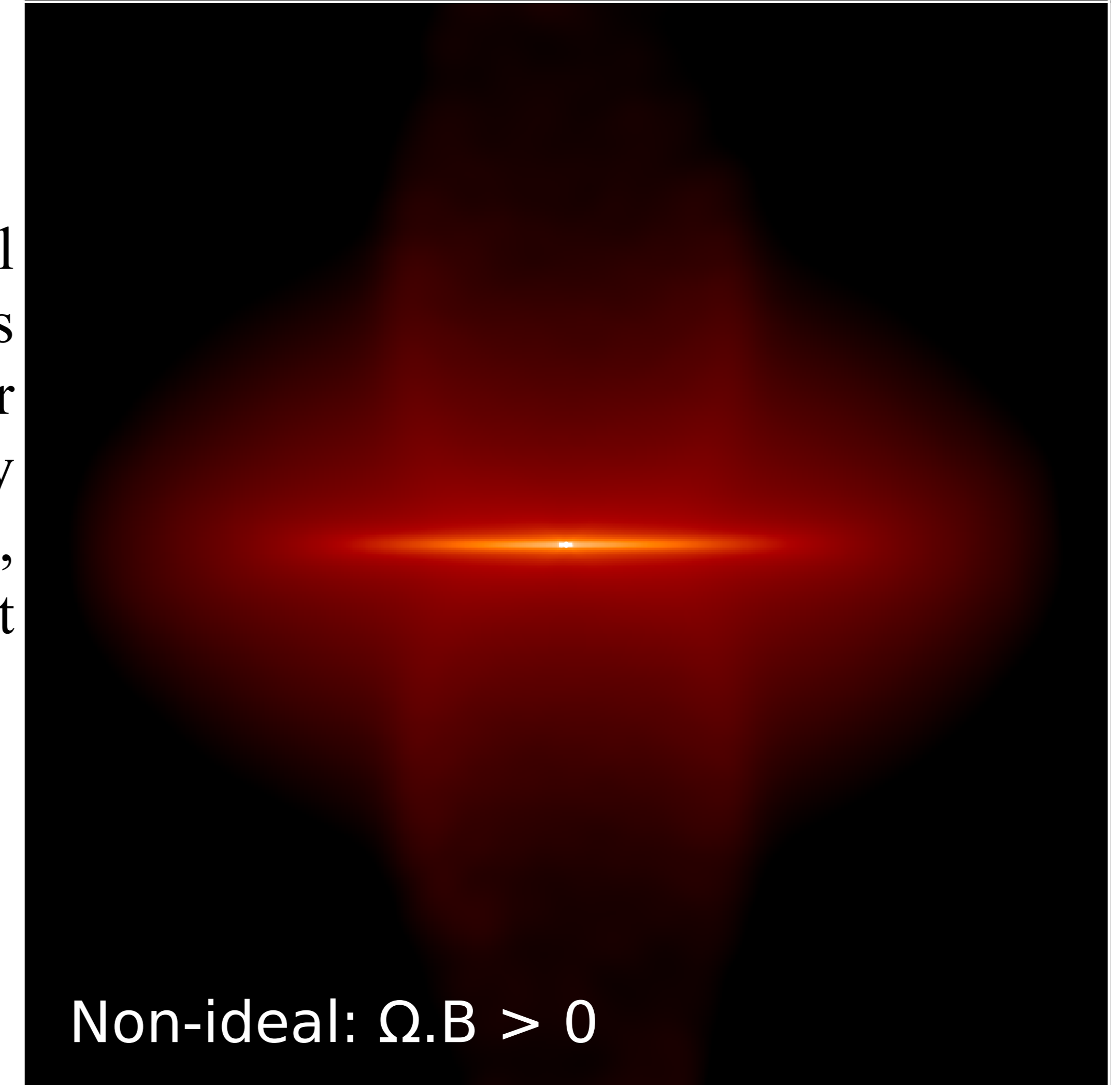
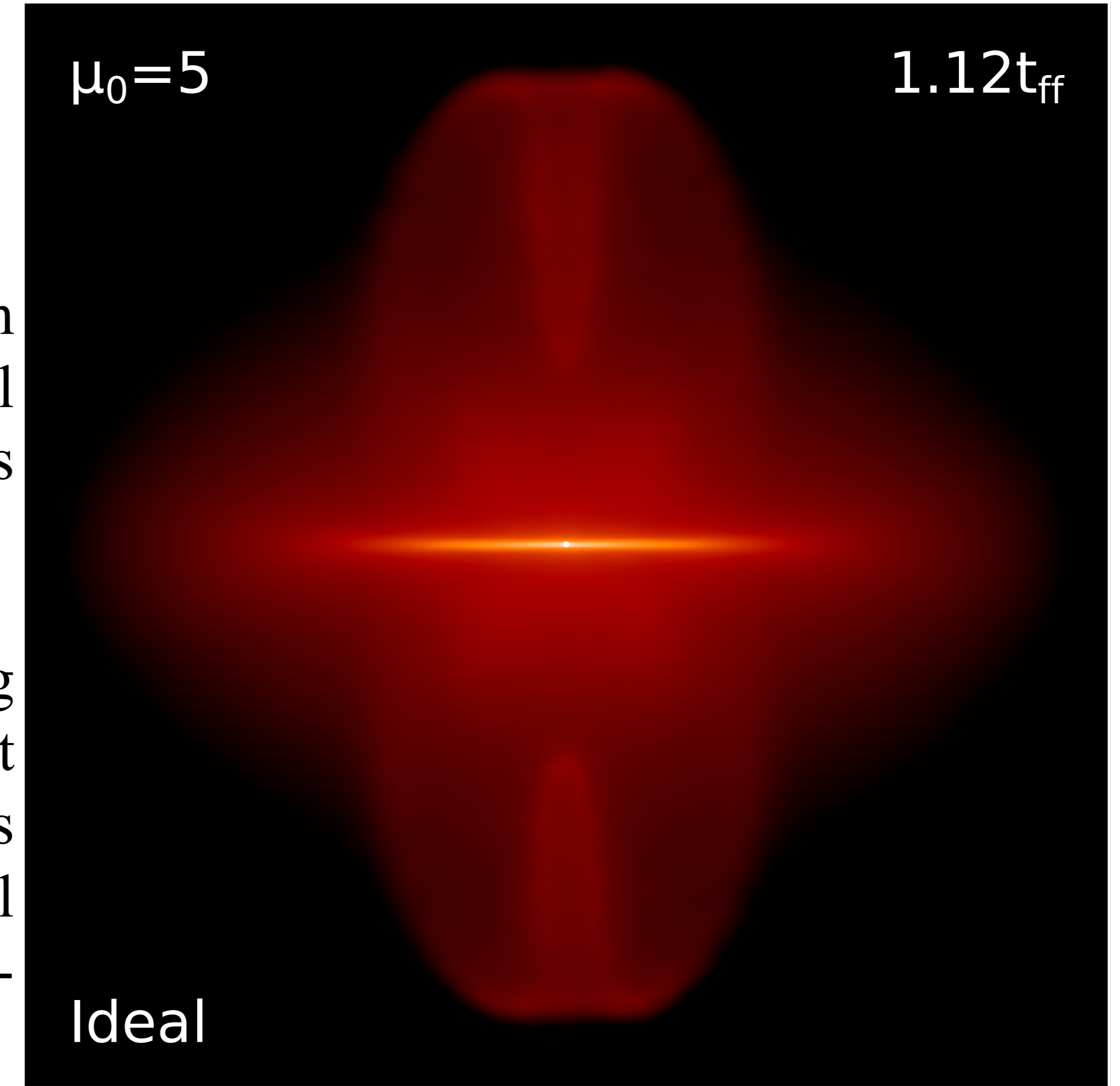
A Partial Solution:

A $\sim 20\text{AU}$ disc forms when non-ideal MHD is included. Bipolar outflows are partially suppressed. Similar results are obtained when only ambipolar diffusion is included, indicating that it is the dominant effect.



A Better Solution:

Due to the Hall effect, a $\sim 30\text{AU}$ disc forms when the direction of the initial magnetic field is reversed. This disc is large enough to form spiral arms due to gravitational instabilities, thus planet formation is possible. Although ambipolar diffusion is the dominant effect, the Hall effect influences the final characteristics of the disc, implying that the Hall effect does not need to be strong in order to yield an observable result.



References: Wurster, Price & Bate (submitted):

Can non-ideal magnetohydrodynamics prevent the magnetic braking catastrophe?

