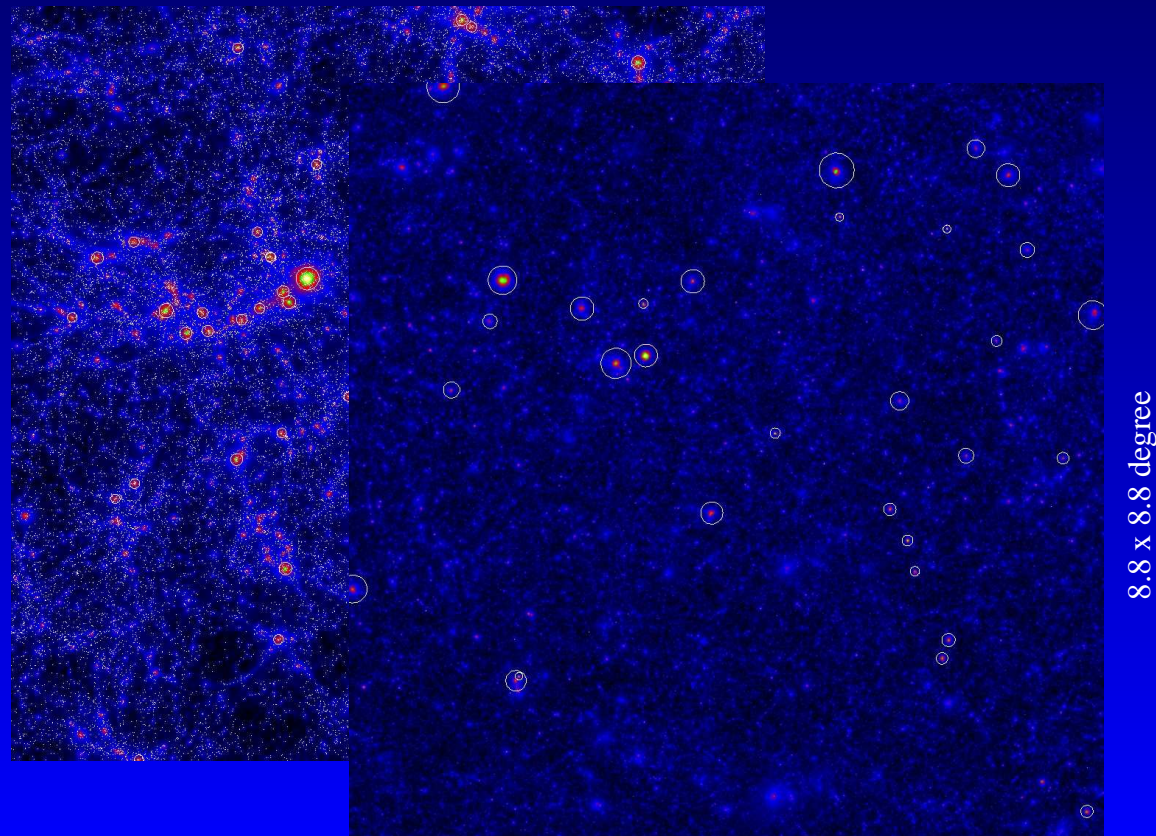


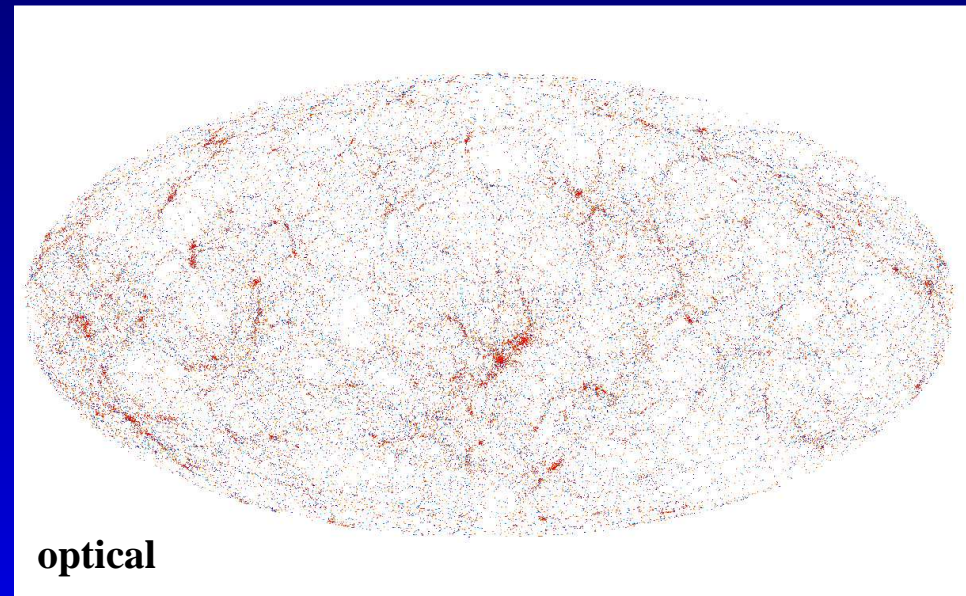
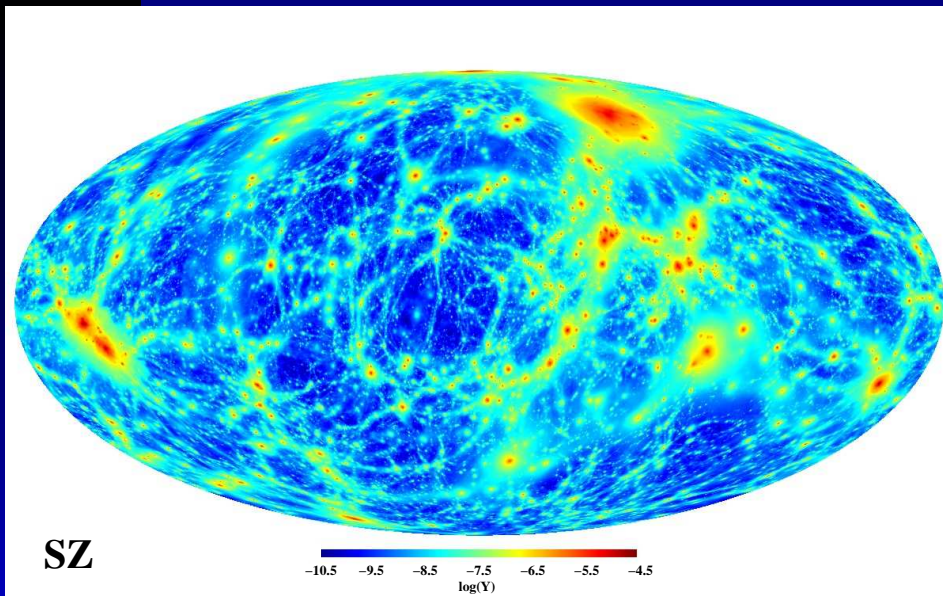
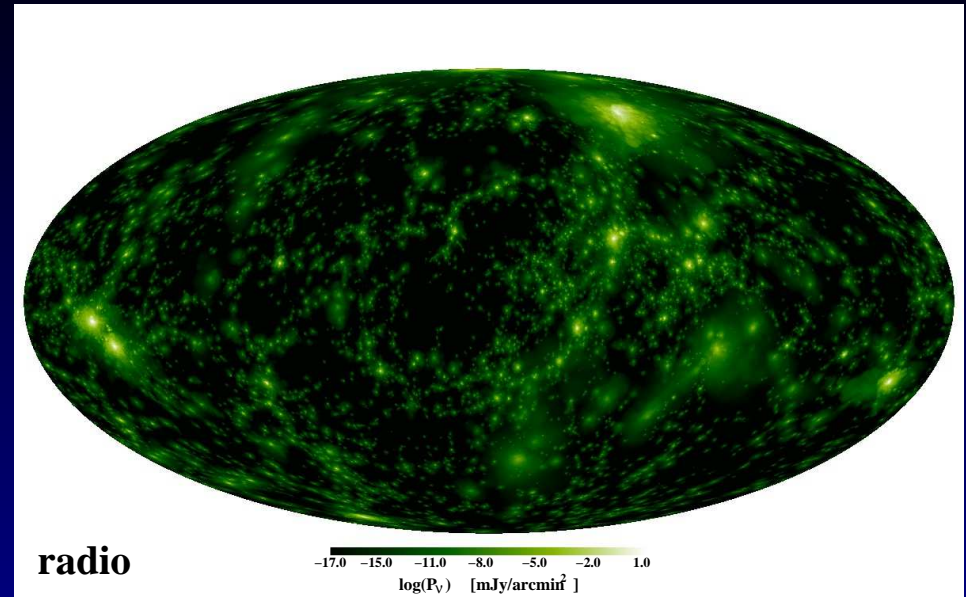
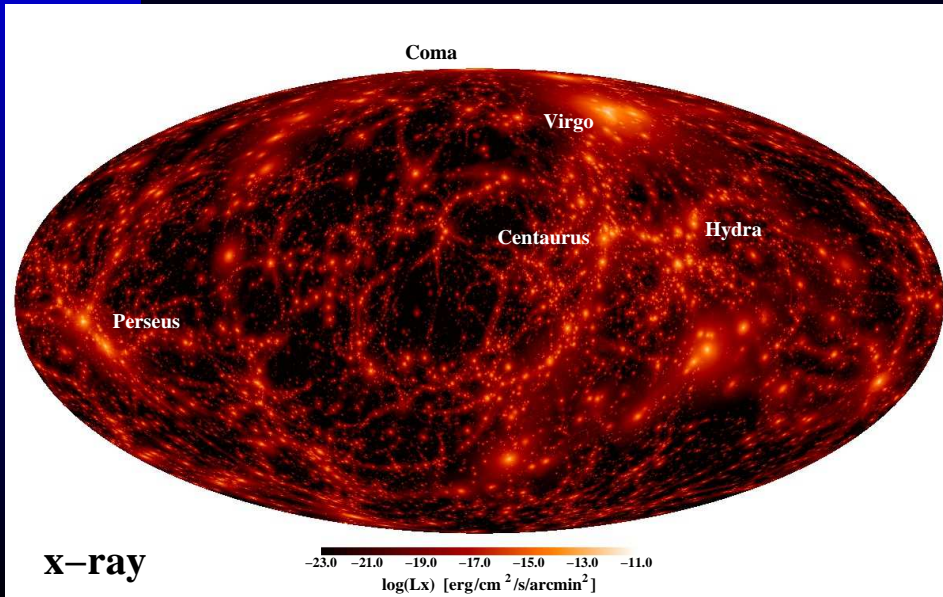
The Magneticum Pathfinder Simulations

