Analysis of two multiple cluster systems detected with SZ effect and observed with VLT/VIMOS

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Introduction : Cosmological generalities

PLCKG214.6+37.0 (or PLCK1) and PLCKG334.8-38.0 (or PLCK2)

Results from VIMOS analysis

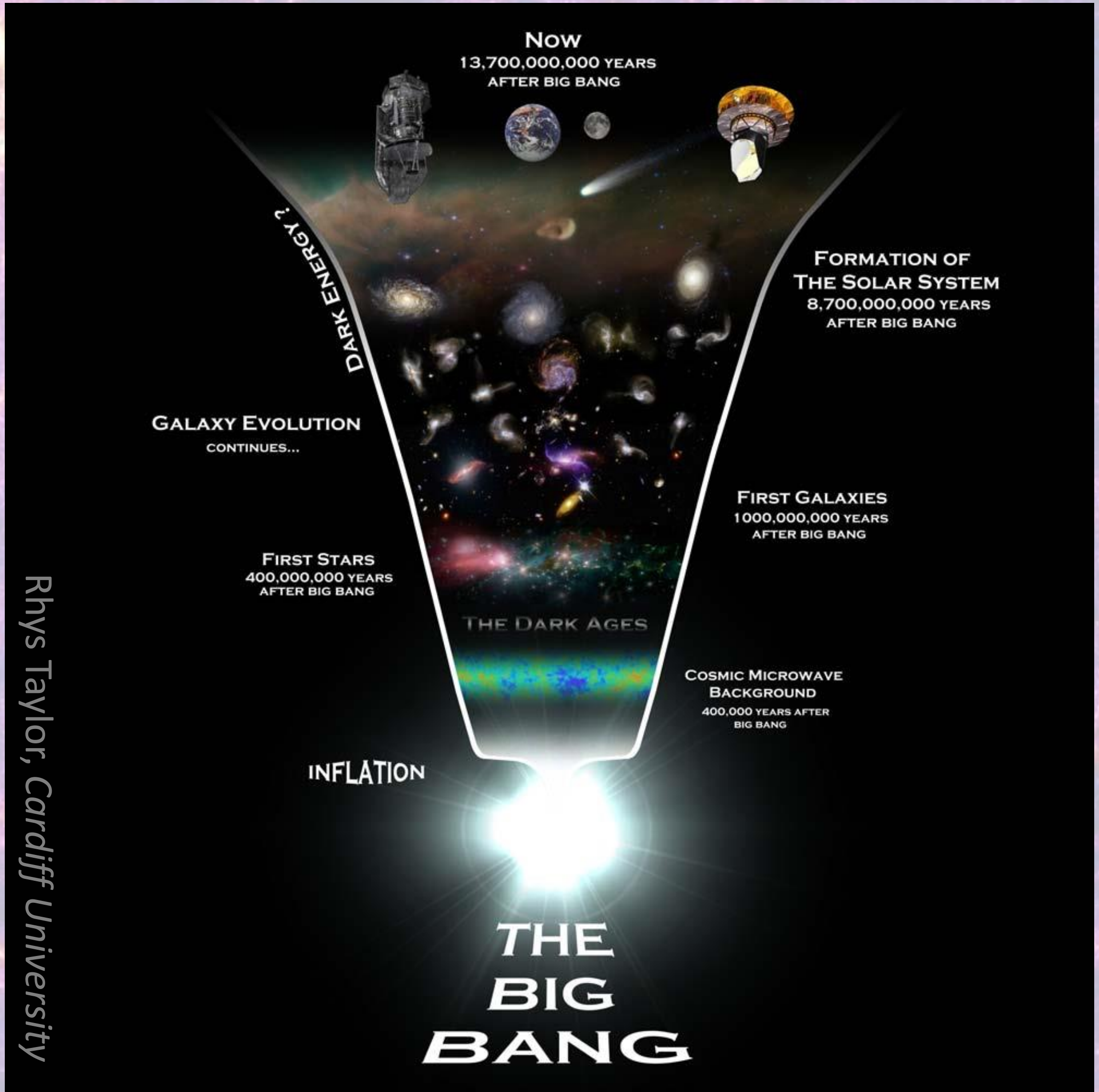
Future prospects, baryons as a cosmological probe

Conclusion

Introduction : Cosmological generalities

We use a cosmological model : Λ-CDM

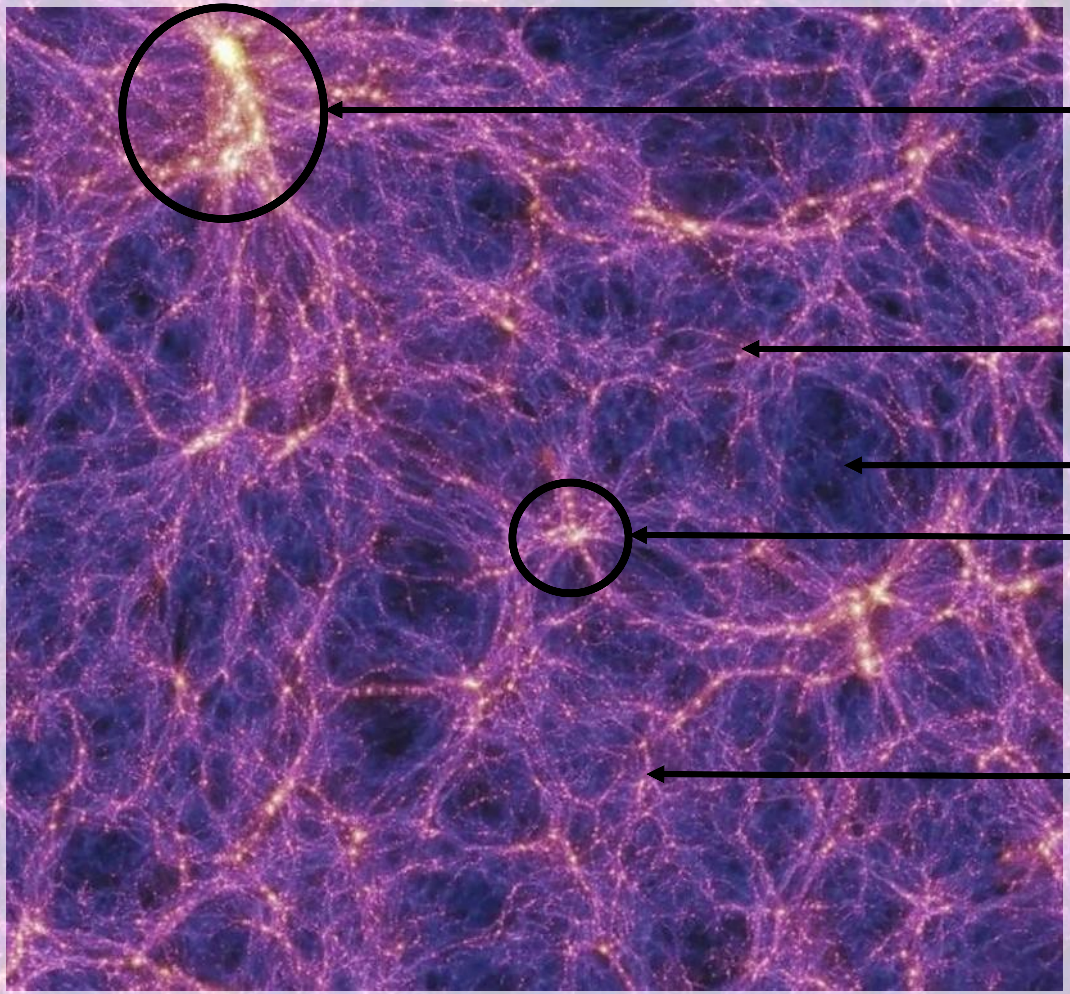
Describes the universe and its evolution thanks to cosmological parameters



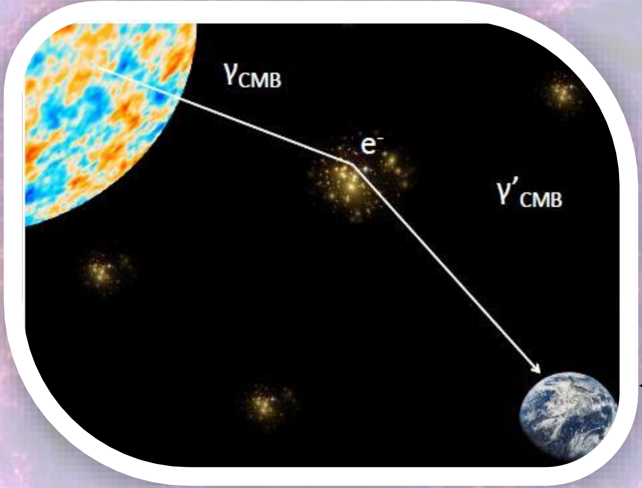
Introduction : Cosmological generalities

Thanks to these parameters and gravitation, it is possible to understand the formation of the large scale structure inside the cosmic web.

