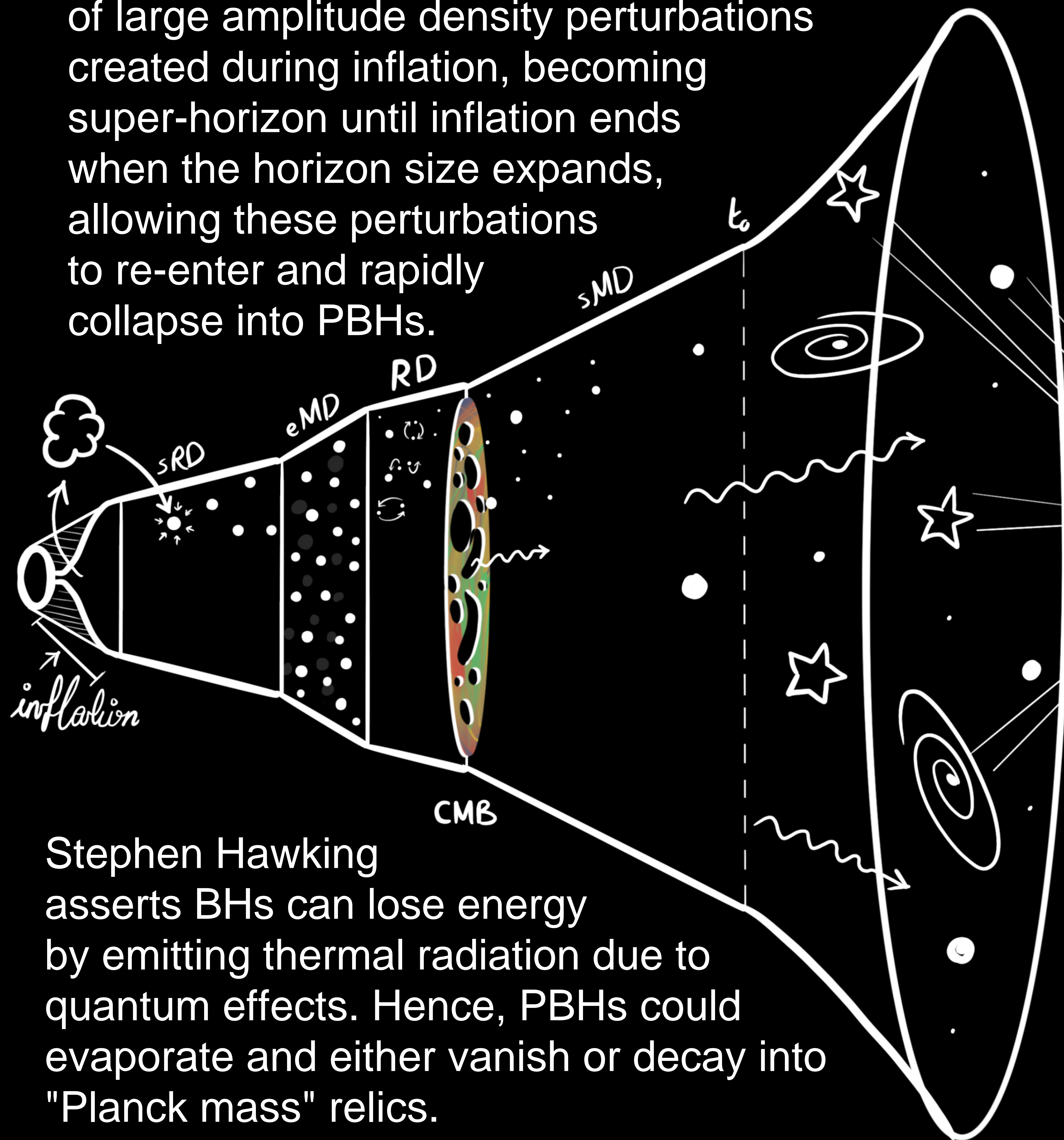


# Primordial Black Holes as Dark Matter

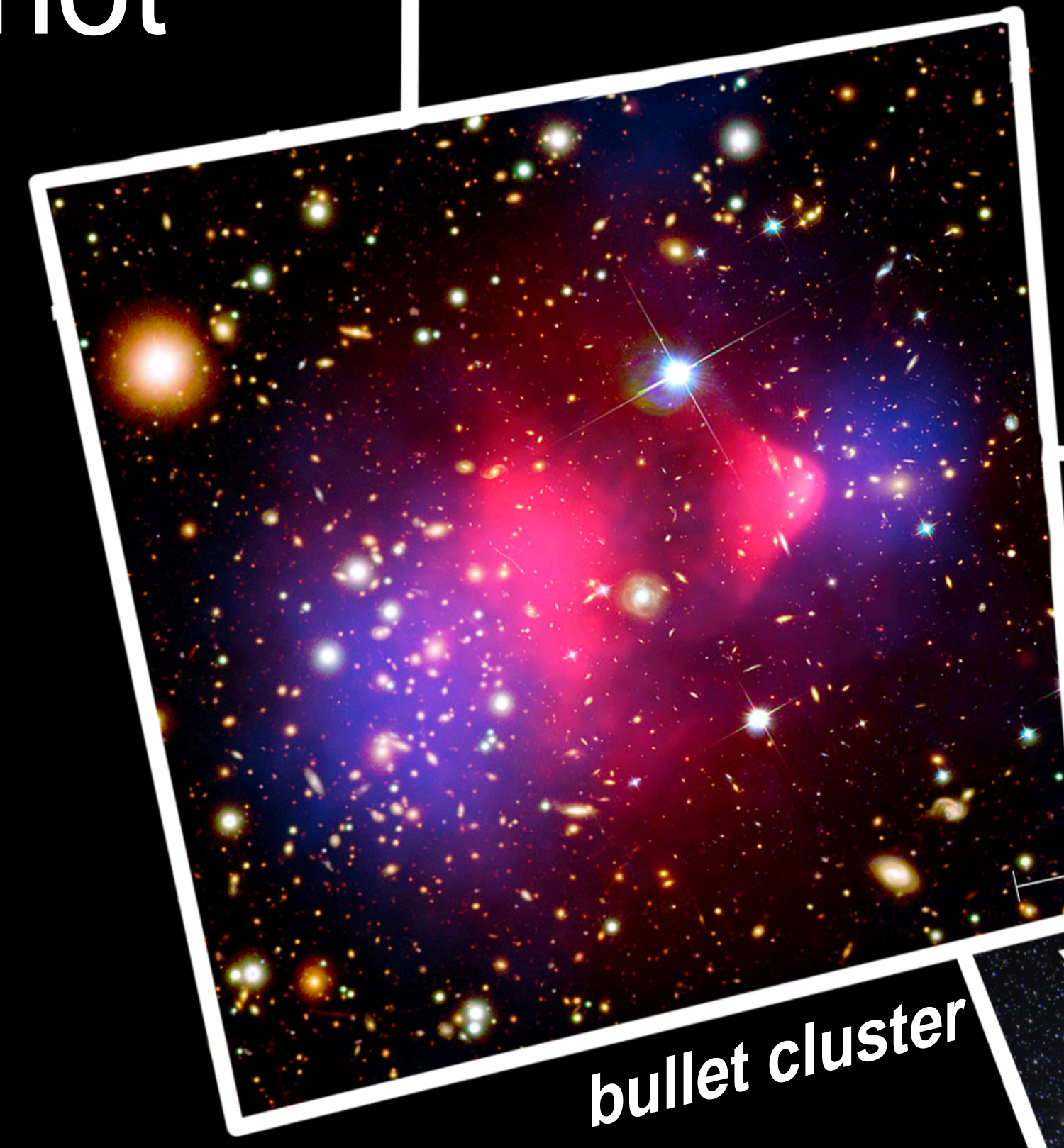
## ① What is Dark Matter?

[1] About five times the mass of ordinary matter is in the form of dark matter, which was proposed in the 1920s to explain gravitational effects on celestial objects. Detecting this invisible matter is challenging; however, several candidates have been suggested, including PBHs, which do not require a new particle.

