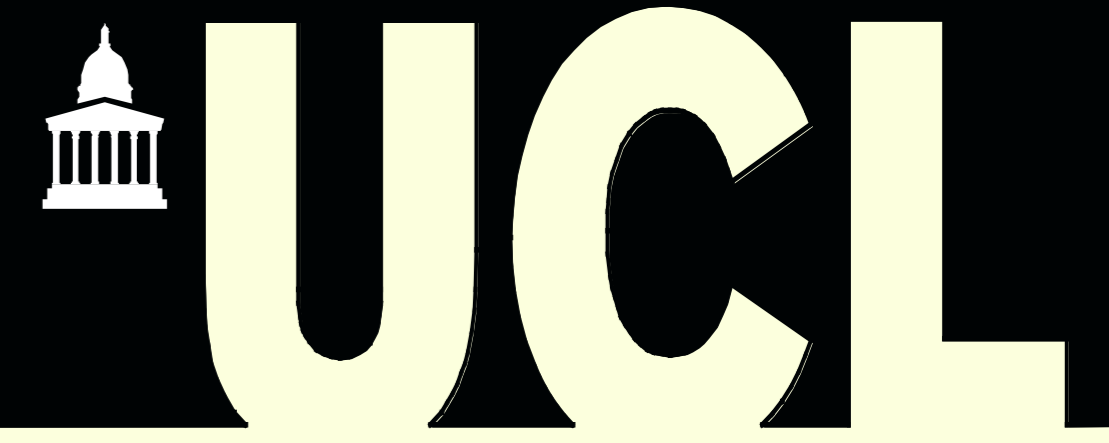




X-ray Properties of Infrared Luminous Galaxies