Klaus Dolag

Universitäts-Sternwarte München

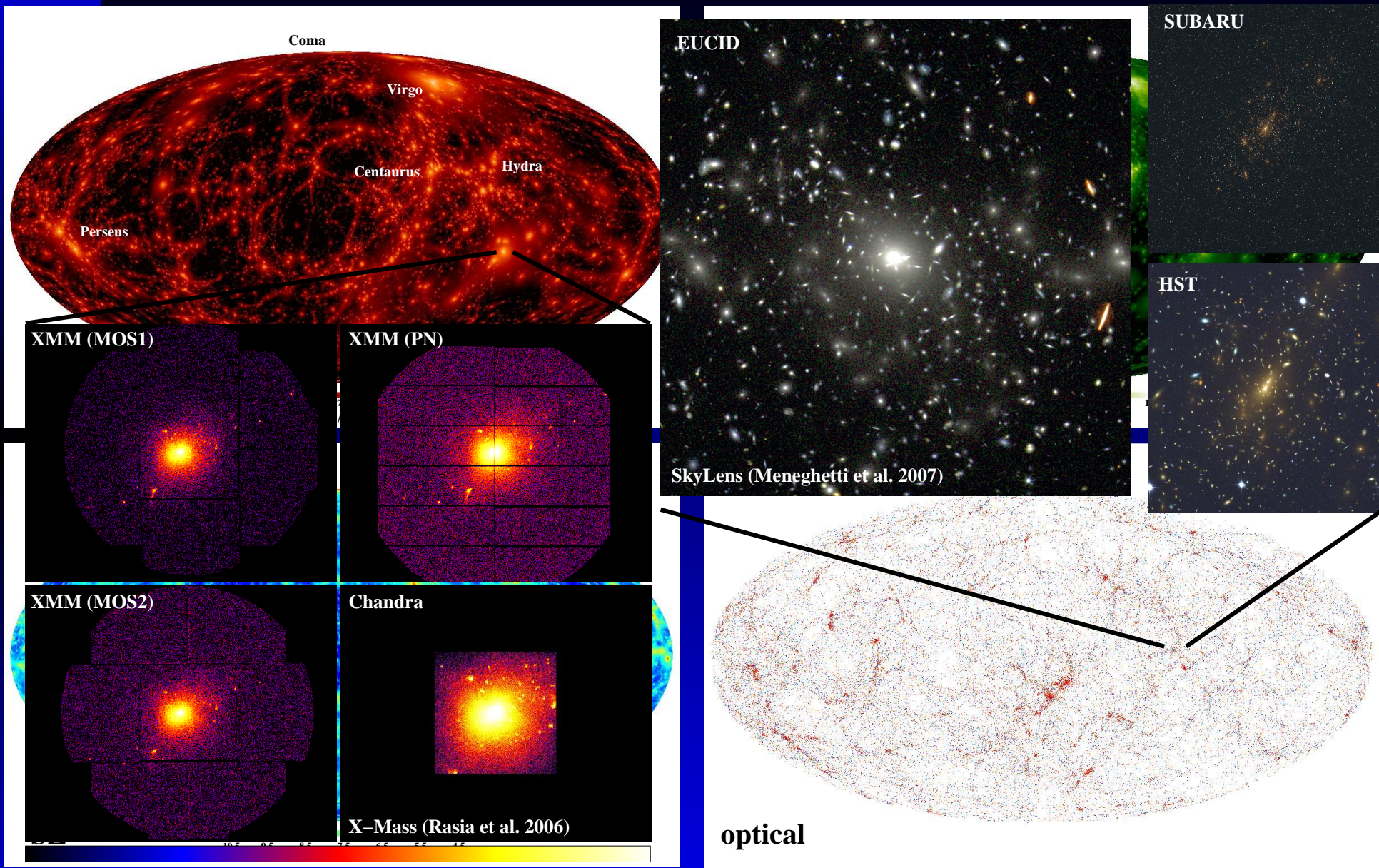


Aim of Magneticum Pathfinder



Cosmological, hydrodynamical simulations which at the same time allows predictions for ICM and stellar component for ongoing/future missions.

Aim of Magneticum Pathfinder



Mock optical/x-ray observations using SkyLens (Meneghetti 2010), X-Mass (Rasia 2007) and Phox (Biffi 2011).

Aim of Magneticum Pathfinder

1 Gpc/h

Magneticum

2×4608^3

DM simulation (M,M-XXL)
72 byte per DM particle

Hydrosimulation
ca. 800 byte per DM particle

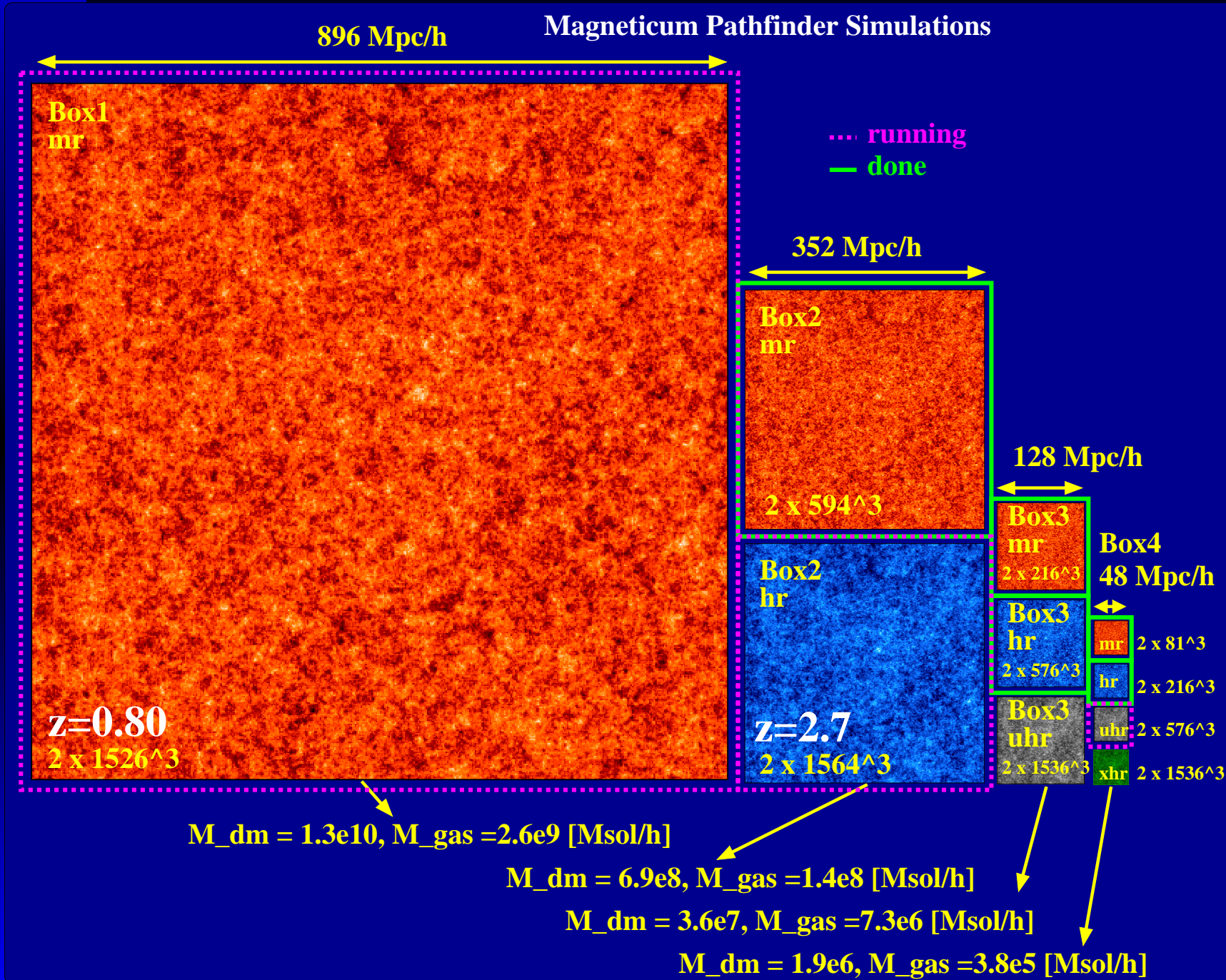
$M_{\text{dm}} = 6.9e8, M_{\text{gas}} = 1.4e8$ [Msol/h]

As much as possible physics !

(cooling, star-formation, conduction, chemistry, blackholes, magnetic fields ...)

