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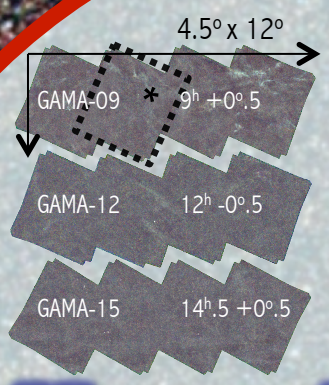
Herschel-ATLAS

Phase 1 Data Release: Autumn 2015

Key facts:

- H-ATLAS will be the largest-area sub-mm sky survey to date, covering ~600 sq.deg.[1]
- Phase 1: 161 sq.deg. GAMA[2] fields (* = previous SDP release =1.6 sq.deg.)
- 5 bands: 100, 160, 250, 350, 500μm
- Valiante et al. 2015 (in prep.): Maps and Cats

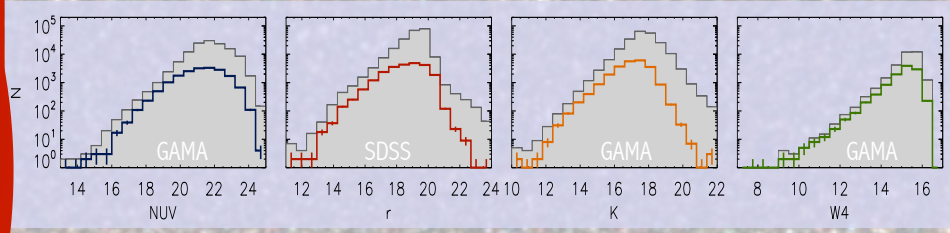


Optical Identifications for H-ATLAS Phase 1

Bourne et al. 2015 (in prep.)

- 161 deg^2 : 114,000 250μm sources >30mJy
- SDSS[3] matching area: 3.2M sources r<22.4
- 220k spec-z from: GAMA, BOSS, WiggleZ, 2SLAQ
- Matching photometry in UV (GALEX), optical (SDSS), NIR (UKIDSS, VIKING), MIR (WISE)[4]
- 44,504 reliable counterparts: 43,284 galaxies, 808 QSOs, 412 stars

UV-MIR magnitude distributions of H-ATLAS IDs compared with SDSS/GAMA



Probability of counterpart identifications measured via likelihood ratio:[5,6]

$$L = \frac{q(m,c)f(r)}{n(m,c)},$$

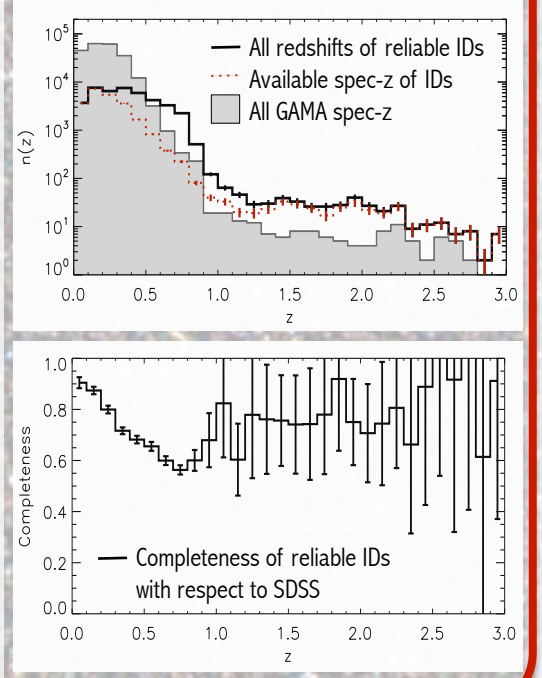
giving Reliability of a match:

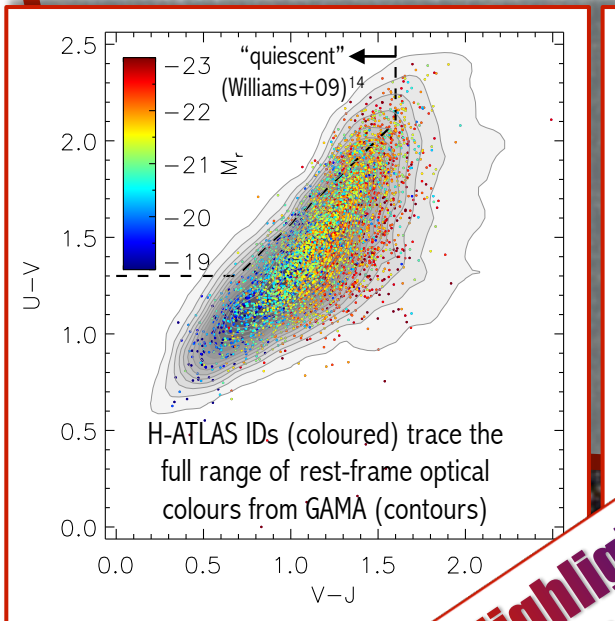
$$R_j = \frac{L_j}{\sum_i L_i + (1 - Q_0)}$$