=> Hierarchical formation

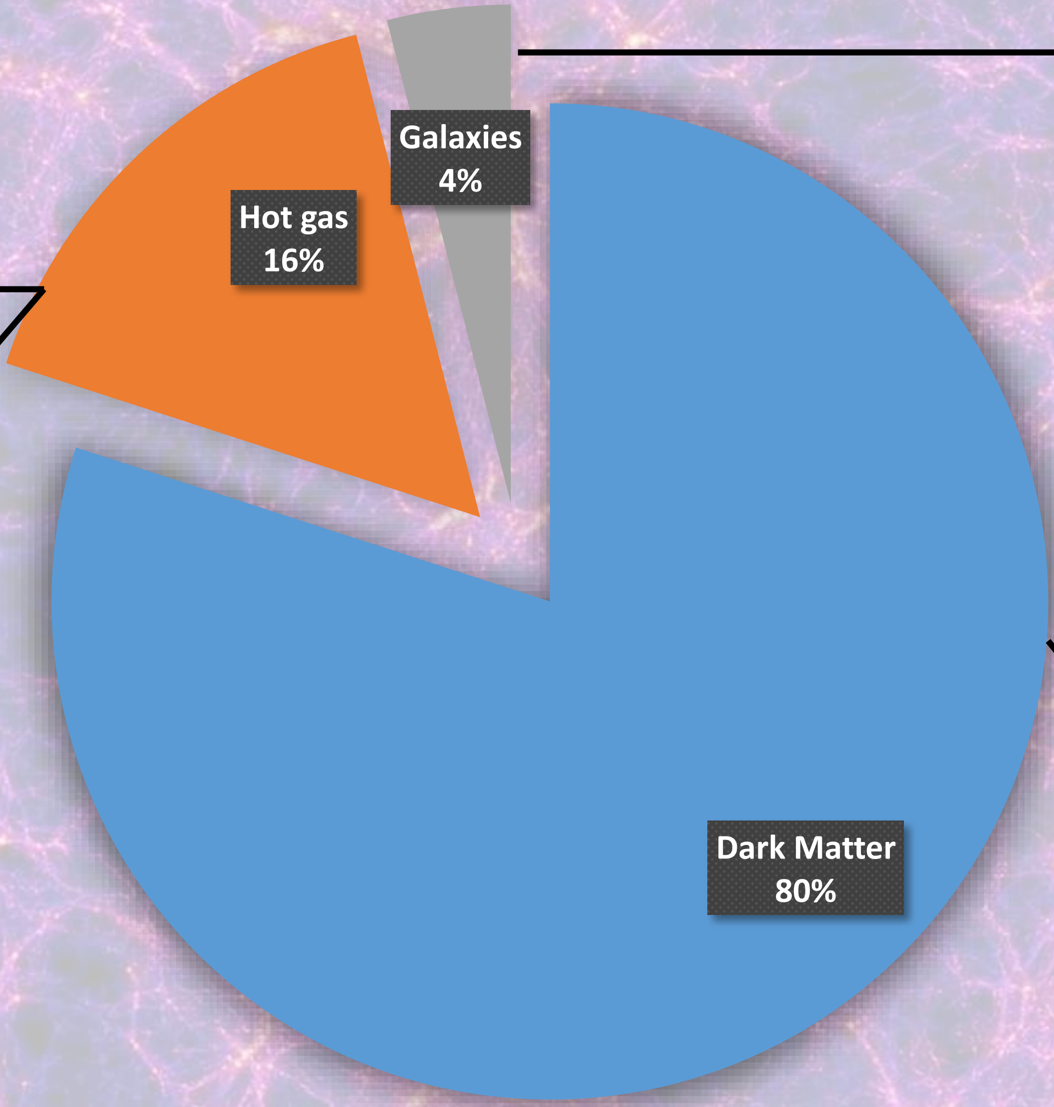


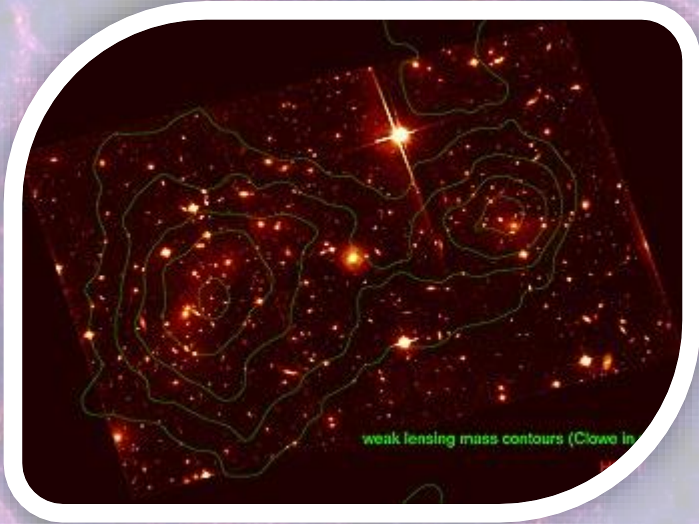
Composition of a galaxy cluster



Sunyaev-Zel'dovich effect (SZ)

Chandra

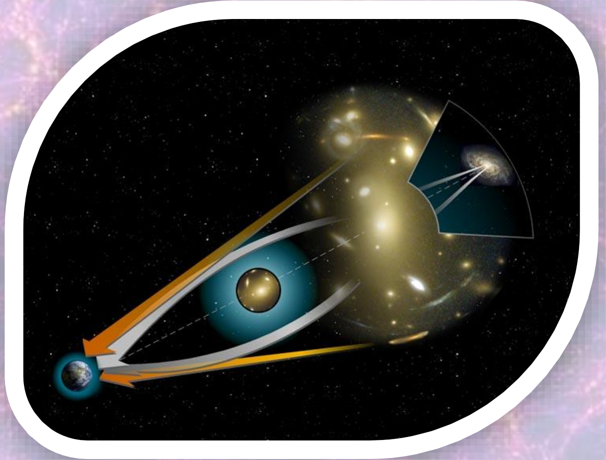




Optical

HST, Clowe

X-rays



Gravitational effects

PLCKG214.6+37.0 (or PLCK1) and PLCKG334.8-38.0 (or PLCK2)

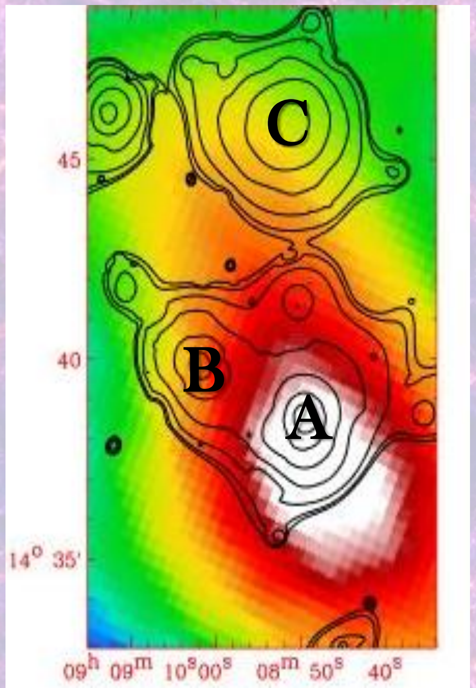
Two multiple cluster systems, discovered in *Planck* SZ data, in 2011.

