

# RUM 2021

## Super-Eddington in a collapsing DM halo at high- $z$

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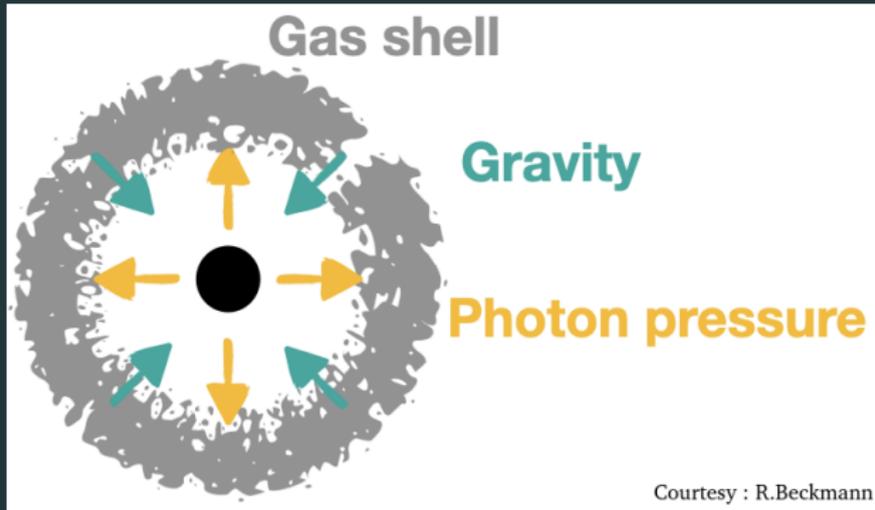
Institut d'Astrophysique de Paris



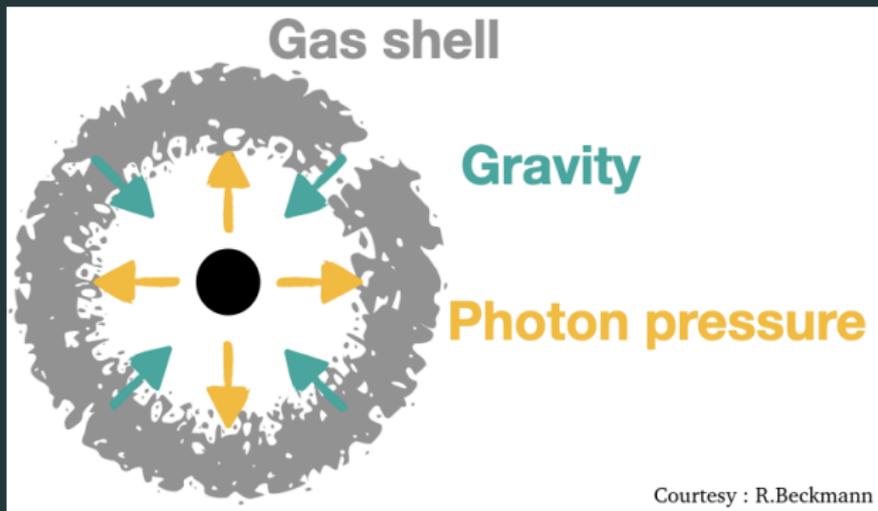
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# The Eddington luminosity and beyond



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Eddington limit = Equilibrium

