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GALAXIES IN THE DEEPEST HERSCHEL FIELD

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INTRODUCTION

A multitude of extragalactic survey fields have been observed by Herschel as part of the HerMES and H-ATLAS programmes.

The project involves data from the Herschel Space Observatory, an infrared-submillimetre telescope operating from 70μm to 500μm, and the SPIRE submillimetre instrument (250μm to 500μm).

When the telescope was operating in space, we created what we refer to as a "dark field" for calibration – a small patch of sky that the telescope returns to in order to calibrate SPIRE over time and as a result, we have built up an large number of individual maps.

If we combine these maps, we have the deepest image every produced by Herschel. The problem is that these maps are so deep that galaxies get crowded together and we cannot extract individual sources; more expert techniques must be used.

THEORY

The project consists of:

- Obtaining ancillary data catalogues from other surveys;
- Extracting sources from the map using iterative methods (XID+);
- Finding galaxy properties (spectral energy density code CIGALE);
- Identifying exotica/rare sources (dusty star forming galaxies).

Along with the SED fits, CIGALE yields parameters such as dust mass, stellar mass, star formation rate (SFR) and star formation history (SFH).

A major question about DSFGs that we are trying to answer is:

- **Do DSFGs lie on the main sequence?**
  Are DSFGs currently undergoing elevated SFRs compared to field galaxies at a similar stellar mass **OR** are they simply massive galaxies with corresponding elevated SFRs?