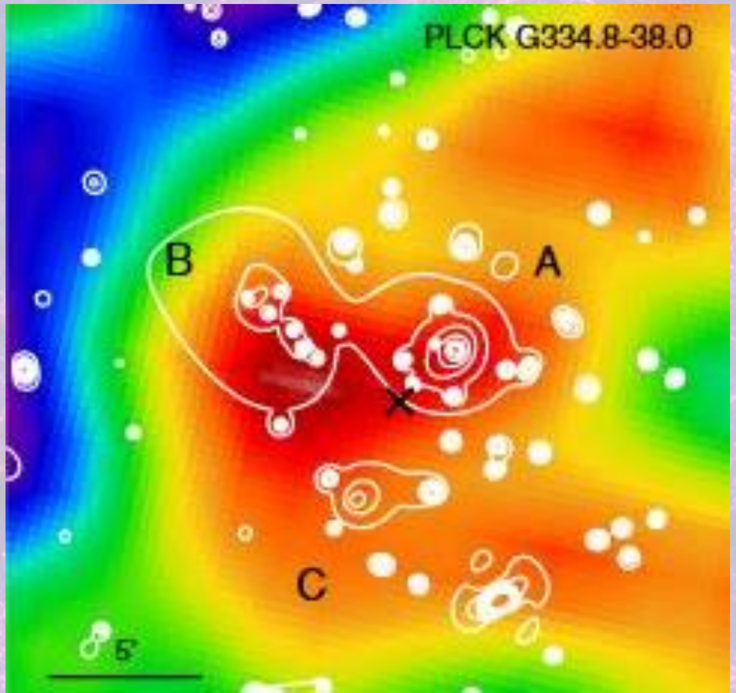
Multiple nature revealed by short XMM-*Newton* observations in 2011.

Observed again in 2013, in X-ray (XMM-Newton) and optical spectroscopy (VIMOS)

Planck Collab. 2011

Planck Collab. 2013





Colored : *Planck* SZ data
Contours : XMM-*Newton* X-ray data

Left : PLCK1
Right : PLCK2

$z_{PLCK1} \simeq 0{,}45$ (slight doubt on B) *Planck Collab. 2013*

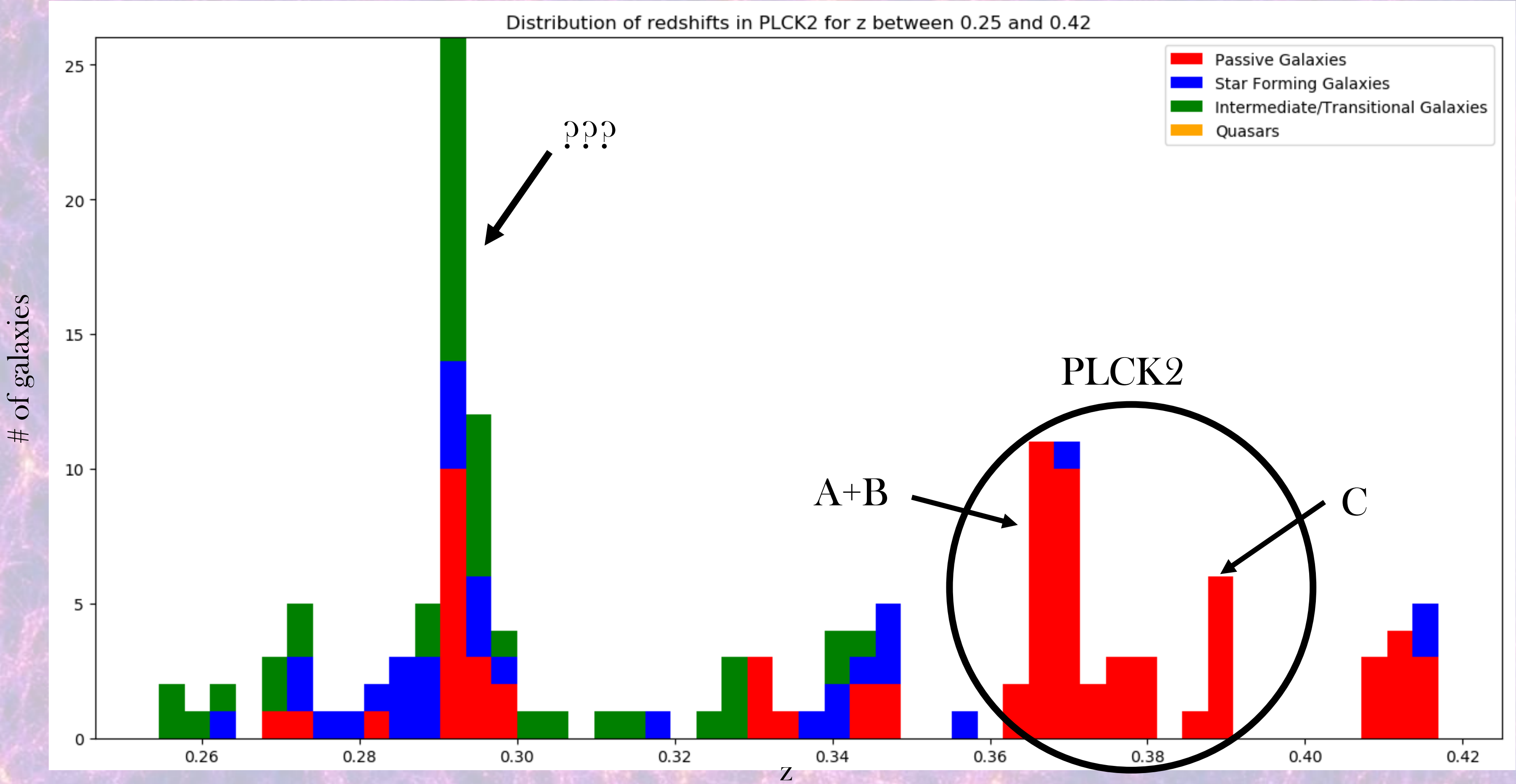
$z_{PLCK2} \simeq 0{,}35$ *Planck Collab. 2011*

PLCK2

Main idea behind the optical analysis : properly constrain the redshifts of the systems. Here, using the online tool marz.

There seems to be a separation between the components C and the rest of the system...