Target: Next generation of European Supercomputing Center (under construction)

Aim of Magneticum Pathfinder



Aim of Magneticum Pathfinder

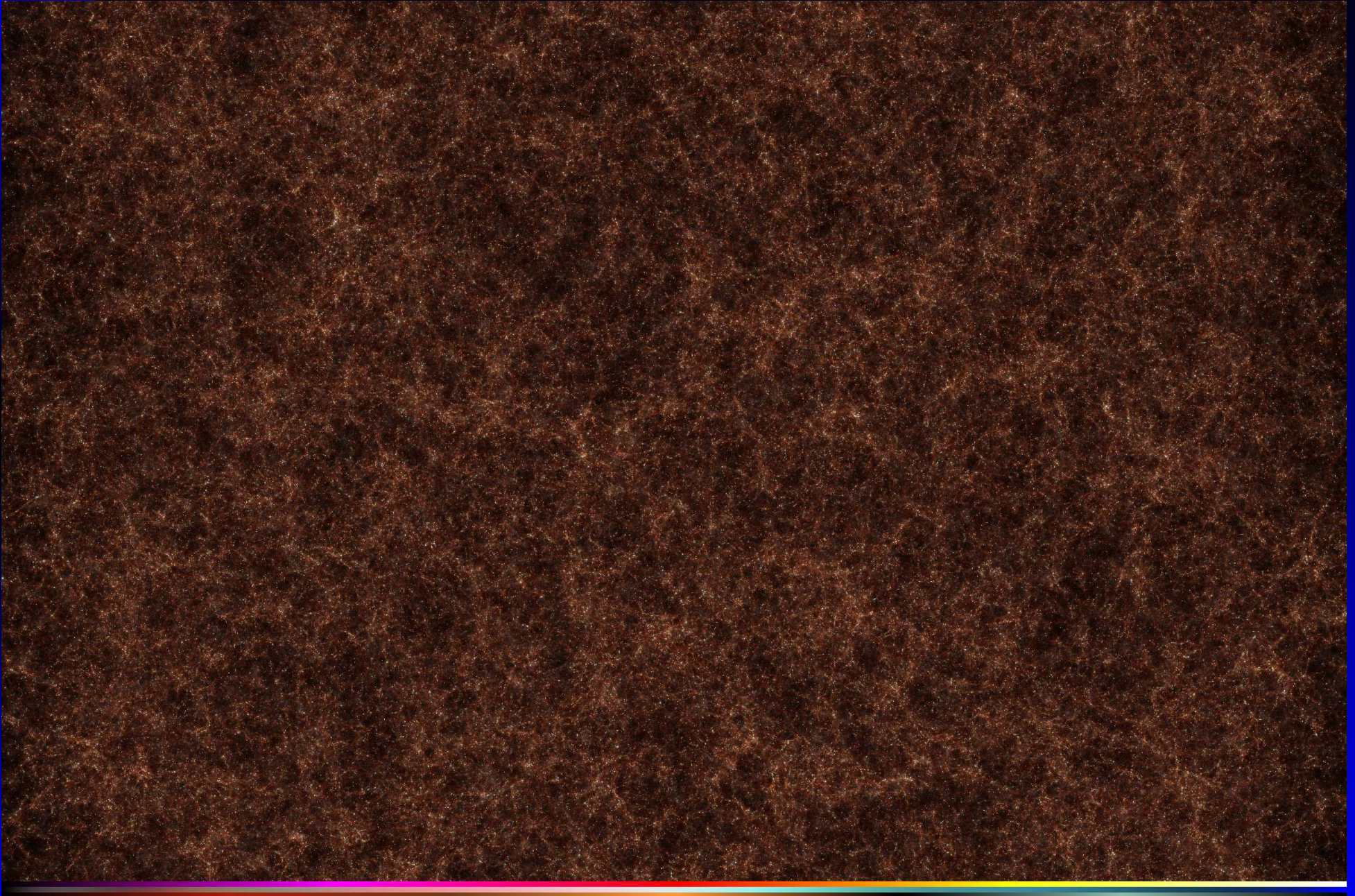
Physics to be included:

- cooling + star formation + winds Springel & Hernquist 2002/2003
- Metals, Stellar population and chemical enrichment, SN-Ia, SN-II, AGB Tornatore et al. 2003/2006
+ new cooling tables Wiersma et al. 2009
- BH and AGN feedback Springel & Di Matteo 2006, Fabjan et al. 2010
+ various modifications
- Low viscosity scheme to track turbulence Dolag et al. 2005
- Magnetic Fields (passive) Dolag & Stasyszyn 2009

Add ons:

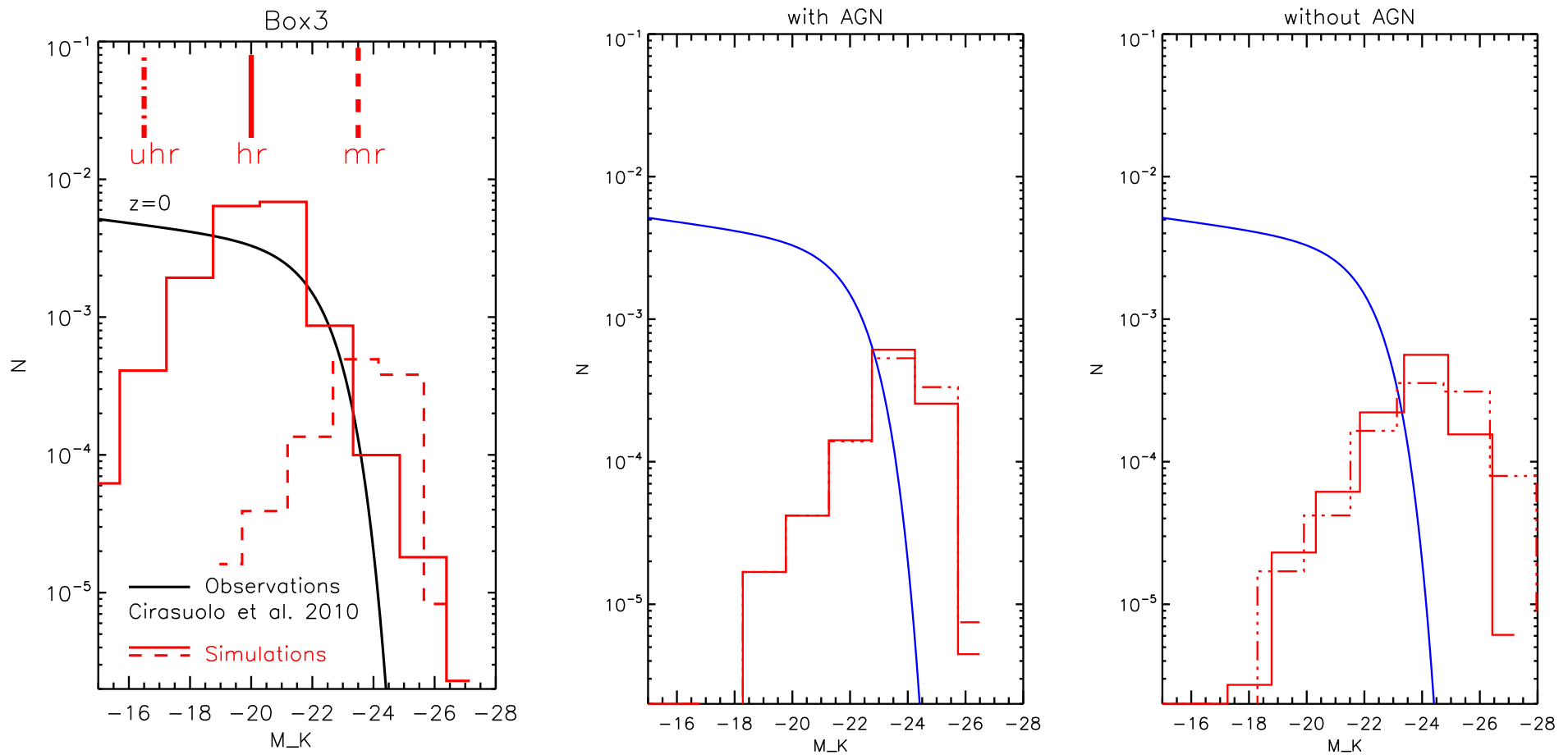
- On the fly Sub-Find Springel et al. 2001/2010, Dolag et al. 2009
- Photometric code to assign optical/near-IR luminosities to galaxies (u,V,G,r,i,z,Y,J,H,K,L,M) Saro et al. 2006, Nuzza et al. 2010
- On the fly Cluster/Groups properties
- Novel sub-data access scheme allowing an efficient read-out of particles belonging to a galaxy cluster