Integrated infrared luminosity functions for $z \in (1.3, 3.6)$

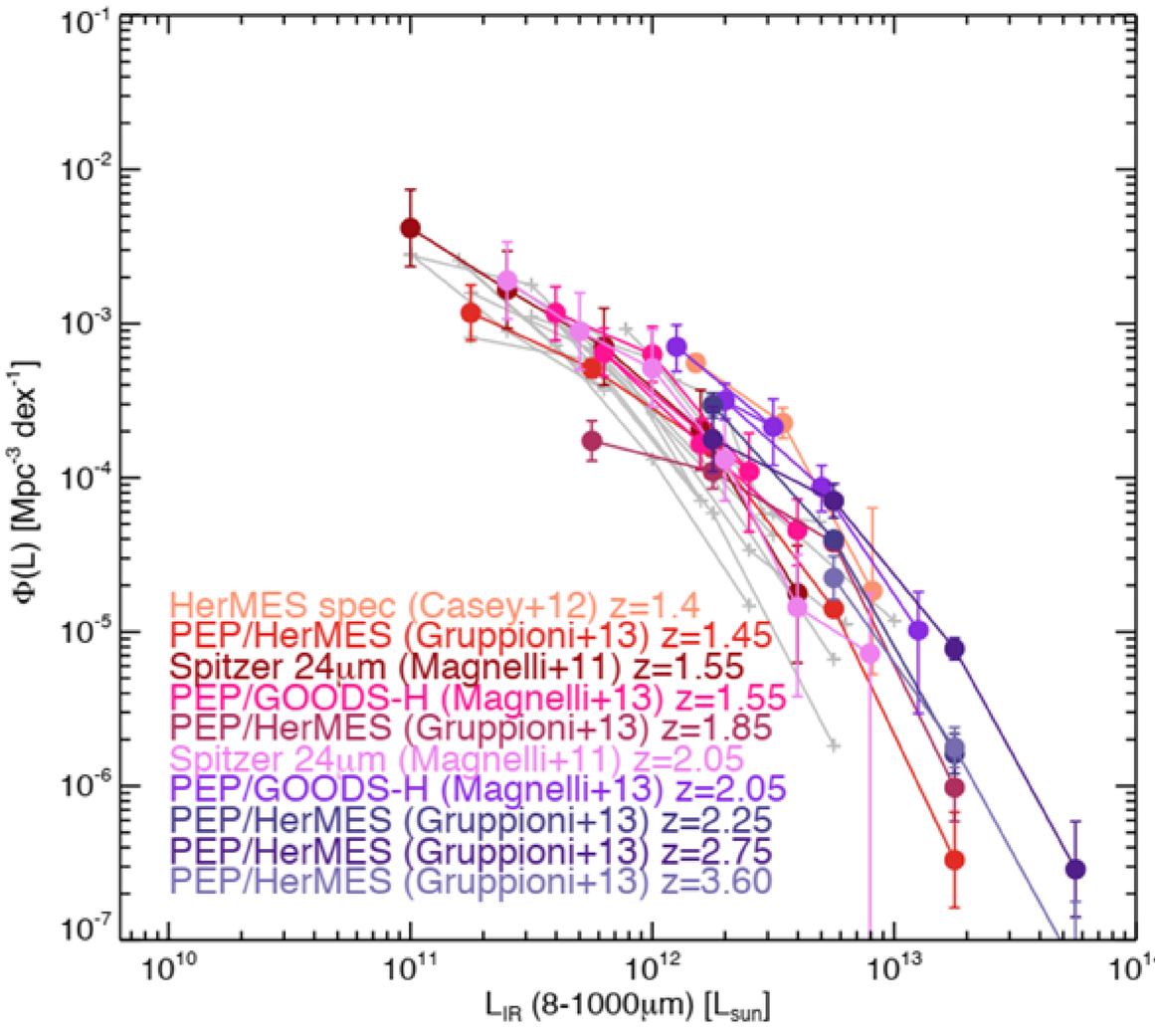

Figure 1: Measured luminosity function data points from literature [1,2,3,4,5,6].

REFERENCES

[1] Sanders, D. B. et al. 2003, AJ, 126, 1607; [2] Le Floc'h, E. et al. 2005, ApJ, 632, 169; [3] Magnelli, B. et al. 2009, AA, 496, 57 –. 2011, AA, 528, A35; [4] Casey, C. M. et al. 2012a, ApJ, 761, 140; [5] Magnelli, B. et al. 2013b, AA, 553, A132; [6] Gruppioni, C. et al. 2013, MNRAS, 432, 23; [7] Santini, P. et al. 2013, ArXiv e-P.

RESULTS

By modifying input parameters used by CIGALE we are able tune the accuracy of the SED fits while maximising efficiency.

An example of a SED at wavelengths $\lambda \in [0.365, 500]\mu$m

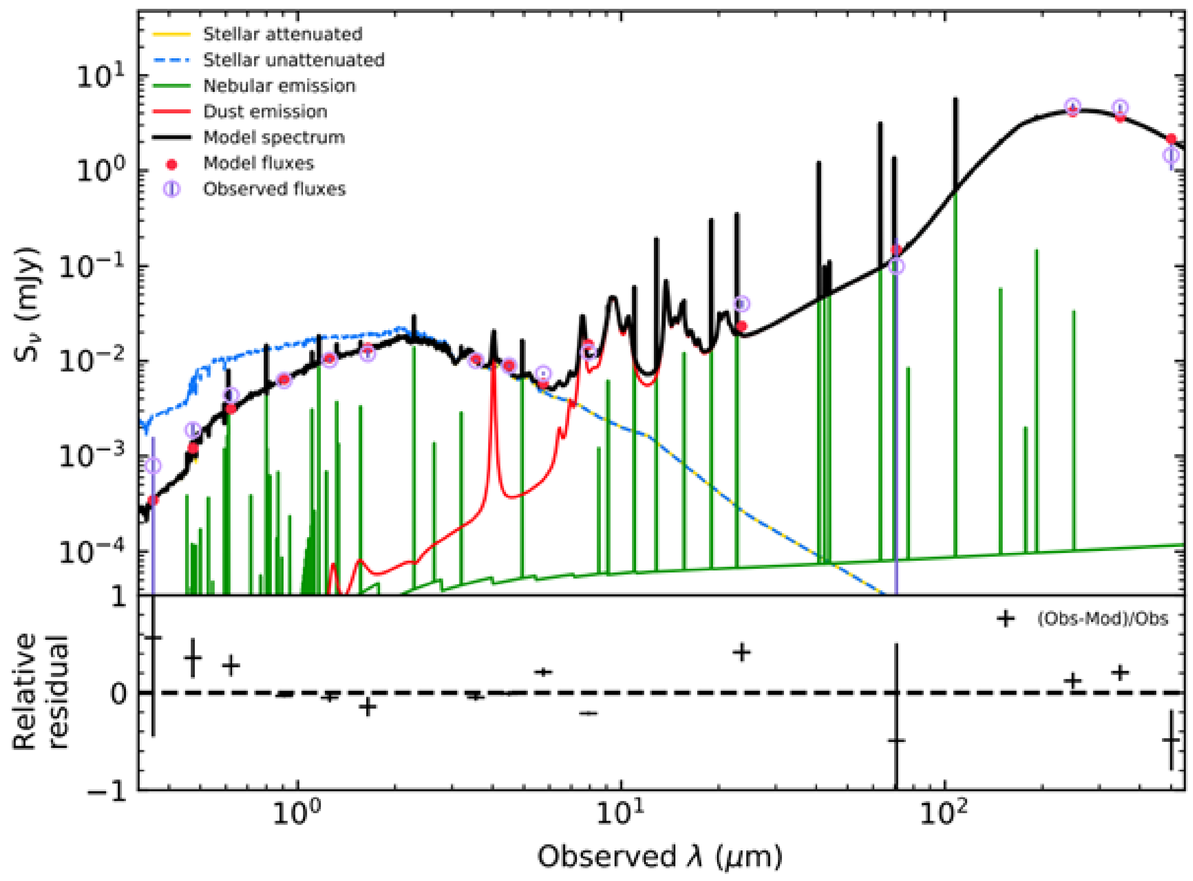

Figure 2: SED for source, redshift $z = 0.22$, reduced chi-squared $\chi^2_\nu = 2.9$.