But a lot of parasite effects

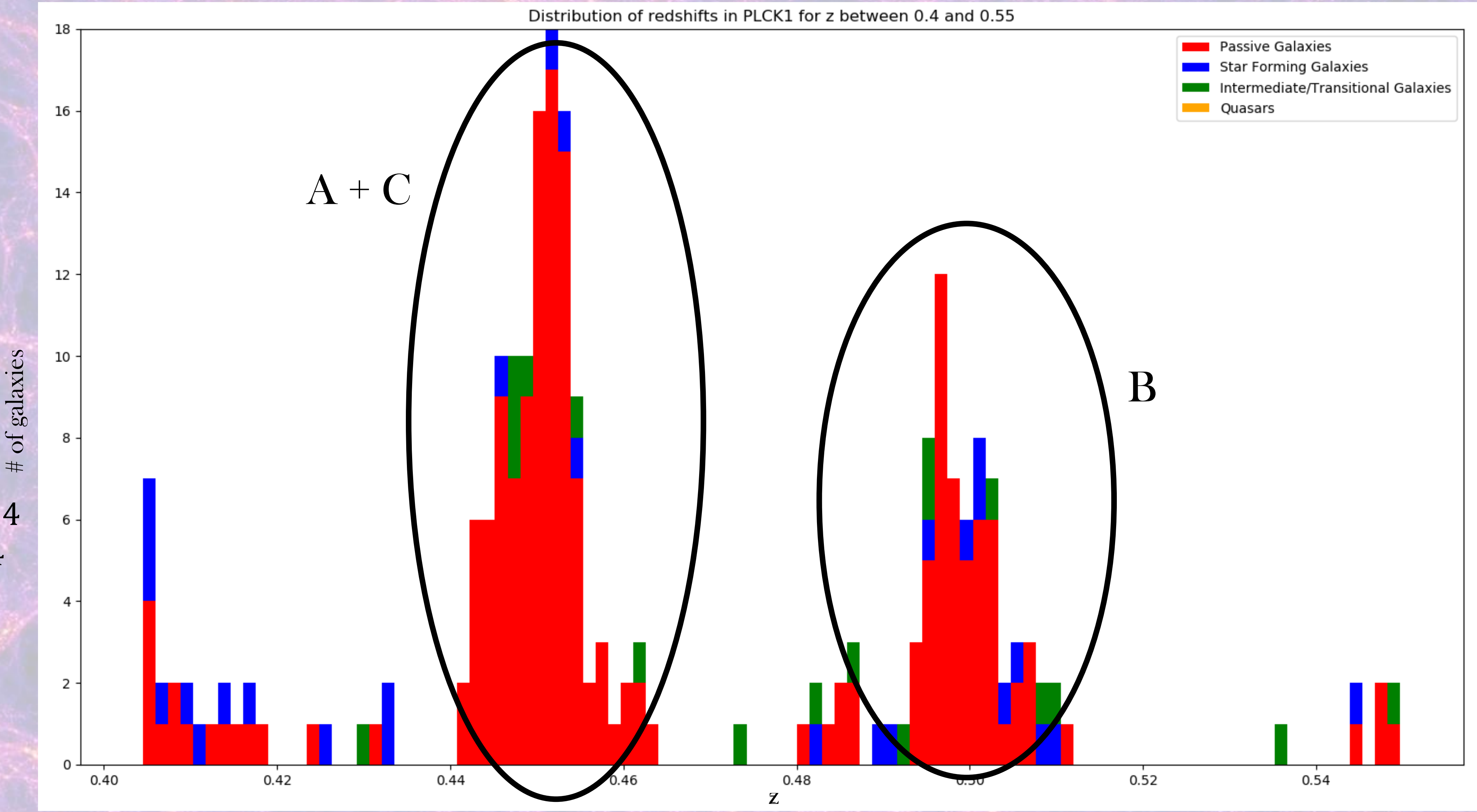


PLCK 1

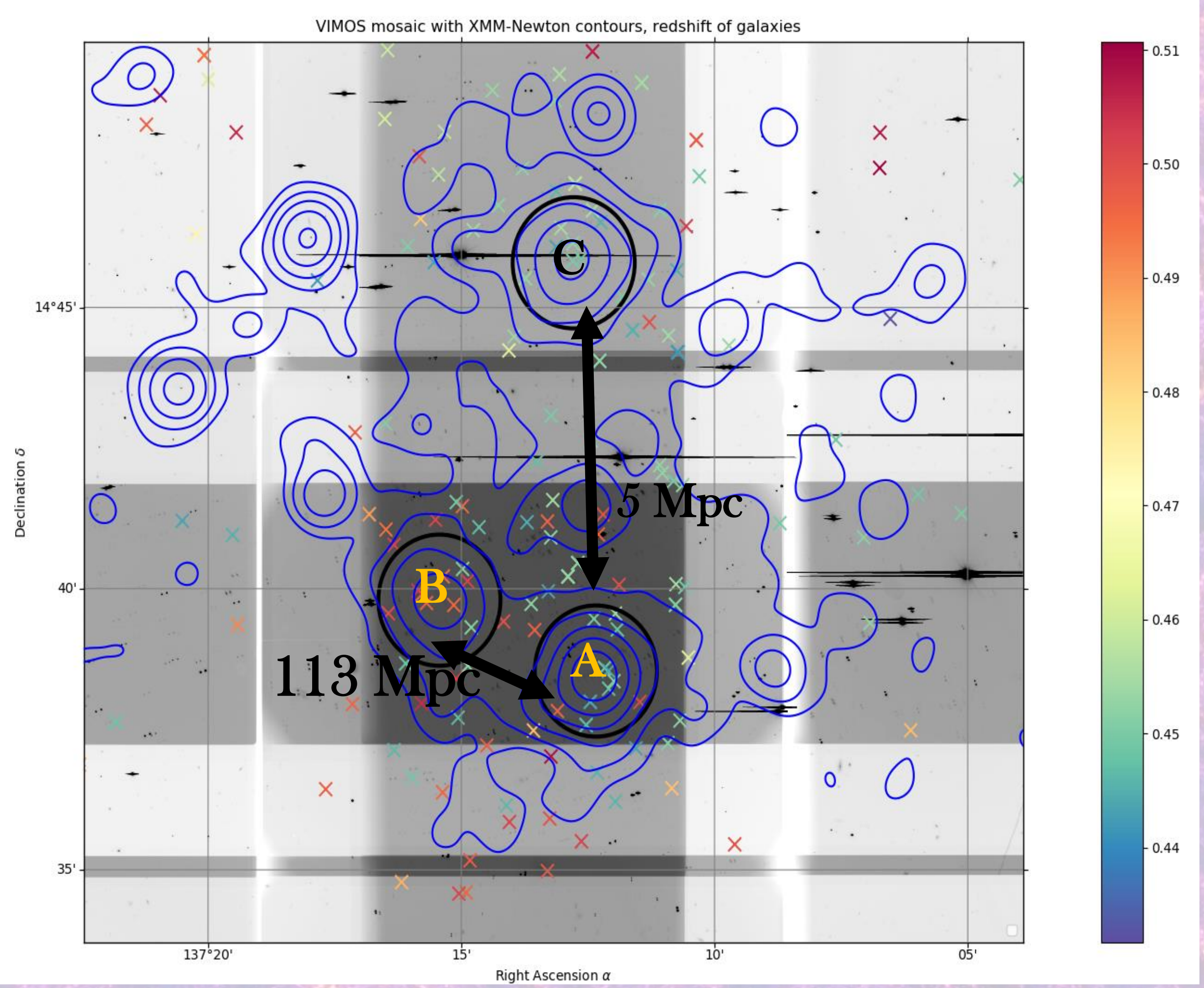
Clear separation between the "A-C pair" and the "cluster B" !

$$z_{A-C} = 0{,}450 \pm 0{,}004$$
$$z_B = 0{,}498 \pm 0{,}004$$

(Lecoq et al. in prep)



PLCK 1



X-Ray contours : courtesy of Edouard Lecoq

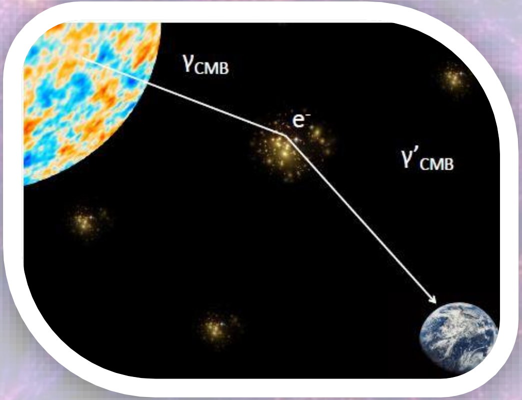
Gas as seen by XMM-*Newton* (X-ray contours) vs Galaxies seen by VIMOS (optical)

Next steps:

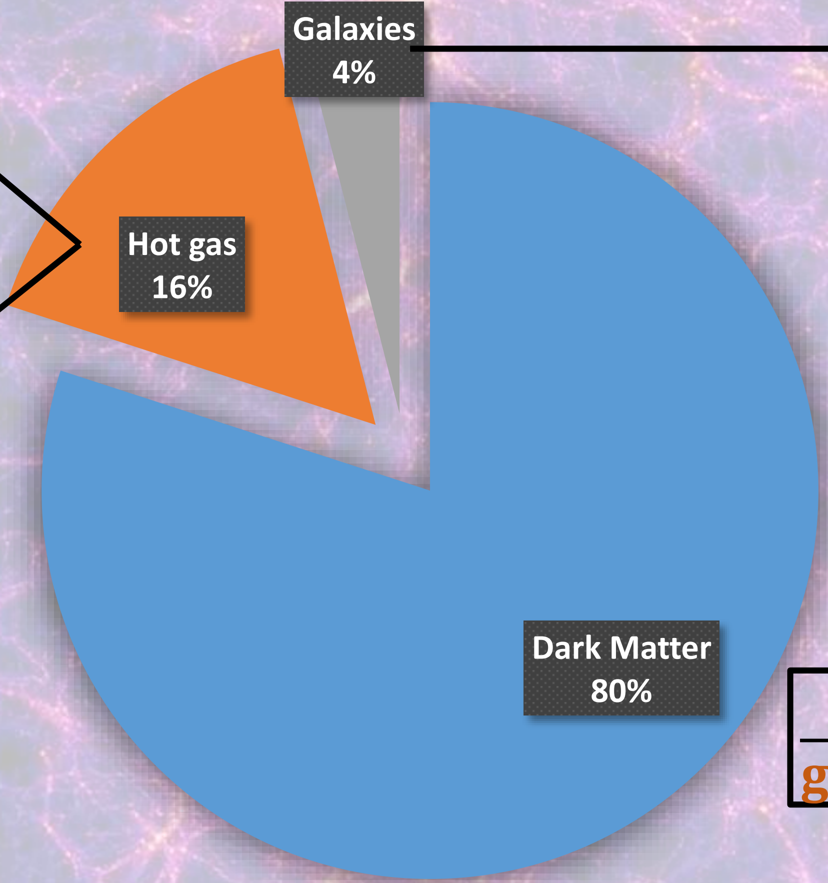
- Computing Star Formation Rates and stellar masses with SED fitting
- Analysing the SZ contribution
- Going further with PLCK2

