Conference Poster

The nature of E+A galaxies in intermediate redshift clusters?

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E+A Galaxies in Intermediate Redshift Clusters

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ABSTRACT

Combining HST/WFPC2 mosaics with extensive ground based spectroscopy, we determine the fraction of E+A ("post–starburst") galaxies in three intermediate redshift clusters (0.33<z<0.83) and study their physical characteristics. For ~500 members, we have galaxy colors, luminosities, Hubble types, and quantitative structural parameters as well as equivalent widths for assigning spectral types. We also include measured internal velocity dispersions for 120 cluster members and estimate dispersions for the rest of the sample using the Fundamental Plane.
Of the 46 cluster E+A candidates, only the 14 that satisfy our strict selection criterial are used in this analysis.

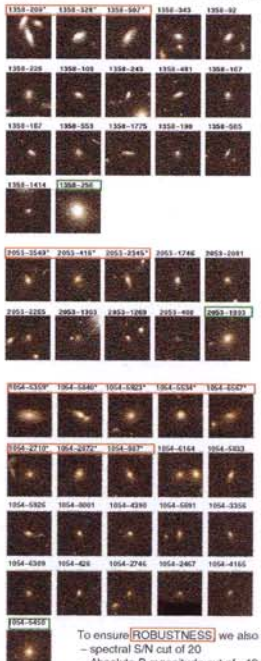
E+A CANDIDATES

Clusters:
- CL1358+62 z=0.33
- MS2053–04 z=0.59
- MS1054–03 z=0.83

E+A Selection Criteria:
- [OII] 3727<5A
- (4102+4341)/2>4A
- —> 46 candidates

HST/WFPC2 Imaging:
- ~6'x6' mosaics in F814 & F606
- Spatial coverage to R~1 Mpc
- Hubble Type
- Quantitative Structural Params, e.g. Bulge/Disk Decomposition & Half–light radii

Keck/LRIS Spectroscopy:
- ~500 confirmed members
- [OII]3727 and Balmer lines
- Measured Internal Velocity Dispersions for 120 members
- Estimated Dispersions for rest of cluster sample



To ensure ROBUSTNESS we also apply
- spectral S/N cut of 20
- Absolute B magnitude cut of –19.1
—> 14 candidates

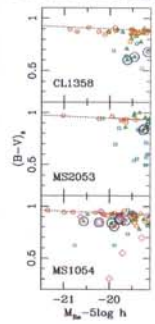
Representative Bright Elliptical Member

QUESTIONS

1. Do E+A ("post–starburst") galaxies exist in intermediate redshift clusters?
   CNOC1 –> NO MORPHS –> YES
2. What are their physical properties? Do they span the range in Hubble type, luminosity, size, and internal velocity dispersion (~mass)?
3. Does the characteristic E+A mass evolve with redshift?
4. Can the E+A phase play a critical role in the transformation of star–forming galaxies into early–type members?

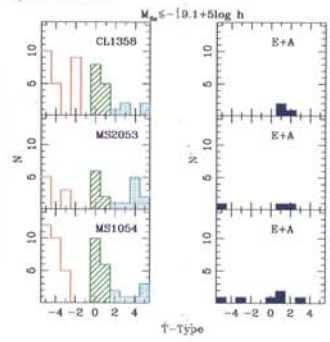
RESULTS

Fig. 1: Color–Magnitude Diagram for members in the three clusters with absolute rest–frame B magnitude brighter than –19.1. The CM Relation (dotted line) is normalized to the E–S0 members and its slope is from van Dokkum et al. (2000).



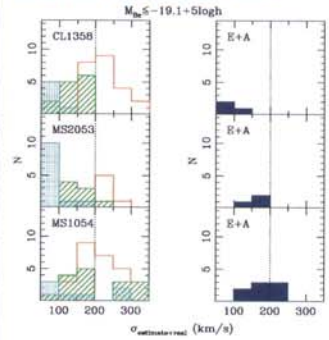
E+A's in the two lower redshift clusters are faint but can be up to a magnitude brighter in MS1054 (z=0.83).

Fig. 2: Histogram of Hubble type for cluster members above our magnitude cut. In the left panels, open regions represent E–S0's, angled regions S0/a–Sa's, and dotted regions spirals. The right panels show the respective E+A distributions; two of the E+A's in MS1054 are mergers (not shown in left).
E+A's span the range of morphological type but tend to be systems with disks.



H=100 km/s/Mpc, Omega=0.3, Lambda=0.7

Fig.3: Histogram of internal velocity dispersion (observed & estimated); regions are as in Fig. 2.
In CL1358, all the high dispersion (>200 km/s) members are E–S0's while in MS1054, high dispersion members include S0/a–Sa's, spirals, E+A's, and mergers (not shown).



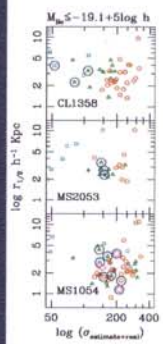


Fig. 4: Half–light radius (~size) vs. velocity dispersion (observed & estimated); neither of these quantities should evolve strongly with redshift. The symbols are as in Fig. 1.

High dispersion E+A's in MS1054 are likely to be the progenitors of massive early–types at low redshift.

CONCLUSIONS

1. E+A galaxies compose a non–negligible fraction (~5–15%) of the cluster population.
2. E+A's span the range in morphology, bulge–to–total fraction, luminosity, internal velocity dispersion (~mass), and half–light radius (~size). Even massive early–types can be E+A's.
3. We find a trend of increasing luminosity and internal velocity dispersion with redshift, suggesting that the characteristic E+A mass evolves ("down–sizing").
4. At least 30% of cluster E–S0's at z=0.83 have had an E+A phase; the true number could be significantly higher. Thus the E+A phase can play an important role in the transformation of star–forming galaxies into early–type members.

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