GROWTH OF LIGHT-SEED BLACK HOLES IN GAS-RICH GALAXIES AT HIGH REDSHIFT

Daxal Mehta, John A. Regan, Lewis Prole
Department of Physics, Maynooth University,
Maynooth, Ireland

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BACK GROUND INFORMATION -

Light Seed vs Heavy Seed Black Hole

Is basically depended on the orgination and intial mass of a black hole.
Light Seed - mass < 1000 M. ands remnants of Pop III Stars
Heavy Seed - mass > 1000 M. and forms from direct collapse

What are Pop III Stars -

First genration stars formed in universe meaning they are metal free (only H and He). These are though to be the first seeds of black holes.

BACK GROUND INFORMATION 2 -

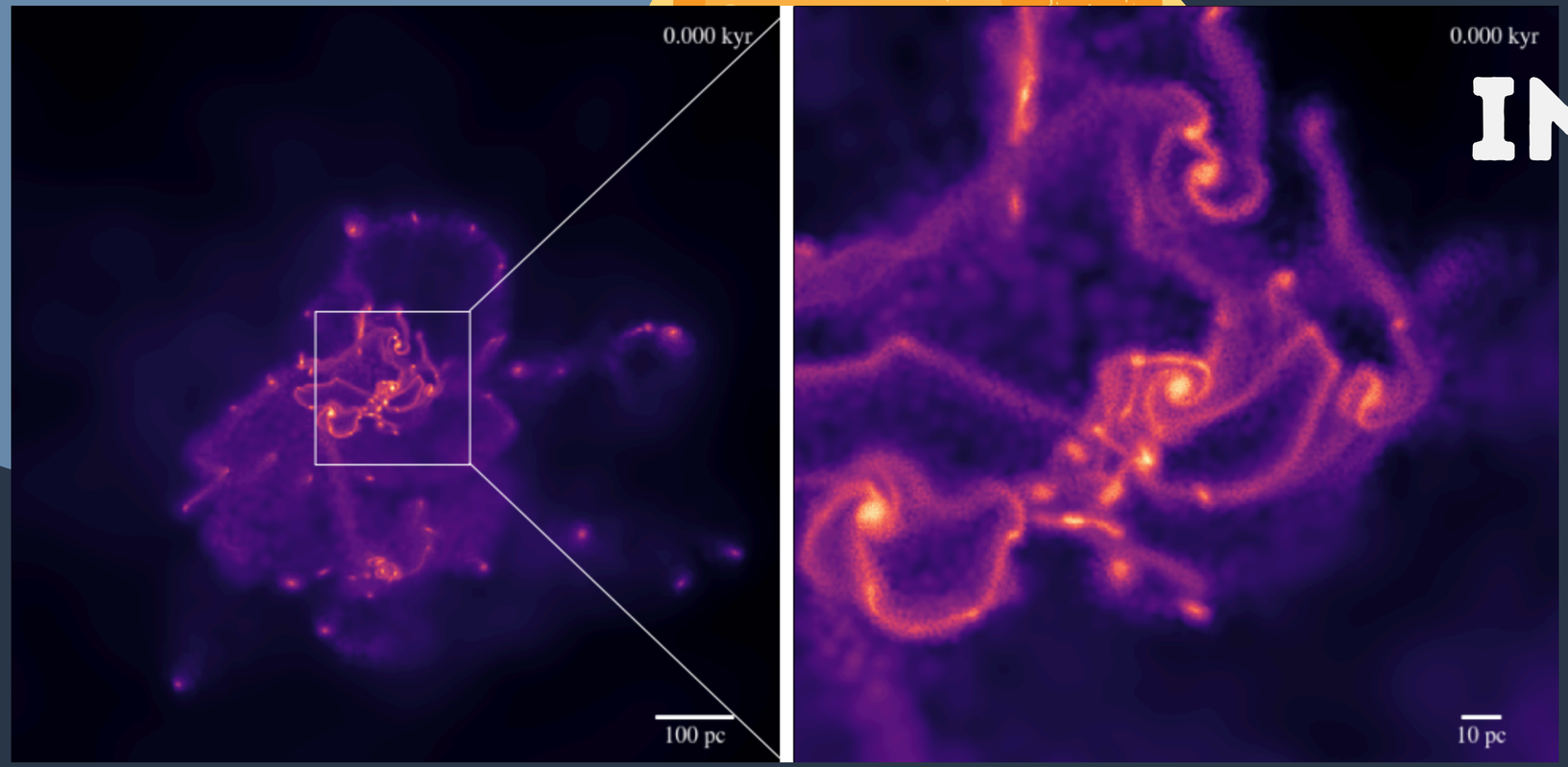
Eddington Accretion limit

A balace point where outward radiation pressure = inward G pull.

Hyper - Eddington Accretion

Is a State wher the BH accretes higher then the Eddington limit.
Leads to rapid growth (expalins how early BHs lead to super massive sizes)

INTIAL SETUP



Left Panel:

That is parent galaxy which they are using as straing points for 2 (feedback and no-feedback simulations) Typical High redshift Galaxy

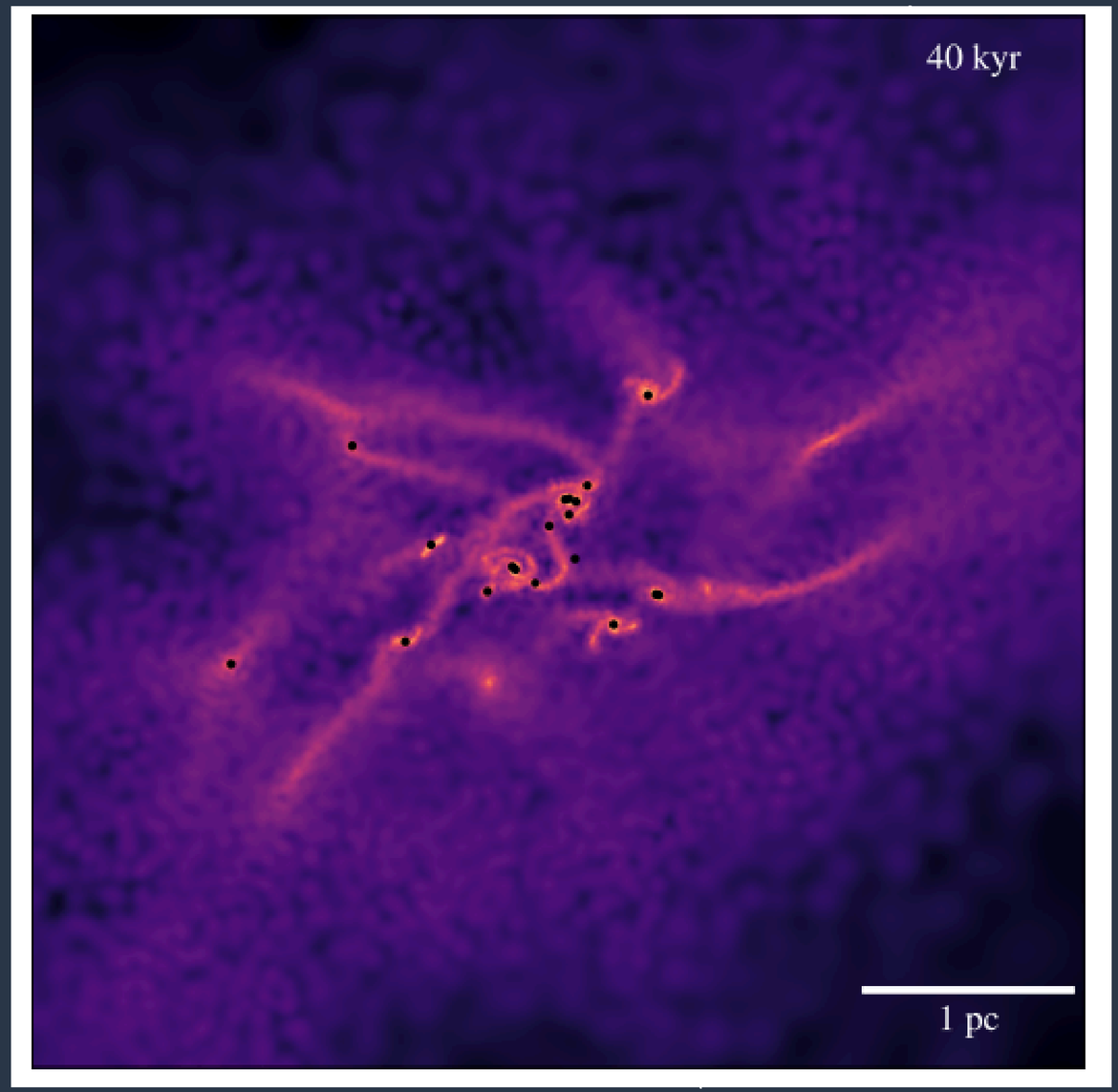
Right panel: Shows the clump where the Pop III Stars are.

