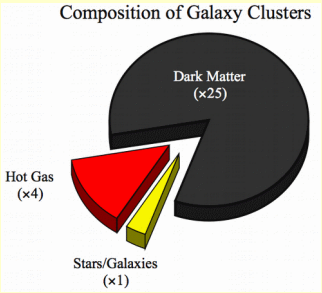
DYNAMICAL STATE OF GALAXY CLUSTERS, A MULTI-WAVELENGTH VIEW

GROUPS AND CLUSTERS OF GALAXIES



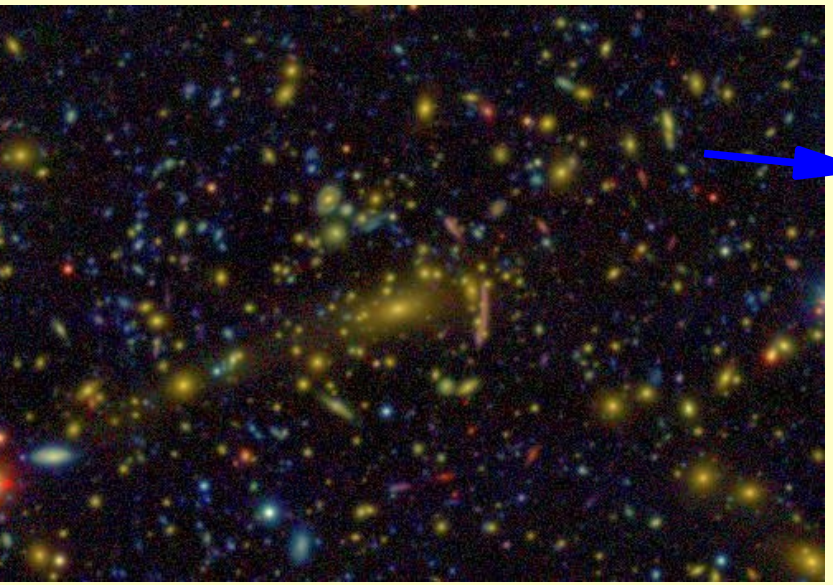
** $M \sim 10^{13\text{-}15} M_{sun}$, $R \sim 0.5\text{-}2$Mpc, $\sigma_v \sim 10^{2\text{-}3}$km/s, $L_X \sim 10^{42\text{-}45}$erg/s*

** multicomponent (DM, hot gas, galaxies) → complex physics*

**multi-wavelength (optical/grav.lensing, X-ray, optical/IR)*

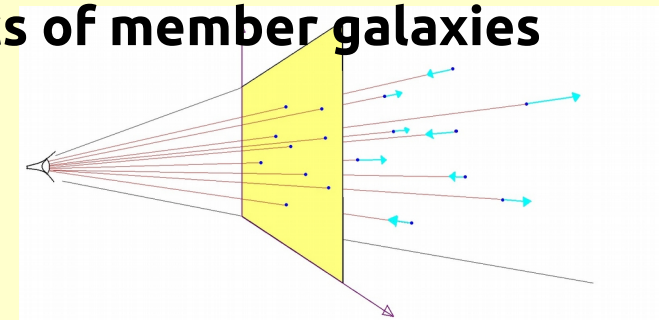
OBSERVATIONS OF CLUSTERS BY USING GALAXIES (= TRACERS OF THE POTENTIAL)

Optical images and spectra → properties and kinematics of member galaxies



6D → 3D

Project. phase space

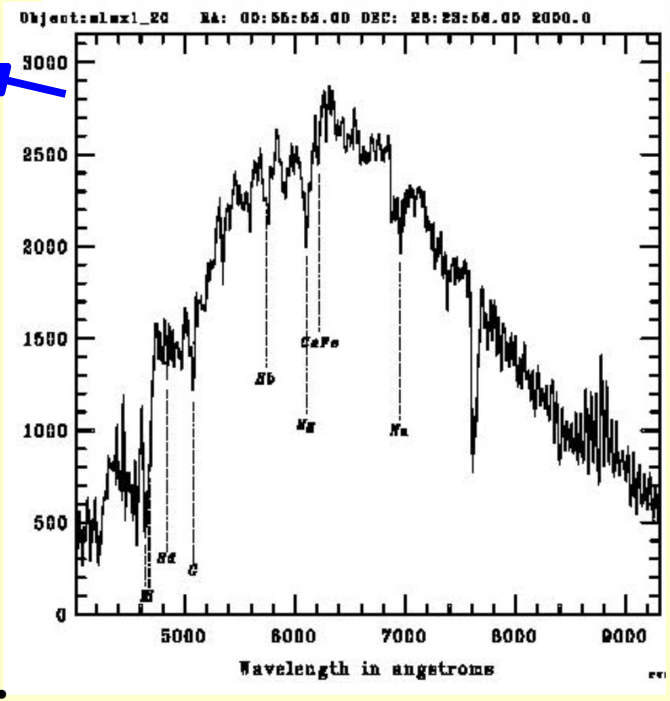


Imaging → 2D Position

Luminosity, color

Spectra → 1D Velocity

Spectral-type



MOTIVATIONS

→ cosmology (e.g., σ_v → cluster mass → cosmo parameters)

