The Large-Scale Filament feeding the Massive Galaxy Cluster MACSJ0717.5+3745

XIth SCHOOL OF COSMOLOGY
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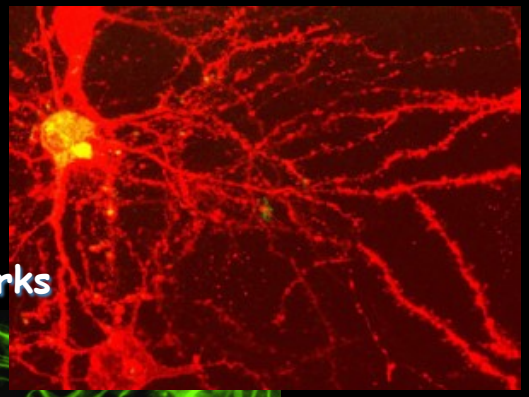
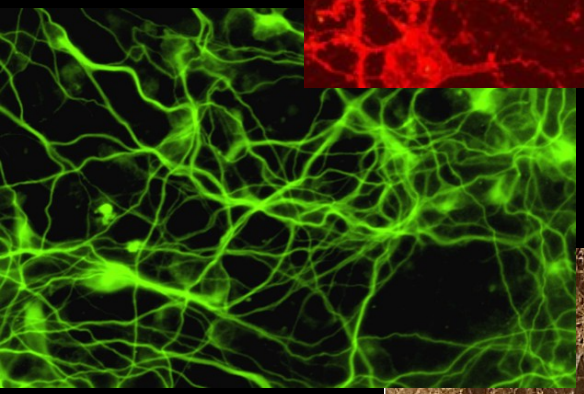
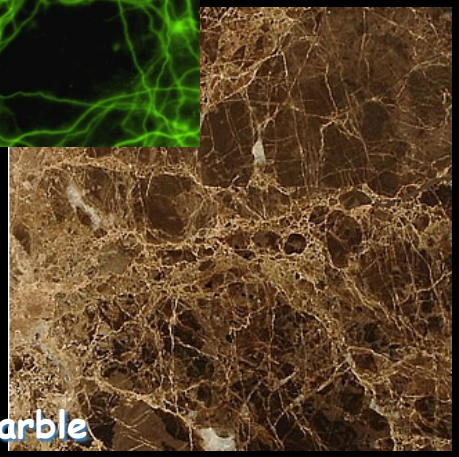
Cosmological Context …

- ✓ Large-scale Universe
  - complex structures → filamentary structures



Neural networks





Marble

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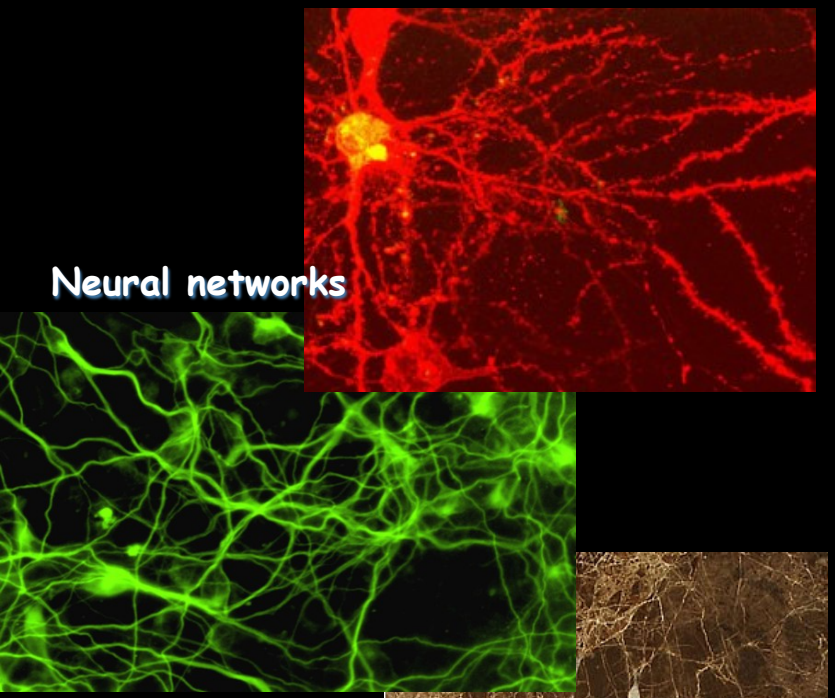

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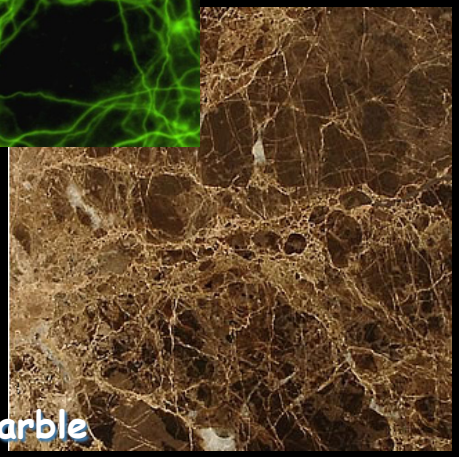

