The contribution of AGN to the high redshift ionizing UV background

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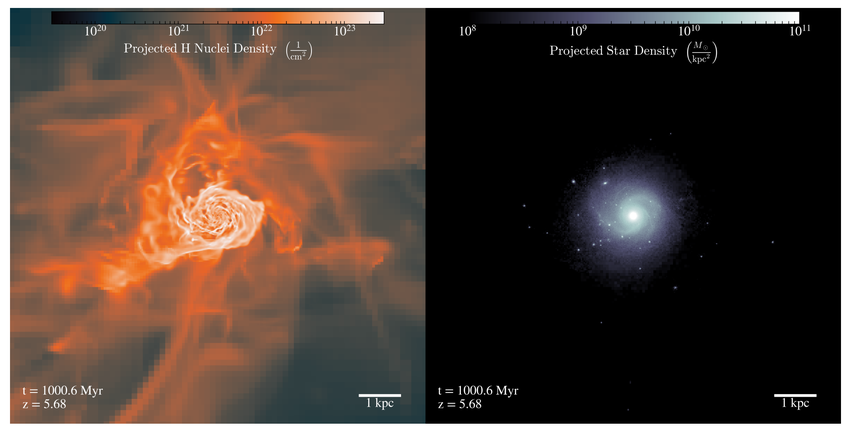
Introduction

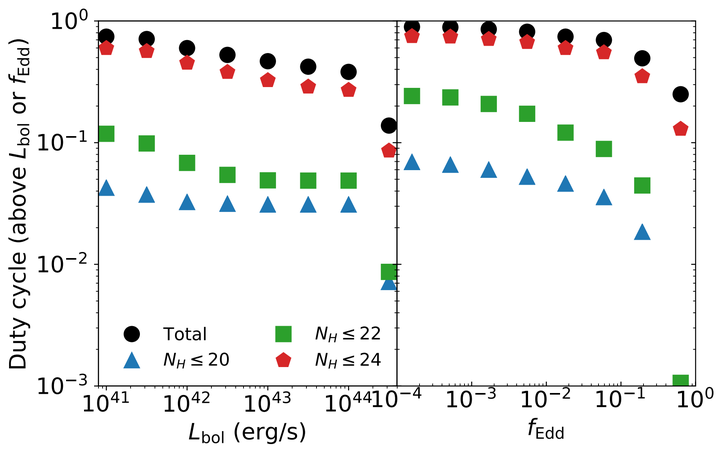
Using high-resolution cosmological simulation with radiative hydrodynamics, we investigate the contribution of accreting SMBH in high redshift galaxies to the ionizing budget of cosmic reionization.

Zooming on a massive galaxy at $z \sim 6$

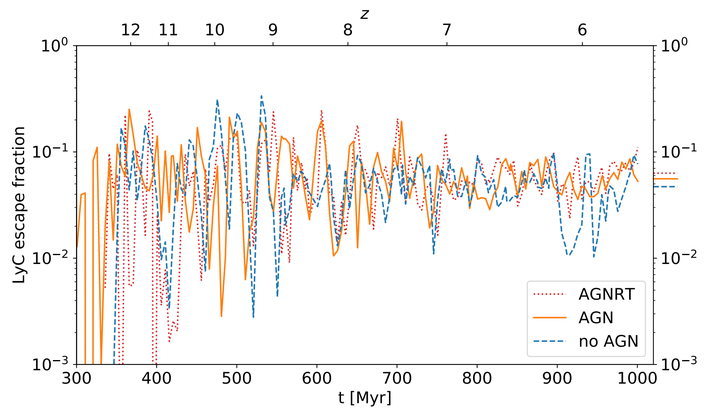
- We focus on a $M_{\rm halo} \sim 3 \times 10^{11}\,{\rm M}_\odot$ halo down to $z \sim 6$
- The galaxy reaches a mass of $M_\star \sim 2 \times 10^{10}\,{\rm M}_\odot$
- The central SMBH grows actively and reaches $M_{\rm BH} \sim 10^7\,{\rm M}_\odot$