→ labs for galaxy evolution

→ extreme states (cluster mergers)

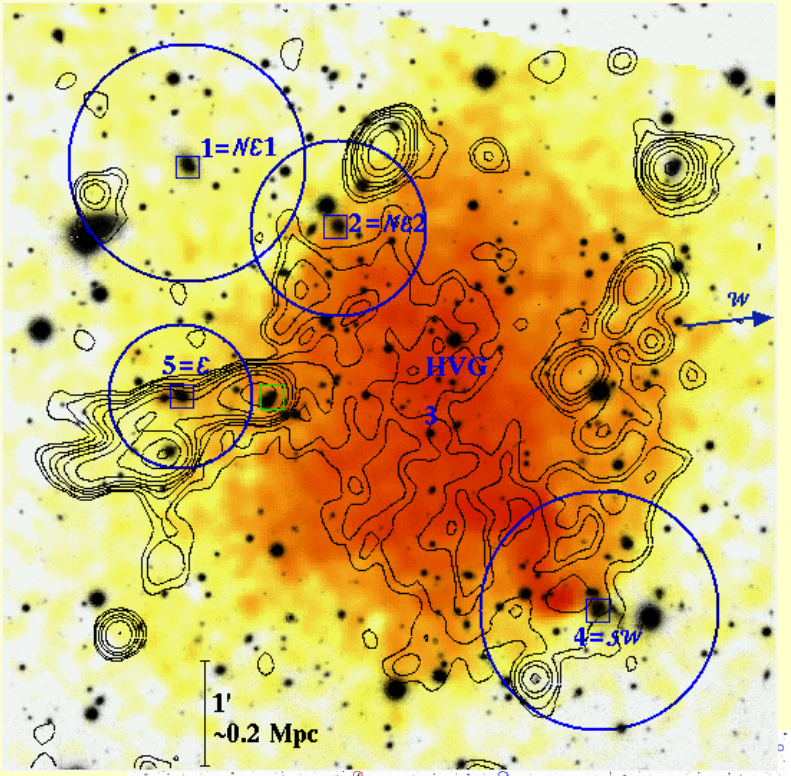
→ Radio emissions, proof and study of dark matter,...

Cluster Mergers

See also the Bullett Cluster → proof of DM

**Here in Trieste (+ W. Boschin – TNG -
Telescopio Nazionale Galileo Canary Islands)**
DARC Dynamical Analysis Of Radio Clusters

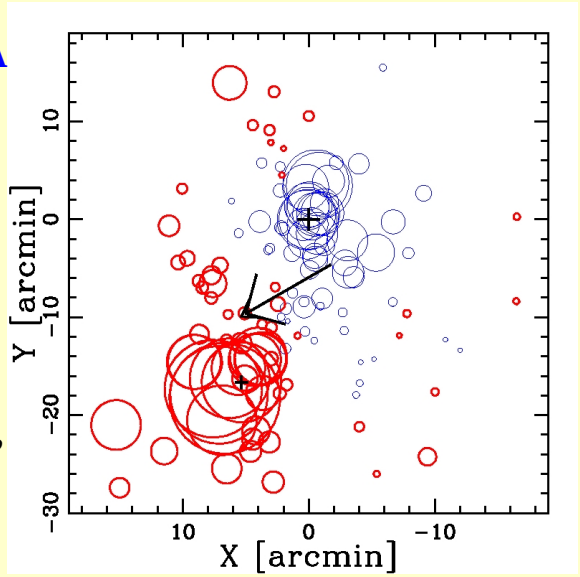
Abell 520 – Train Wreck Cluster (z=0.2)
**WCF/INT r-band image;
subclusters of galaxies (blue circles, TNG+CFHT spectra);
smoothed Chandra image (orange; Markevitch);
VLA radio contours (Govoni);
blue numbers=peaks in the mass distribution (GL, Mahdavi).**