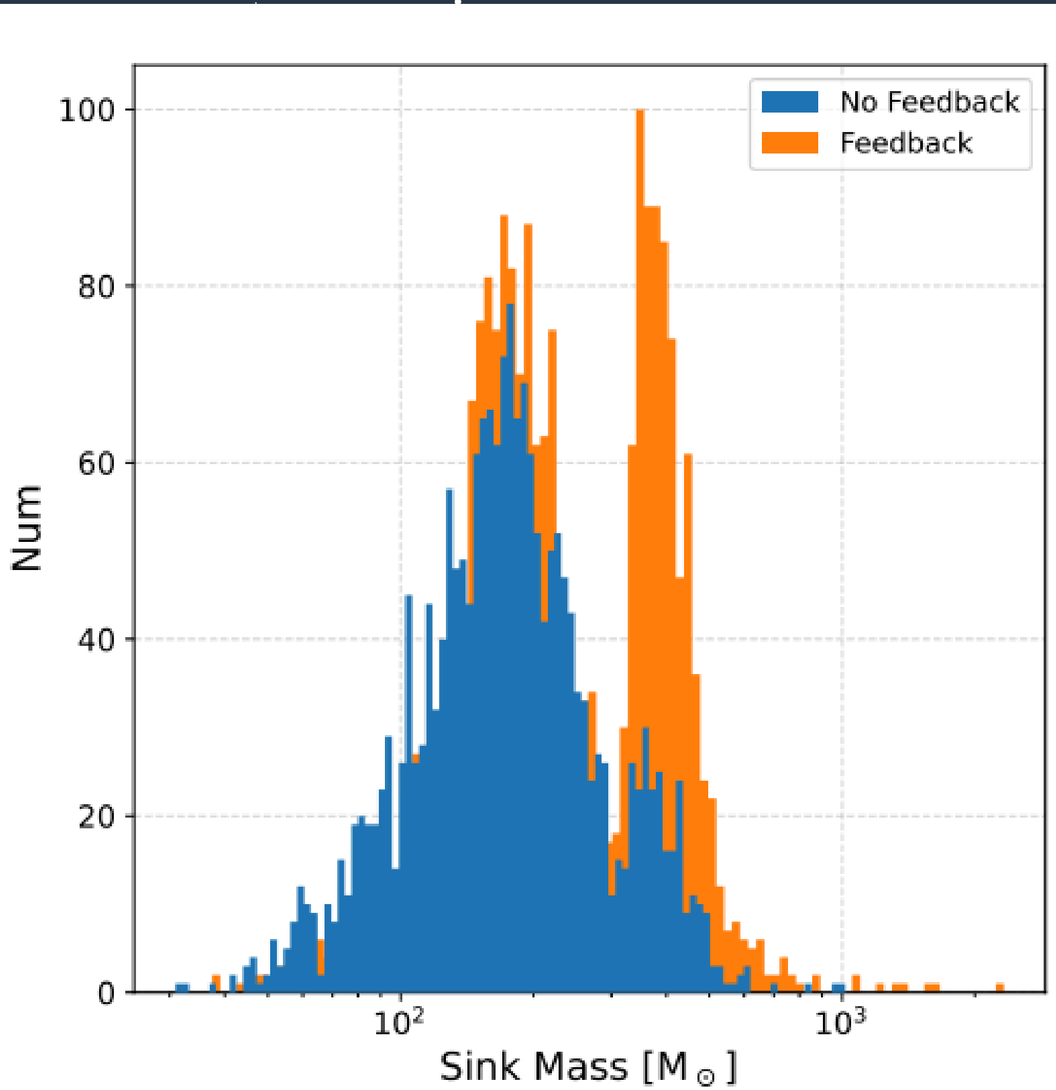
EVOLVING THE GALAXY

Thye run the simulation

- Sink Particles are activated
- Get 2 scenarios: with and without Supernova feedback

Different behaviors are tracked between black holes formed directly (no SNe) and those formed after supernovae explosions (followed by black hole accretion)