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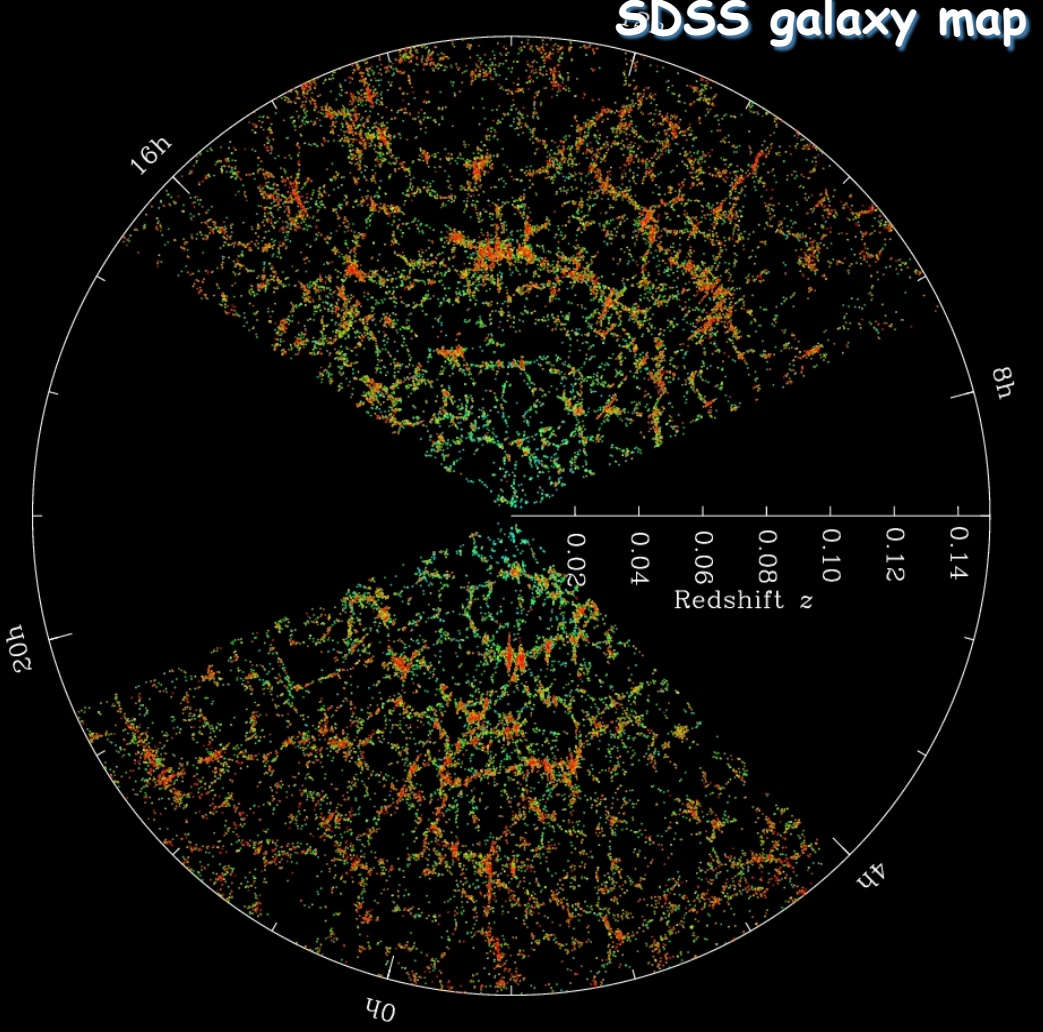