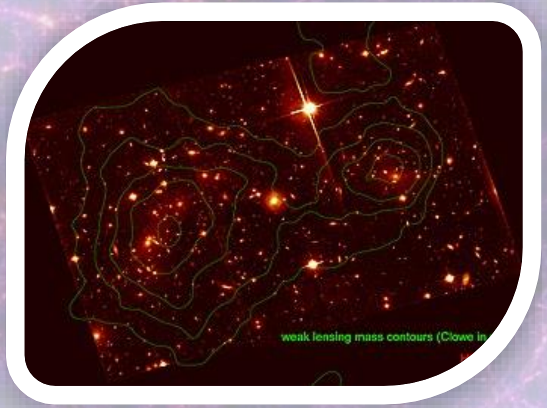
Future prospects, baryons as a cosmological probe

Composition of a galaxy cluster



Sunyaev-Zel'dovich effect (SZ)





Optical

HST, Clowe

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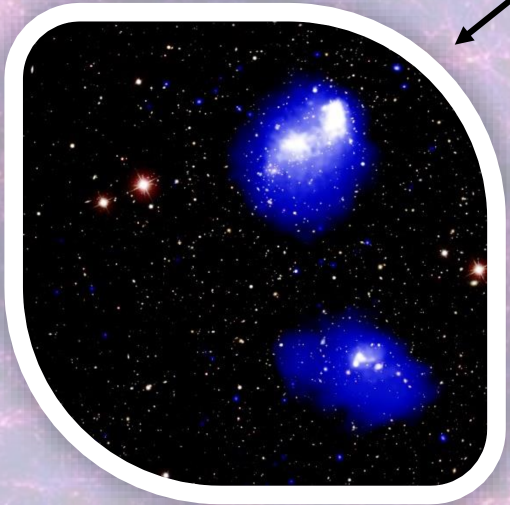
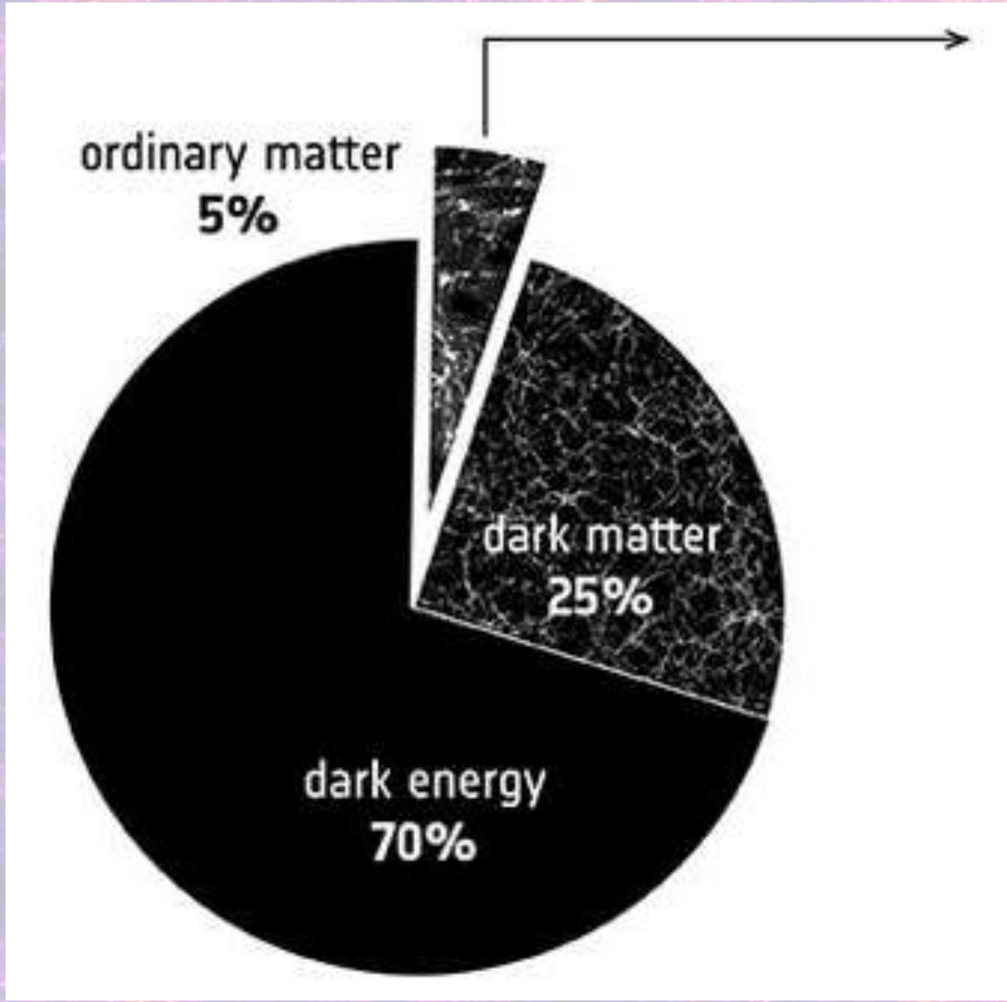


X-rays

$$\frac{\text{gas} + \text{galaxies}}{\text{gas} + \text{gal.} + \text{D. M.}} = \textbf{Baryon fraction}$$

Future prospects, baryons as a cosmological probe

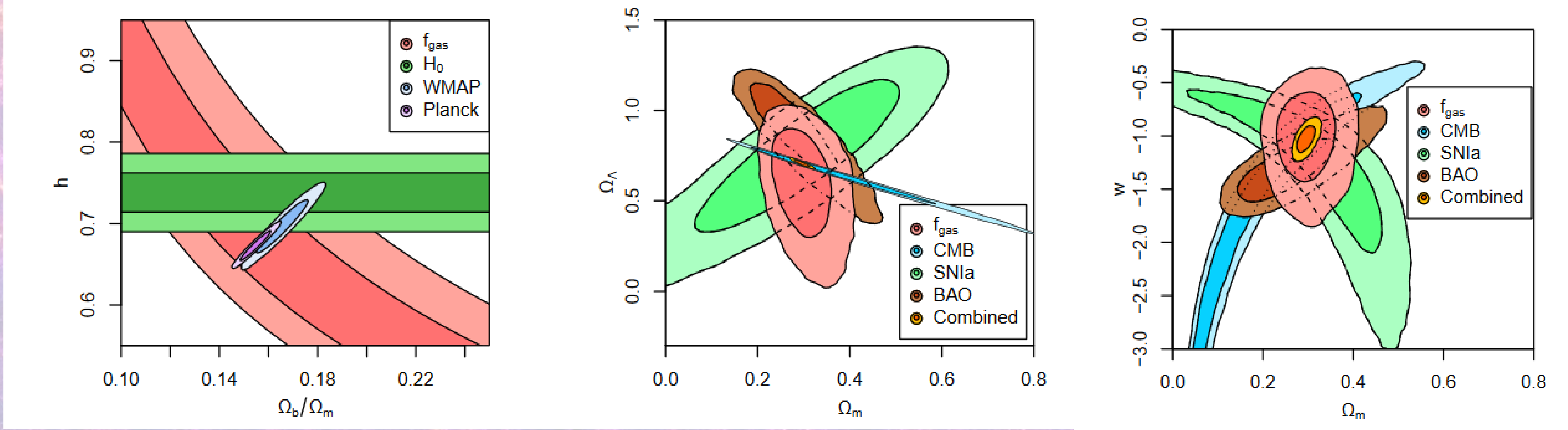


ESA

- Tiny fraction, but at the origin of all our observables
- Mass contained mainly in galaxy clusters

=> Carry a lot of cosmological information

The baryon/gas mass fraction in clusters can be used to constrain cosmological parameters, like Ω_m, H_0 etc.