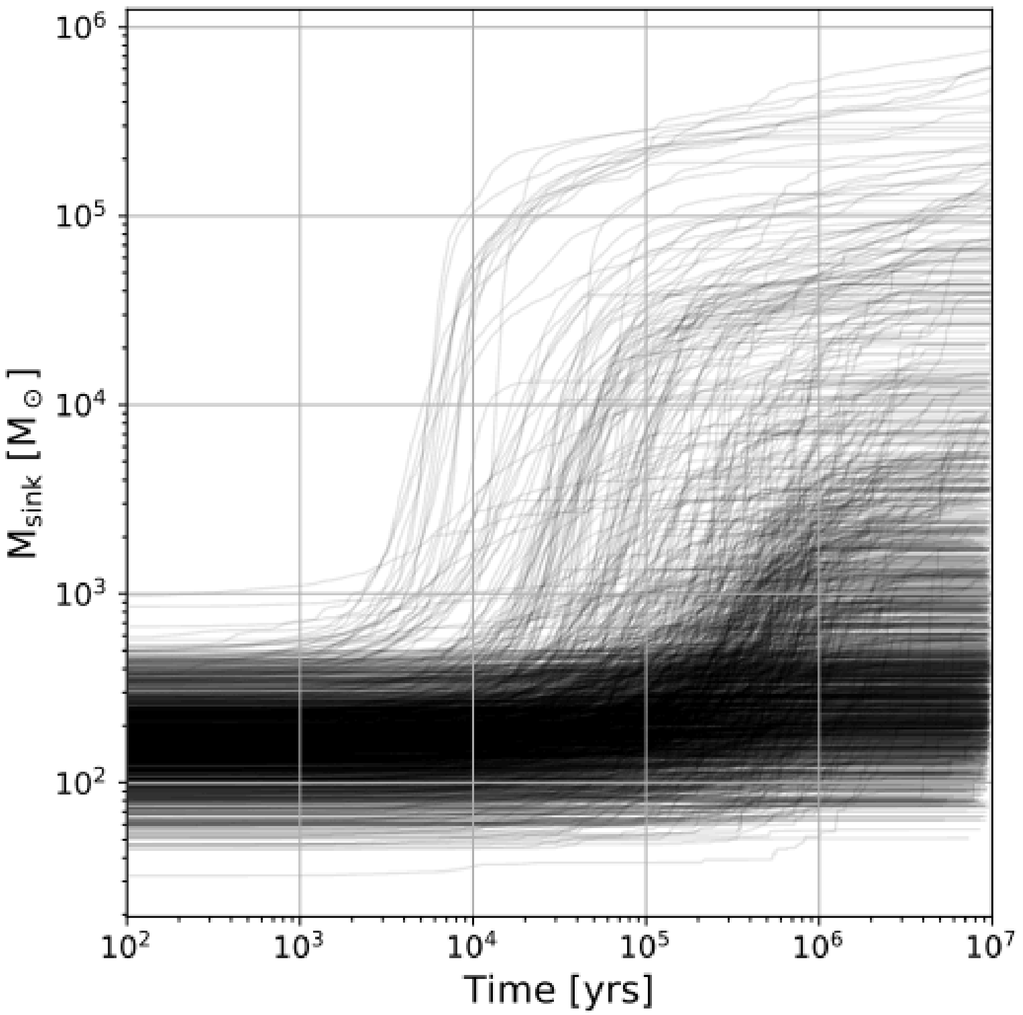


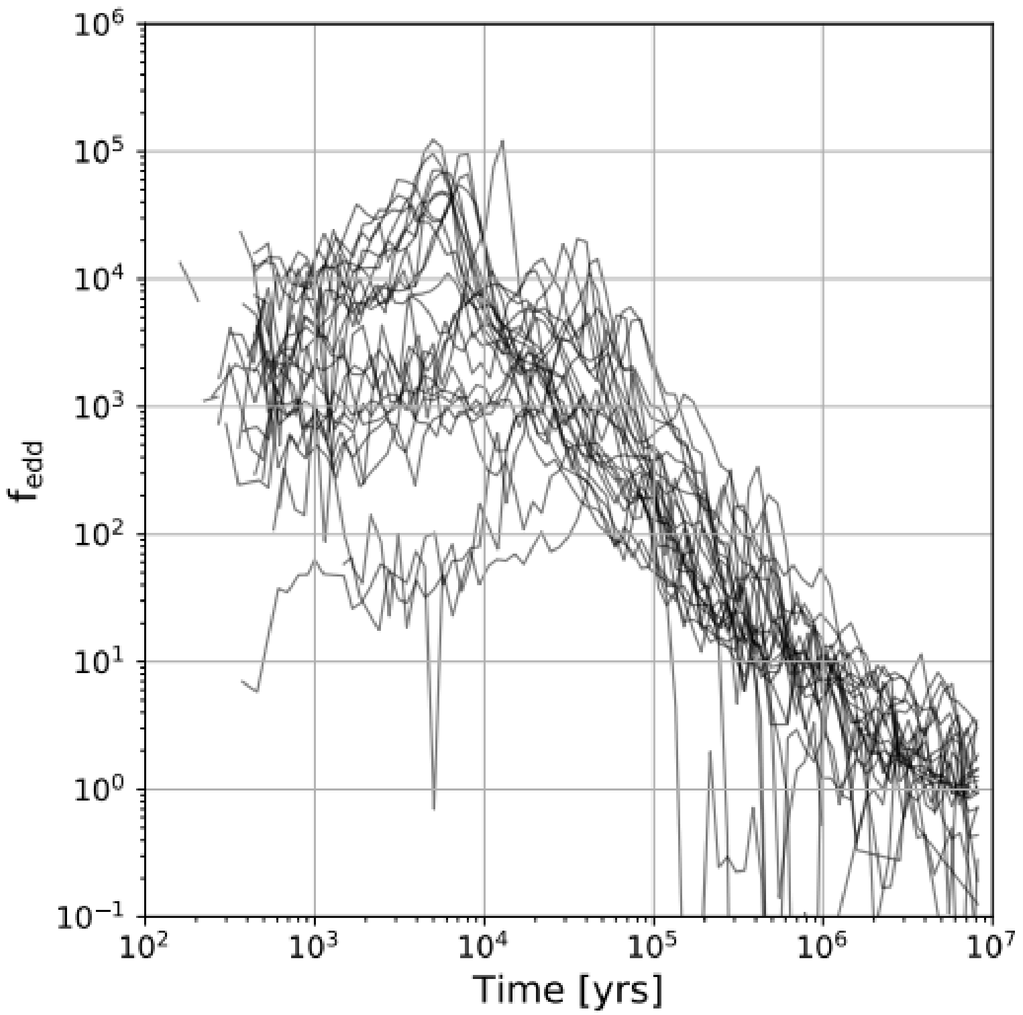
FIC_ 3: MASS DIS

Shows us that :

The impact of gas temprature and denisty on particle formation
focuses on bimodal mass distribution observed in feedback case.