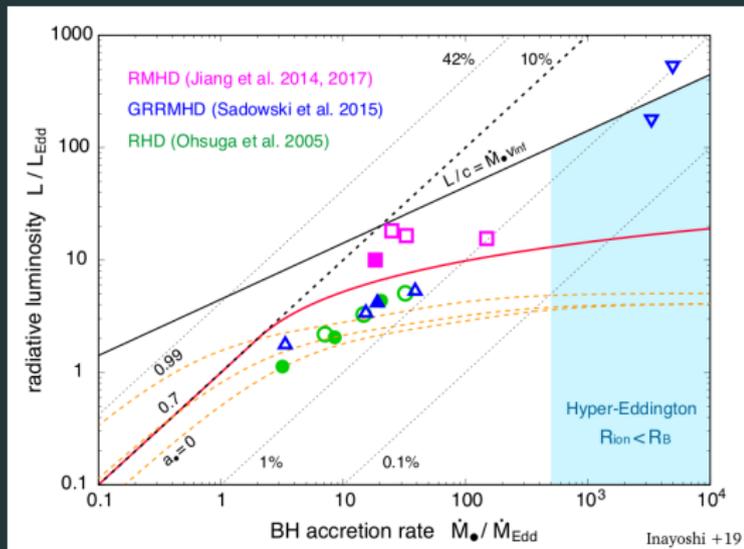
## The Eddington luminosity and beyond

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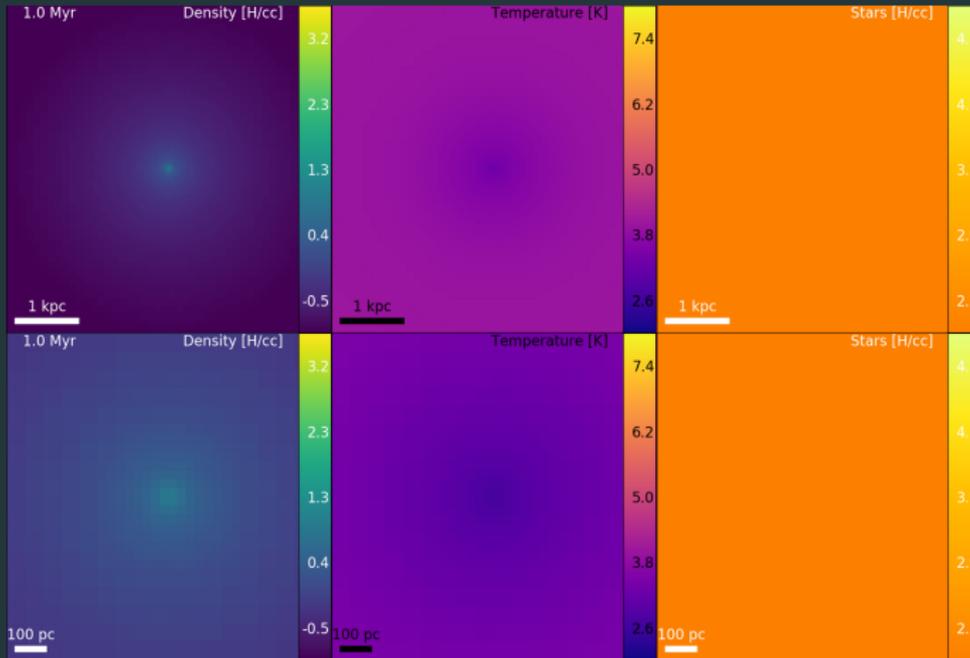
$$\text{Photon trapping} : L \propto \log(\dot{M})$$





