The background of the slide is a complex, interconnected network of thin, grey lines on a light grey background, representing a simulated cosmic web or filamentary structure. This network is composed of numerous small, interconnected nodes and filaments, creating a dense, web-like pattern. The overall appearance is that of a large-scale simulation of the universe's structure.

# Horizon @ SKA: le point sur les simulations numériques

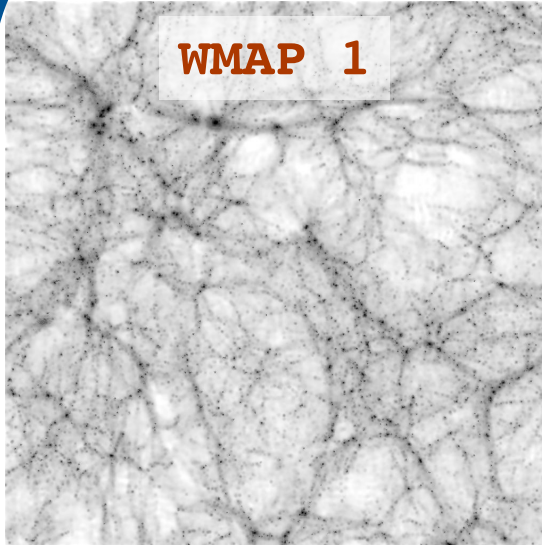
J. Devriendt, CRAL

# Outline

- ⇒ Presentation of the simulations which have been done so far
- ⇒ (brief) Illustration of what we can use them for: analysis of N-body runs vs hydro simulations
- ⇒ Work in progress: future simulations & their analysis

# Cosmic DM N-body simulations

Aubert / Fuzfa / Pichon / Teyssier (2006)