No - feedback scenarios



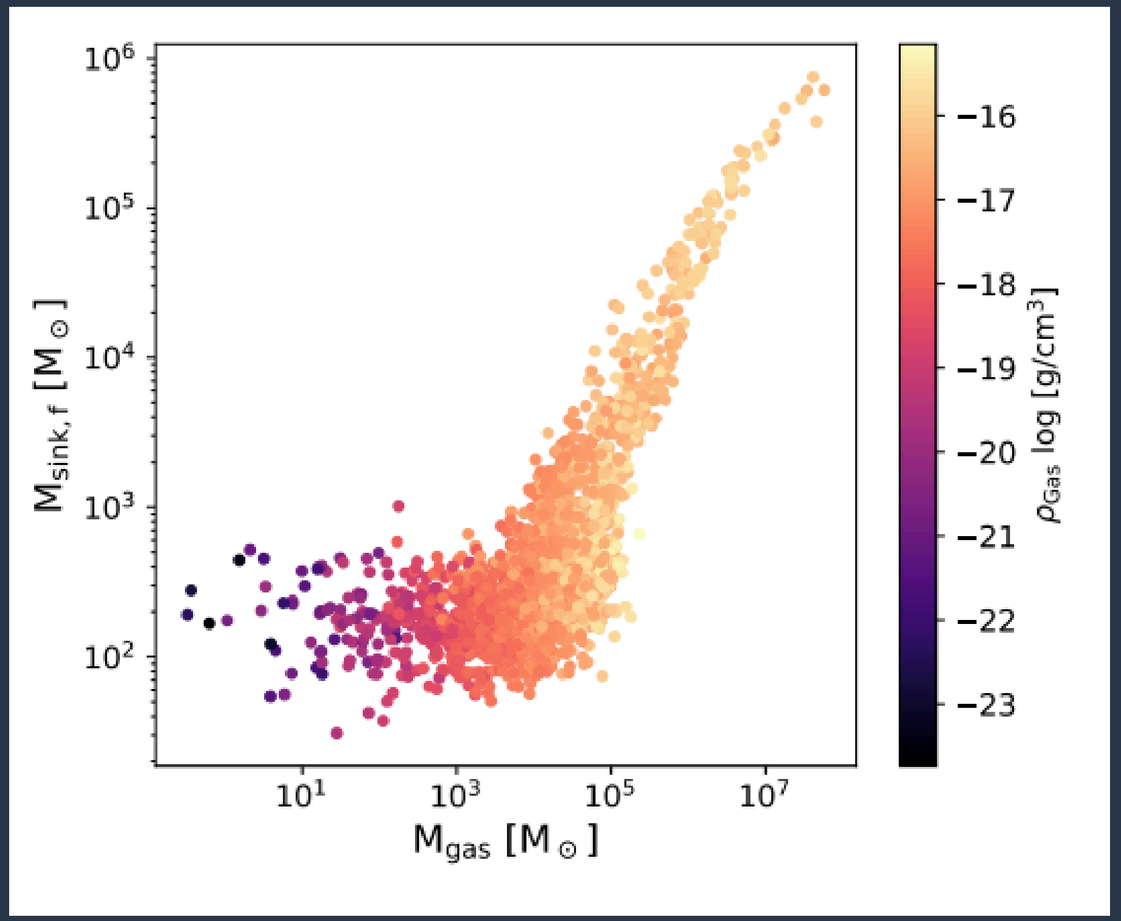


Growth rat eof Active sinks

- Active sink - accrete more then 1M.

Eddington Ratios:

- Shows ratios of MBH final mass > 10^5 M.