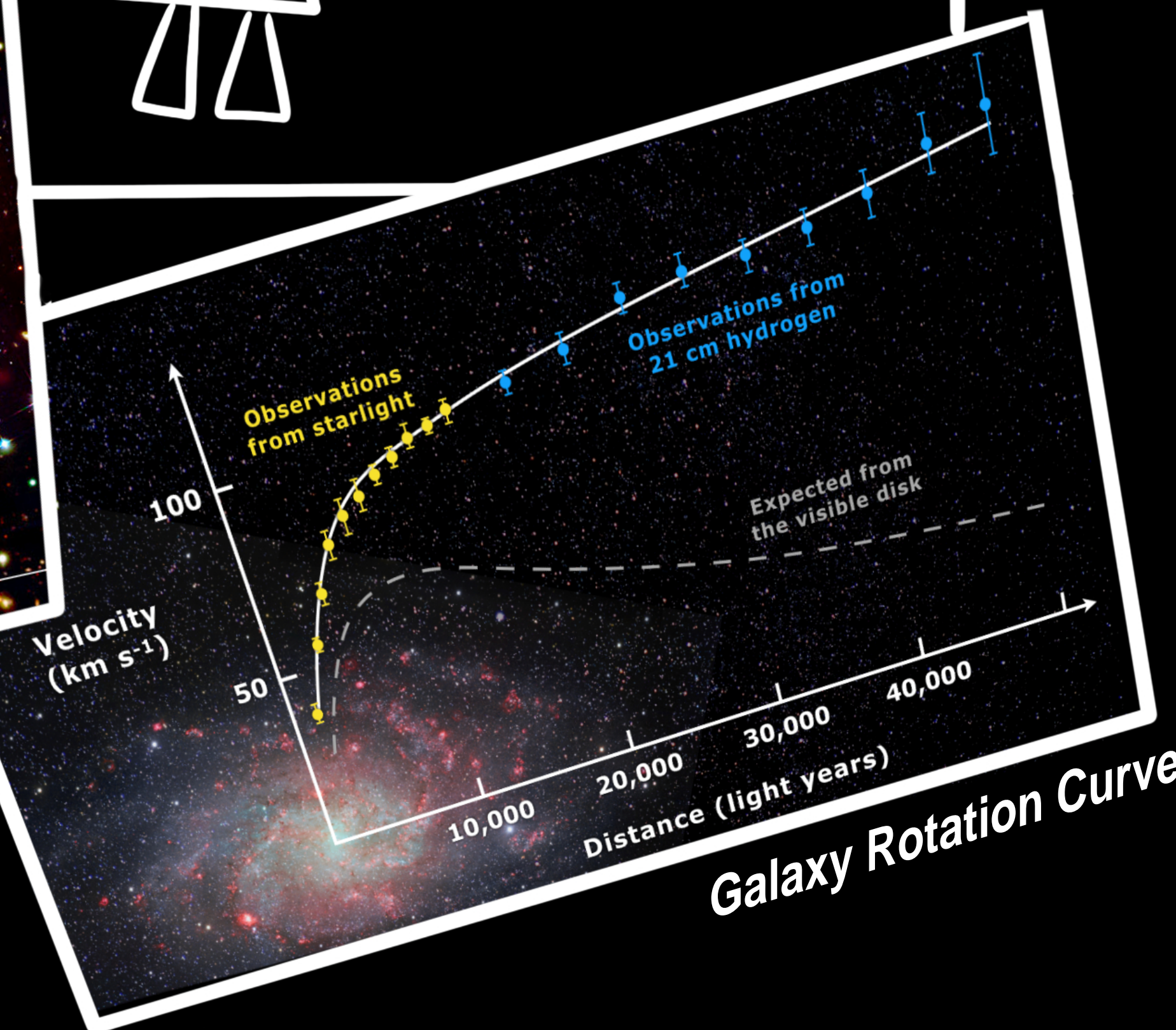
[3] A popular formation mechanism is the collapse of large amplitude density perturbations created during inflation, becoming super-horizon until inflation ends when the horizon size expands, allowing these perturbations to re-enter and rapidly collapse into PBHs.



Stephen Hawking asserts BHs can lose energy by emitting thermal radiation due to quantum effects. Hence, PBHs could evaporate and either vanish or decay into "Planck mass" relics.



bullet cluster



## ② What are Primordial Black Holes

[2] PBHs are a theoretical type of black hole that might have emerged in the early universe, which allowed them to have almost any initial mass.