**WMAP 1**

2  $\neq$  cosmologies

+ quintessence

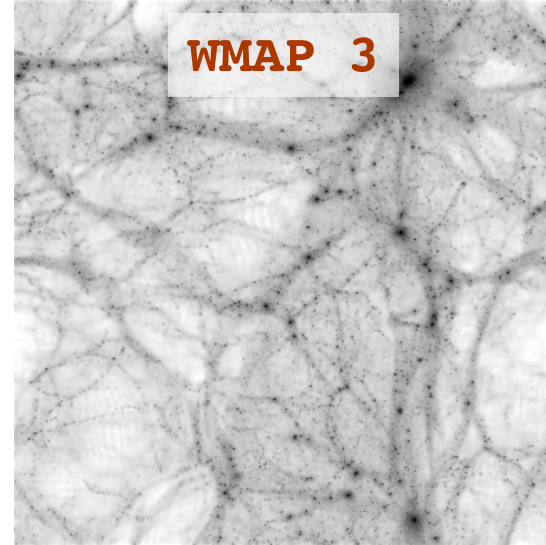
$$\Omega_m = 0.3 / 0.26$$

$$\Omega_\Lambda = 0.7 / 0.74$$

$$\sigma_8 = 0.84 / 0.74$$

$$h = 0.7 / 0.7$$

**BUT** same ICs!

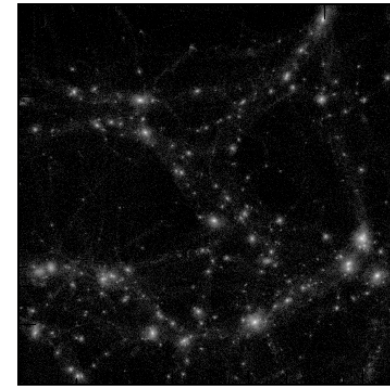
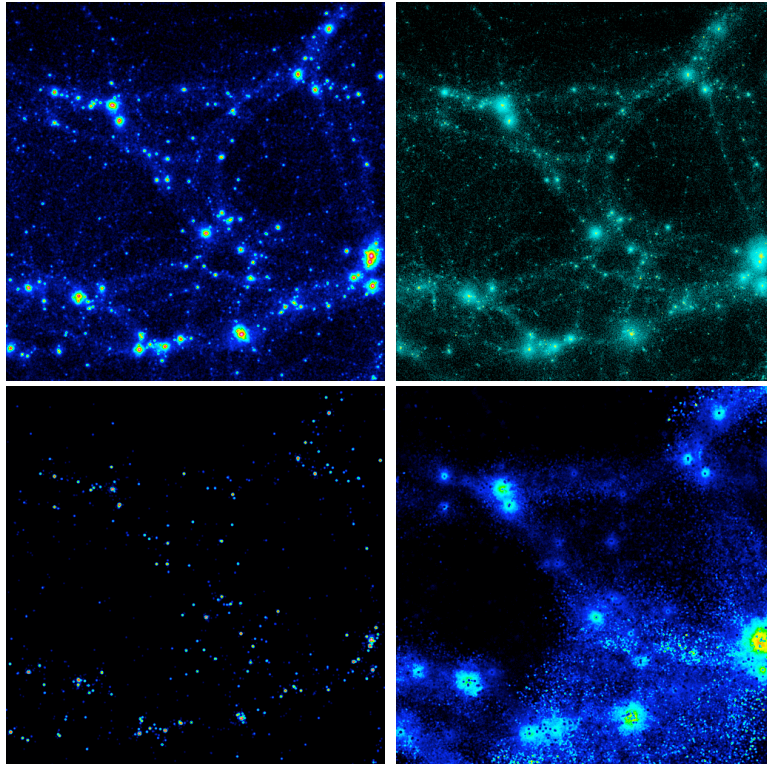


**WMAP 3**

	<b>Gadget 2</b>	<b>RAMSES</b>
Box size	20/100/500 h <sup>-1</sup> Mpc	20/100/500 h <sup>-1</sup> Mpc
Nb of particles	128/256/512 <sup>3</sup> <b>1024<sup>3</sup></b>	128/256/512 <sup>3</sup> <b>1024<sup>3</sup></b>
Particle mass	10 <sup>6</sup> to 8 x 10 <sup>12</sup> M <sub>⊙</sub>	10 <sup>6</sup> to 8 x 10 <sup>12</sup> M <sub>⊙</sub>

# Zoom simulations

Aubert / Pichon / Revaz / Teyssier / Semelin (2006)



DM haloes extracted from previous cosmic simulations and resimulated at much higher resolution

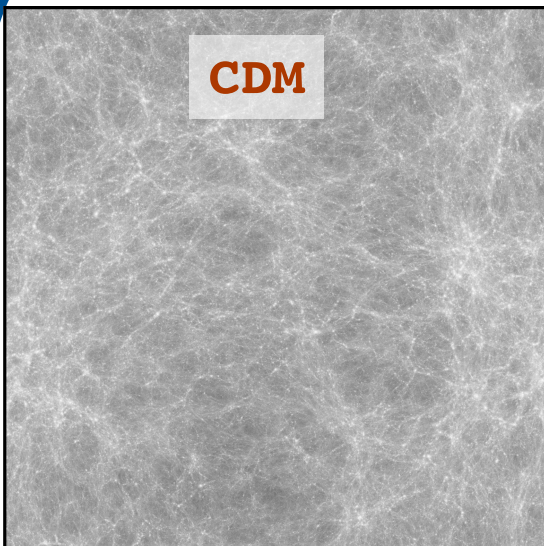
**Halo FOF # 6133**

Gadget 2, RAMSES, multi-zoom



# The Mare Nostrum simulation

Aubert / Audit / Devriendt / Pichon / Teyssier (2006)



## Cosmology

$$\Omega_m = 0.3$$

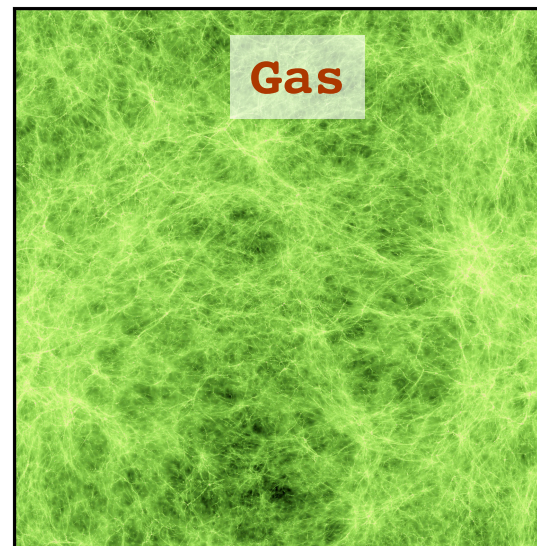
$$\Omega_\Lambda = 0.7$$

$$\sigma_8 = 0.9$$

$$h = 0.7$$

NB: Gadget2 too!