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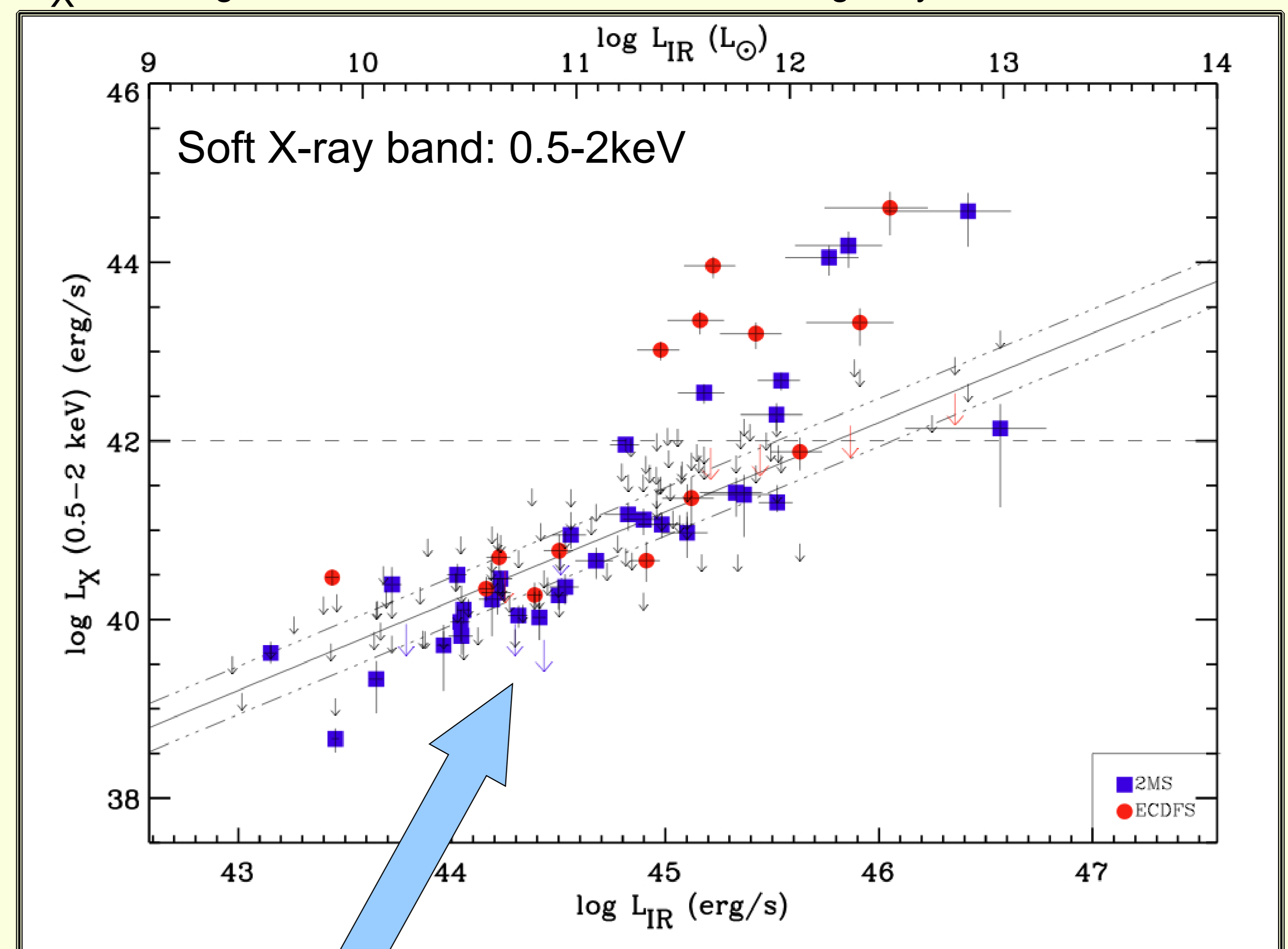
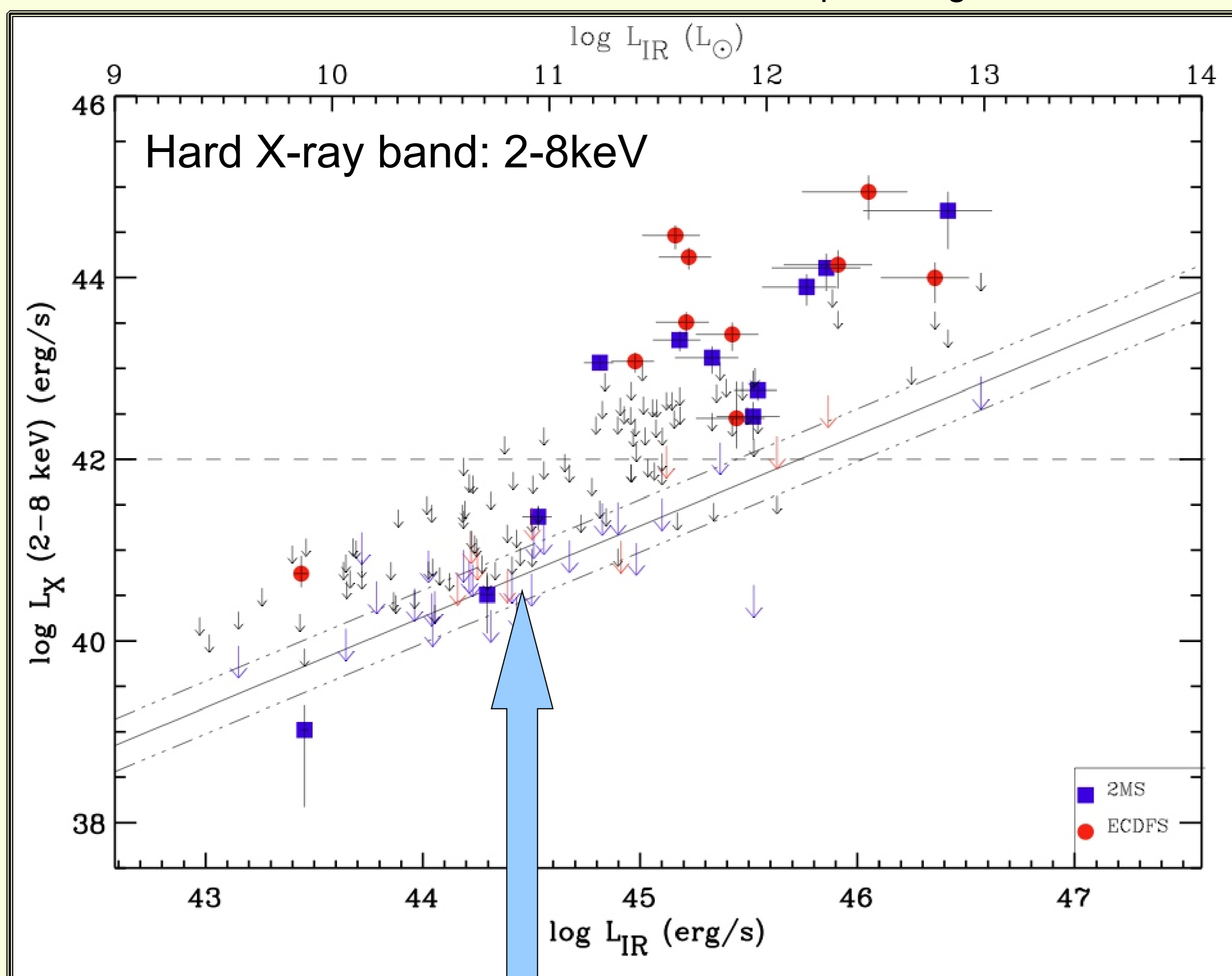


