Herschel Bright Sources

by Tom Bakx

Want to know more?
email: bakxtj@cardiff.ac.uk
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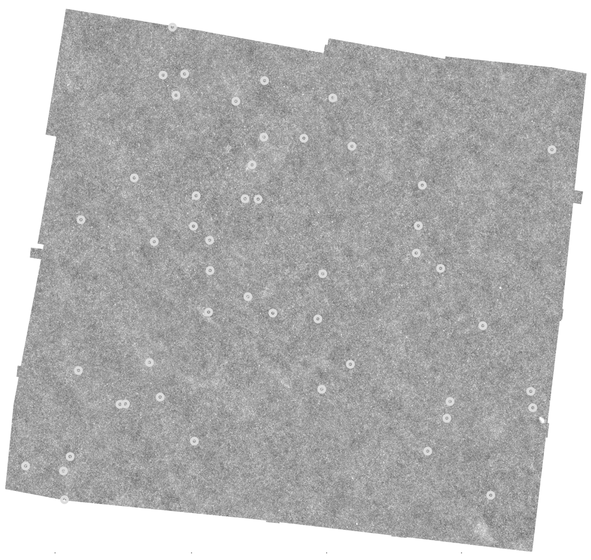
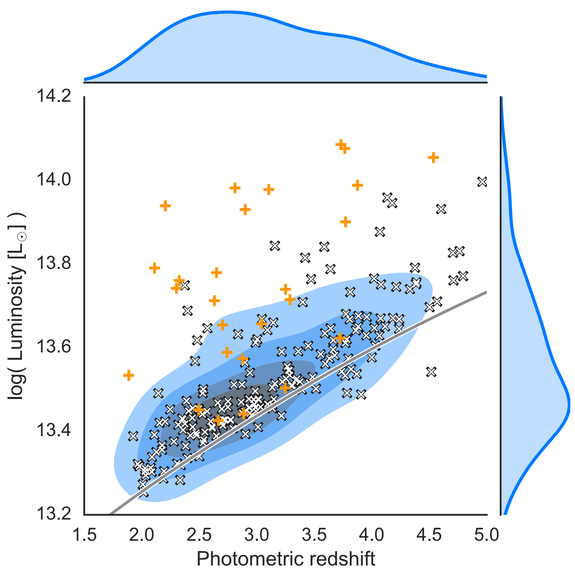
S. A. E. Eales, M. Negrello
M. W. L. Smith, E. Valiante
H. Dannerbauer, A. Endo



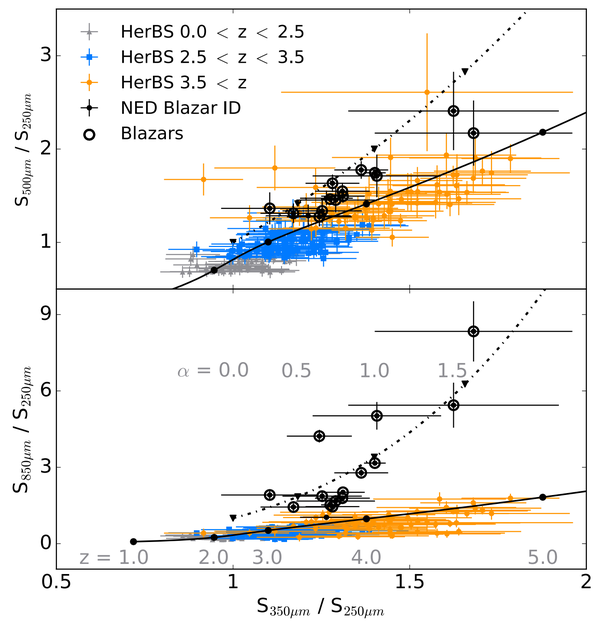
HerBS contains 209 sources, selected from the 616 square degree H-ATLAS field. We selected the sources with a minimum 500 micron flux of 80 mJy, and a minimum photometric redshift of 2, which was calculated from SPIRE-fluxes. The sample aims to be a resource of high-redshift lensed sources, as well as the most extremely star-forming galaxies in the night's sky — allowing us to solve questions about galaxy formation, galaxy evolution and cosmological models. Currently, we are working on acquiring more detailed spectroscopic redshifts and on understanding the optical and near-infrared counterparts to these sources.

209 lensed ULIRGs and HyLIRGS are contained in our sample. This figure shows the observed luminosity of the HerBS sources as a function of the photometric redshift. The majority of the 22 sources with spectroscopic redshifts (orange points) are brighter than the overall sample, as brighter sources are often selected for spectroscopic follow-up. Many sources lie close to the cut-off line (grey), indicating we are finding a lot of extra sources by decreasing our flux cut compared to Negrello+16 and Nayyeri+16



