IntraCluster Light at $z \sim 0.5$: the MUSE and CFHT view

XMM-XXL project

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http://irfu.cea.fr/xxl

- 10ks XMM survey / 50 deg$^2$ divided in two fields

- Expected > 500 clusters and 20000 AGNs
- XMM VLP (3 Ms over AO10 / AO11)
- World-wide collaboration of ~100 scientists

mainly from Europe and US, Canada, Australia
Intracluster Light (ICL)

- It is composed both of gas and stars;
- It *may* become the site of intra-cluster/group star formation;
- It is a tracer of types and frequency of the physical processes at work in a cluster or in a group.

**BUT**

- It is difficult to disentangle ICL from halo emission;
- It is difficult to observe it outside our local Universe.
XLSSC 116: an unusual cluster

C2 cluster;

CFHT W1 field
(Coupon et al., 2009)

$Z_{\text{phot}} = 0.47$
(Durrett et al., 2011)

$z_{\text{spec}} = 0.53$
(WHT, Kolouridis et al., in prep)
XLSSC 116: an unusual cluster

$\Delta r ([0.5-2\text{keV}]-i) = 11'' (=70\text{kpc})$

Bimodal (?) gas distribution:
$T_1 = 0.3 \text{keV}$
$T_2 = 2.1 \text{keV}$

$L_{x,500}([0.5-2] \text{keV}) = 4.7 \times 10^{43} \text{erg/s}$
XLSSC 116: galaxies and ICL

★ ICL detection through OV_WAV method  
(Pereira et al., 2003; Da Rocha&Mendes-Oliveira, 2005)
ICL

detection: $2.5\sigma$ above the sky
observed: out to 180 kpc from the cluster center
$L \approx 2 \times L_{\text{BCG}}$
XLSSC 116: galaxies and ICL

★ ICL detection through OV_WAV method (Pereira et al., 2003; Da Rocha & Mendes-Oliveira, 2005)

★ SED fitting of the main galaxies, including the main cluster galaxy and the ICL
**ICL**

\[ \log(M) \sim 10.7 \, M_\odot \]

Age \sim 2.3 \times 10^9 \, \text{yr}

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**BCG**

\[ \log(M) \sim 11.2 \, M_\odot \]

Age \sim 6.9 \times 10^9 \, \text{yr}
XLSSC 116: galaxies and ICL

★ ICL detection through OV_WAV method (Pereira et al., 2003; Da Rocha&Mendes-Oliveira, 2005)

★ SED fitting of the main galaxies, including the main cluster galaxy and the ICL

★ MUSE Science Verification data: 4h on target. Spectra of the cluster members and of ICL
BCG
SFR([OII])= 32.2±0.75 M/yr (Kennicutt 98 calibration)

Member galaxies and ICL:
★ Two structures:
σ₁ = 570 km/s
σ₂ = 170 km/s
Δv = 2000 km/s
BCG
SFR([OII]) = 32.2±0.75 M\(_{\odot}\)/yr
(Kennicutt 98 calibration)

OLD galaxies!!
....and a surprise
....and a surprise

Size = 13 x 6 kpc
SFR([OII])= 2.2±0.2 M\(\odot\)/yr (Kennicutt 98 calibration)
R23 = 9.8  Z=0.3-0.5 Z\(\odot\), log(U)\(\sim\)-2 (Oey & Shields, 2000)
Size = 13 x 6 kpc
SFR([OII])= 2.2±0.2 $M_\odot$/yr (Kennicutt 98 calibration)
R23 = 9.8  Z=0.3-0.5 Z_\odot, log(U)~-2 (Oey & Shields, 2000)
Anatomist report

Incoming first approach of the galaxy group through the cluster center. Gas loss through RAM Stripping and onset of SF

The group falls back and it is now seen as a substructure of the cluster.

we are now in second pericenter approach. (see also Poole et al., 2007)
Anatomist report

i) Elapsed time: \( \sim 2 \) Gyr

- Impact parameter \( \leq 0.15 \)
  \( \frac{M_{\text{cluster}}}{M_{\text{infall}}} \sim 1 \)

- ★ RAM pressure stripping
  generation of the ICL tails
- ★ SF burst in the central cluster galaxy

- Second pericenter passage

Dynamical modeling required!!