# Isolated DM halo

$$z = 4, M_{\text{halo}} = 10^{11} M_{\odot}$$



Collapse

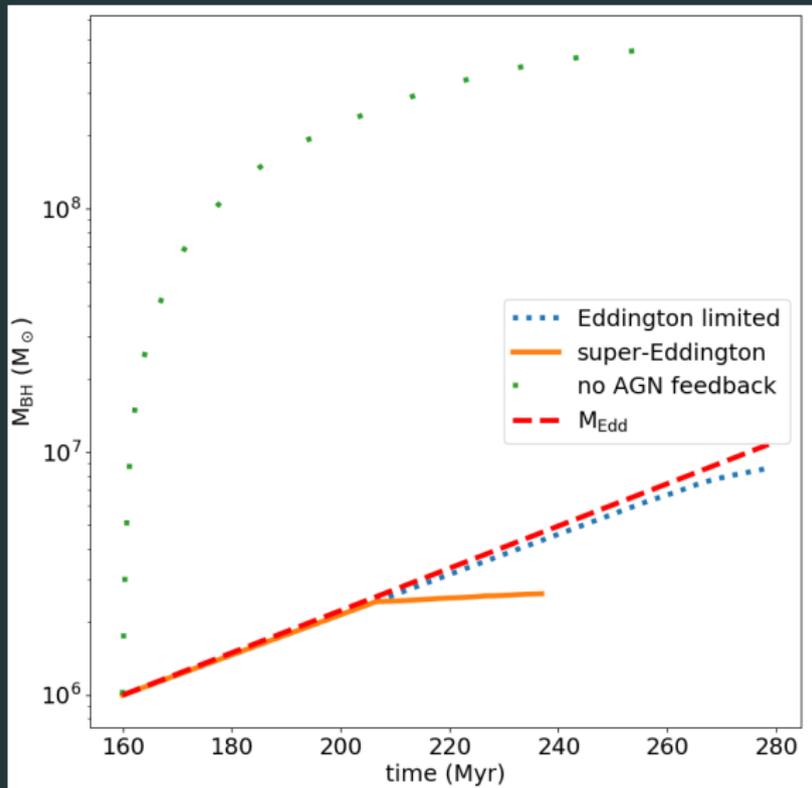


Galaxy forms

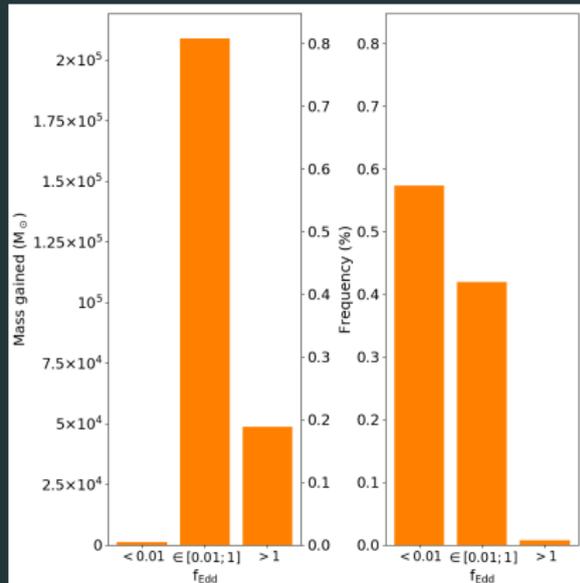
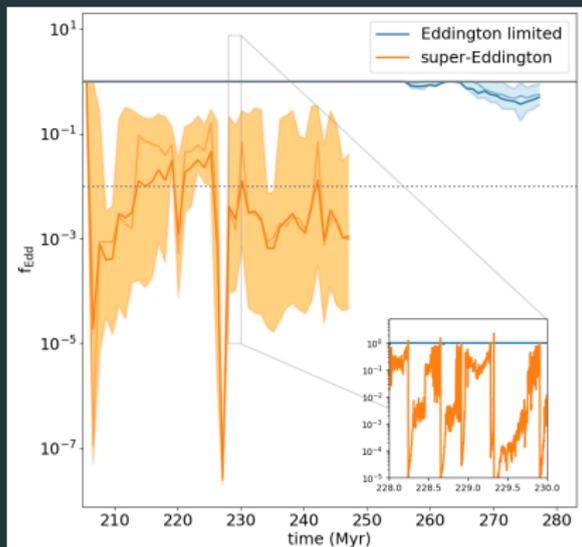


Black hole added

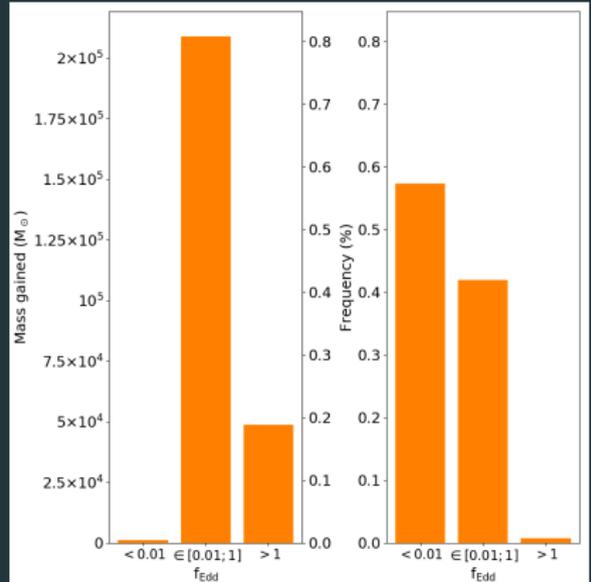
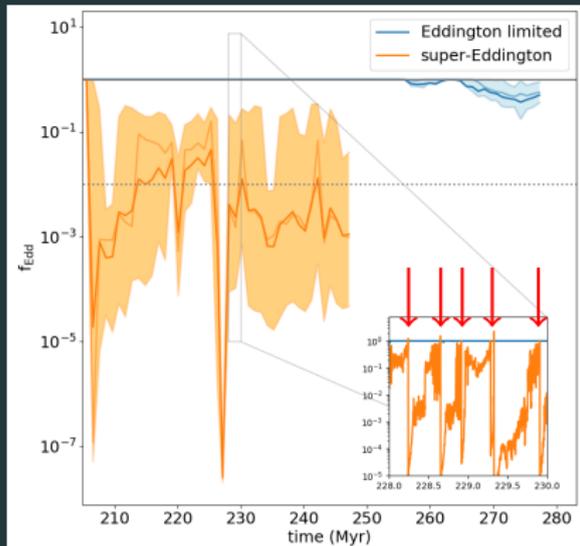
# Evolution of the BH mass