AIM & METHOD:

We investigate the properties of 70 μ m selected sources in the Chandra Deep Field South. We concentrate on a central region of the field where there is a wide range of multi-wavelength data which we are able to exploit for this study. We create a unique 70 μ m catalogue, which combines all the publicly available 70 μ m Spitzer data, combined and re-reduced using techniques similar to (Frayer et al. 2009)¹. This gives us one of the deepest 70 μ m catalogues currently available, containing 190 70 μ m sources with fluxes > 2.8mJy (5 σ). We match the 70 μ m sources to 24 μ m counterparts from FIDEL² & SWIRE³ using a 5.0'' search radius. Using the 24 μ m counterpart positions we match to optical counterparts from COMBO-17⁴, MUSYC⁵ and VIMOS⁶ catalogues using a 1.0'' search radius to obtain the redshift for the sources. The mean redshift is 0.46. In order to examine their X-ray properties we combine the 2MS CDFS catalogue⁷ and ECDFS catalogue⁸. With this combined X-ray catalogue we find that ~33% of our 70 μ m sources have an X-ray counterpart within 5.0''.

	Number	%
70 μ m sources	190	
70 μ m sources with 24 μ m counterparts	184/190	~97%
70 μ m sources with both 24 μ m and optical counterparts.	171/184	~93%
70 μ m sources with 24 μ m, optical and X-ray counterparts	57/171	~33%

Solid line: Ranalli⁹ star formation relationship of HII galaxies; Dashed line: $L_X > 10^{42}$ erg/s above this line we assume that this galaxy hosts an AGN