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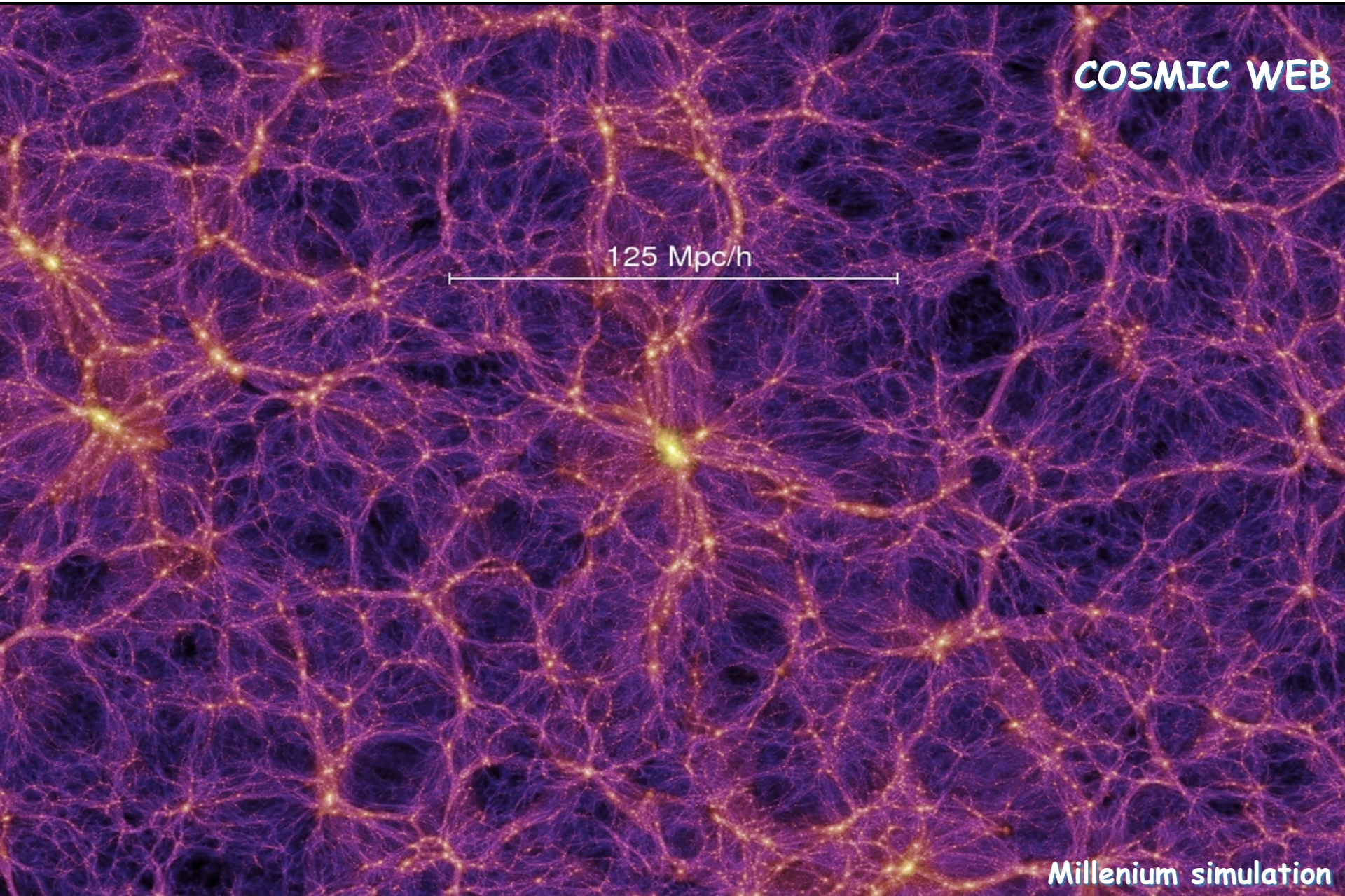
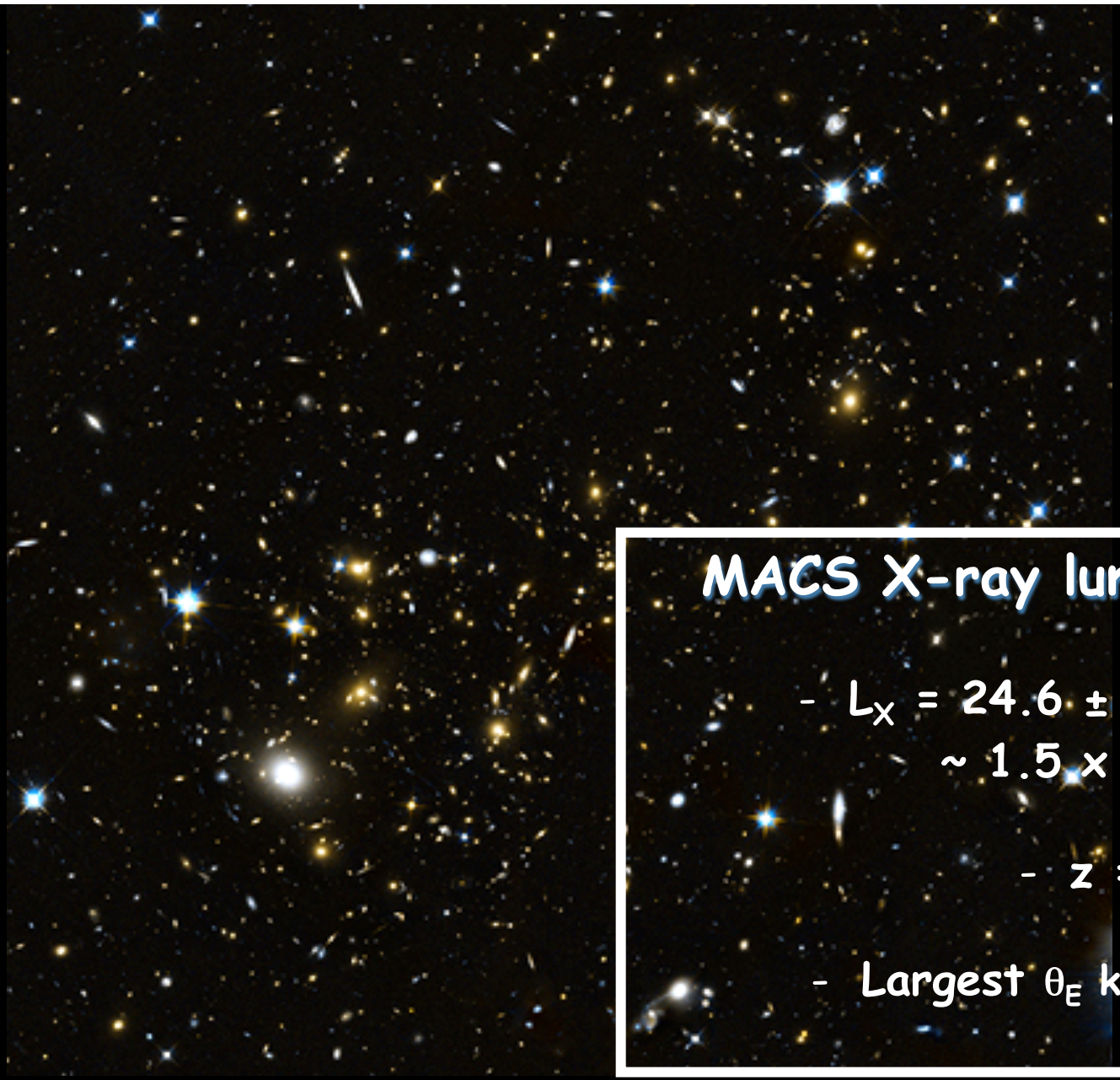


