

How do the first massive black holes grow ?

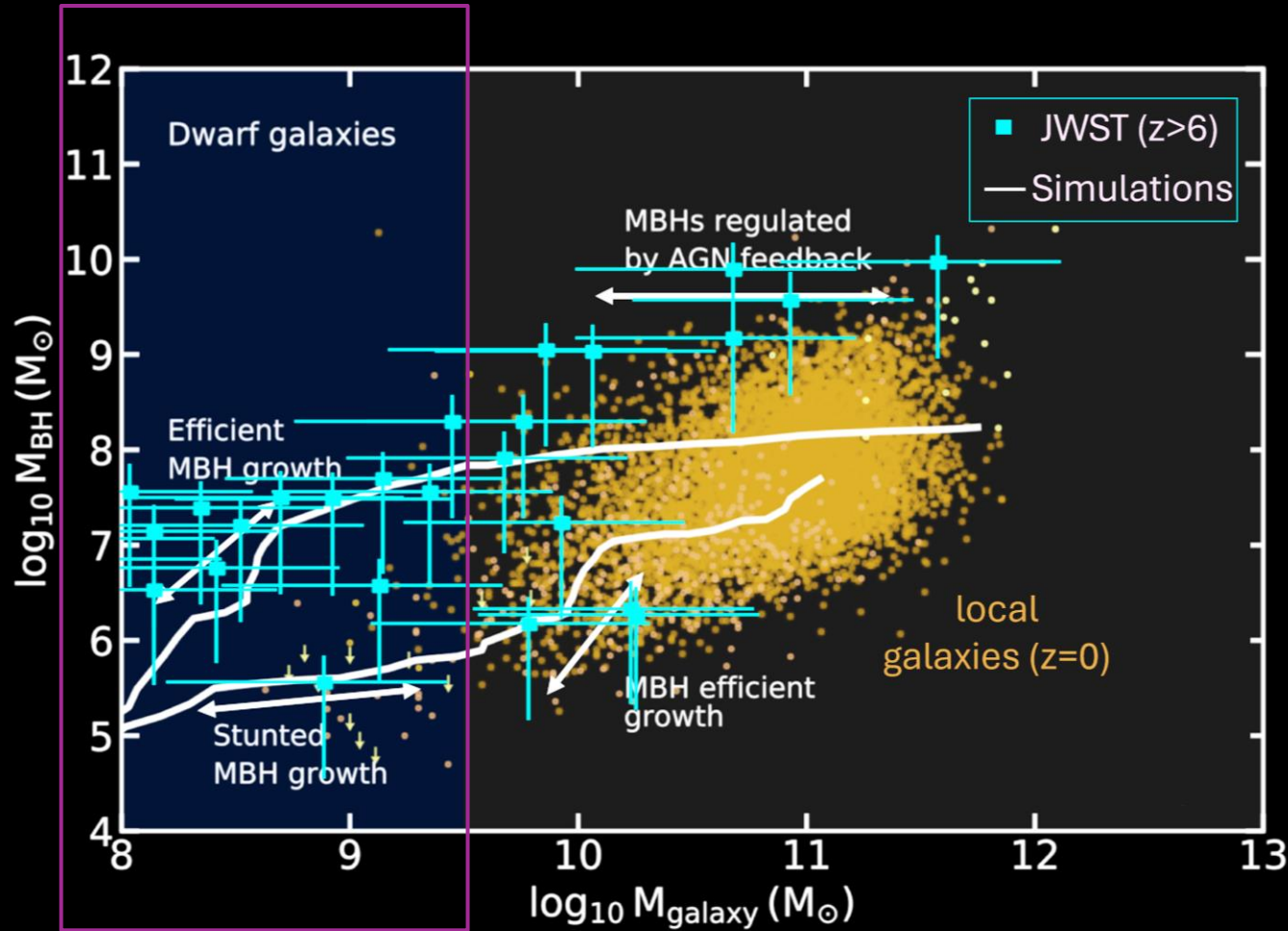
PhD thesis 2025-2028

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Scientific context / Motivation



Adapted from Volonteri et al., 2021

Recent **JWST** AGN observation
at **high- z** ($z \gtrsim 5$) - **Little Red
Dots** (Greene et al. 2023)

BUT

Galaxy Formation simulations –
Stellar Feedback models



Supermassive Black Hole (**SMBH**)
growth through gas accretion is
inhibited in low-mass galaxies

Objectives

« Stellar Feedback »

→ **More** comprehensive study in galaxy formation simulations of the impact of stellar feedback on the accretion of massive black holes and additionally on the structure of galaxies

Supernovae

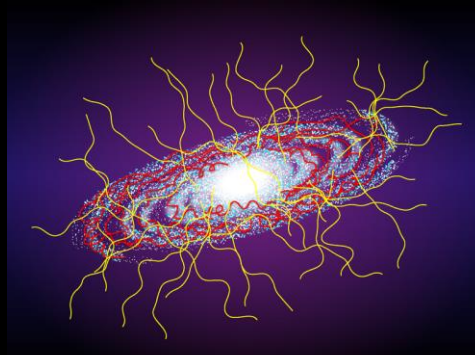
(Dubois et al. 2015, Anglés-Alcázar et al. 2017)



Cassiopeia A. Photo credit: NASA / CXC / SAO

Cosmic Rays

(Commerçon et al. 2019; Dashyan & Dubois 2020)



APS/Alan Stonebraker

OB Stars : Winds and radiation

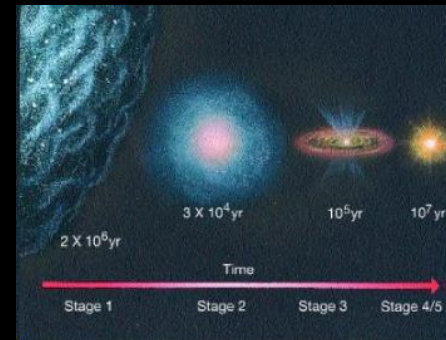
(Rosdahl et al. 2015)



Nébuleuse d'Orion, NIRCcam, JWST

Star Formation : efficiency, density threshold ...

(Nuñez-Castiñeyra et al. 2022)



Cours M2 ASEP, Charlotte Vastel

1 MBH growth

2 Galaxies structures

Use of RAMSES

« zoom » cosmological simulations – 1 galaxy and its nearby environment :
 $z > 4$ – target minimal resolution < 10 pc

RAMSES

Multi-Physics : Radiation-Hydrodynamics and
Magnetohydrodynamics

Multi-Scale : Adaptive Mesh Refinement (AMR)

*Thanks for
your attention !*