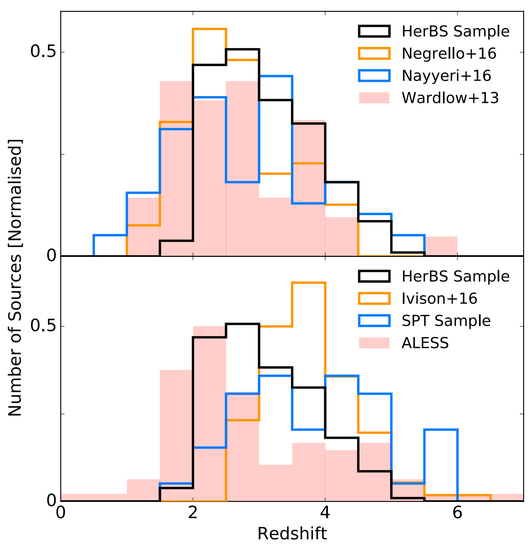
SCUBA-2 observations

of the majority of the HerBS sample have allowed us to remove 14 blazar sources from our initial sample. This figure shows that blazar spectra have indistinguishable SPIRE-photometry. By including a 850 micron data point, we are able to discern and remove the blazar contaminants. We can also see the colour evolution of sources as they are pushed to higher redshift (black line, and grey, blue and orange points).



Redshift distributions

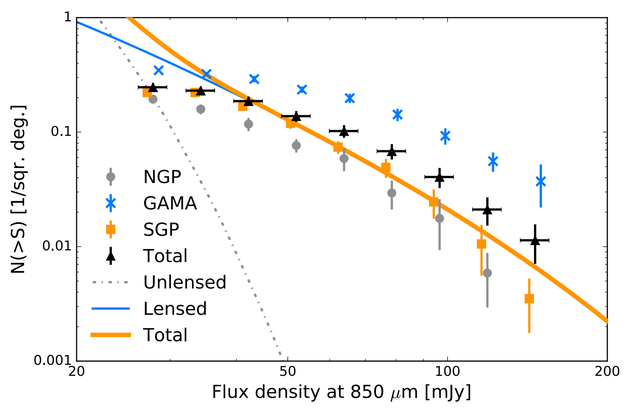
of galaxy samples can tell us about their likeness to other samples. This figure shows the redshift distributions for various samples. When we apply a similar selection function to the HerBS sources as in other samples, and compare with a likeness test (K-S test), we find strong similarities between HerBS and Nayyeri+16, Wardlow+13, and the SPT sample. All these samples are known for their high fraction of lenses. Other samples appear to select for different sources

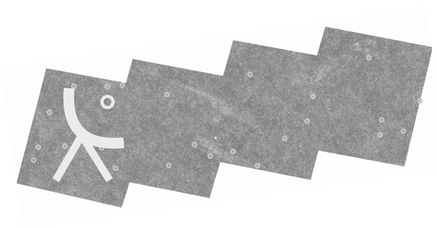


Lensed galaxies

make up about 75% of our sample, which is calculated by comparing our sources to cosmological models that take gravitational lensing and galaxy evolution into account. The specific model we used, from Cai et al. uses a hybrid approach, combining the best parts of parametric backward and of physical models.

This figure shows the source counts for all sources. We are confident in stating our sample has a high fraction of lensed sources, as the model predicts the data points accurately, and the percentage of lensed sources is very low.

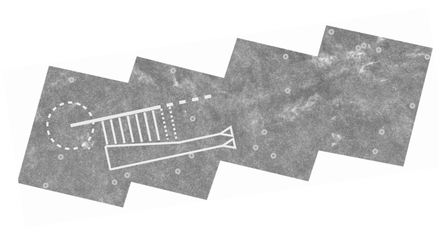




IRAM

Recently, we observed six of our HerBS sources with the 30m telescope. Initial analysis indicates at least two sources have robust spectroscopic redshifts, because two rungs of the CO-ladder are detected. We are now in the process of removing poor-quality scans, as a lot of our observations are plagued by bad weather.

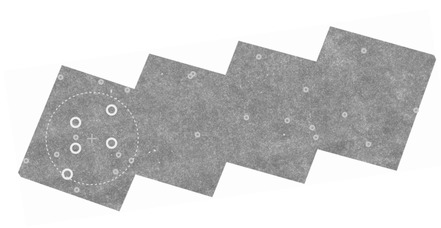
The observed sources were selected for their high photometric redshift. With their spectroscopic redshift, we are now able to calculate their observed luminosity, and use their line intensities to find molecular gas content in these highly star-forming galaxies.



DESHIMA

Our sample will be one of the first samples to be observed by a revolutionary type of broad-band spectrometer. This instrument uses Microwave Kinetic Inductance Detectors (M-KIDs) to detect far-infrared photons. Unlike existing designs as AM-KID and NIKA, a filterbank will split up the incoming signal into frequency bins, turning the detector into a spectrometer.

The prototype version is set to observe sources this November (2017) on ASTE, and will cover 326 to 386 GHz, instantaneously. The full version will cover 240 to 720 GHz, and should be available within a few years.



Cross-IDs

Four of our five H-ATLAS fields are covered by the near-infrared VIKING survey. By calculating the probability of a near-infrared source close to our HerBS sources, we aim to find and analyse the counterparts in all five of the VIKING colours.

Detected counterparts are most likely the low-redshift lensing galaxies. We confirm this by fitting SDSS, VIKING, SPIRE and, if available SCUBA-2 fluxes with the Magphys package, and check the quality of the fit.

Undetected sources are likely to be unlensed HyLIRGs, with extremely high intrinsic luminosities and star-formation rates.