@  $z = 4$



	<b>RAMSES</b>
Box size	50 h <sup>-1</sup> Mpc
Nb of particles / grid cells	1024 <sup>3</sup> / 1024 <sup>3</sup> + 4 AMR levs
Particle mass / spatial res.	1 x 10 <sup>7</sup> M <sub>⊙</sub> / ≈ 1 kpc phys.

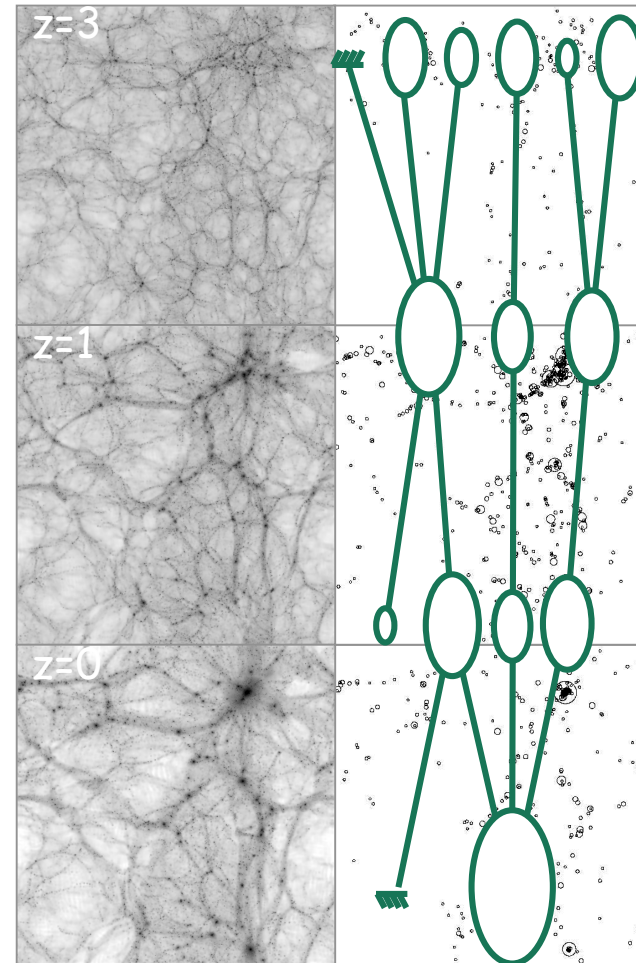
# From particles to galaxies

From particles to  
« haloes »

Halo identification (FOF) and  
characterisation (Mass, Spin,  
Energies, etc.)