Preliminary Results



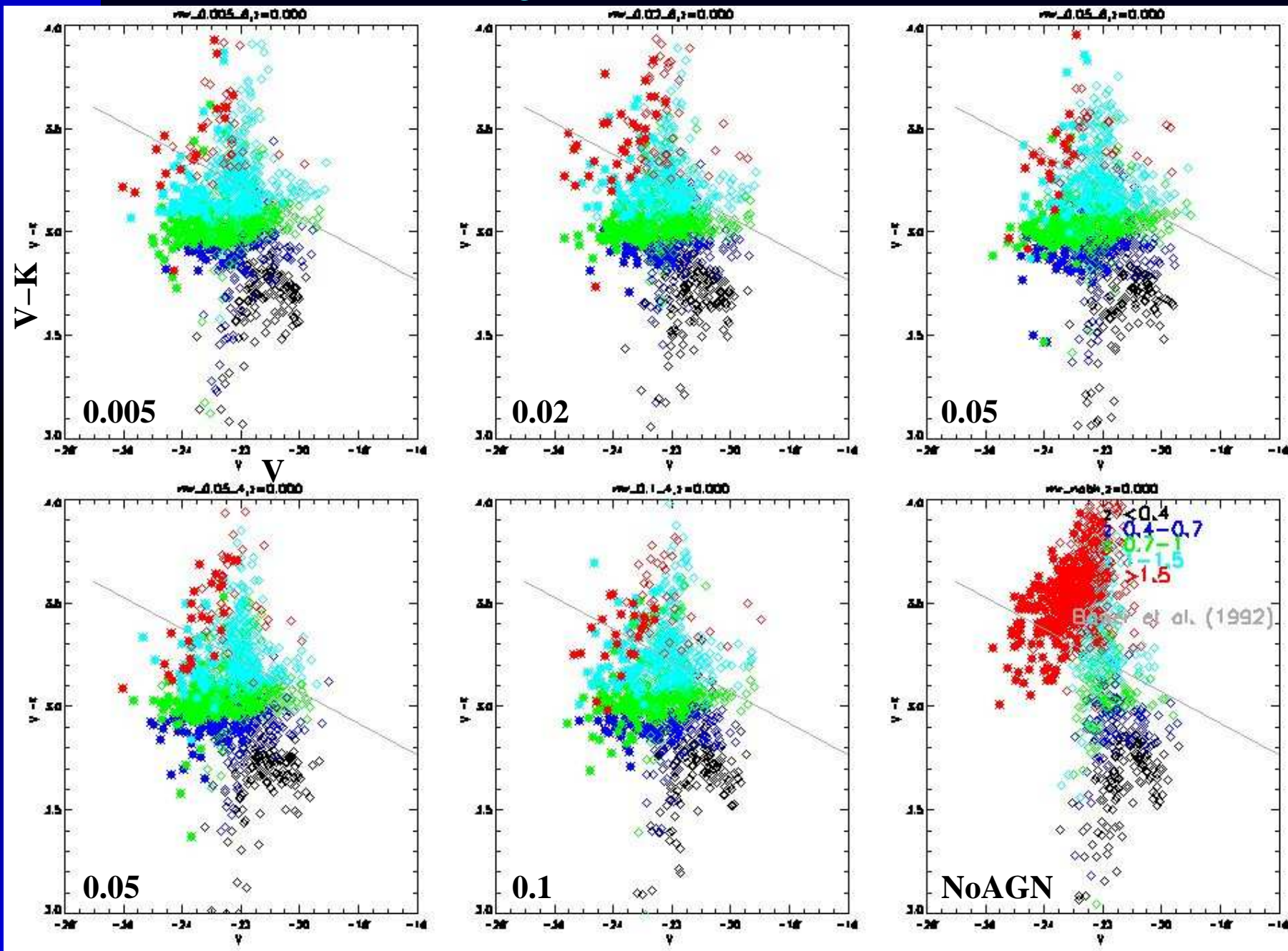
Box1/mr at $z=2$, currently at $z=0.8$

Preliminary Results (Galaxies)



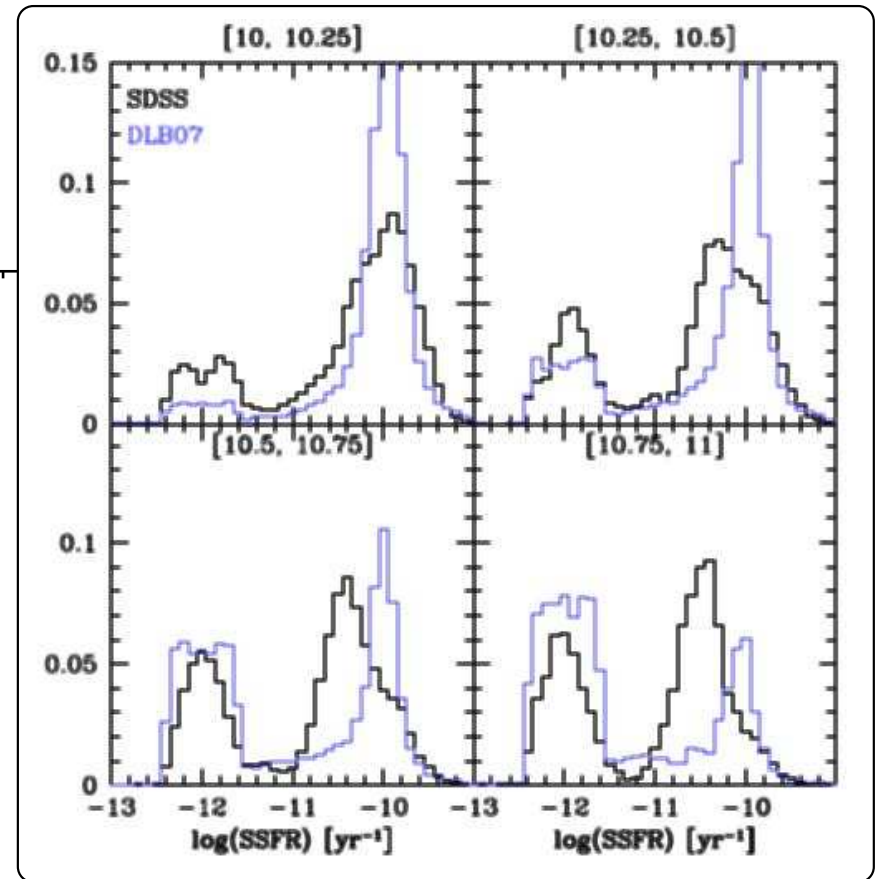
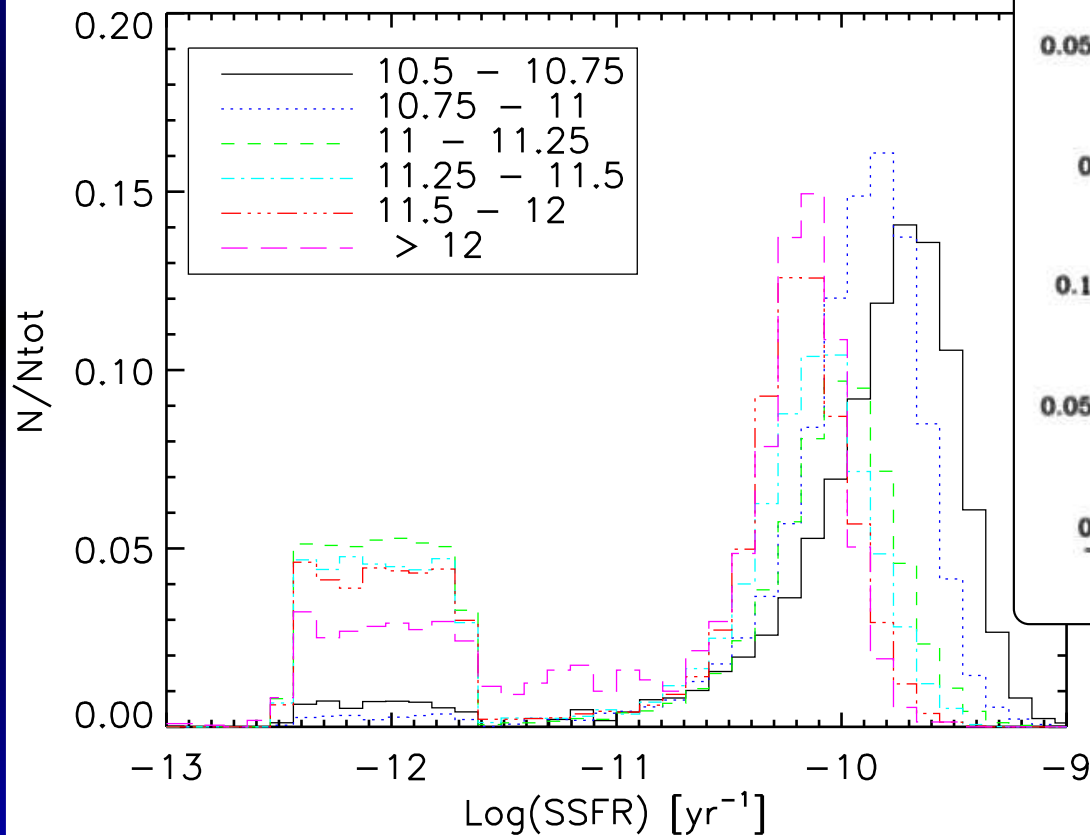
Example luminosity function (A. Saro, work in progress)

Preliminary Results (Galaxies)



Color-Magnitude relation (A. Saro, work in progress)

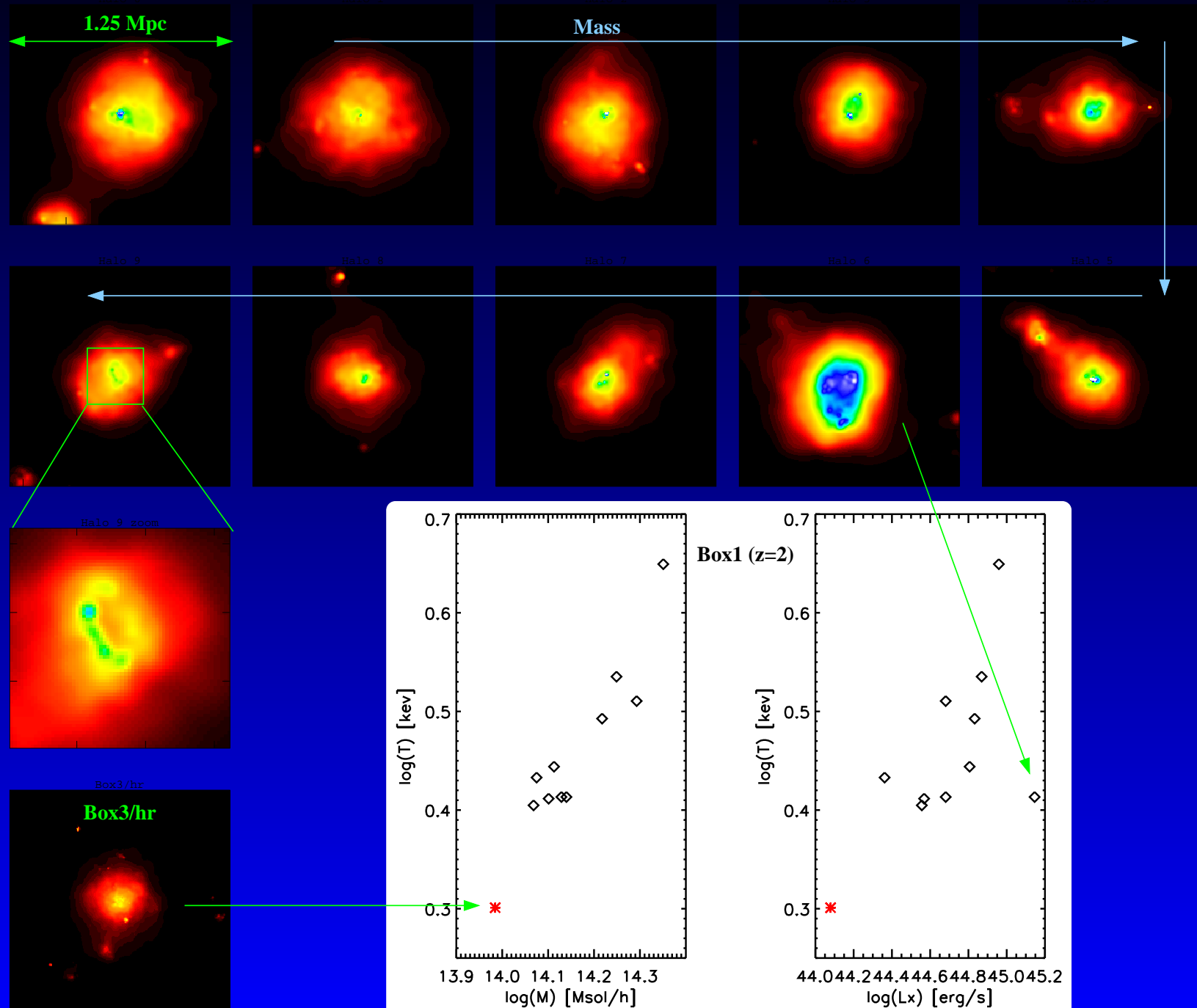
Preliminary Results (Galaxies)