Escape of ionizing radiation



- The AGN is mostly unobservable in the UV, due to the large amount of gas feeding the SMBH
- Very little of the ionizing radiation produced by the AGN can escape
- On average, $f_{\rm esc} \sim 5 - 10\%$ for the galaxy
- The AGN dœs not impact significantly the evolution of $f_{\rm esc}$

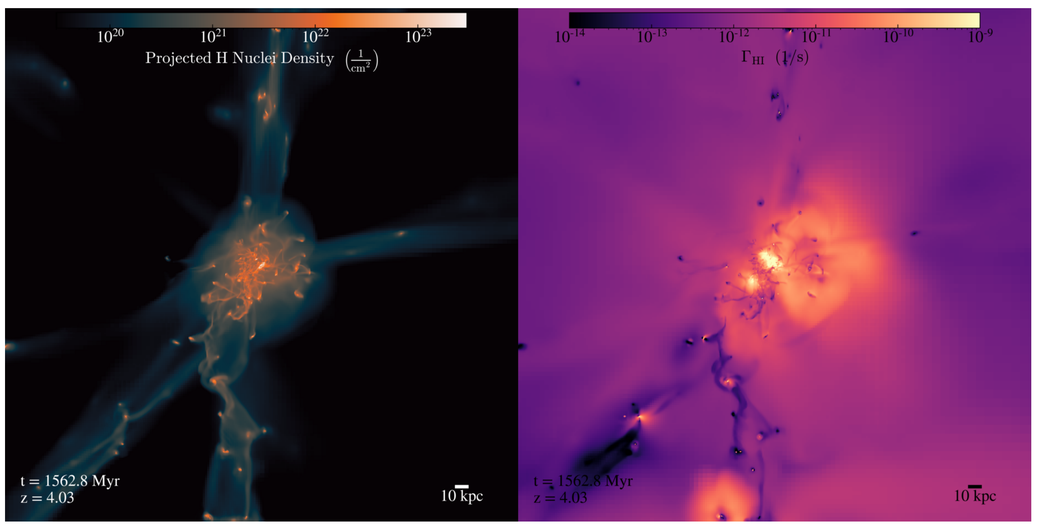


Obelisk: Description of the simulation

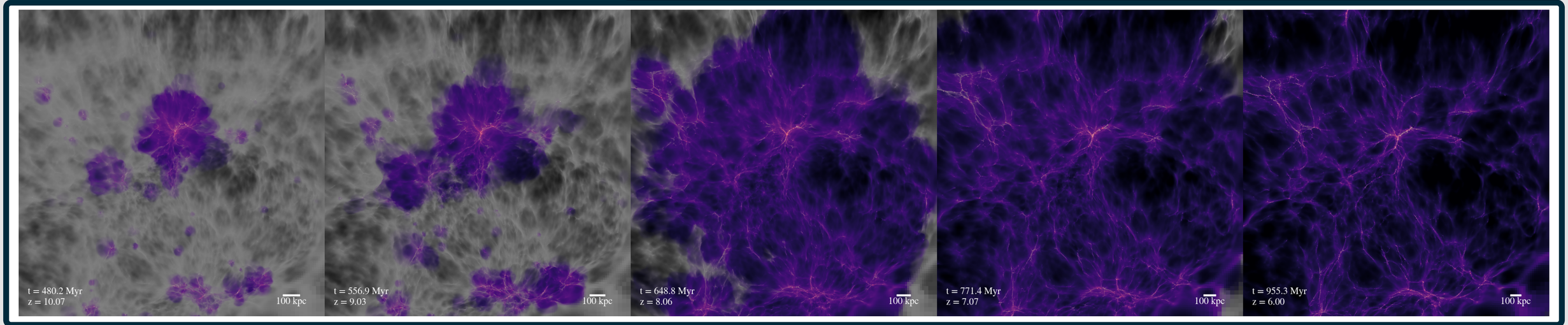
PRACE project (20 millions core hours) to zoom on a $z \sim 2$ proto-cluster