# Evolution of $f_{\text{Edd}}$

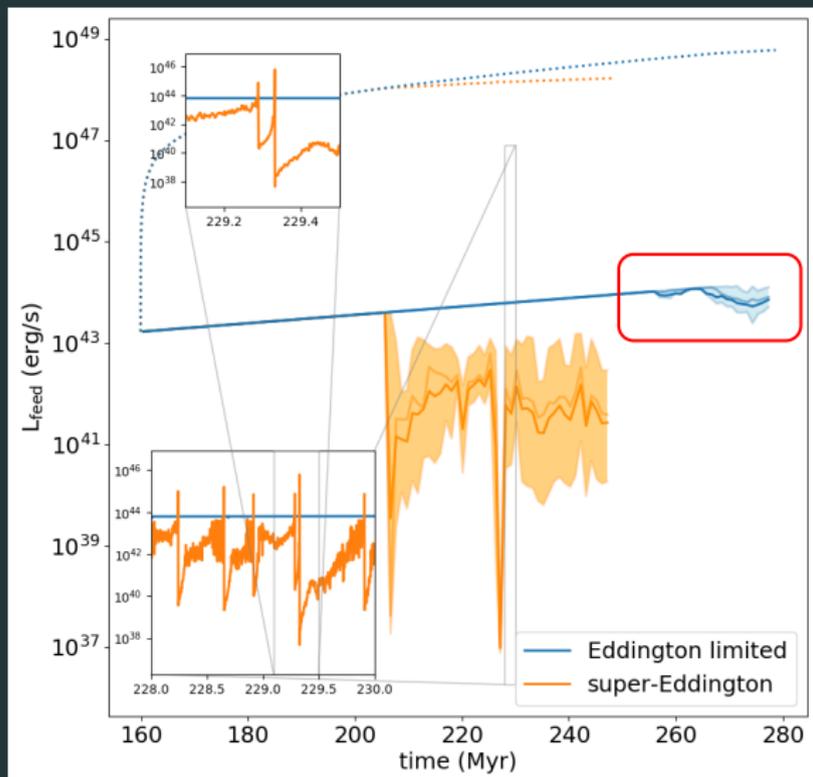


# Evolution of $f_{\text{Edd}}$

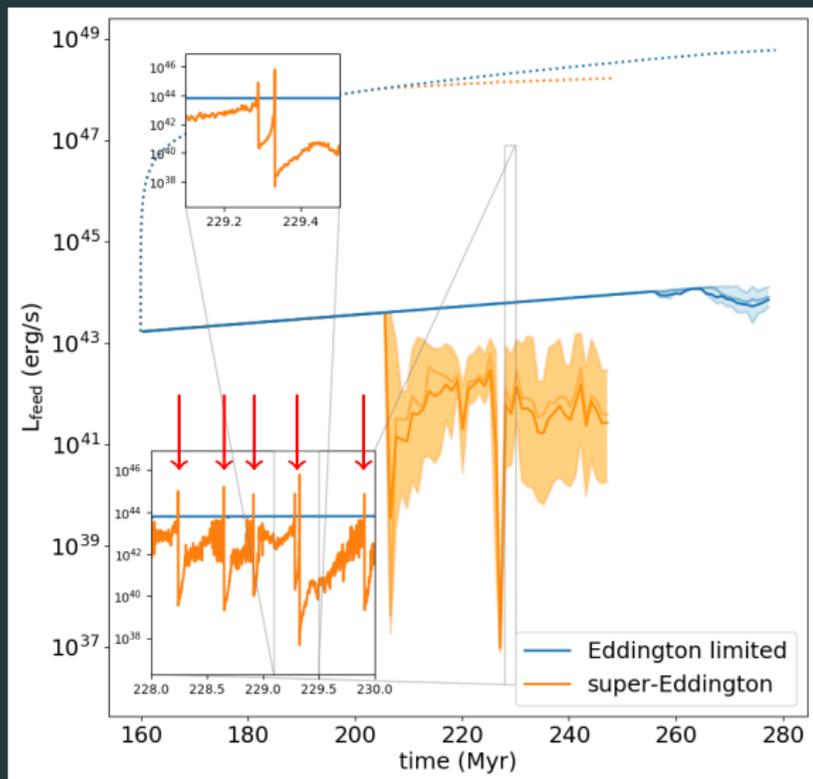


Significant amount of mass gained,  
but a lot of super-Eddington events required