- We expect to find to find DSFGs on or above the main sequence due to the far-infrared component;
- Recent work on Herschel samples of DSFGs at $z \in (0.2, 2)$ have found tight correlation between dust and stellar mass or SFRs [7].

We can see the strong correlation between galaxies at varying redshifts.

SFRs of sources for stellar masses $10^9 - 10^{12}$ solar masses

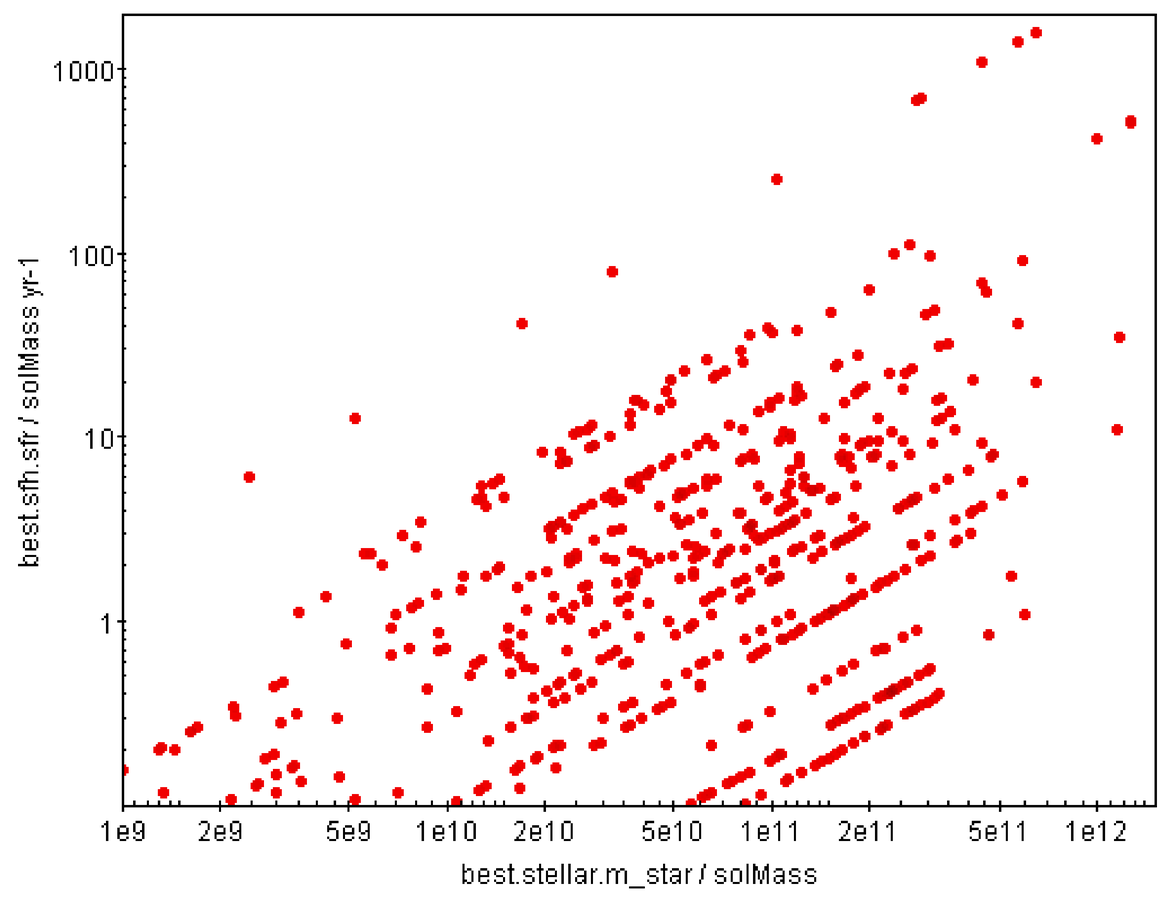

Figure 3: Scatter plot of selected sources with their stellar masses and SFRs.

CONCLUSION

SED fitting has been conducted on nearly 1500 selected data sources. Galaxy properties have been examined as well as their relation to the characterisation of DSFGs; luminosity functions in particular, which will greatly aid in future DSFG work in the astrophysics community. This project still needs to:

- Compare the positions of 250μm, 350μm and 500μm selected sources with respect to the main sequence;
- Look at Hubble Space Telescope images to determine what the galaxies on and above the main sequence look like.