- High resolution
  - $\triangle x$ = 35 pc
  - $M_{\rm DM} = 10^6\,{\rm M}_\odot$
- Stellar physics
  - Turbulent star formation
  - Mechanical SN feedback
  - BPASS model for radiation
- Radiation Hydrodynamics
  - RHD simulation with VSLA
  - Trace sources of radiation
- Black-hole physics
  - Eddington-limited Bondi accretion
  - Thermal + jet AGN feedback
  - Radiation following the BH mass and accretion rate

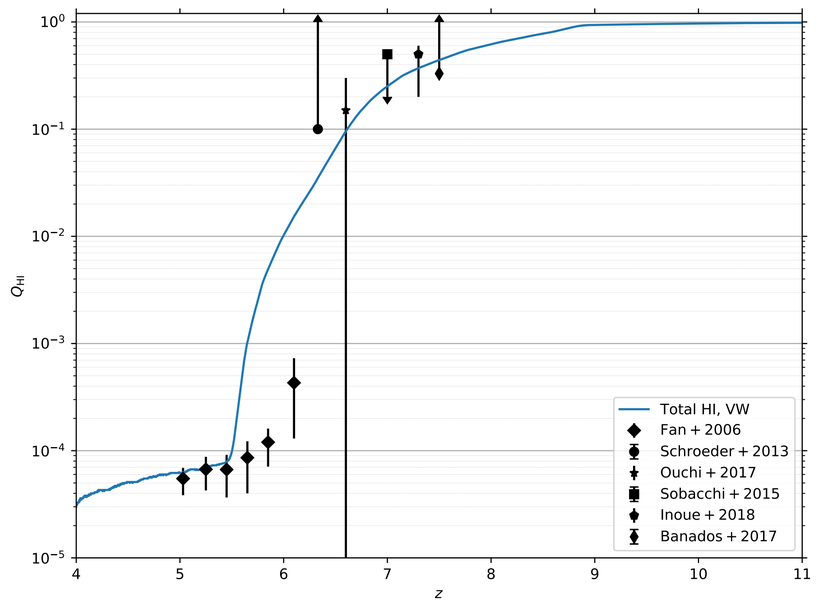
Obelisk: Most massive halo at $z \sim 4$



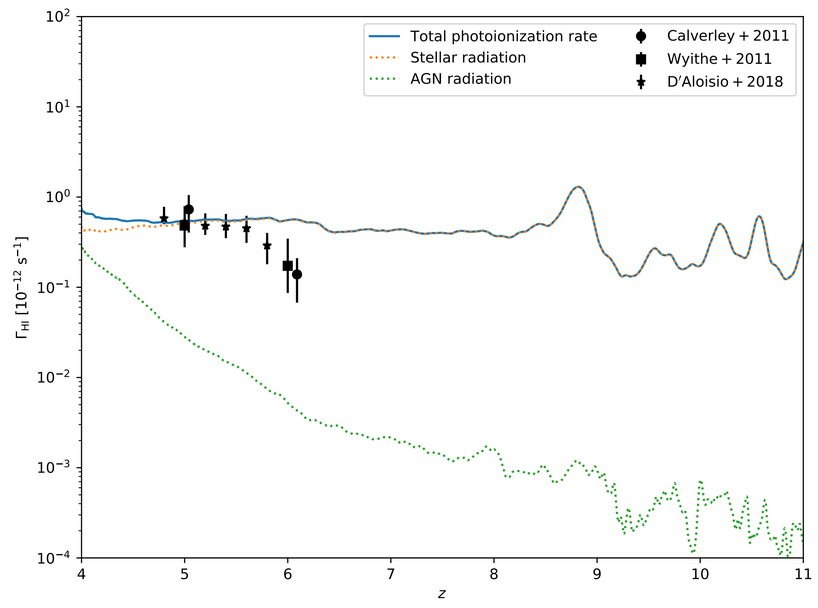
Obelisk: Evolution of the ionized volume



Obelisk: Reionization history



Obelisk: Establishment of the UV background



- The UV background is dominated by stars during the Epoch of Reionization
- Ultimately, AGN take over and dominate the UV background at $z \lesssim 4$

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