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The Herschel-ATLAS: Far-IR Galaxy Counts

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Abstract

We present galaxy number counts obtained using 250, 350 and 500μm SPIRE observations of the first ~14 sq. deg. of the Herschel-ATLAS survey. Correction factors for completeness and flux boosting are derived by applying our extraction method to model catalogs. We find a steep rise in the number counts at flux levels of 100—200mJy in all three SPIRE bands, consistent with results from BLAST. The counts are compared to a range of galaxy evolution models. None of the current models is an ideal fit to the data but all ascribe the steep rise to a population of luminous, rapidly evolving dusty galaxies at moderate to high redshift.

Introduction

Number counts are a fundmental tool for observational astronomy, with their use dating back to William Herschel's determination of the structure of our galaxy (Herschel, 1784). They are used today as a fundamental probe of galaxy evolution models. The advent of the Herschel Space Observatory allows us to apply this technique to the far-IR/submm at fainter fluxes over larger areas than has previously been possible.

The Herschel-ATLAS Survey

The H-ATLAS survey is the largest area extragalactic survey to be undertaken by Herschel and the single largest Open Time Key Programme (Eales et al., 2010). It will cover 550 sq. deg. in well studied areas of the extragalactic sky using the PACS and SPIRE instruments simultaneously in parallel mode, at wavelengths of 100, 160, 250, 350 and 500 μm reaching 5σ depths of 32-145mJy. This poster presents results obtained from the first 14 sq. deg. region of H-ATLAS to be observed.

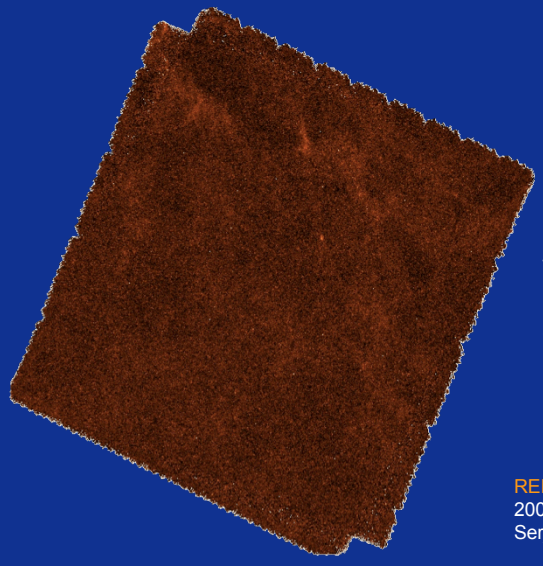
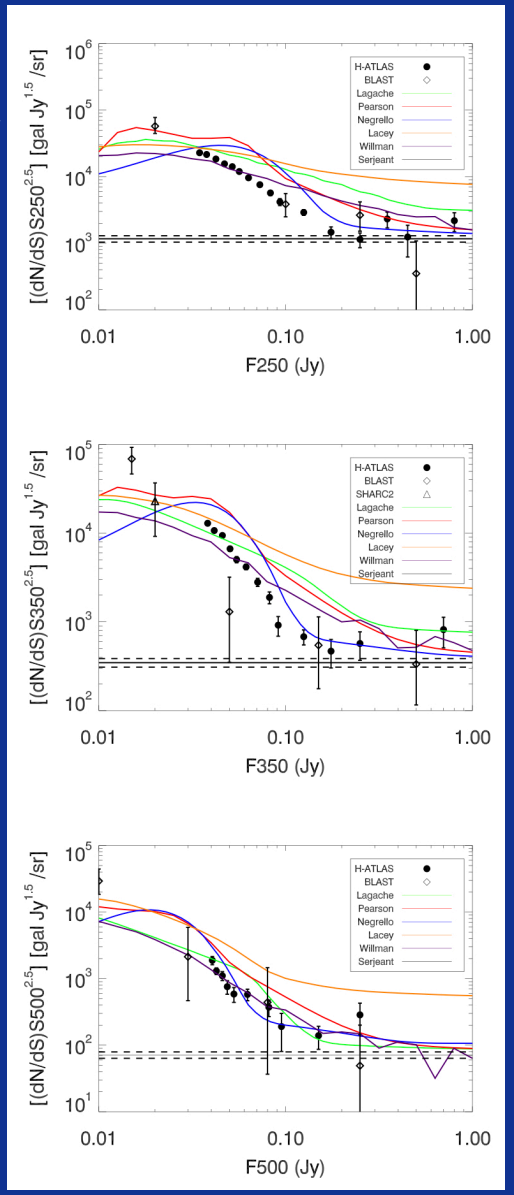


Figure 1: 250mm image of the H-ATLAS region observed during the Herschel Science Demonstration Phase (SDP). Maps were produced using a naive mapping technique after removing instrumental temperature variations from the time-line data (Pascale et al. in prep). Source catalogs were produced using the MADX method, descibed in detail in Rigby et al. (in prep).



Number Counts

Euclidean Normalized Differential Counts were derived for H-ATLAS sources in the SDP field using the MADX cataogs. A number of corrections were applied to the raw counts to account for resolved objects as well as the effects of variations in completeness, reliability, flux boosting and source blending. The latter issues were assessed using simulated observations that were reduced and analyzed using the same methods as the real data. A common feature in the observed counts is a steep rise beyond the Euclidean extrapolated local counts in the 100-200mJy flux range.

Model Comparisons

The observed counts are compared to a range of models from the literature as well as existing data. None of the models provide an ideal fit to the data, but this is not to be expected when new wavebands are opened to observations. Of the models here, the best at reproducing the general properties of the counts – flat to 100-200mJy and then a steep rise – is perhaps that of Negrello et al. (2007). An interesting feature of this model is the role of gravitational lensing at ~100mJy in the SPIRE bands.

Conclusions

We have used the first 14 sq. deg. of the H-ATLAS to determine the number counts of far-IR/submm sources in the SPIRE bands at 250, 350 and 500μm. We find that there is a steep rise in the counts at fluxes of 100 - 200mJy. The H-ATLAS counts are found to be consistent with previous observations, but no theoretical model is an ideal fit. These observations represent just 3% of the H-ATLAS survey. This project will clearly be a very powerful tool for understanding the far-IR/submm galaxy population, especially at the bright end where models differ greatly.

REFERENCES: Herschel, W., 1784, RSPT, 74, 437; Eales, S.A., et al., 2010, PASP, in press; Negrello, M., et al., 2007,MNRAS, 377, 1557; Lagache, G., et al., 2004, ApJS, 154, 112; Pearson, C., et al., 2009, MNRAS, 299, L11; Lacey, C., et al., 2008, MNRAS, 385, 1155; Wilman, R.J., et al., 2010, MNRAS in press; Serjeant, S., et al., 2005, 356, 192