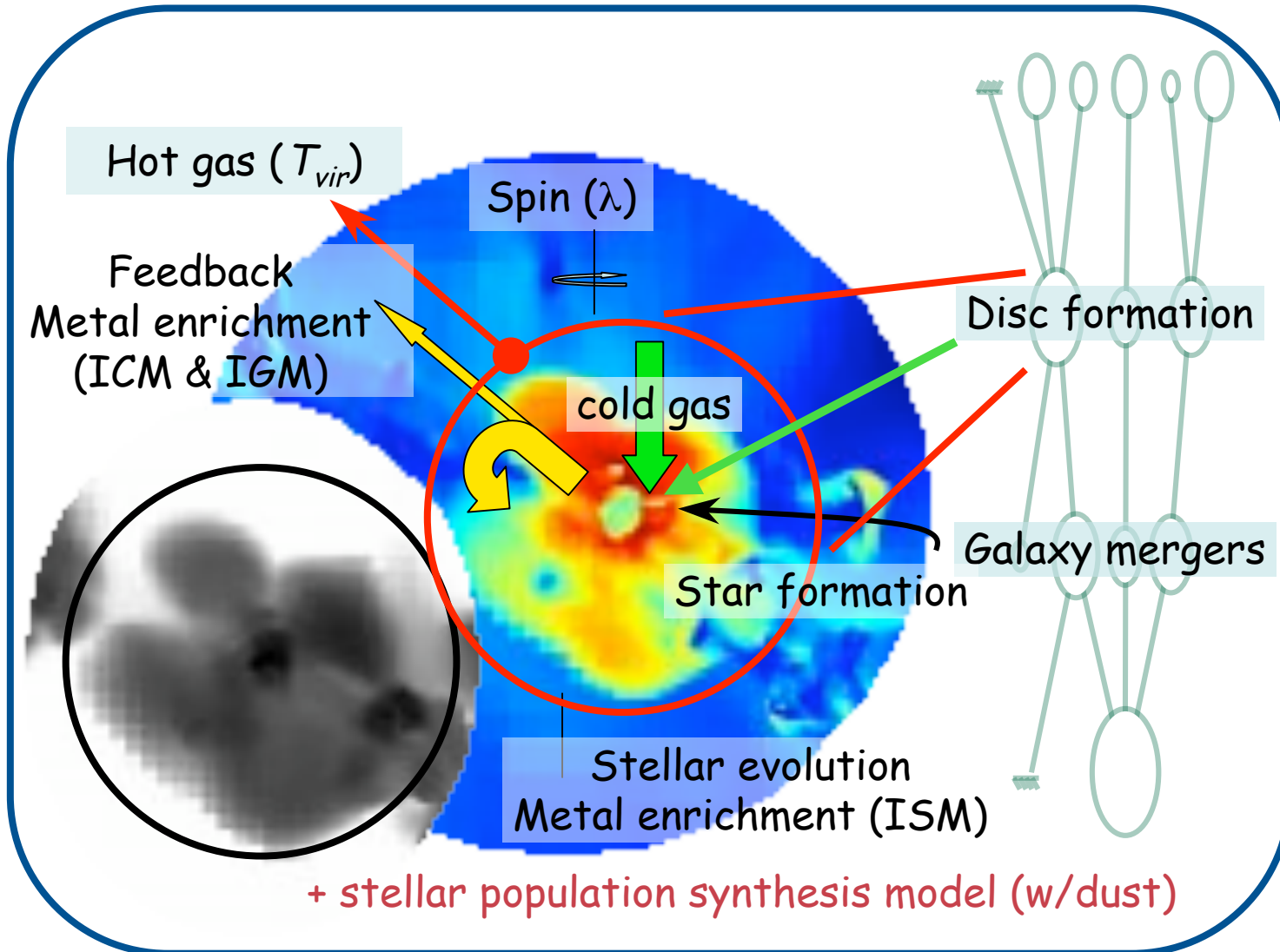
From density evolution  
to merger trees

Construction of a full merger  
tree (mergers, accretion,  
fragmentation, evaporation)