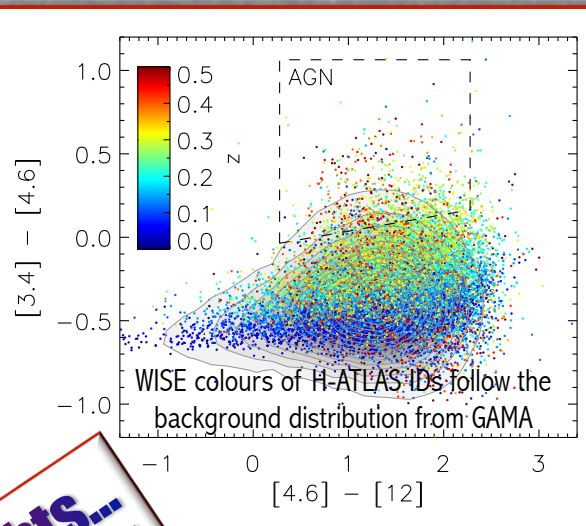
This depends on:

- Optical magnitude distributions of true counterparts q(m), and of SDSS, n(m), as a function of class c (=star/galaxy)
- The probability for a counter-part to be detected in SDSS, Q_0
- The probability distribution of positional offsets, f(r) (see below)

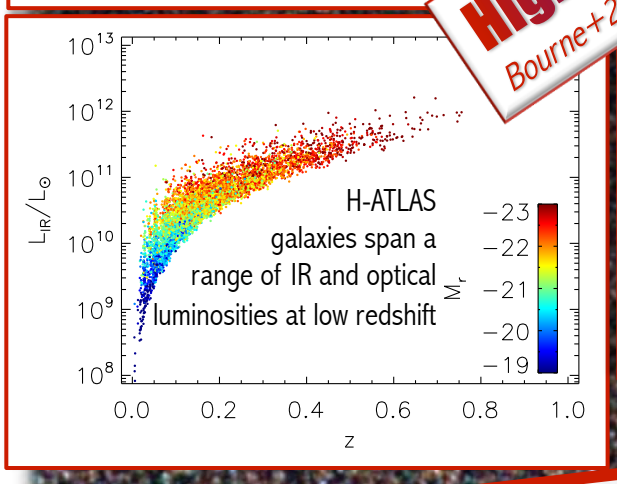
Redshift distributions and completeness of H-ATLAS

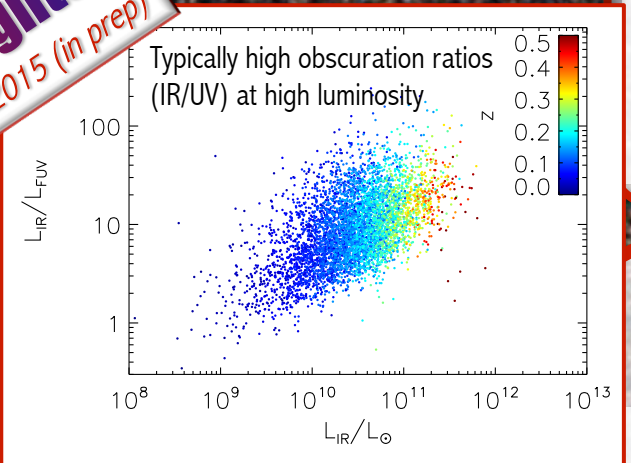






Highlights... Bourne+2015 (in prep)





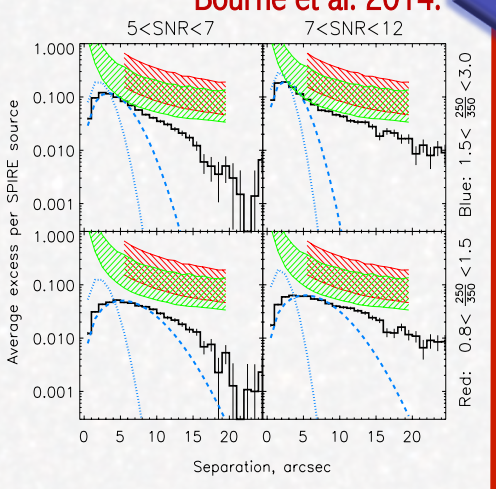
Positional offsets of candidate IDs: sub-mm colour dependence

Bourne et al. 2014:[7] We find that the positional offsets between sub-mm sources and their candidate counterparts in SDSS are increased for redder sub-mm sources. Either their positional errors are larger than they should be, or there is some additional contribution to the offsets distribution increasingly affecting brighter and redder sub-mm sources.