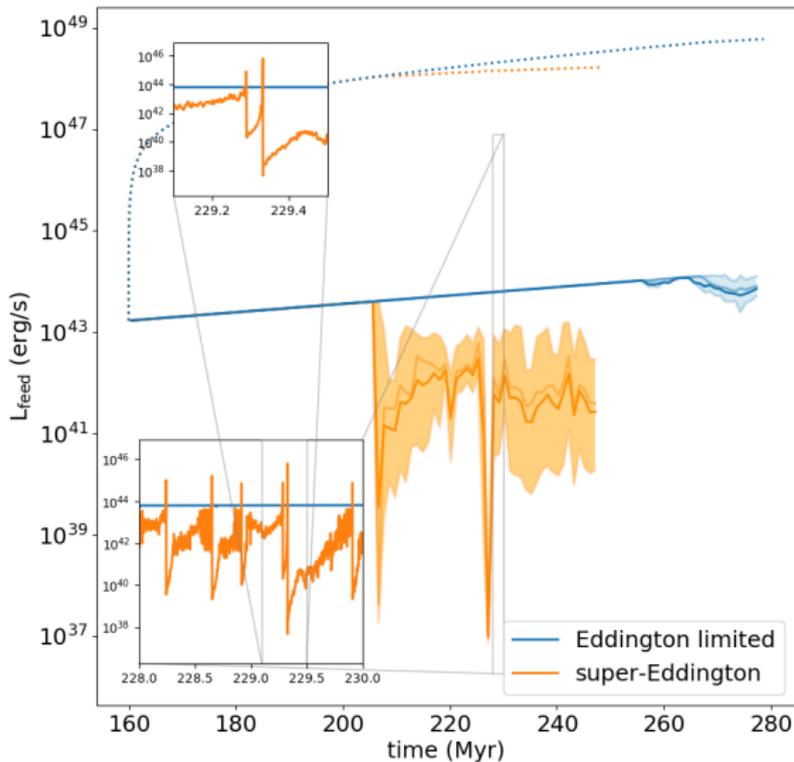
# Evolution of the feedback luminosity



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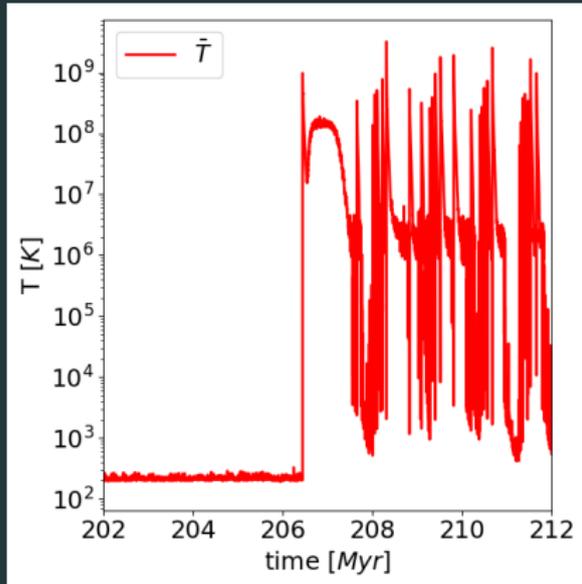
# Evolution of the feedback luminosity



