ABSTRACT

We study the IR properties of galaxies in the young massive galaxy cluster RXJ1257+4738 at z=0.866, and their relation with the environment, by combining new observations of the GLACE survey (Sánchez-Portal et al. 2012) (broad band imaging with GTC-OSIRIS & WHT-LIRIS) and Herschel-PACS&SPIRE imaging photometry, along with existing Spitzer-IRAC&MIPS data. With this wide wavelength coverage, we derived photometric redshifts through a SED-fitting procedure to obtain 96 cluster candidate galaxies with an accurately sample of the IR peak. The analysis of the star formation activity of these cluster members galaxies show no clear relation with local density. From a global point of view, we find that RXJ1257 properties are consistent with the mass-normalized total SFR evolution with redshift.

CATALOG: CLUSTER MEMBER CANDIDATES

Aimed at building a merge catalog including all detected sources, we performed a cross-match of individual catalogs, from optical to FIR, by applying a criterion of minimum sky distance. A quantitative analysis of our procedure, with the methodology of de Ruitter et al. (1977), gives us completeness and reliability values above 90% and 80%, respectively. The resulting raw catalog has 7226 sources. To compute the redshift for all galaxies in the sample we carried out a SED-fitting using the LePhare code (Ilbert et al. 2006). We obtained 651 galaxies with 0.8 < z < 0.95, of which 96 have their IR part of the SED well fitted. LePhare directly gives as output the age, stellar mass, IR and UV luminosities and extinction of the galaxies. We derived the total SFR, using Kenicutt (1998) calibrations, as the sum of SFR/agecorrected plus the FIR contribution.

LOCAL DENSITY RELATIONS

In order to study the environmental dependence of the star formation activity, we built the density-SFR and density-sSFR relations. We estimated the local density, Σ (in Mpc^-2 units), at each galaxy position using its neighbouring galaxies by calculating the surface of the circle whose radius equals the projected distance to the 5th nearest galaxy. In this calculation, all galaxies with Σ < 0.05 are considered.

To distinguish the environmental and the mass effects, we analyzed two bins of stellar masses: the low mass sample with M < 5x10^10 M☉ and the high mass sample with M > 5x10^10 M☉. As in Popesso et al. (2011), the approach is to derive the mean density per SFR and sSFR for each bin. In both samples we found no clear correlation between density and SFR or between density and sSFR, although we see that high mass systems tend to dominate high SFR bins while the low mass sample dominates high sSFR ones. A similar result is obtained if we estimate the mean SFR (and mean sSFR) per density bin, since as shown in figure below both relations are flat with a marked difference between mass samples.

GLOBAL EVOLUTION

We characterize the RXJ1257 cluster SFR properties in terms of the mass-normalized total SFR, SFR/M, to compare them with previous studies in the literature. Following Finn et al. (2005), we estimate SFR using all the cluster member galaxies within 0.5R200, and divide it by M200 to derive SFR/M, where both parameters, R200 and M200, are calculated based on a velocity dispersion of 600Km/s (Ulmer et al. 2009).

In the plots below, we include our cluster in the sample compiled by Koyama et al. (2010), where we see the mass-normalized total SFR increases towards higher redshift clusters. Although the scatter is large, this evolutionary trend with redshift can be fitted with (1+z)^2. This global cluster property is also well correlated with cluster mass, which can cause the scatter among clusters at a similar redshift, implying that a wide range of masses in each redshift bin is needed to understand the evolution of starforming activity in clusters.

RESULTS

(1) We obtained 641 photometric cluster members candidates, of which 96 have fitted their FIR emission.

(2) Studying the dependence of the star formation activity with local density no clear correlation is obtained.

(3) As a whole, RXJ1257 satisfies the evolutionary trend with redshift reported by previous works.

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