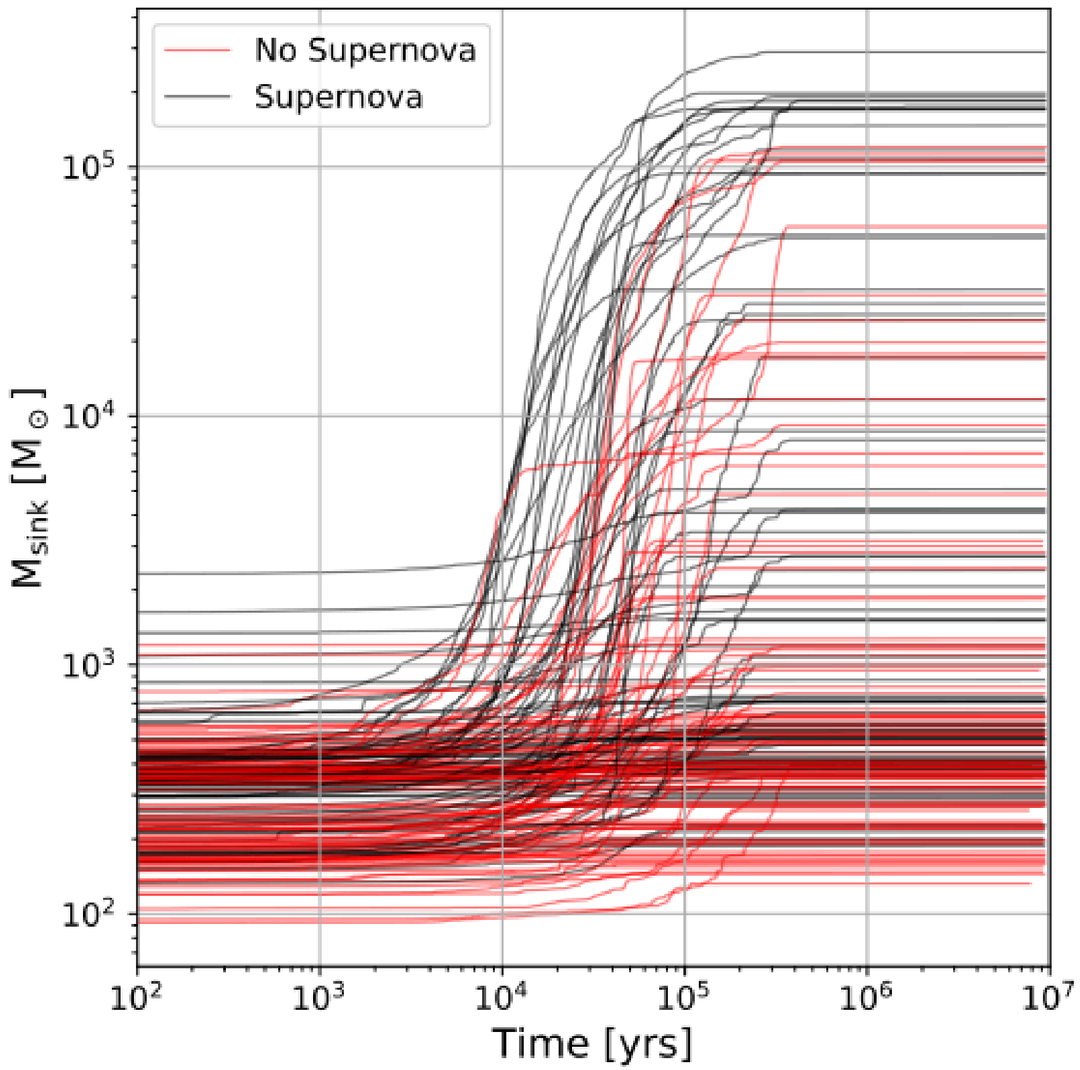


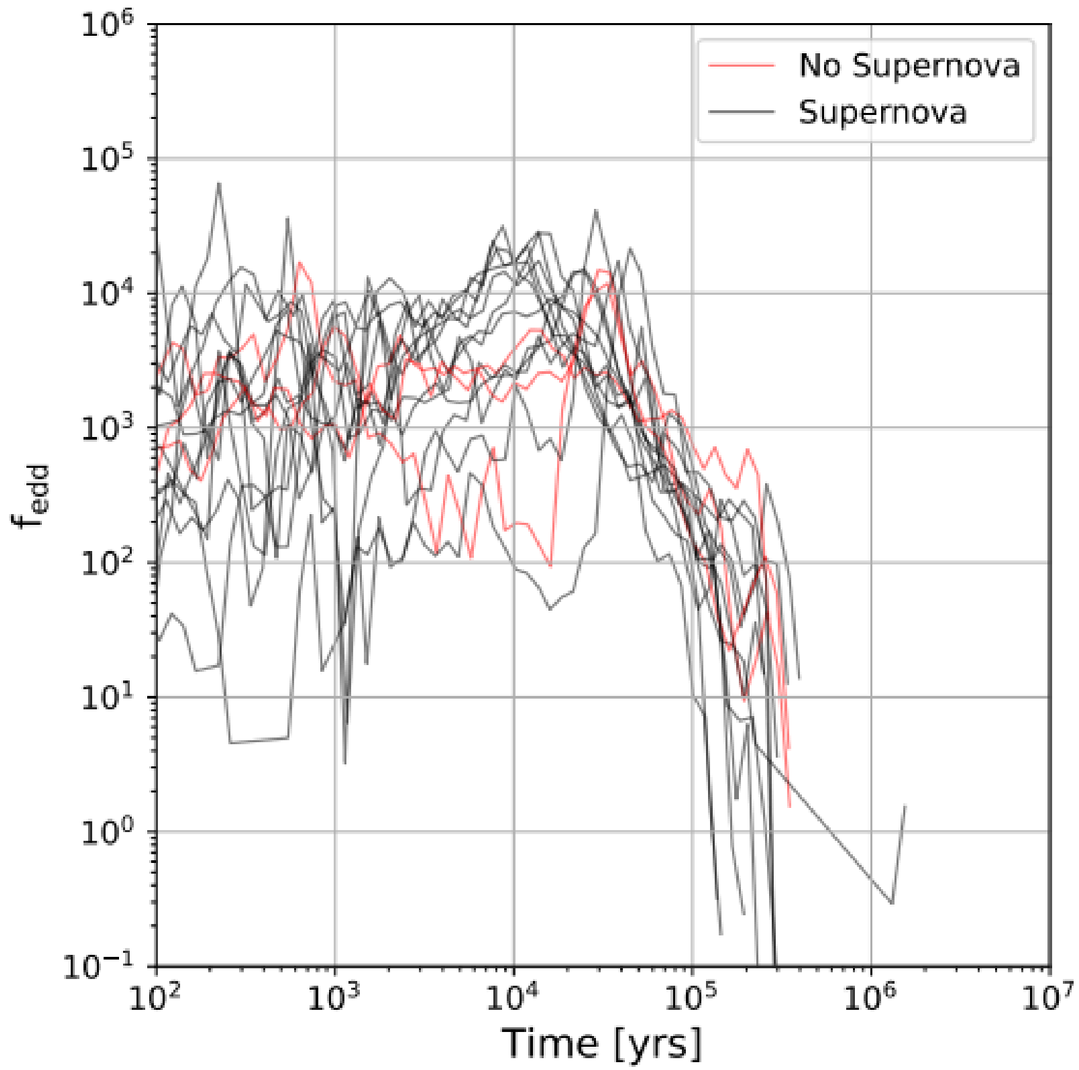
FIC_ 5: MASS VZ. GASS MASS

Final mass MBH particles against total gass
color bar represents the average density of the surrounding gas

The fianl mass of the MBH is positively correlated with avg surrounding gas density

With Feedback





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CONCLUSION

Effcient Growth of Light Seeds:

The study concludes that stellar mass black holes (light seeds) can grow extremely efficiently and rapidly in gas-rich environments typical of high redshift galaxies.

Impact of No feedback:

In the no-feedback simulation, out of 2004 MBH particles, 1520 managed to accrete more than 1 M, with 33 of these reaching masses greater than 10^5 M.

Feedback Scenario

In the feedback simulation, 2082 MBH particles formed, but only 184 were able to accrete more than 1 M.


QUESTIONS
PLEASE