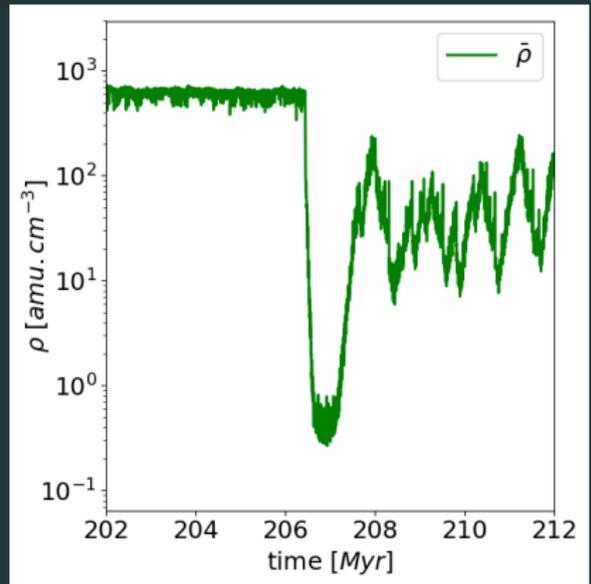
Rapid and strong impact on growth

Less AGN feedback for self-regulation

# Gas properties

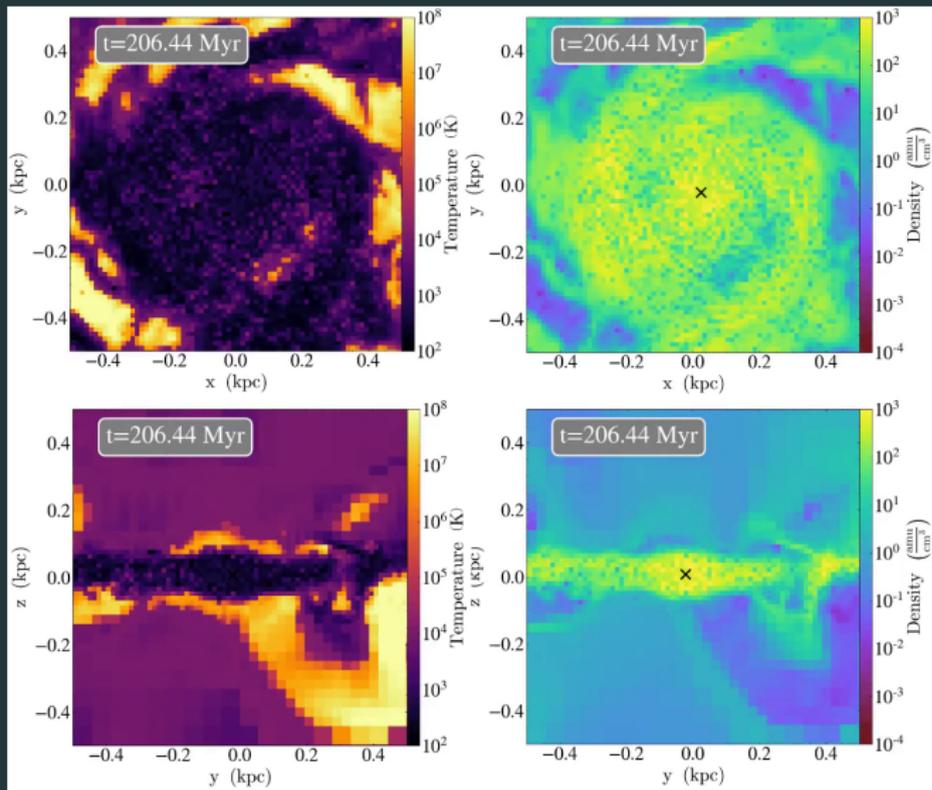


Temperature increases  
instantaneously

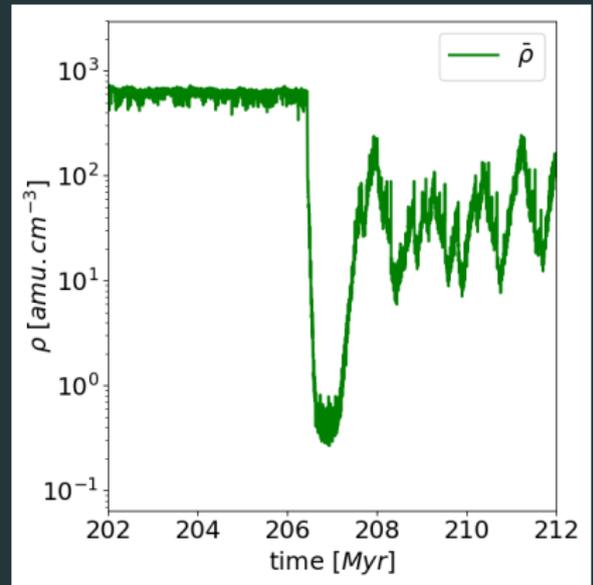
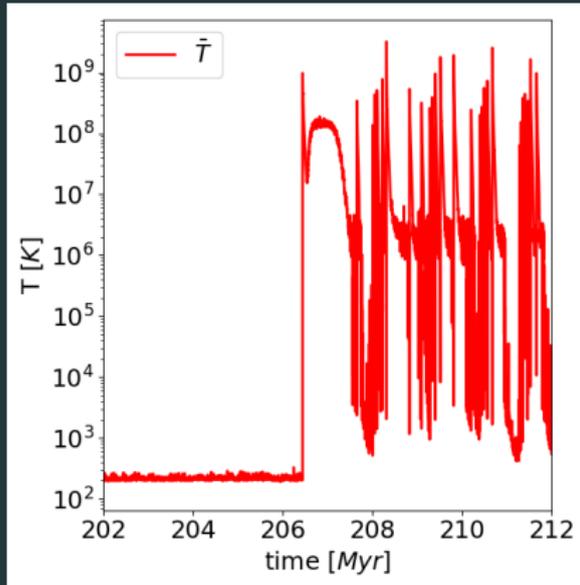