1. MACSJ0717.5+3745



MACS X-ray luminous cluster:

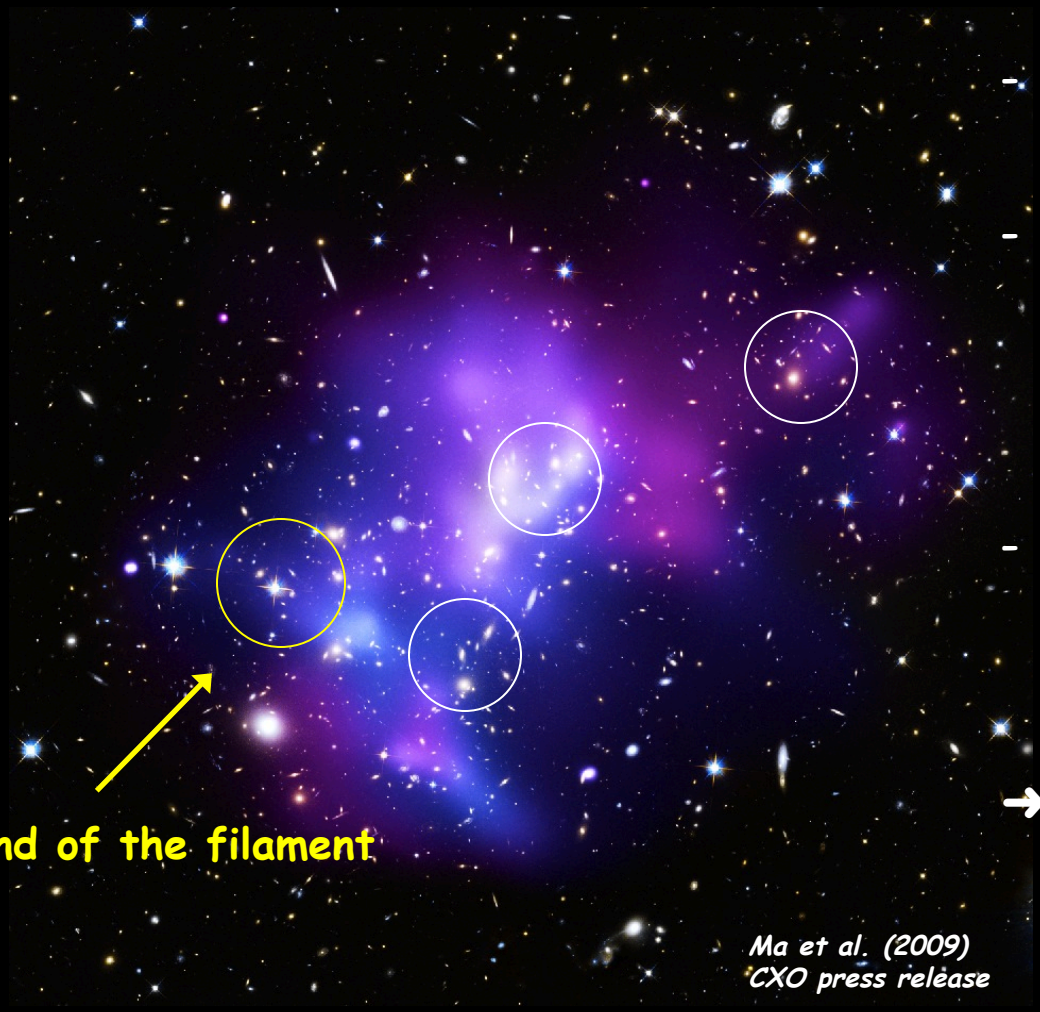
- $L_X = 24.6 \pm 0.3\ 10^{44}\ erg.s^{-1}$
  $\sim 1.5 \times L_{x\text{-}A1689}$

- $z = 0.55$

- Largest θ_E known : $\theta_E \sim 55$ ''
  $\theta_{E\text{-}A1689} \sim 45$ ''