Weinmann et al. 2010

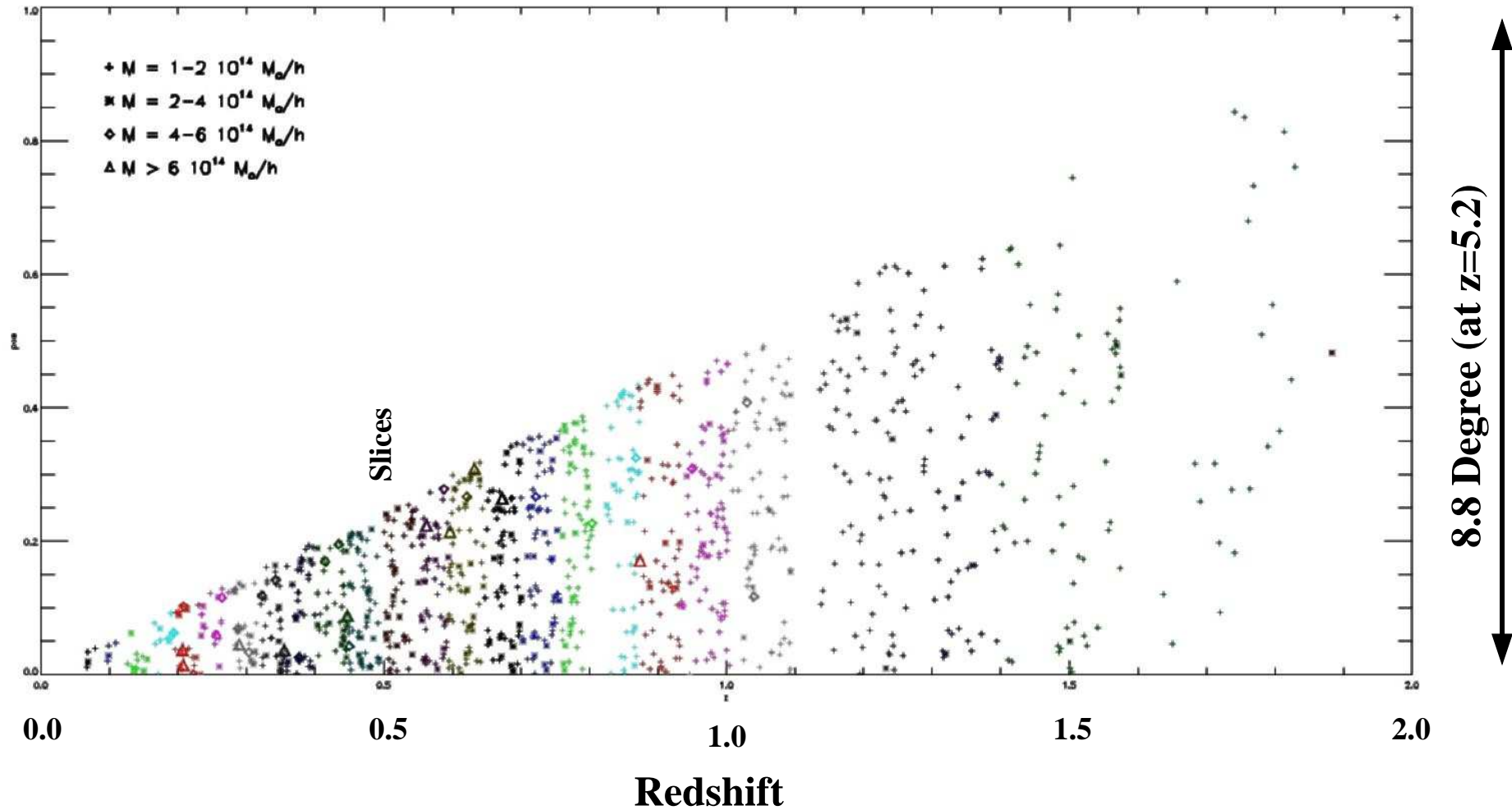
SSFR (compared to SAM and SDSS, Weinmann 2010)

High z Clusters (z=2)