Mantz et al. 2014

Need to be careful to systematics and non-cosmological effects

Conclusion

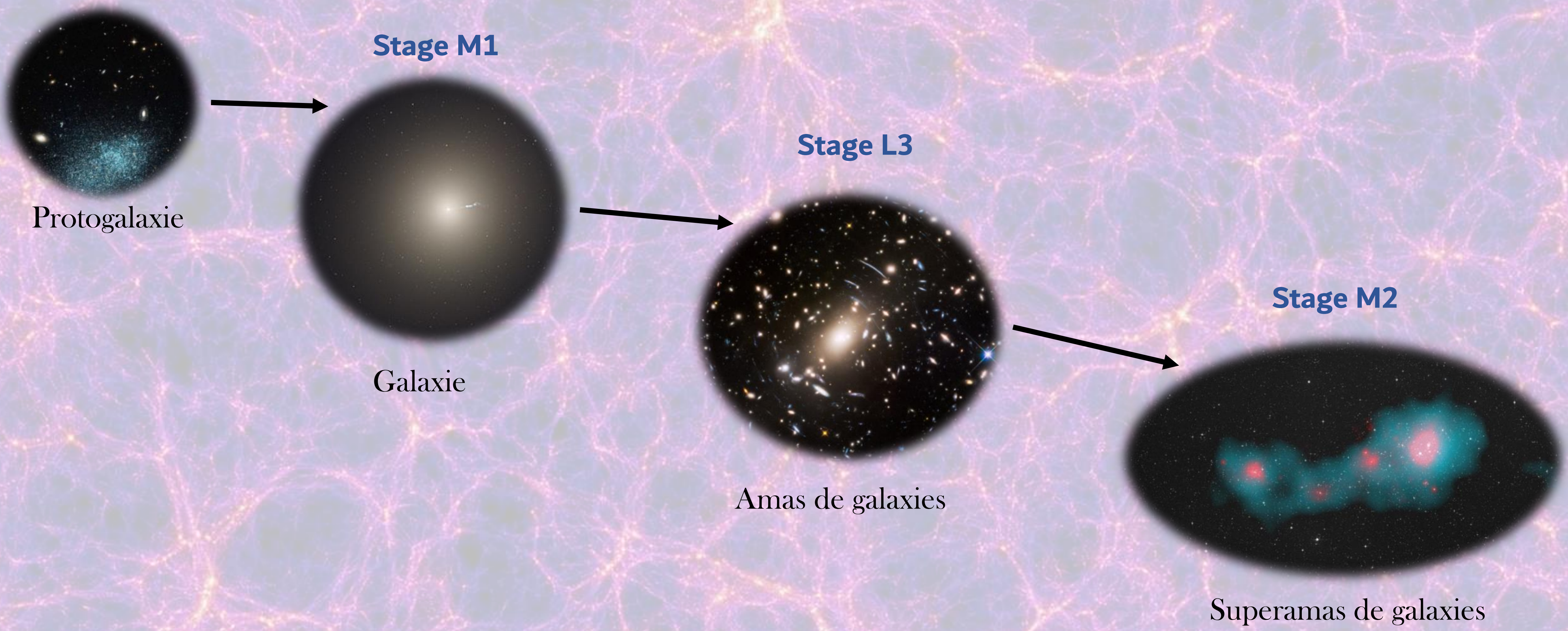
- Important results on the structure of the two first Planck discovered "triple systems"
- Analysis for two objects which may be repeated on other systems to constrain their baryon content and use it as a cosmological probe

Thank you very much !

3D DTFE map of PLCK1

BACKUP

Introduction : Cosmological generalities



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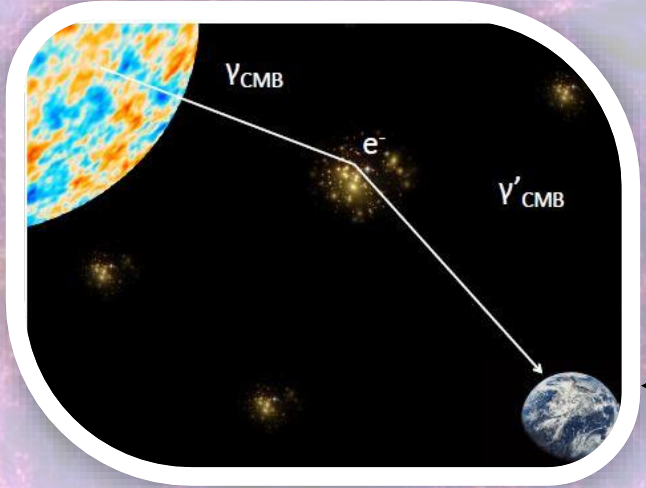

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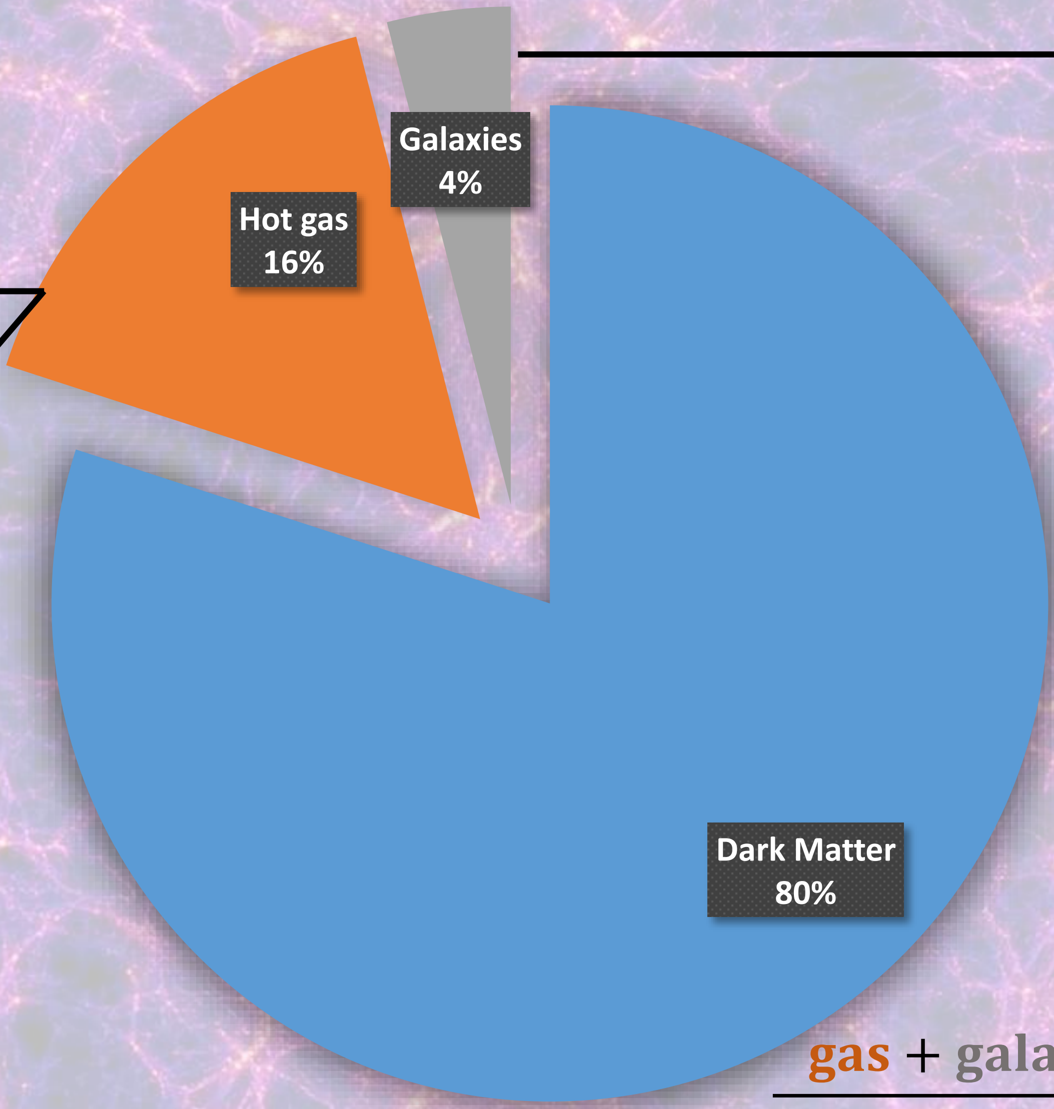