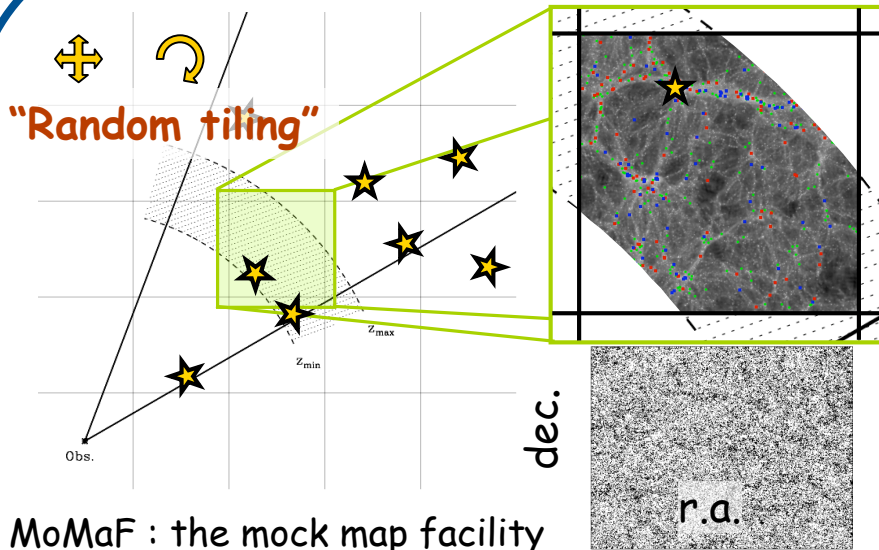


# ... vs hydro (MN) sim

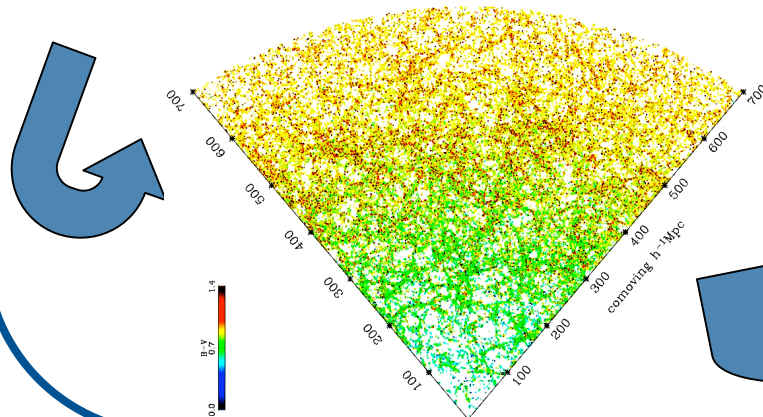




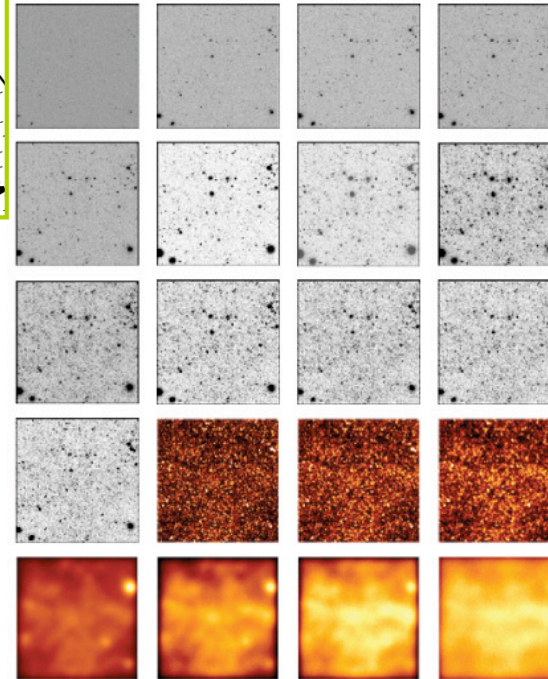
# ... to mock images



MoMaF : the mock map facility  