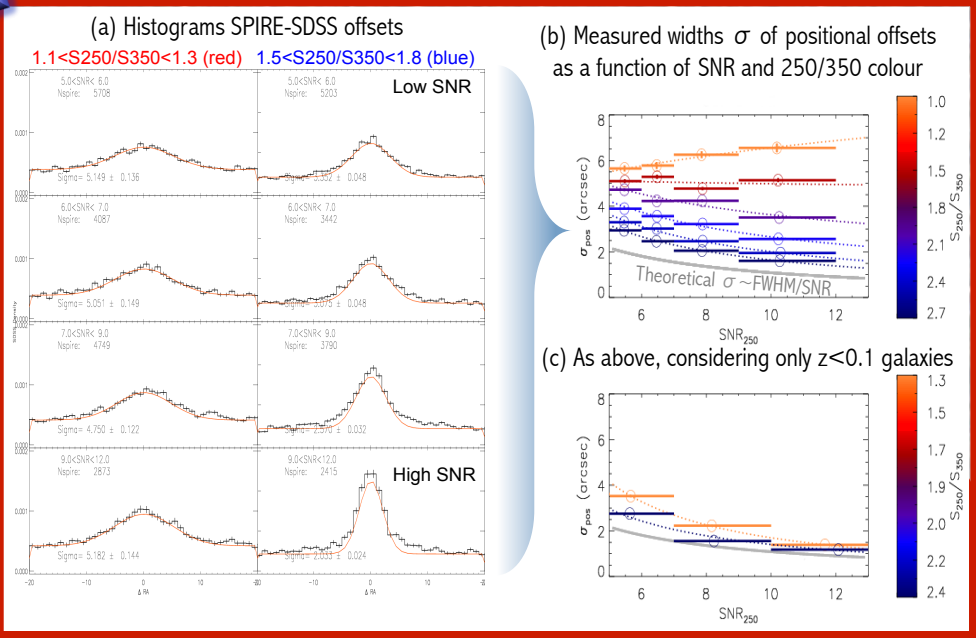
Implications for Widespread Lensing of Sub-mm Sources

The colour dependence is seen in unresolved sources and can only be explained if (i) red sources are more clustered, hence reddened by confusion, or (ii) the offset distributions are contaminated with lenses in the line of sight to distant red SMGs.[8-10] The lensing scenario is supported by the lack of colour dependence for low-z galaxies, which are unlikely to be lenses (c), and by simulations[11] of the excess line-of-sight associations due to weak lensing (d). The results imply widespread weak lensing of SMGs of F_{250}>30mJy, consistent with recent results from correlation studies.[11-13] This has implications for identifying the sources, their redshift distributions and luminosity functions.

Bourne et al. 2014:



(d) SPIRE-SDSS radial offsets (black) in SNR & colour bins. Blue lines indicate theoretical (dot) and measured (dash) positional error functions. Hatched regions show the predicted profile of lensing-induced associations from simulations:[11] green=galaxy-galaxy, red=cluster-galaxy lenses.



(a) Histograms of the offsets from each Herschel-SPIRE source to **all potential counterparts** in SDSS, divided into bins of SPIRE colour (250/350μm) and signal/noise ratio (SNR). Fitting these with a Gaussian positional error function plus power-law cross-correlation, we find (b) that the positional errors (σ_{pos}) follows a smooth function of SNR and colour, yet sub-mm positions are derived from the 250μm maps and are independent of 350μm measurements. (c) The effect is weak when counting only SDSS galaxies at z<0.1, which have a low probability of lensing a background object.

References:

(1) Eales S. et al. 2010 PASP 122:499
(2) Driver S. et al. 2011 MNRAS 413:971
(3) Abazajian K.N. et al. 2009 ApJS 182:543
(4) Driver S. et al. 2015 (in prep.)
(5) Sutherland & Saunders 1992 MNRAS 259:413
(6) Smith D.J.B. et al. 2011 MNRAS 416:857
(7) Bourne N. et al. 2014 MNRAS 444:1884
(8) Wardlow J. L. et al. 2013 ApJ 762:59
(9) Aretxaga I. et al. 2011 MNRAS 415:3831
(10) Chapin E. et al. 2011 MNRAS 411:505
(11) Gonzalez-Nuevo J. et al. MNRAS 442:2680
(12) Almaini O. et al. 2005 MNRAS 358:875
(13) Wang L. et al. 2011 MNRAS 414:596
(14) Williams R.J. et al. 2009 ApJ 691:1879

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