Shock propagation :  
Density decreases

# Gas properties

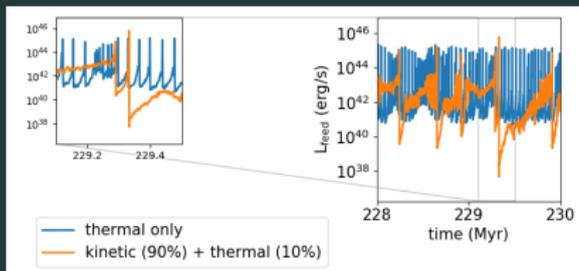
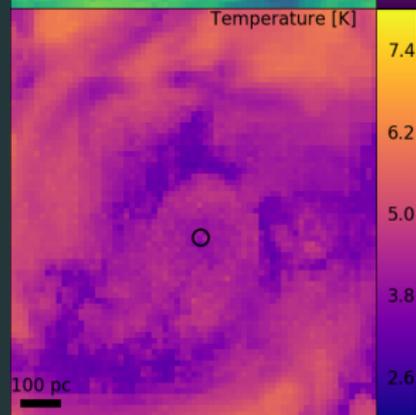
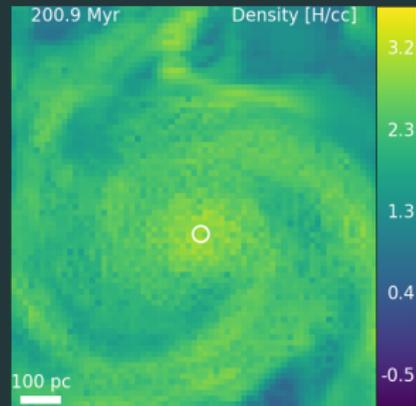
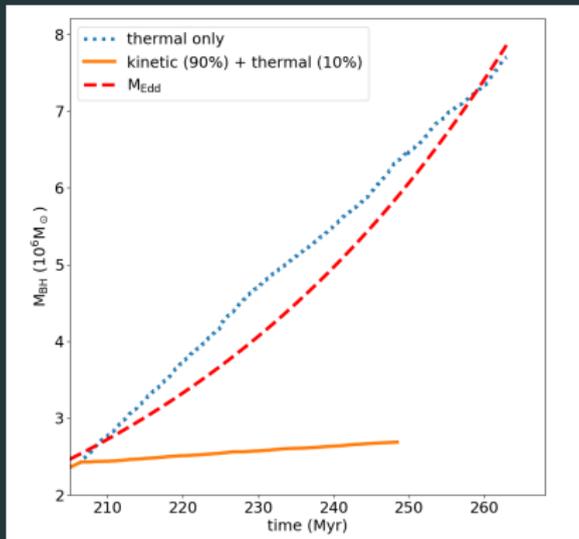


# Gas properties



Very sharp temperature increase, density decreases  
but cold & dense gas gets replenished  $\rightarrow$  more super-Eddington

# Thermal and Kinetic feedback



# Parameter space exploration & conclusions

## > Other parameters :

- Effect of the resolution
- Effect of the efficiency
- Effect of the spin
- Effect of  $M_{\text{BH}}$

> **A lot** of mass can be gained via super-Eddington accretion but...

> Super-Eddington feedback **shuts off black hole growth**

> Strong effects on the gas on **all (pc to kpc) scales**

> Idealized simulation : need to explore this in full **cosmological** context