Blaizot et al. 2005



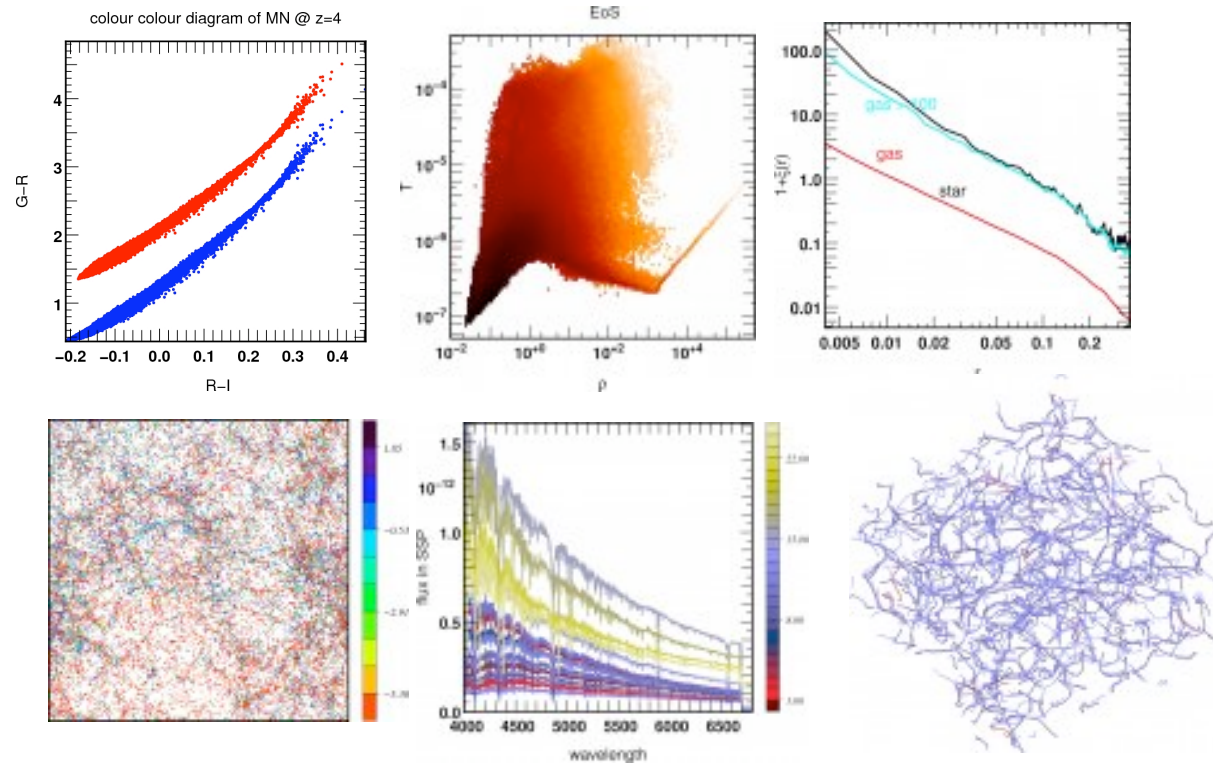
SDSS





# Example science with MN

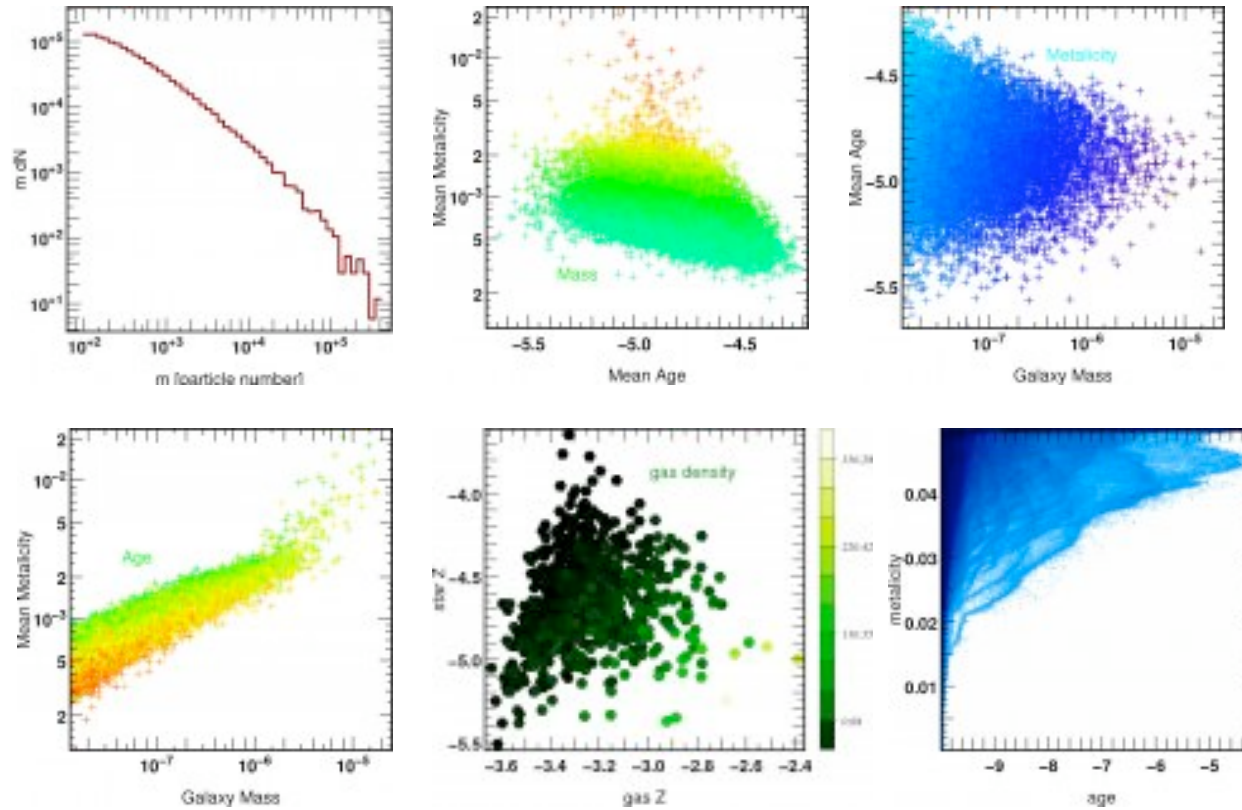
Aubert / Audit / Devriendt / Pichon / Sémelin / Teyssier (2006)



