The X-ray Emission of Local LIRGs

M. Pereira-Santaella[1], A. Alonso-Herrero[1], M. Santos-Lleo[2], L. Colina[1], E. Jiménez-Bailón[3], A. Longinotti[4], G. Rieke[5], M. J. Ward[6], and P. Esquej[1]

[1]CAB, INTA-CSIC (Spain) [2]ESAC (Spain) [3]UNAM (Mexico) [3]University of Durham (UK) [4]MIT Kavli (US) [5]Steward Observatory (US)

ABSTRACT

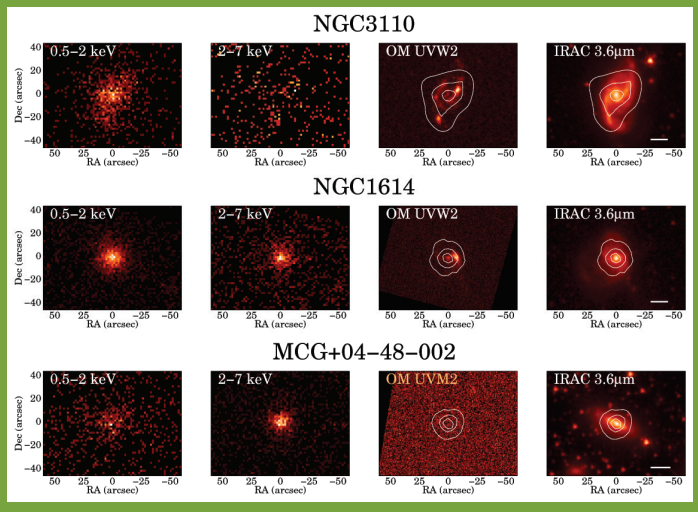
Deep infrared cosmological surveys show that Luminous and Ultraluminous Infrared Galaxies (LIRGs, L(IR)=10^{11} to 10^{12} Lsun; ULIRGs, L(IR) 10^{12} Lsun) are major contributors to the star-formation rate (SFR) density at z~1-2. In local ULIRG most of the star-formation activity takes place in very compact (<< 1 kpc) regions, however in z~2 IR bright galaxies star-formation appears distributed over spatial scales of a few kpc as in local LIRGs. Thus local LIRGs might be scaled down analogs of distant star-forming galaxies.

We study the X-ray emission of a representative sample of 27 local LIRGs. We found that the soft X-ray (0.5-2 keV) emission of most of the LIRGs is produced by star-formation related processes. These LIRGs follow the SFR vs. soft X-ray luminosity correlation observed in local starbursts. Likewise the non-Seyfert LIRGs also follow the hard X-ray (2-10 keV) luminosity vs. SFR relation of local starbursts. No deeply obscured bright AGN seem to be present in these LIRGs. We estimate that the AGN contribution to the total luminosity of our sample is 7-10%.

1. Data

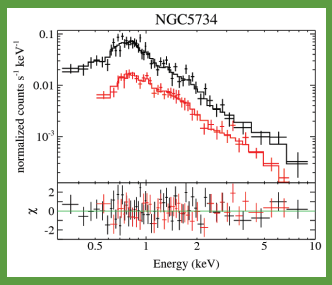
We obtained new *XMM-Newton* data for 9 galaxies. These galaxies together with another 16 LIRGs with existing X-ray data form a representative sample of the LIRG class in terms of both IR luminosity and nuclear activity (Alonso-Herrero et al. 2006). 60% are classified as HII and 30% are AGN.

XMM-Newton/EPIC pn 0.5-2 keV and 2-7 keV images of 3 LIRGs in our sample. For reference UV and near-IR images are shown with the X-ray emission contours. NGC3110 and NGC1614 are classified as HII galaxies, but the hard X-ray luminosity is lower in NGC3110. MCG+04-48-002 is an obscured AGN only visible in the hard X-ray range.



2. X-ray Modeling

A model consisting of an absorbed power-law plus a soft thermal plasma provides a good fit to the X-ray spectra of the star-forming LIRGs. The typical parameters of the fits are: kT = 0.5-0.7 keV, Γ = 1.3-2.2, N_H = 10^{21}-10^{22} cm^{-2} and [Fe/O] = -0.5- -0.1. The figure to the right shows an example of the fits.



3. Origin of the X-ray Emission

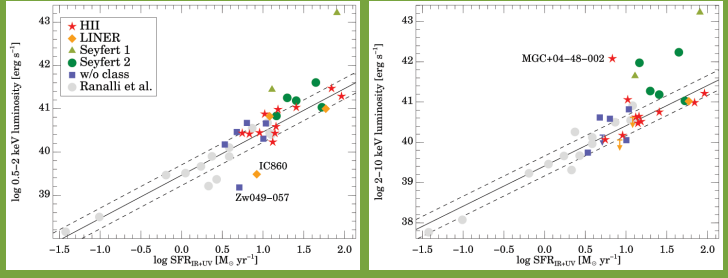
We find that, for most of these galaxies, the X-ray emission can be explained by star-formation. Both the soft and hard X-ray emission of the HII LIRGs follow the SFR vs. X-ray luminosity of local starbursts (Ranalli et al. 2003; Persic et al. 2004).

The figures below show these corre-la-tions. Some Seyfert 2s with powerful starbursts relative to their obscured AGN also lie in the soft X-ray vs. SFR correlation. On the other hand, Seyfert 1s and 2s have excess 2-10 keV emission from the AGN when compared to the star-formation correlation.

4. AGN Integrated Luminosity

We do not detect the 6.4 keV FeKα emission line in most of the HII LIRGs (>90%). Thus we rule out the presence of a luminous obscured (or Compont thick) AGN in these LIRGs. If present, the AGN contribution to the bolometric luminosity would be <10%.

Adding up the emission of X-ray detected AGN and these upper limits we estimate that the AGN contribution to the total bolometric luminosity is between 7 and 10% in our sample of local LIRGs



REFERENCES: Alonso-Herrero et al. 2006, ApJ, 650, 835; Persic et al. 2004, A&A, 419, 849; Ranalli et al. 2003, A&A, 399, 39

CENTRO DE ASTROBIOLOGÍA