

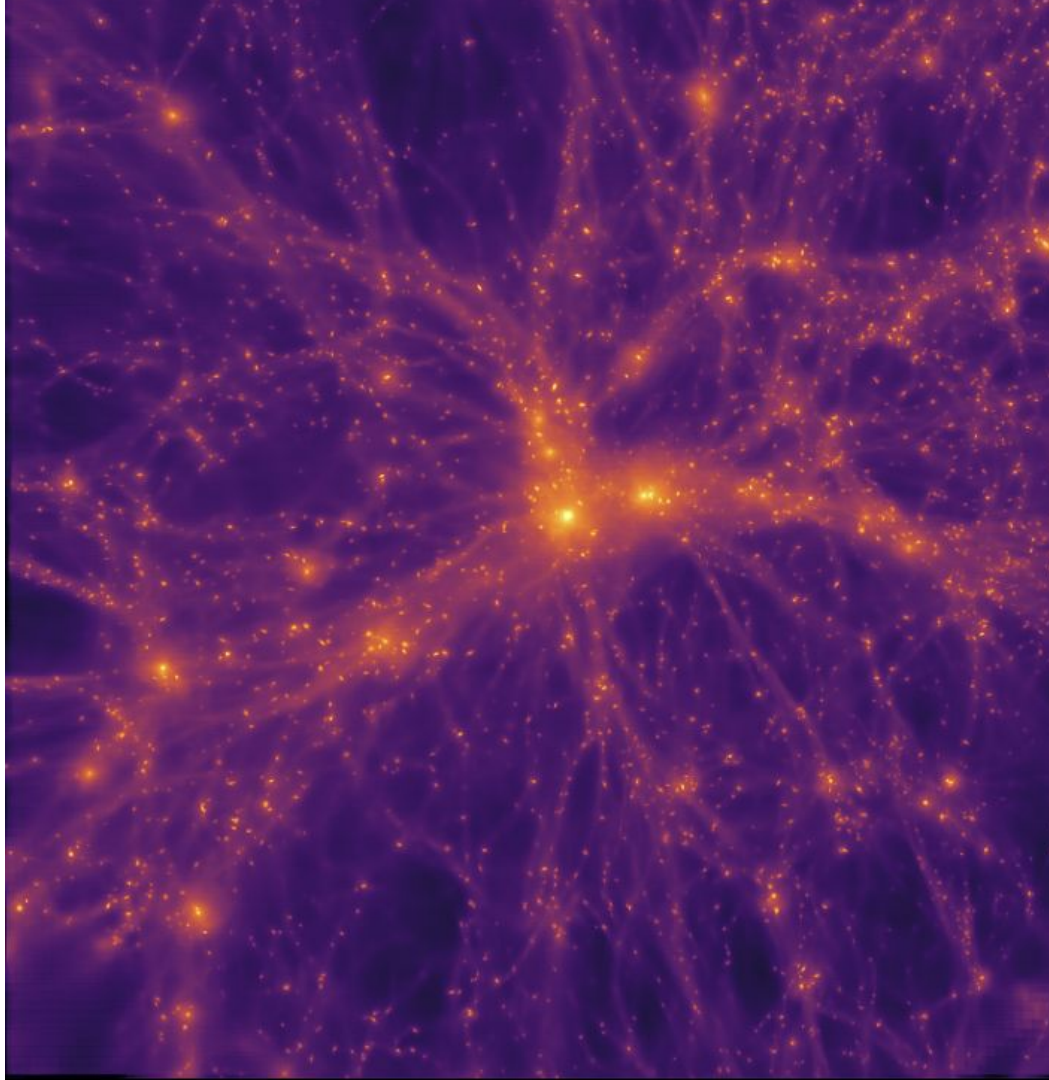
# Simulations of galaxy clusters in evolving dark energy models

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With **Amandine Le Brun &  
Pier Stefano Corasaniti**