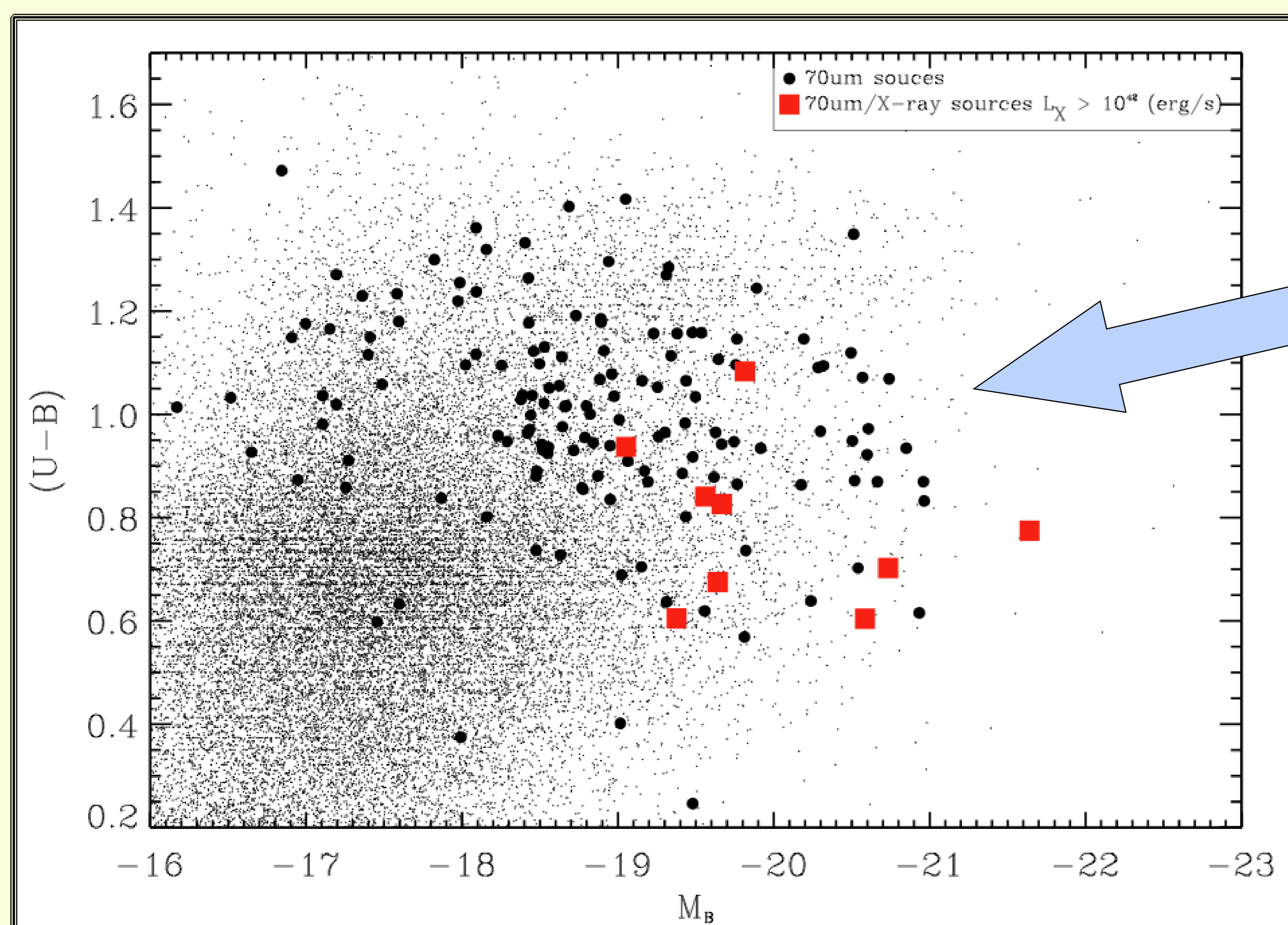


L_X Vs L_{IR} :

We calculate L_{IR} from the 70 μ m luminosity using the equation from Symeonidis et al. (2008)¹⁰ $\log_{10} L_{IR} = 1.16 + 0.92 \log_{10} L_{70\mu m}$

Sources which appear as upper limits on the hard-band graph often fall on the Ranalli et al (2003)⁹ relationship on the soft-band graph.

- 1) We are probably detecting X-rays from starbursts which are detected in the soft-band and not the hard-band.
- 2) The AGN fraction increases with an increase in the total IR luminosity.



Colour Magnitude Diagram:

The small dots are the COMBO-17 catalogue with the following selection criterion applied: ($R_{mag} < 24$ & $z < 1.1$). We over plot our 70 μ m sources which have reliable COMBO-17 redshifts. Red squares highlight 70 μ m sources with an X-ray counterpart of $L_X(0.5-8\text{keV}) > 10^{42}$ erg/s, i.e. AGN. We find that 70 μ m sources with $L_X > 10^{42}$ erg/s X-ray counterparts are bluer and have brighter absolute B-band magnitude than the 70 μ m population (black circles) as a whole.

References:

1. Frayer D. T., et al., 2009, ArXiv e-prints
2. Lonsdale C.J., et al., 2003, Publ. Astron. Soc. Pac., 115, 897
3. Dickinson M., et al., 2006, in Spitzer Proposal ID#30948 A Deep-Wide Far-Infrared Survey of Cosmological Star Formation and AGN Activity. Pp 30948+
4. Wolf C., et al., 2004, A&A, 421, 913
5. Taylor E. N., et al., 2009, ApJS, 183, 295
6. Balestra I., et al., 2010, A&A, 512, A12+
7. Luo B., et al., 2008, ApJS, 179, 19
8. Lehmer B. D., et al., 2005, ApJS, 161, 21
9. Ranalli P., Comastri A., Setti G., 2003, A&A, 399, 39
10. Symeonidis et al., 2003, MNRAS, 385, 1015