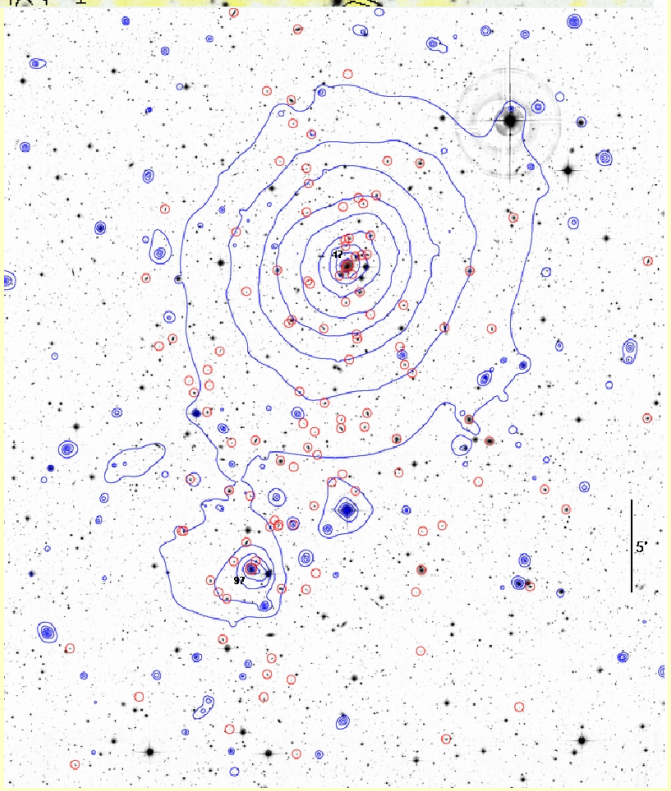


MG involved in METEORA (PI. V. Vacca, INAF-OAC)
MagnETismo Extragalattico con Osservazioni multi-fRequenzA

**Abell 780 –
with the powerful radio source Hydra A
and a spectacular X-ray tail**

**XMM X-ray data +
TNG and VLT spectra
(Very Large Telescope – ESO).
A X-ray tail related
to an infalling galaxy group.
W. Boschin, S. De Grandi (X-ray data),
C. Innocentin, M. Nonino.**