RAMSES SNO days 2025



# A new suite of galaxy cluster zoom-in simulation with RAMSES

## Goal:

**Study the combined effect of AGN feedback and evolving dark energy in the internal properties of galaxy clusters**

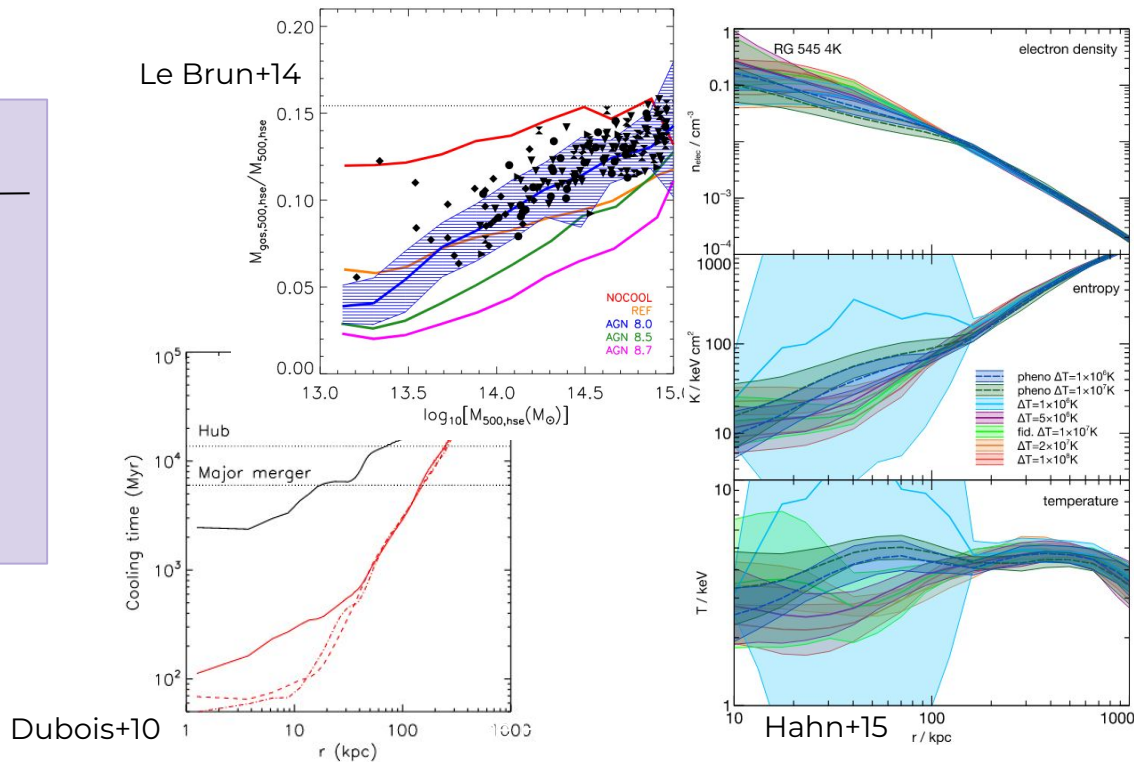
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Study the combined effect of AGN feedback and evolving dark energy in the internal properties of galaxy clusters

## The Literature:

- A lot of studies of the **impact of AGN feedback in clusters**
- Regulate cooling catastrophe
- Lower central densities
- Lower  $M_{\text{gas}}/M_{\text{halo}}$  &  $M_{\text{star}}/M_{\text{halo}}$



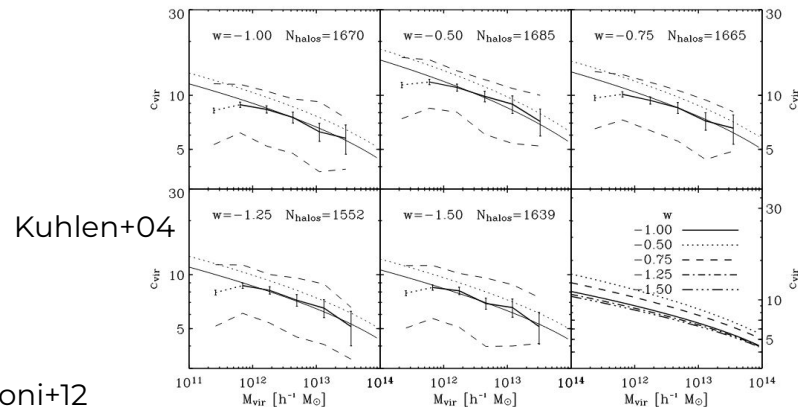
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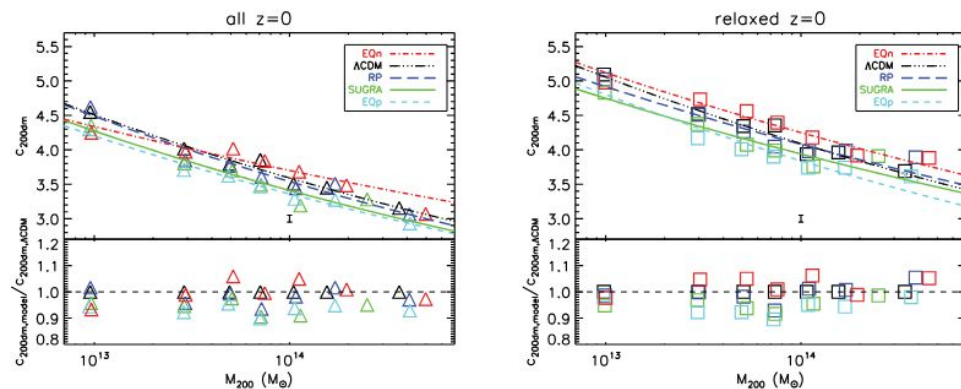
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## The Literature:

- Studies of the **impact of evolving dark energy** (although not with zoom-in simulations)
- Lower / increase halo concentration
- **No study of the combined impact!**



De Boni+12



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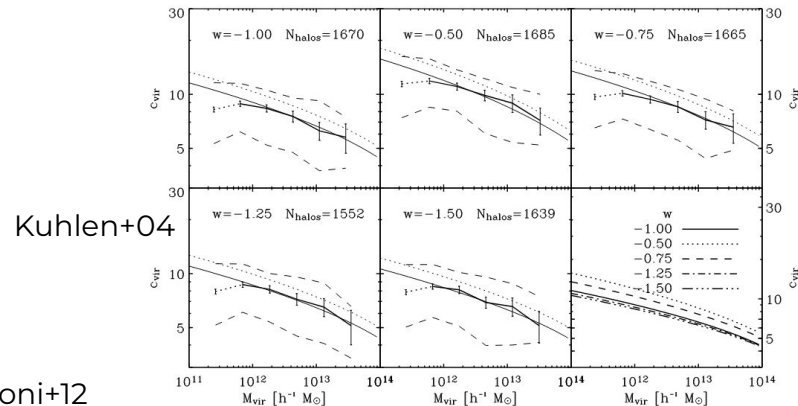
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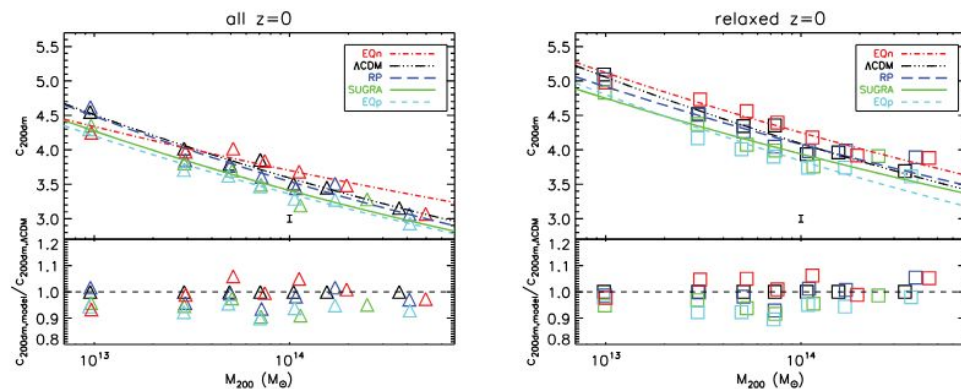
**Degeneracies not understood**

=

**Biases in the cosmological inference**



De Boni+12



**12 massive systems from a Dark Matter Only 1 Gpc box:**

—→ **2 evolving DE cosmologies:**  $w$ CDM models,  $w = -0.8$ ,  $w = -1.2$   
**1  $\Lambda$ CDM cosmology:**  $w = -1$

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# The project

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**Grid resolution:**  $\sim 1$  kpc comoving at all redshift (level 20)

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- Quasar mode (thermal feedback)
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**16 Million cpuh allocation** on Adastra/Jean-Zay computer



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**16 Million cpuh allocation** on Adastra/Jean-Zay computer

$\sim 240k$  cpuh per run

- Use of the new  
**LASSO** halo finder

**Production  
has started!**

## A lot to study:

- Mass profiles and sparsities
- Gas and star profiles
- Galaxy morphology
- Shear signal, X maps, SZ signal
- CMB induced polarization
- Merger history

**If you have ideas / want to collaborate, I would be very happy to discuss with you!**