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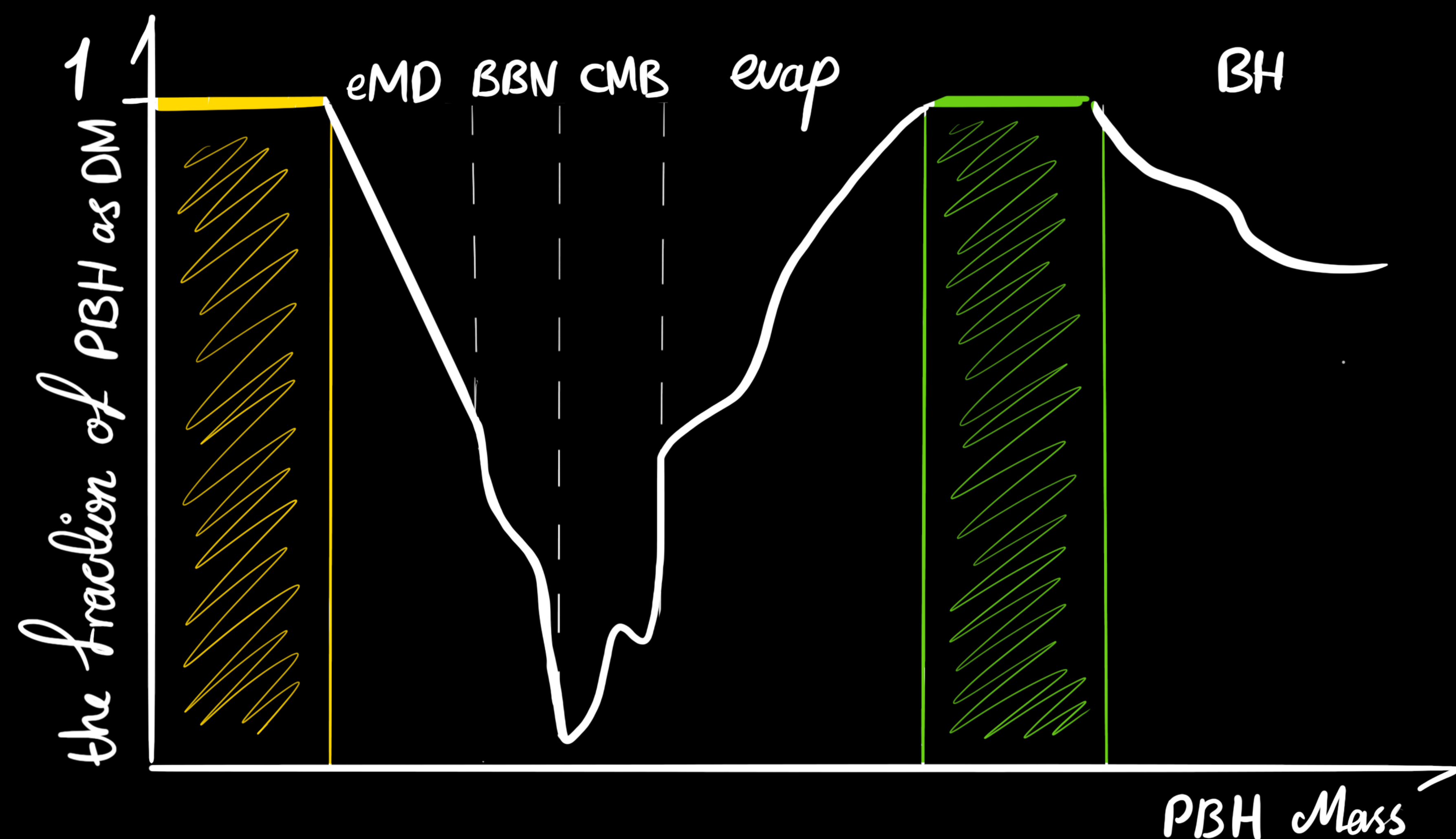
## ③ What if we found them...

as relics

[4] Light PBHs that have evaporated by today and emit Hawking radiation are constrained in abundance by the effects of their radiation on today's observations.

as BH

Heavy PBHs that have persisted to this time can typically be observed through their lensing and their dynamic and gravitational effects on other astrophysical objects and processes.



While no PBHs have been detected, their abundance is tightly constrained through many approaches.