+ post-treatment radiative transfer ( with moments method developed by Gonzalez & Audit) to do EoR and 21 cm line

# ... examples cont'd

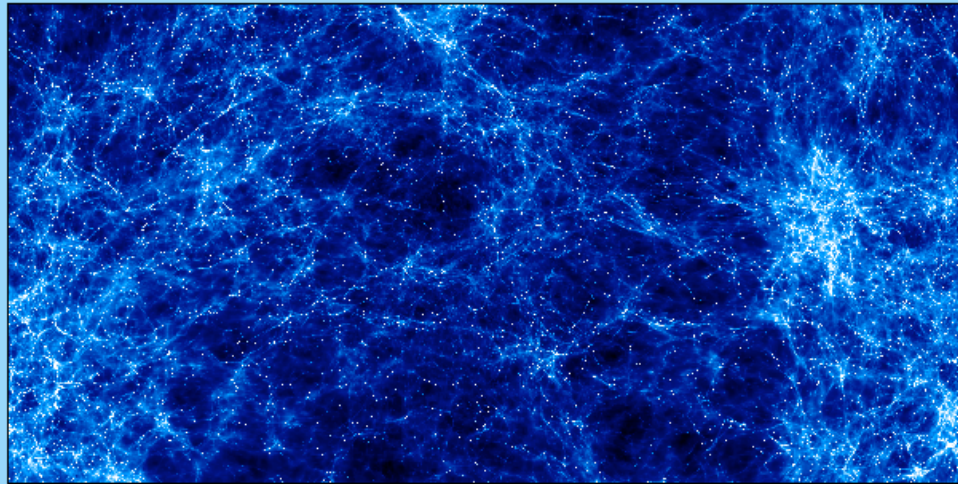
Aubert / Audit / Devriendt / Pichon / Sémelin / Teyssier (2006)



... in the Horizon database

## *The Horizon Database*

Le Fèvre, Wozniak, Guiderdoni



Welcome to the Horizon database home page !  
It gives access to the results of various simulations.

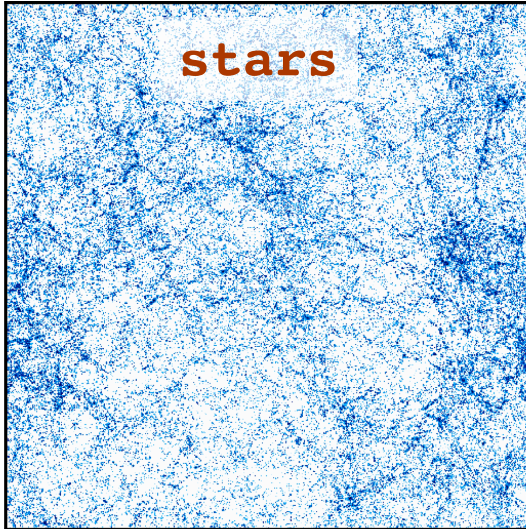
Please [login](#) to proceed ...

[Back](#) to the Horizon main page.

Contact : [Jean-Paul Le Fèvre](#).

# In progress: cosmic hydro sims

Aubert / Pichon / Teyssier (2006)



2 ≠ cosmologies

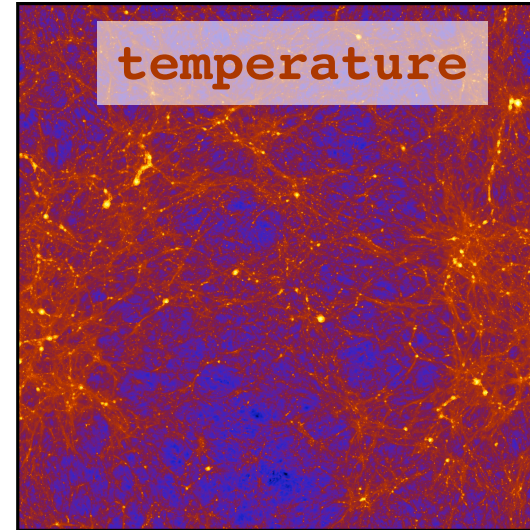
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