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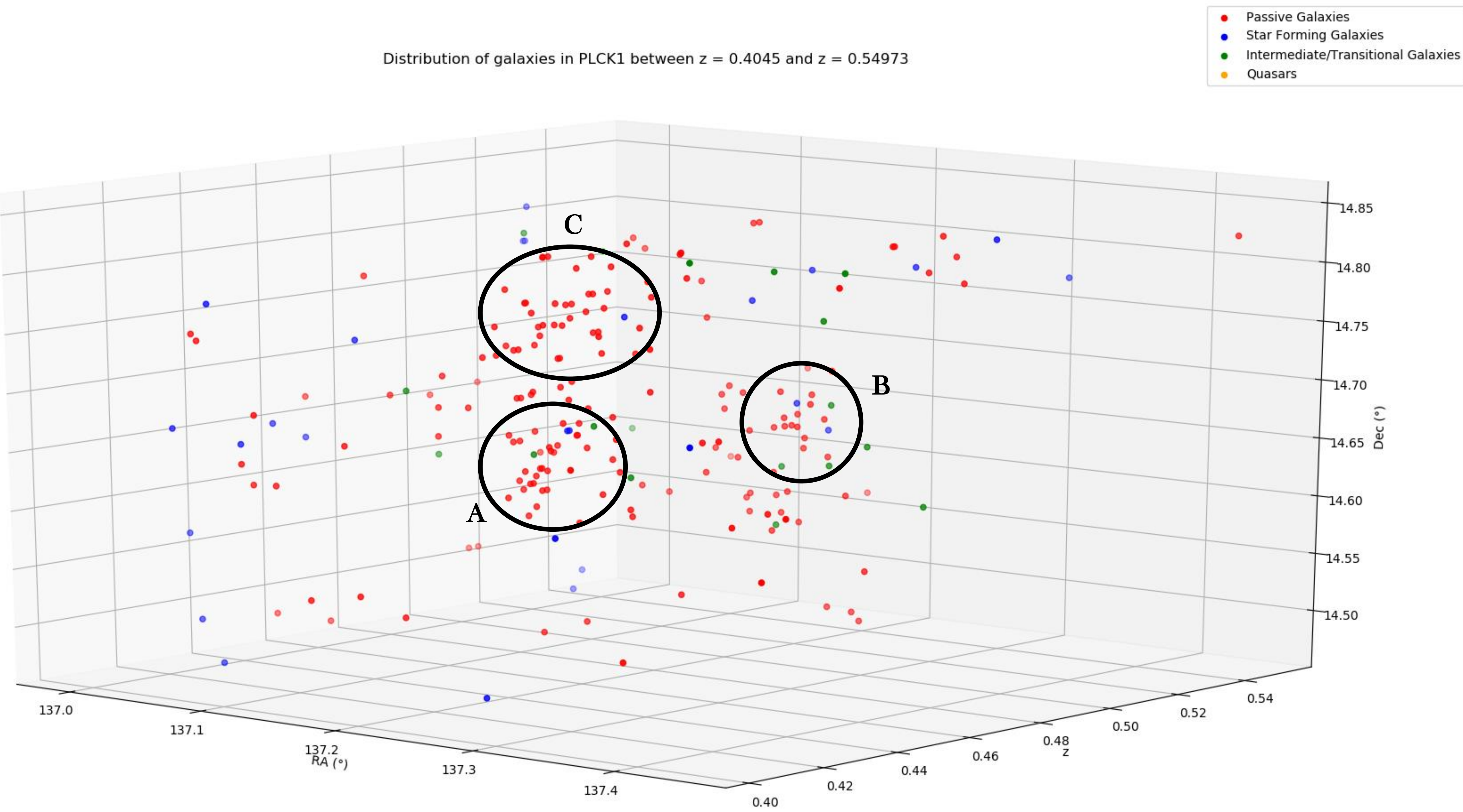
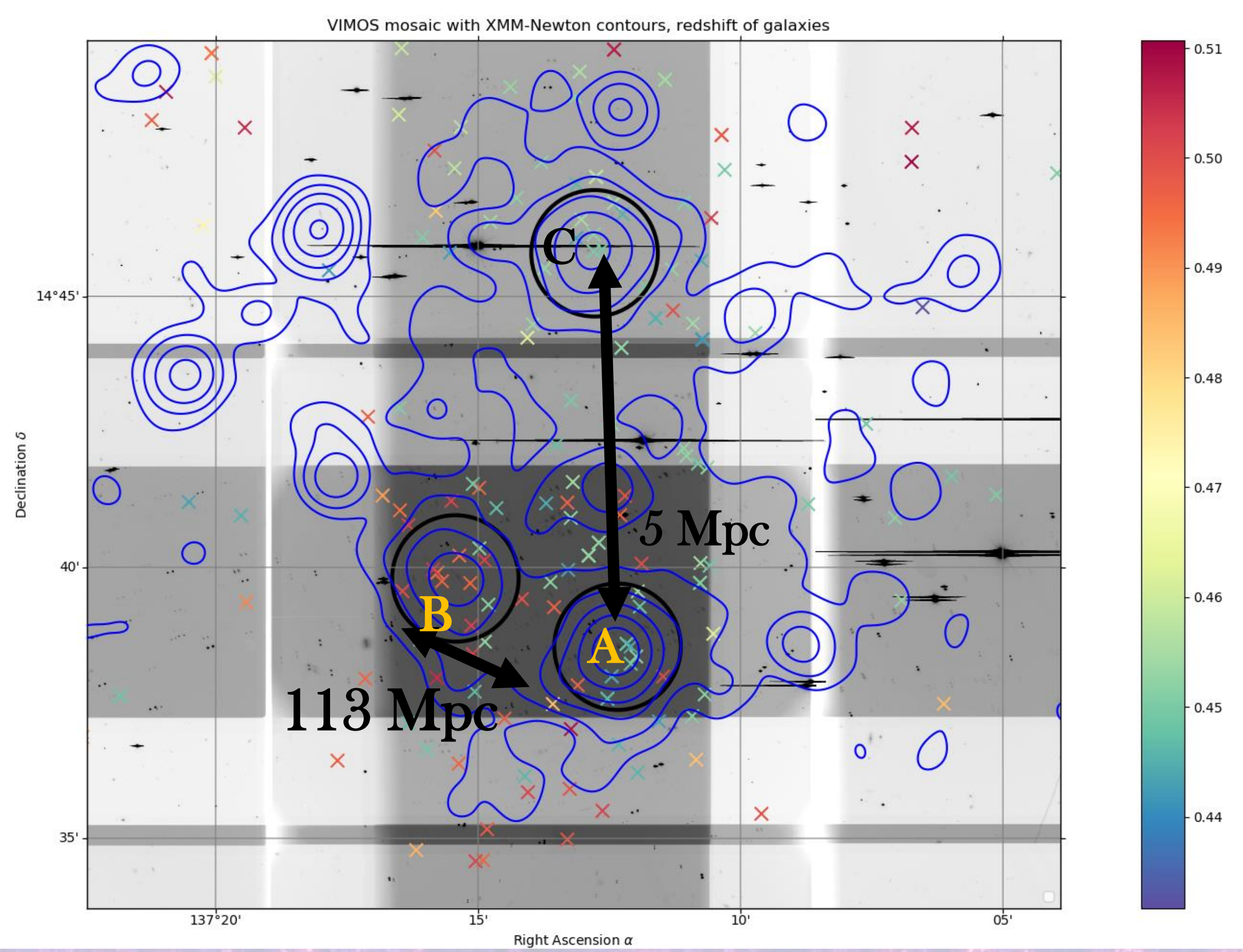