2. MACSJ0717.5+3745 : Previous Analysis

Ma et al. 2009



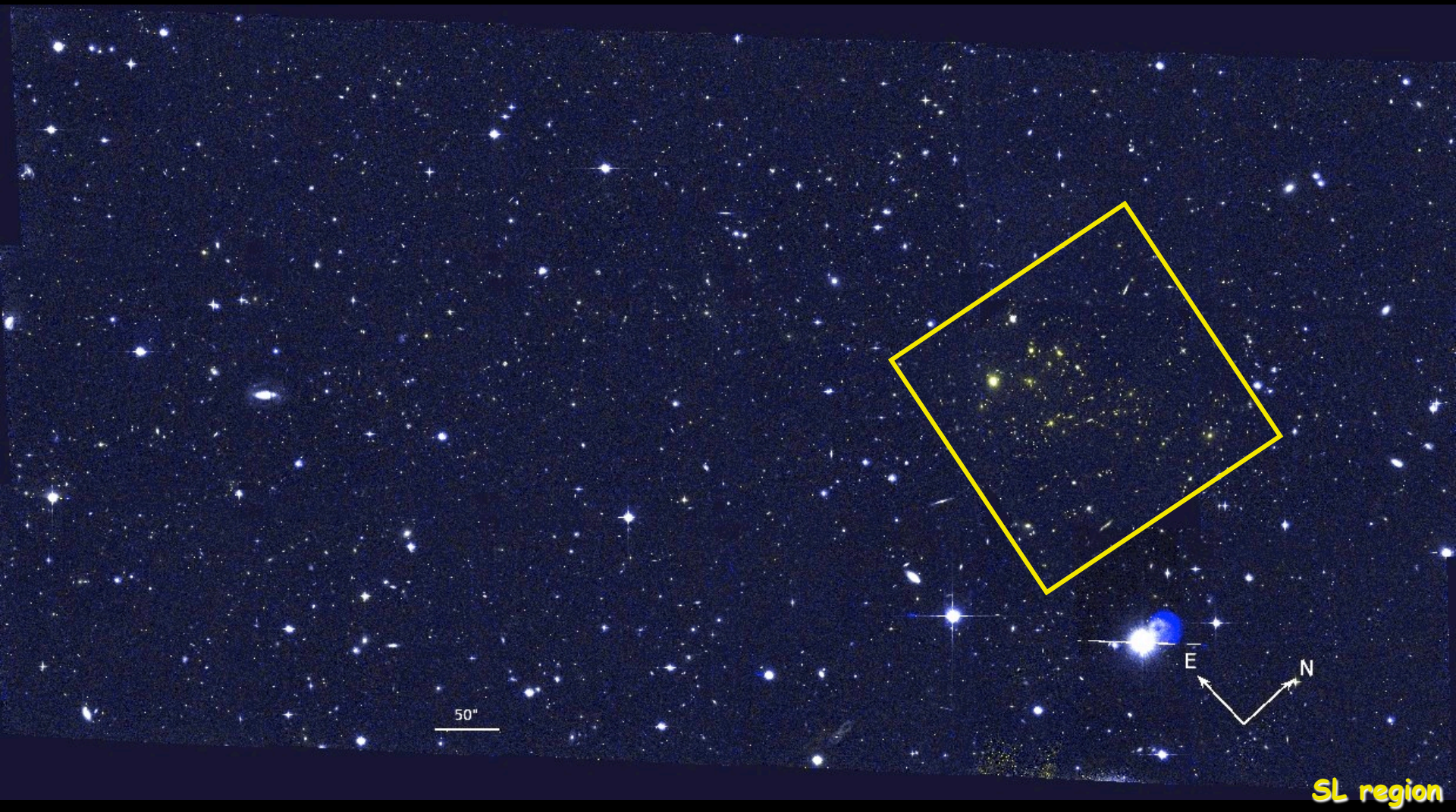
- Ma et al. (2009) : Active triple merger
- Limousin et al. (2012) : Confirmed the complex dynamics of the cluster core
- Ma et al. (2010) : Elongated structure in the field linked to the cluster core