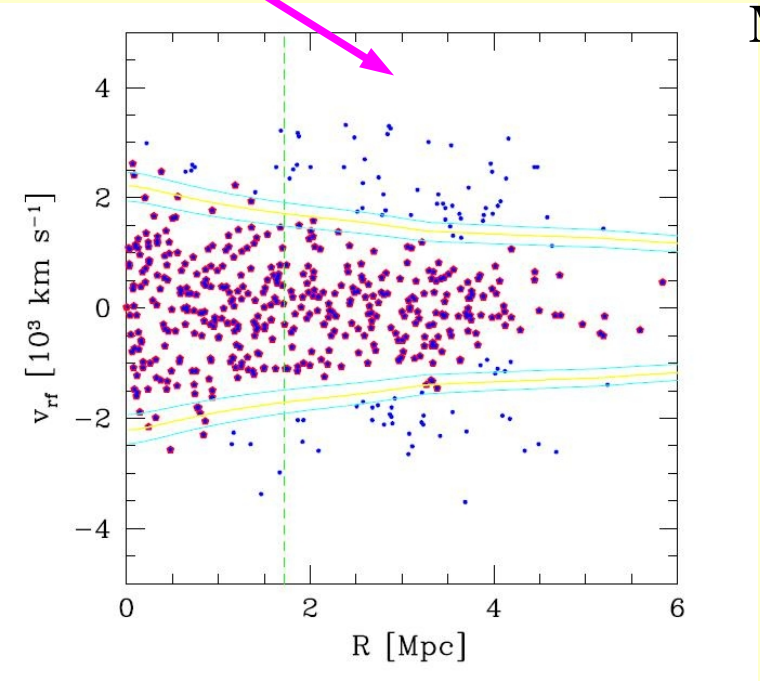


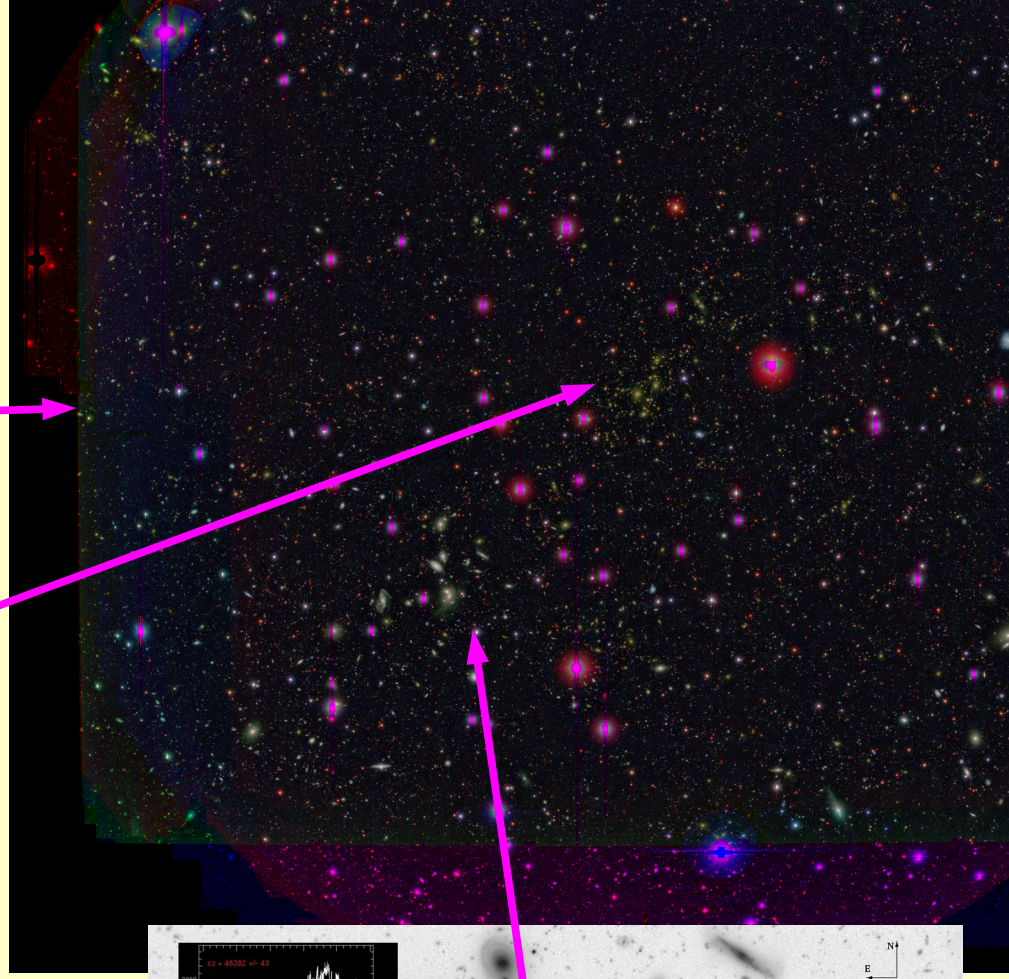
CLASH-VLT +ZOOMING projects

PI. P. Rosati (UniFe)
13 clusters with 500-1000 gals, VIMOS+MUSE spectra
(VLT-ESO data, European Southern Observatories)

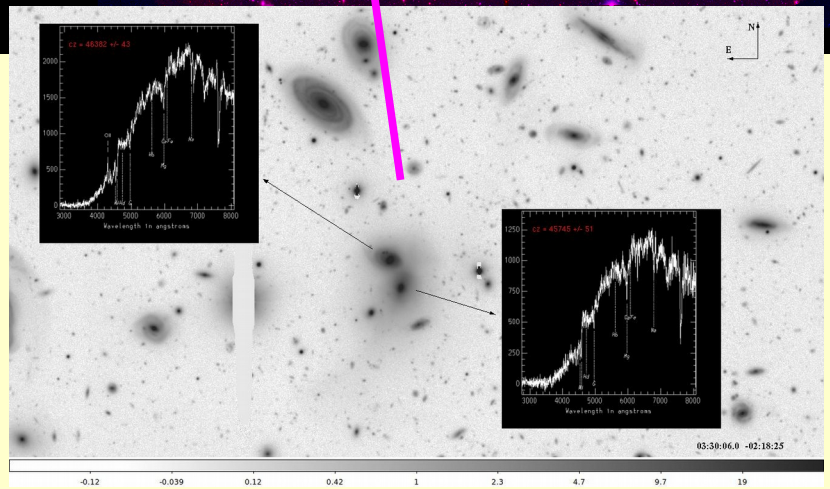
M. Nonino (INAF-OATS)
(PI of GCAV, ESO imaging survey)

A. Biviano (INAF-OATS)
(galaxy orbits → mass determination)





MACS0329
z=0.45



Foreground group
+ intracluster light
VLT+TNG spectra

EUCLID-ESA mission

Determination of velocity dispersion, σ_v → Cluster Mass (clusters at z=0.9-1.8)