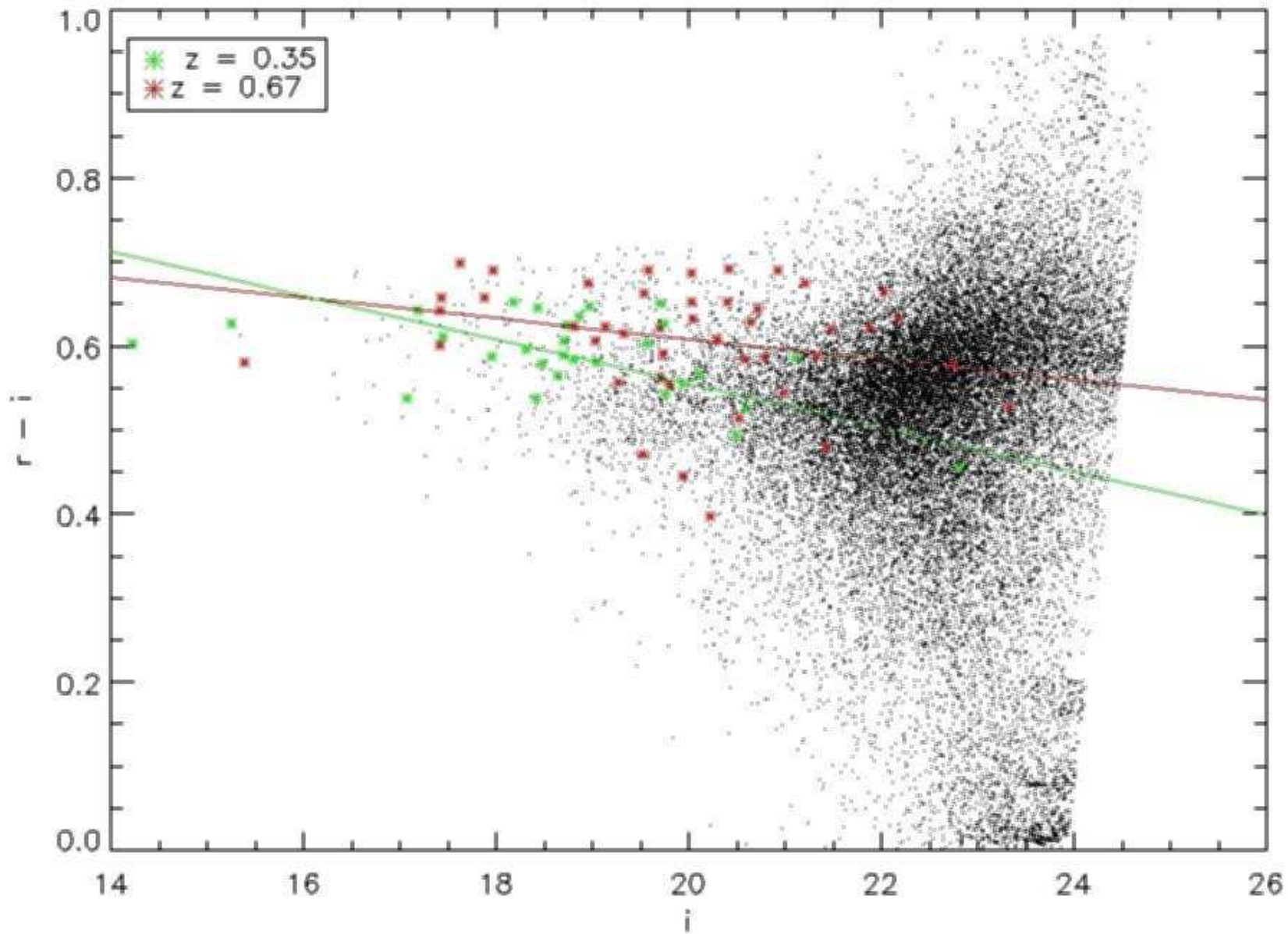
Preliminary Light-Cone

Galaxy Clusters



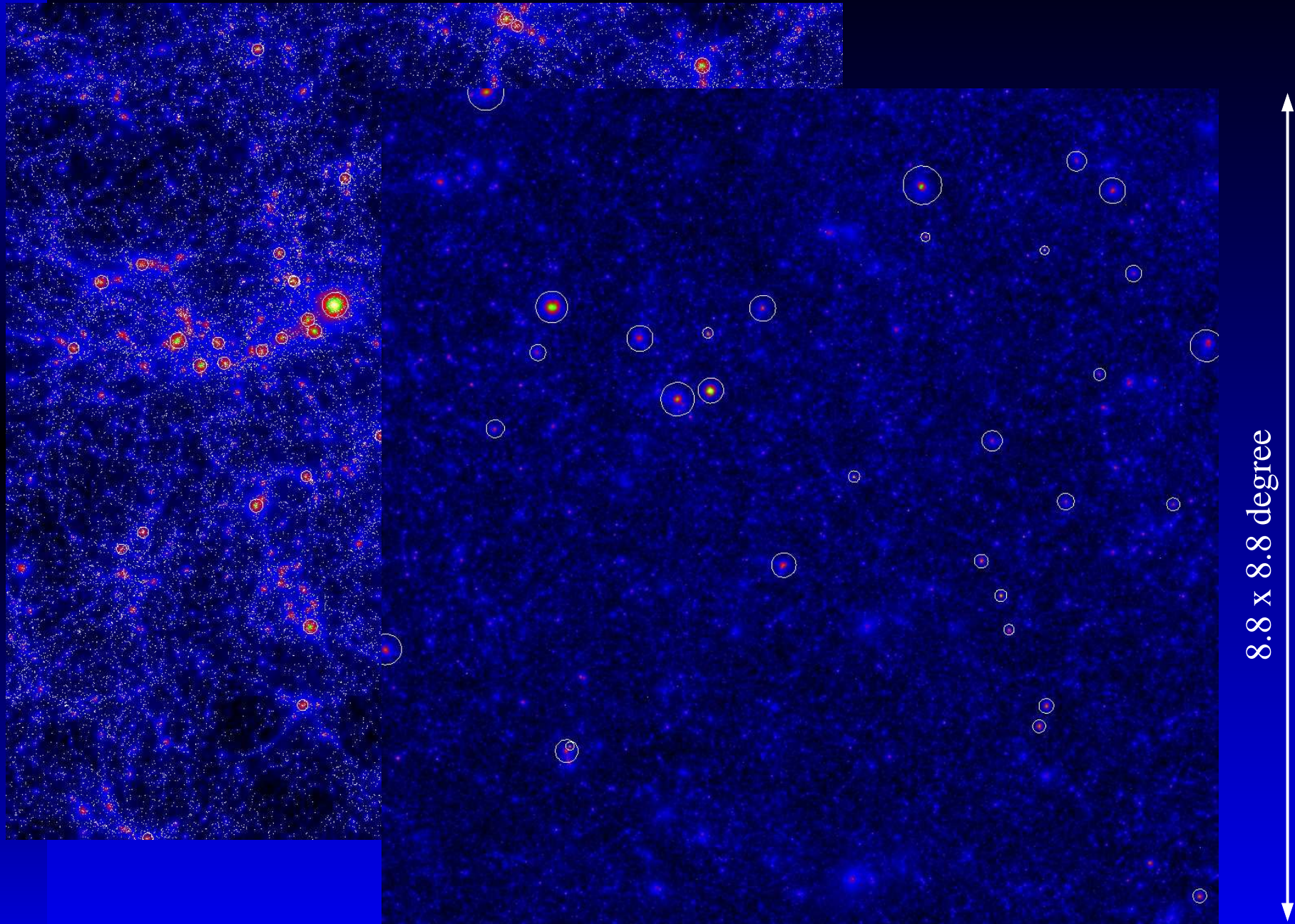
Clusters in a light-cone ($8.8^{\circ} \times 8.8^{\circ}$) till $z=2.0$

Preliminary Light-Cone



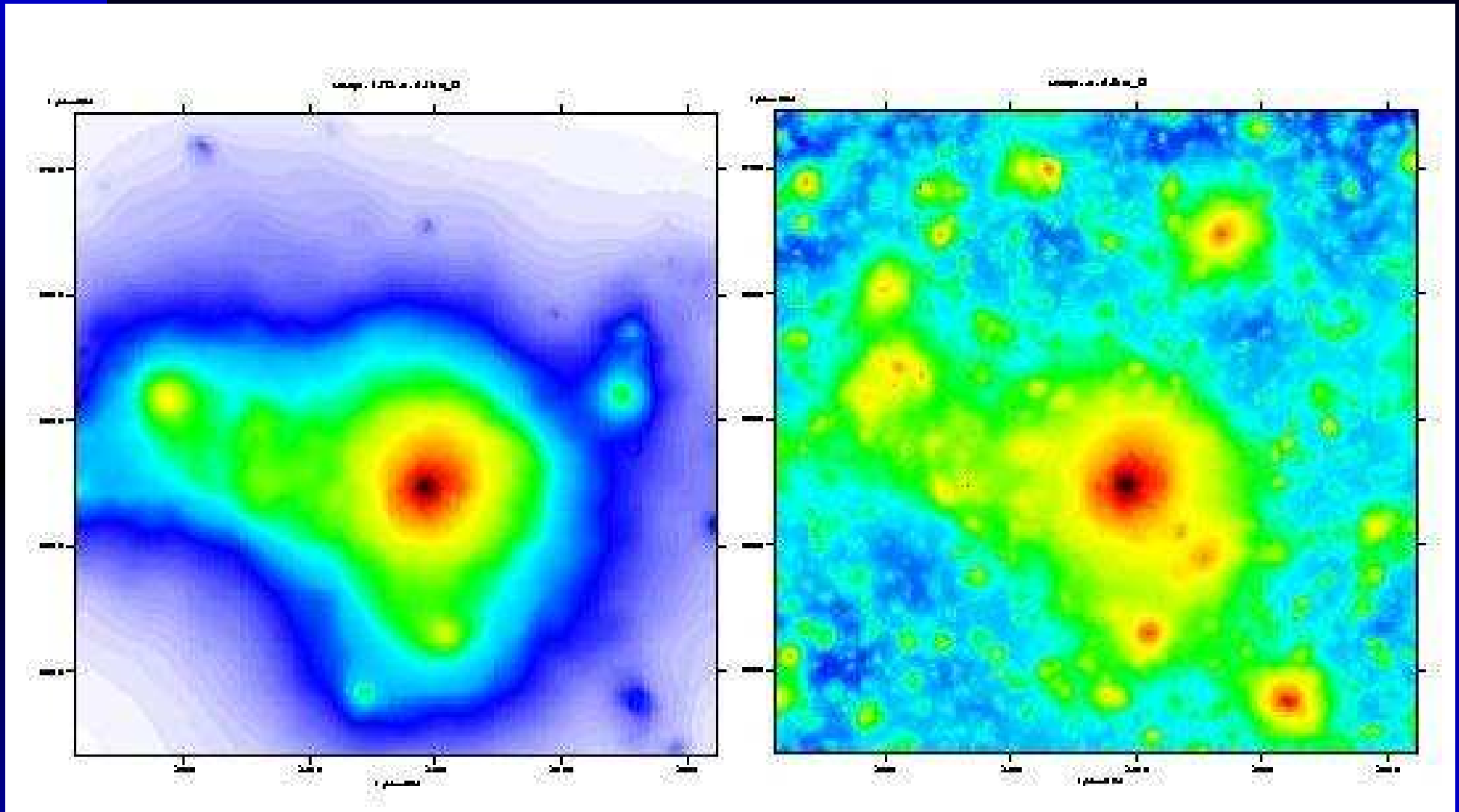
Red sequence selection (A. Saro, work in progress)

Preliminary Light-Cone



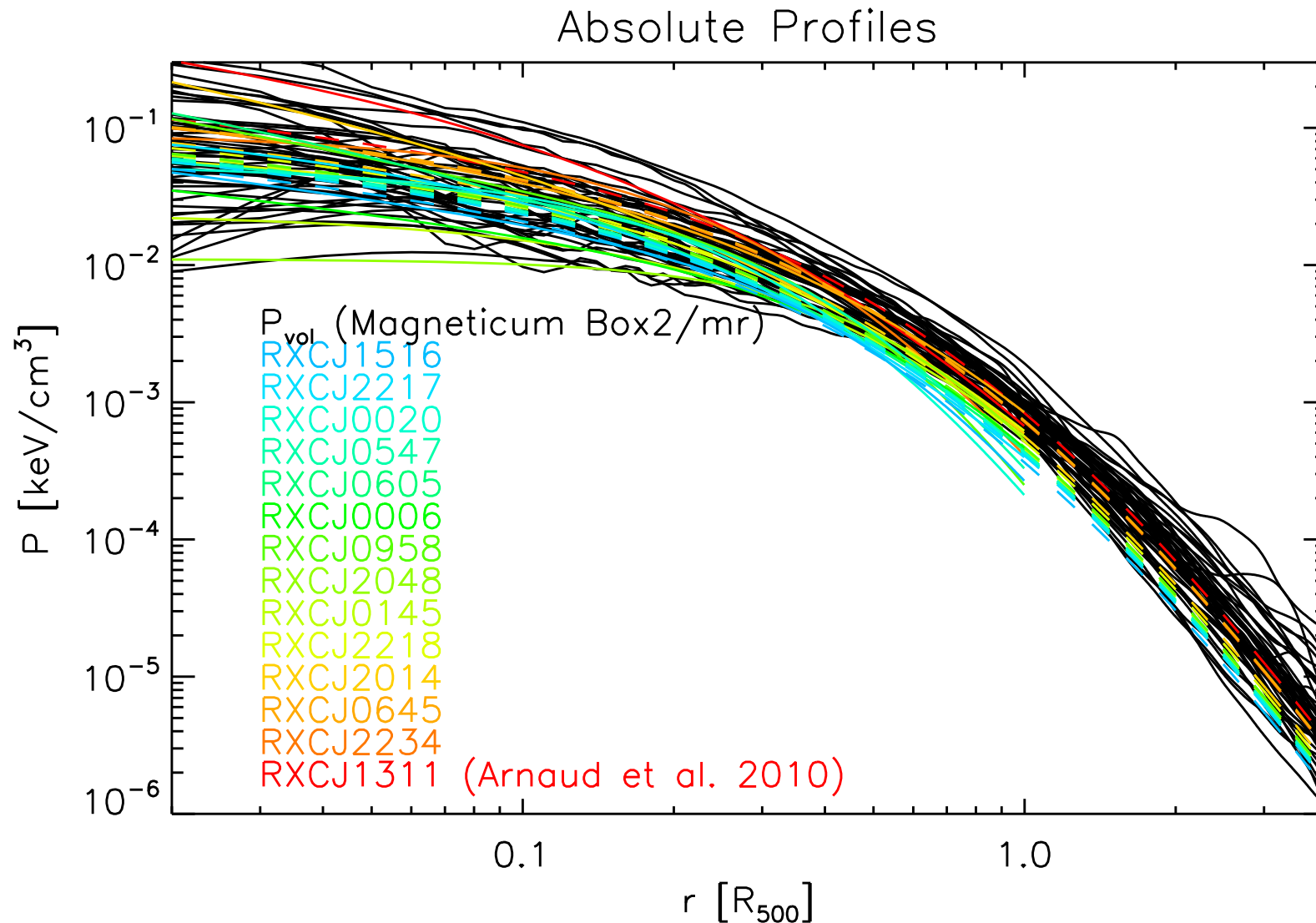
SZ signal integrated till $z = 5.2$.