➜ <u>NODE of the COSMIC WEB</u>

3. MACSJ0717.5+3745 *WEAK LENSING ANALYSIS*

➡ 18 HST/ACS maps in 2 bands : F814W & F606W

→ ~ 10 x 20 armin^2



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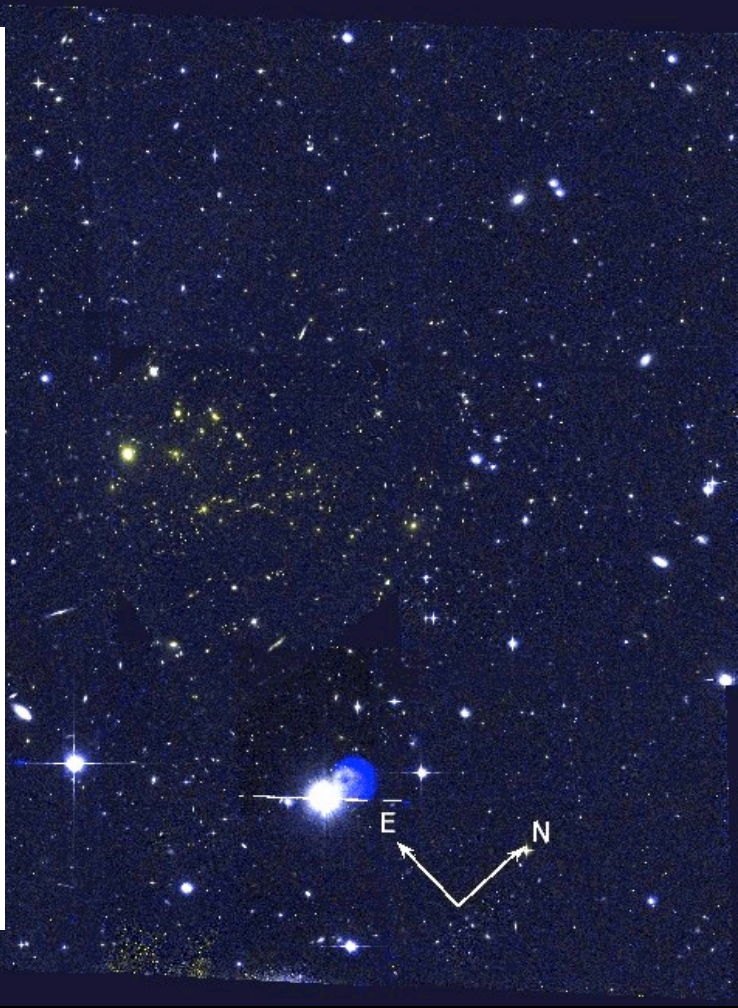
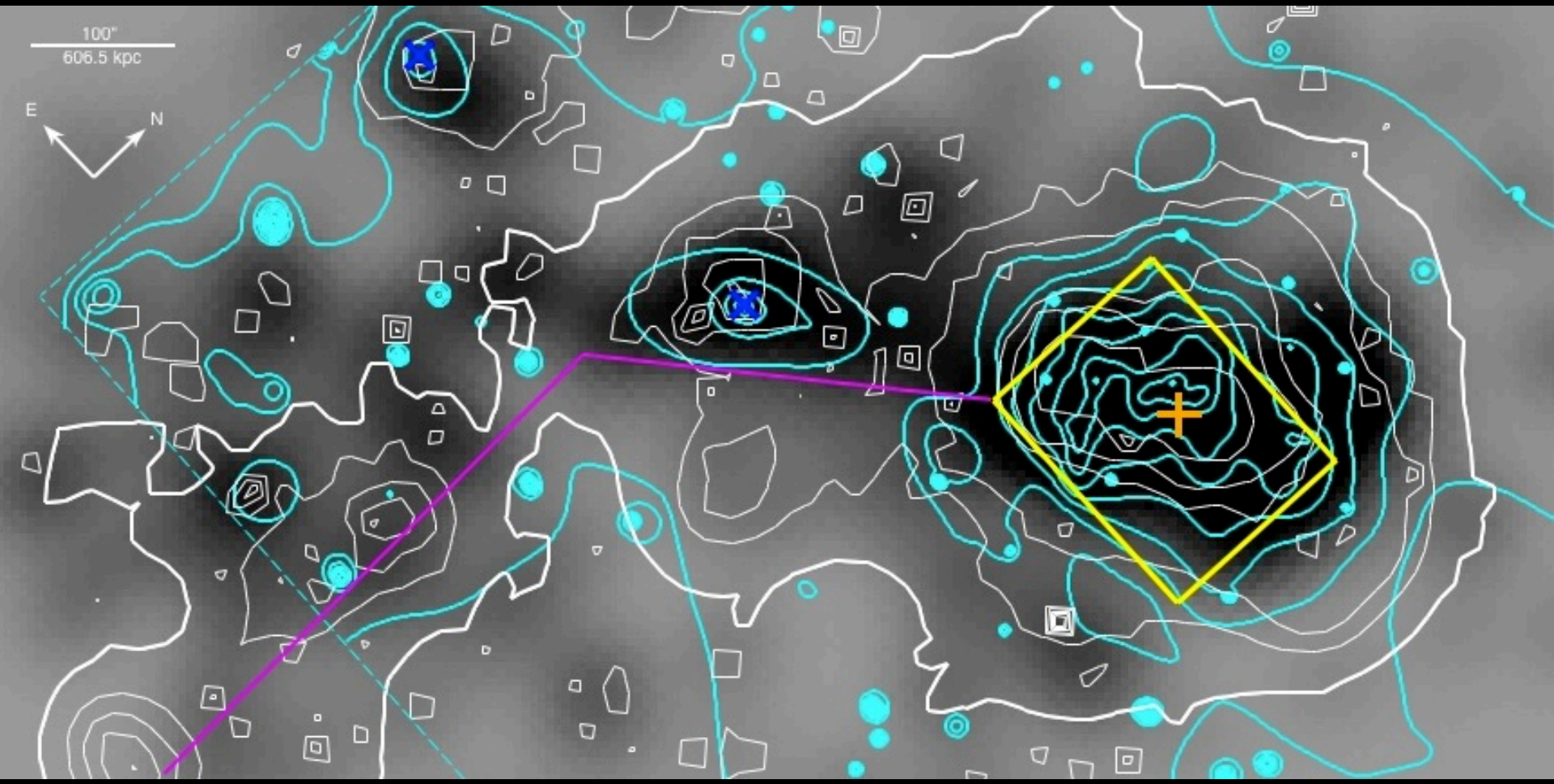
WL analysis : Recipe

1. Detection
2. Selection (galaxies, stars & fakes)
3. **CORRECT FOR PSF** (anisotropies & circularization) & Shape measurements
4. Redshift information
5. Mass distribution reconstruction



4. MACSJ0717.5+3745 : WEAK LENSING RESULTS

DETECTION OF A FILAMENTARY STRUCTURE !



