Dust properties of LIRGs and ULIRGs from the AKARI Deep Field-South

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[Ultra] Luminous InfraRed Galaxies ([U]LIRGs) have a very high star formation rate among star forming galaxies. We model the Spectral Energy Distributions (SEDs) of galaxies from the AKARI Deep Field-South selected at 90μm. Applying the CIGALE fitter to estimate their stellar mass, dust mass and dust temperatures, we found 22 LIRGs and 17 ULIRGs, which comprises ∼25% of our sample. We found that the majority of ULIRGs harbour Type 2 AGN, whereas LIRGs can have both AGN types.

1 Introduction

Luminous and Ultra Luminous InfraRed Galaxies ([U]LIRGs) are galaxies with bolometric IR luminosities from $10^{11} L_\odot$ to $10^{12} L_\odot$, and from $10^{12} L_\odot$ to $10^{13} L_\odot$, respectively. They emit over 90% of their energy in the IR part of the spectrum. [U]LIRGs are rare in local universe, but more common at higher redshift, and they are major contributors to the star formation (SF) density at z∼1–2. They are often found to be merging galaxies. Depending on the sample selection and diagnostic method used to quantify the active galactic nucleus (AGN) contribution in the bolometric luminosity, between 30–70% of local [U]LIRGs may host an AGN.

2 Data and tools

We used a sample of 556 galaxies at the South Ecliptic Pool observed by the Japanese IR space telescope AKARI, in the AKARI Deep Field South (ADF-S). The AKARI data were cross-correlated with other samples, including Herschel data. To construct our sample we restrict our analysis to sources with the best quality photometry available to fit SED models (Małek et al., 2017) Our final sample consists of 22 galaxies with spectroscopic redshifts and 58 galaxies with photometric redshifts calculated by CIGALE (Małek et al., 2014). To analyse their dust properties, we use the CMCIRSED (Casey, 2012) and CIGALE (Noll et al., 2009; Serra et al., 2011) SED fitting codes. CMCIRSED, dedicated to modelling of the IR part of the spectra, fits the convolution of the grey-body function with the power-law function in a narrow range of the spectrum: 8-1000μm, while CIGALE fits many models over a wide spectral range, from ultraviolet (UV) to far IR (FIR).

3 Results and conclusions

In our sample we found 13 LIRGs and 12 ULIRGs using CMCIRSED, and 22 LIRGs and 17 ULIRGs using CIGALE (Małek et al., 2017). The main fitted parameters for our sample divided into ULIRGs, LIRGs and remaining galaxies from both codes are presented in Table 1.

CIGALE

	#	$\log(L_{dust})[L_\odot]$	$\log(M_{star})[M_\odot]$	$AGN_{fraction}[\%]$
ULIRG	17	12.40 ± 0.32	11.51 ± 0.37	19.12 ± 6.76
LIRG	22	11.31 ± 0.25	10.95 ± 0.31	12.54 ± 3.59
$L_{IR} < 10^{11} L_\odot$	30	9.78 ± 0.62	9.50 ± 0.74	12.82 ± 1.27

CMCIRSED

	#	$T_{dust}[K]$	$\log(M_{dust})[M_\odot]$	
ULIRG	12	29.83 ± 0.64	8.69 ± 0.07	
LIRG	13	29.22 ± 0.50	7.46 ± 0.02	
$L_{IR} < 10^{11} L_\odot$	17	26.12 ± 1.07	6.07 ± 0.11	

Table 1: Mean values of dust luminosity, total stellar mass, dust temperature and dust mass computed by CIGALE and CMCIRSED for ULIRGs, LIRGs and other ADF-S galaxies.

As CIGALE covers a wider range of spectra than CMCIRSED, it is less sensitive to the lack of the FIR data, which may be a reason why the number of [U]LIRGs detected by CIGALE is higher. We found that (comparably to [U]LIRGS found in other surveys) the dust temperature is inversely proportional to the dust mass and this relation is dependent on sample selection. We derived that 12% and 20% of IR luminosities in LIRGs and ULIRGs, respectively, comes from an AGN, and the separation between them maybe related to the viewing angle of an AGN.

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