Preliminary Light-Cone



Simulated $0.5^\circ \times 0.5^\circ$ view of “Isolated” cluster (within 134 Mpc slice) vs. same cluster embedded in deep ($z=5.2$) light-cone .

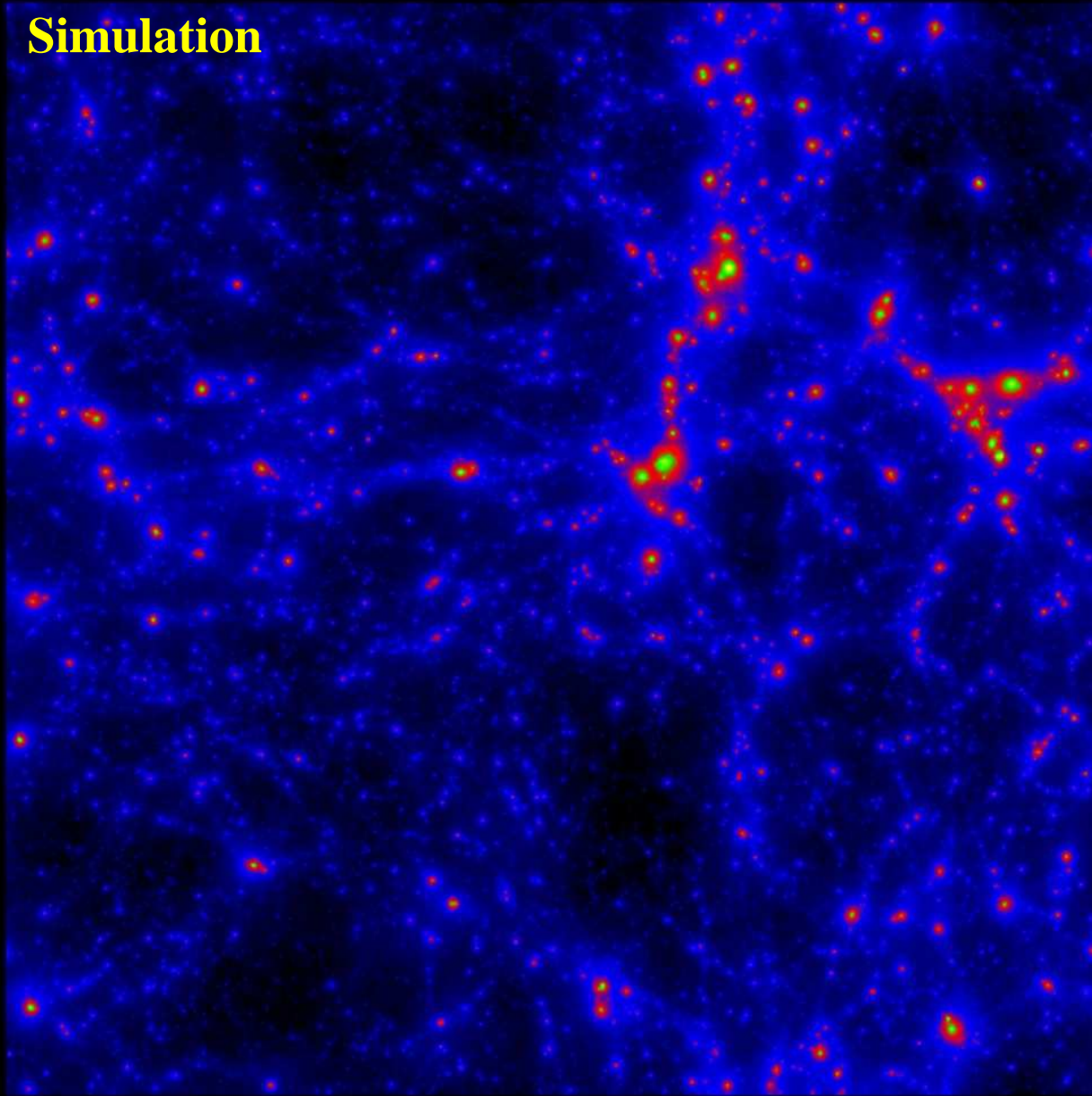
Preliminary Results (ICM)



Comparison of simulated pressure profiles with observations (shape and scatter !).

Synthetic X-ray Observations

Simulation

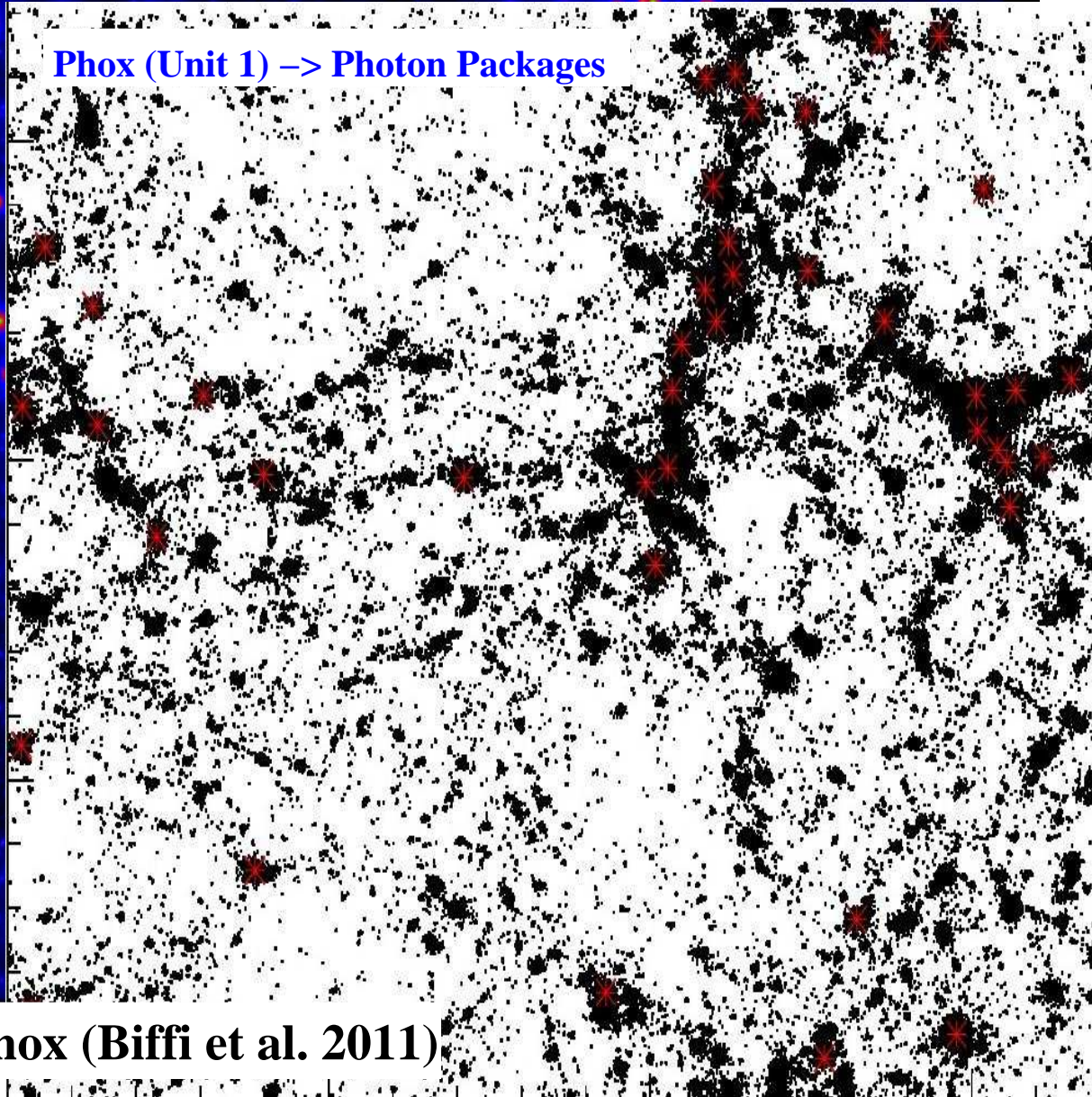


Phox (Biffi et al. 2011)