→ WL detection of a large-scale filament with 3σ

→ ~4.5 Mpc long & $\Sigma_{filament}$ = 2.92 ± 0.66 10^8 $M_{SUN}.kpc^{-2}$

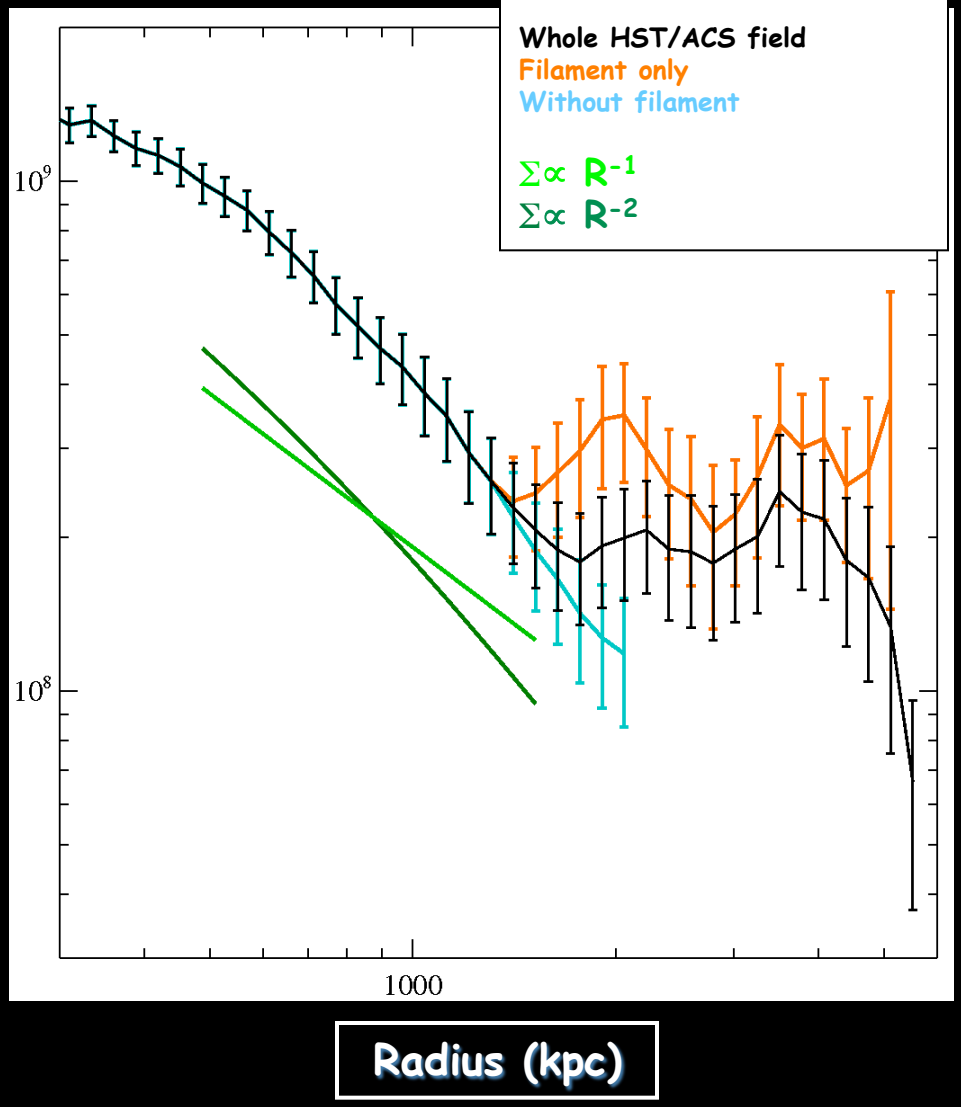
5. MACSJ0717.5+3745 : DISCUSSION

a) DENSITY PROFILES

- ✓ Cluster core : Really good agreement with SL analysis (Limousin et al. 2012)

$M_{WL}(R<500\ kpc) = 1.04 \pm 0.08 * 10^{15}\ M_{SUN}$
$M_{SL}(R<500\ kpc) = 1.06 \pm 0.03 * 10^{15}\ M_{SUN}$

- ✓ Filament starts to dominate the profile at ~2Mpc from the core
- ✓ Fitting by NFW, SIS profiles not relevant due to the complexity of the cluster
- ✓ Slope of the density profile within 2Mpc from the core evolves as $\Sigma(R) \propto R^{-2}$



5. MACSJ0717.5+3745 : DISCUSSION

b) 3D-PICTURE OF THE FILAMENT

✓ ***Ma et al. (2008)*** :

