OSIRIS TF Survey of the galaxy cluster ZwCl 0024.0+1652

Star formation, AGN population and cluster dynamics from Emission Line Galaxies

M. Sánchez-Portal[1,2], I. Pintos-Castro[2,3,4,5], R. Pérez-Martínez[1,2], J.Cepa[4,5], A.M. Pérez García[4,5], A. Bongiovanni [4,5] and The GLACE Team

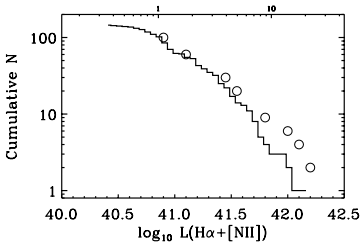
[1]*European Space Astronomy Centre;* [2]*ISDEFE;* [3]*CAB-INTA/CSIC;* [4]*IAC;* [5]*ULL*

Introduction

- GLACE is an innovative survey of ELGs aimed to study the evolution of galaxies in clusters, addressing several issues:
  - Star formation in clusters:
  - Variation of star formation properties with position within the large-scale structure, testing different models of environmental influence in galaxy evolution (galaxy-galaxy, galaxy-ICM interactions).
  - Star formation history of galaxies in clusters
  - The role of AGNs (fraction vs. density)
  - Distribution of galaxy metallicities
  - Galaxy dynamics and cluster accretion history
- The survey is being carried out with the OSIRIS Tunable Filters (TF) in spectral scanning mode, covering a range of the velocity field for several emission lines (Hα/[NII], Hβ, [OII], [OIII]).
- Two clusters have been observed so far. Here we report on Hα/[NII] observations of Zw Cl0024.0+1652, a rich galaxy cluster at z = 0.395. See talk of Pintos-Castro in this meeting for results on [OII] observations of RXJ1257+4738 at z = 0.867.

Star-forming (SF) galaxies and AGN

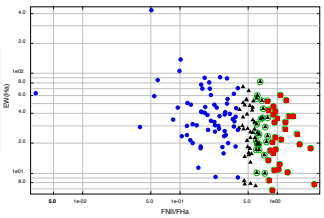
- Hα+[NII] luminosities well aligned with previous surveys.



Cumulative luminosity within r_{cal} = 1.7 Mpc. The circles correspond to Kodama+04 LF. The discrepancies at high luminosities are mainly attributed to our incomplete spatial coverage to the E and SE. Otherwise, there is a relatively good agreement between both data sets.

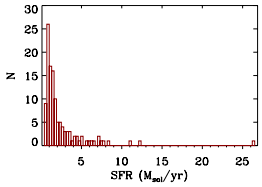
- We have discriminated between SF and AGN populations using the EWαn2 diagram from Cid-Fernandes+10, that correlates the $F_{Hα}/F_{[NII]}$ ratio with the Hα equivalent width. The fraction of AGN depends on the limits set to $F_{Hα}/F_{[NII]}$:

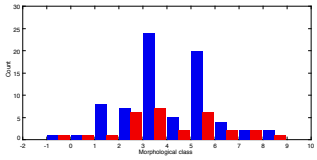
Criterion	$F_{Hα}/F_{[NII]}$	Number	Fraction (%)
Pure AGN (Kewley+01)	0.794	30	17
Classical AGN (Ho+97)	0.60	53	30
AGN+all transition types (Stasinska+06)	0.398	89	51



EWαn2 diagram showing pure SF galaxies (blue dots), pure AGN (red dots) and transition objects (black triangles). Classical AGN as defined by Ho+97 are denoted by open green circles.

- Regarding the AGN class, all the objects are very likely Seyfert galaxies (EW(Hα) > 6Å). No clear LINER-class objects are detected due to our EW detection limits.
- The median SFR of the SF population is 1.47 $M_{\odot}$/yr (with 1 mag. extinction at Hα)





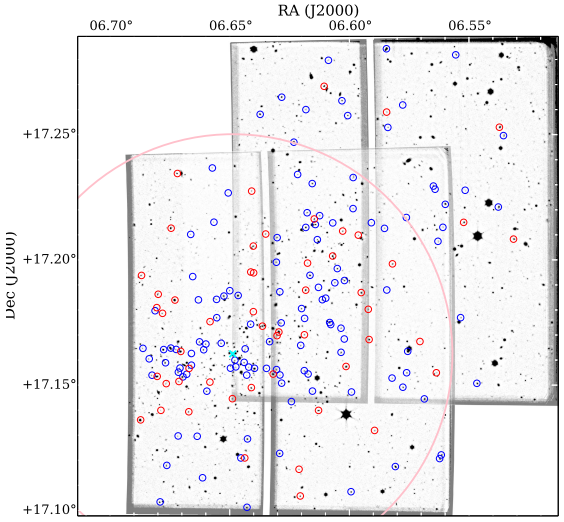
- ELG (both AGN and SF galaxies) are generally found in spiral galaxies (Abraham class 3, 4, 5) but a non-negligible fraction is found in morphologically early-type galaxies.

Morphological classification of the robust ELG detections, (blue –SF; red – AGN) according to Abraham+96: -2=star, -1=compact, 0=E, 1=E/S0, 2=S0, 3=Sab, 4=S, 5=Scdm, 6=Irr, 7=peculiar, 8=merger, 9 = defect

Contact: miguel.sanchez@sciops.esa.int

The catalogue

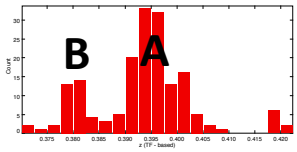
- Two OSIRIS pointings (towards cluster centre and offset to the NW).
- Total on-source exposure time is 5.1 and 2.9h for the centre and offset pointings, respectively.
- The total number of sources detected above 3σ is 1482.
- The total number of robust ELG detections is 210
- The total number of robust ELG candidates (after rejecting interlopers by colour-colour diagrams and existing spectroscopic redshifts) is 174
- The completion limit is $f_{Hα} \approx 0.9 \times 10^{-16}$ *erg cm*$^{-2}$ *s*$^{-1}$ after deblending the [NII] line.



The figure depicts the two OSIRIS/GTC pointings towards Cl0024. Blue circles correspond to SF galaxies and red ones correspond to AGNs according to the [NII]/Hα ≥ 0.6 criterion from Ho+97. The cyan cross (x) denotes the centre of the cluster (galaxies/BCG) and the large pink circle marks the virial radius of 1.7 Mpc (Treu+03). A general alignment of ELG is observed in the NW – SE direction, consistent with a a structure assembling onto the cluster core from the NW with an orientation almost in the plane of the sky (Moran+07, Zhang+05, Kneib+03).

Cluster dynamics from emission lines

Using the redshifts derived from our data, it is possible to recognize two dynamical structures as in Czoske+01: 'A' is the main cluster component, while 'B' lies along the line of sight to the cluster centre and has been interpreted as an infalling group at high velocity.



- We have applied the technique of caustics in the redshift space (Diaferio+97, 99) using the ***CausticApp*** code (Serra+11) to explore the possibility of using ELG radial velocity data to trace the cluster mass.
- Integrating the squared caustic amplitude we can derive the mass profile.
- We derive $r_{200} \approx 1.2 \pm 0.1$ Mpc/h and $M_{200} \approx 4.1 \pm 0.2 \times 10^{14}$ $M_{\odot}$/h. For comparison, Kneib+03, from weak lensing analysis, derive $r_{200} \approx 1.2 \pm 0.9$ Mpc/h and $M_{200} = 4.0 \pm 0.8 \times 10^{14}$ $M_{\odot}$/h, hence in excellent agreement.