Distribution of galaxies in PLCK1 between z = 0.4045 and z = 0.54973
Passive Galaxies
Star Forming Galaxies
Intermediate/Transitional Galaxies
Quasars
A
B
C
RA (°)
137.0
137.1
137.2
137.3
137.4
z
0.40
0.42
0.44
0.46
0.48
0.50
0.52
0.54
Dec (°)
14.50
14.55
14.60
14.65
14.70
14.75
14.80
14.85



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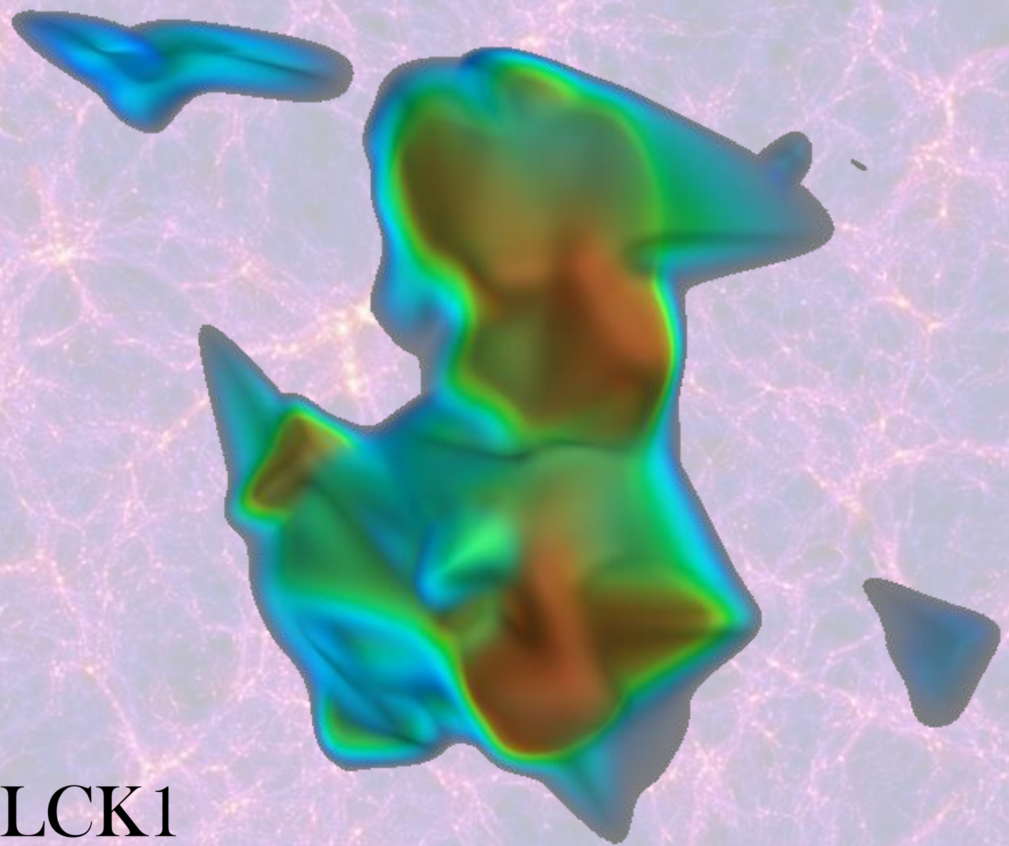
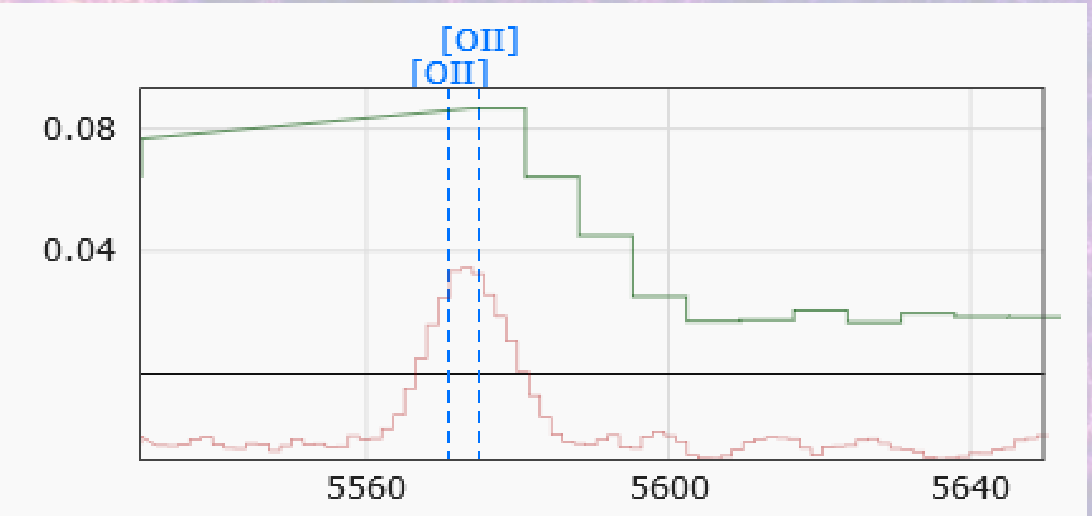


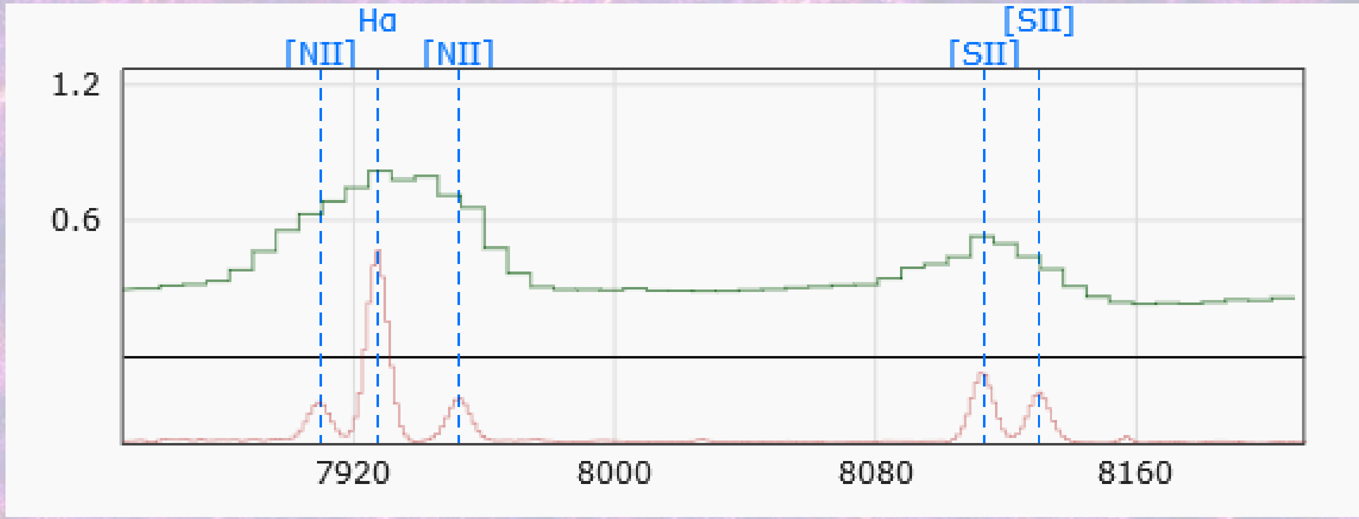
3D DTFE map of PLCK1

Why use SED fitting when we have spectroscopy ?

Main approach in spectroscopy to compute **SFR** : **Luminosity of Hα** line or **[OII]** line



[OII] line for a galaxy at z = 0,49 withour wavelength range and R



Hα line for our wavelength range and R