Synthetic X-ray Observations

Simulation

Phox (Unit 1) → Photon Packages



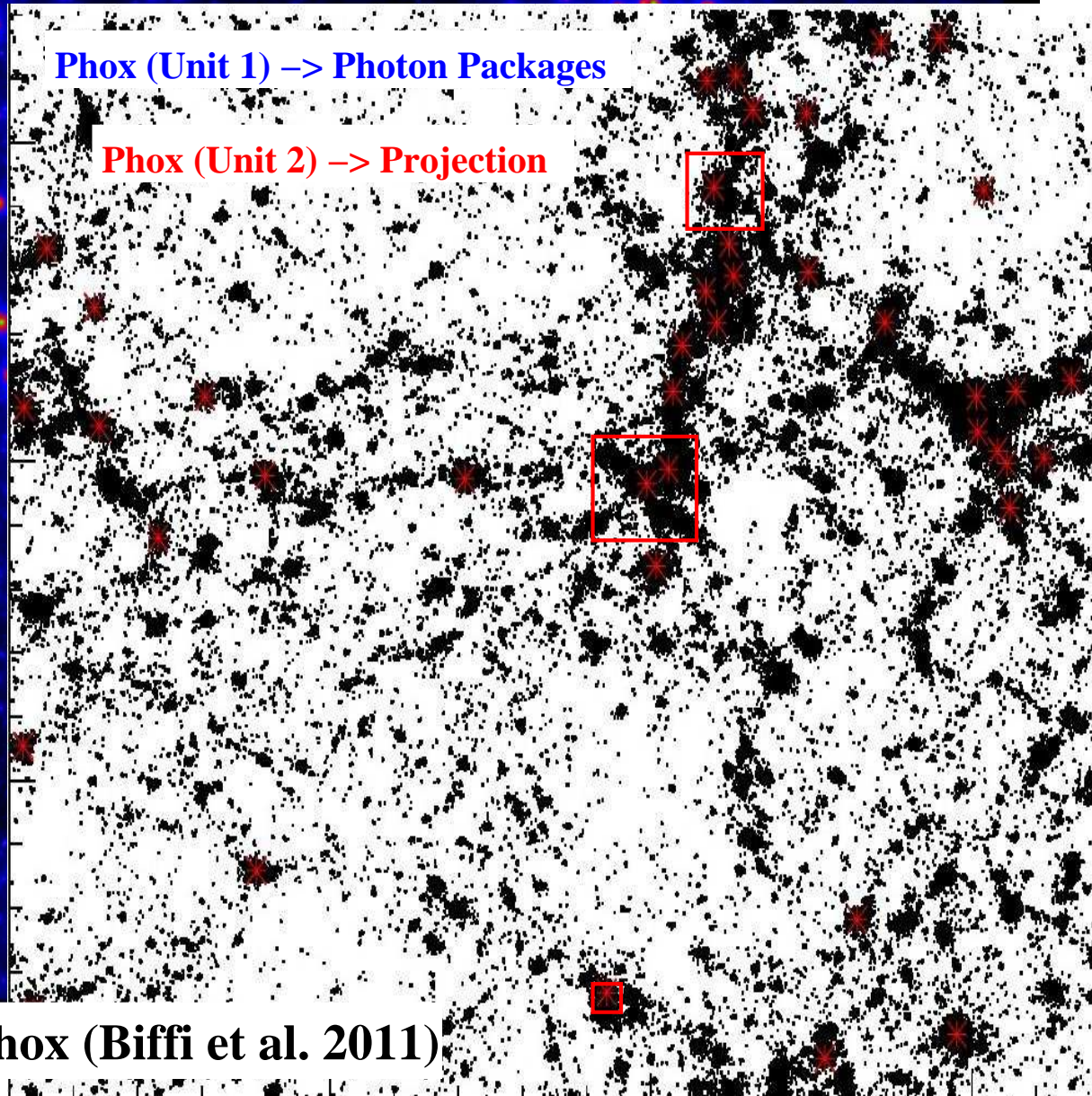
Phox (Biffi et al. 2011)

Synthetic X-ray Observations

Simulation

Phox (Unit 1) -> Photon Packages

Phox (Unit 2) -> Projection



Phox (Biffi et al. 2011)

Synthetic X-ray Observations

Simulation

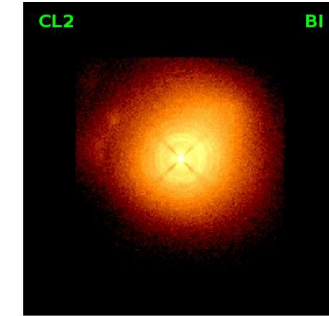
Phox (Unit 1) \rightarrow Photon Packages

Phox (Unit 2) \rightarrow Projection

Phox (Unit 3) \rightarrow Instrument

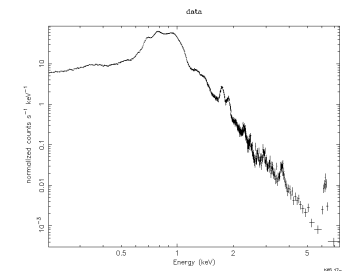
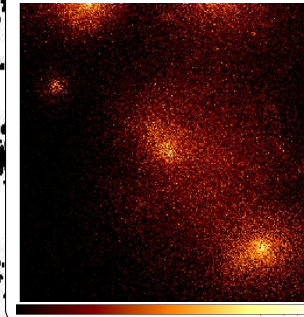
Phox (Biffi et al. 2011)

Suzaku

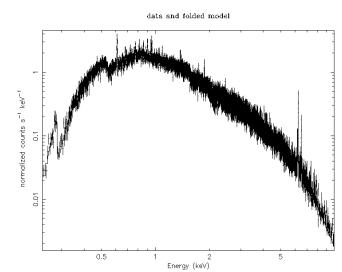


XISSIM Ishisaki 2007

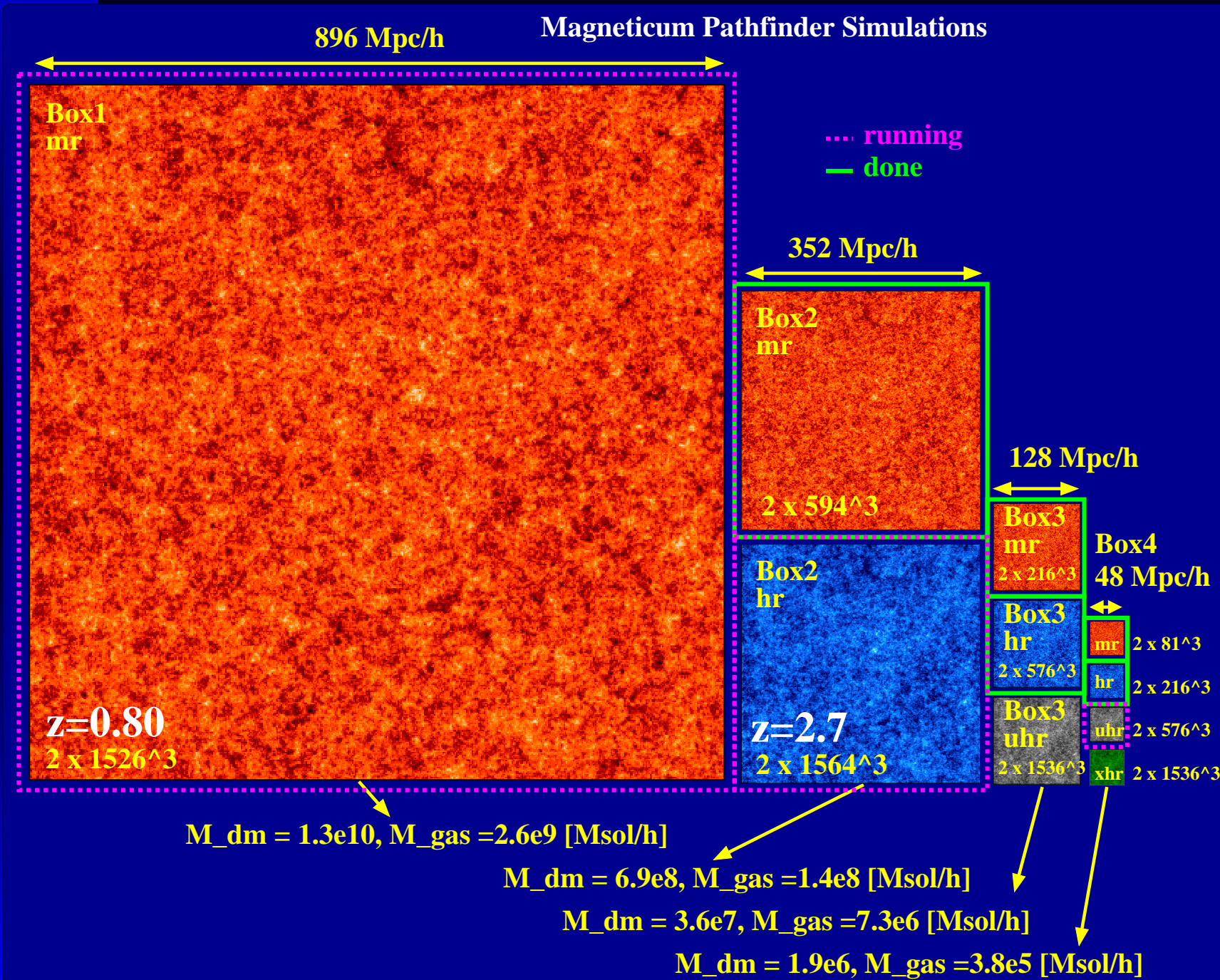
eRosita



Athena



Conclusions



Conclusions

Cosmological, hydrodynamical simulations which at the same time allows predictions for ICM and stellar component for ongoing/future missions.

- Simulated stellar properties
luminosity function, colors, specific star-formation rates
- ICM properties
pressure profiles (shape and scatter !)
- Deep light-cones
important for outskirts, cluster finding
- **Multi purpose X-ray simulator available** (Biffi et al. 2011)
- Online interface (prototype)