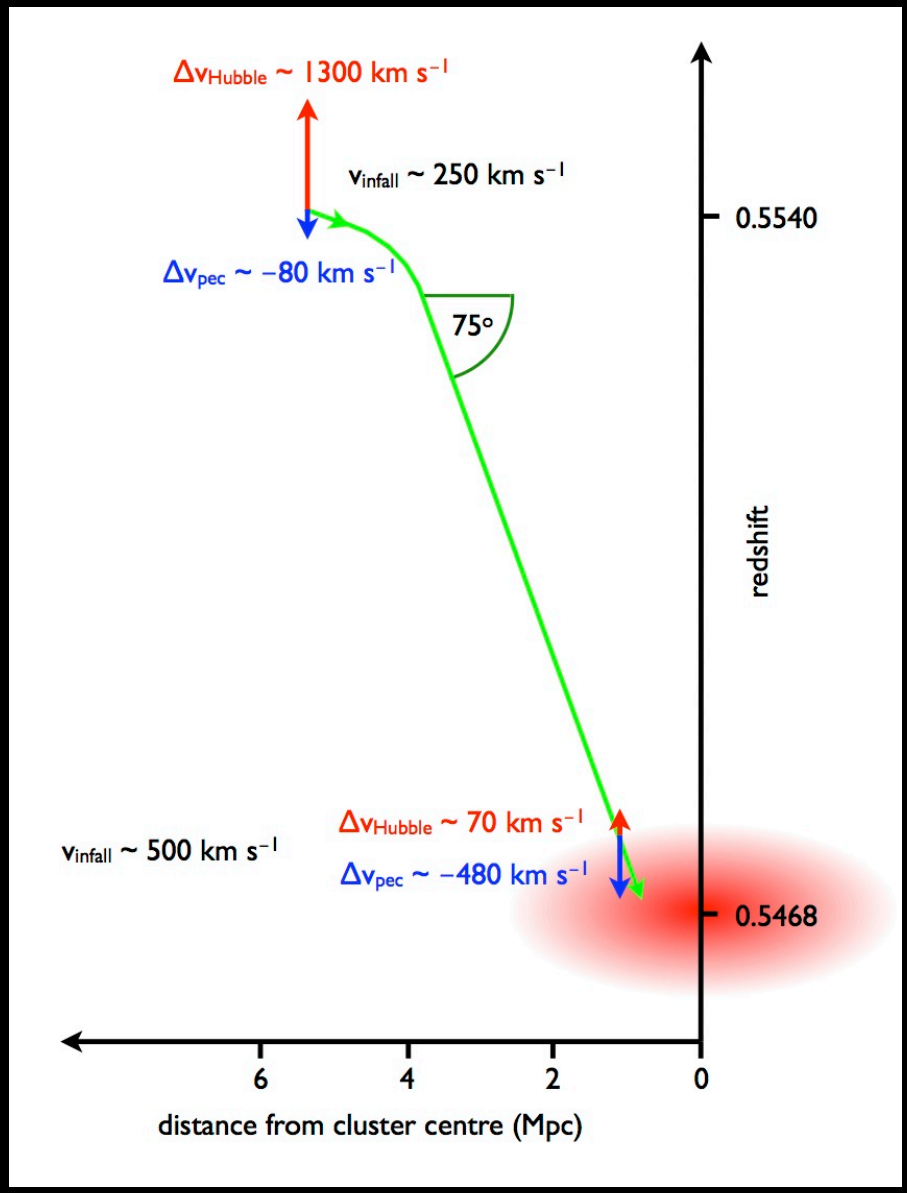
- Offset in the redshift distribution

✓ ***Ebeling et al. (2012, in prep)*** :

- Measured variation in the mean radial velocity of galaxies along the filament
- Comparison to expectations of Hubble-flow velocities & predictions of peculiar velocities within filaments from numerical simulations

(Colberg et al. 2005, Cuesta et al. 2008, Ceccarelli et al. 2011)

- A self-consistent description : an average inclination angle of 75° of the filament with respect to the plane of the sky



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b) 3D-PICTURE OF THE FILAMENT

→ ~ 18 Mpc long filament

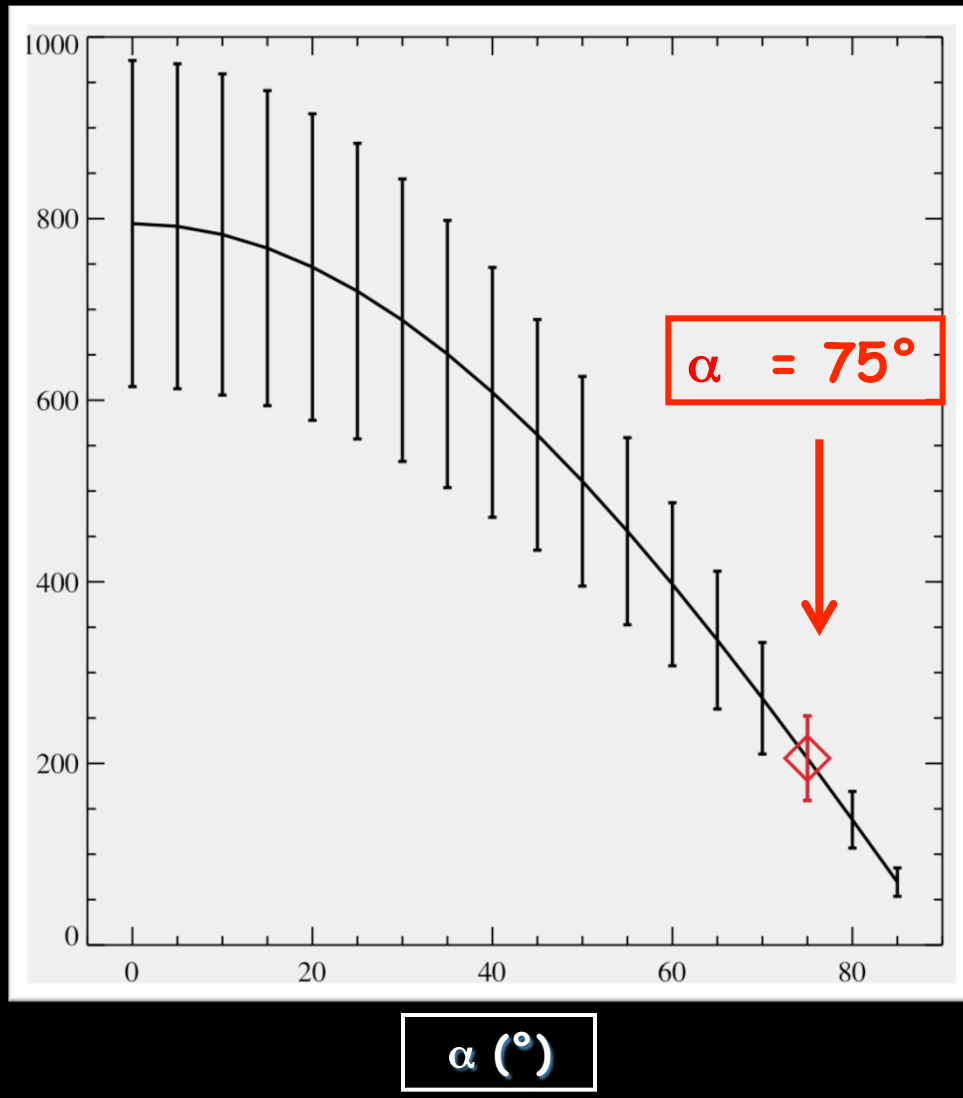
$\rho_{filament} = 3.13 \pm 0.71\ 10^{13}\ M_{SUN}.Mpc^{-3}$

$\rho_{filament} = 206 \pm 46\ \rho_{crit}$

→ A more complex density distribution along the filament POSSIBLE & PLAUSIBLE

→ Density depends STRONGLY on α

→ well constrained in average but uncertain at large cluster-centric distances



Thank you for your attention