XID+high redshift gals: Detecting high redshift galaxies in the Herschel maps using hierarchical Bayesian inference

Peter Hurley[1], Stephan Wilkins[1], Seb Oliver[1]

[1] *Astronomy Centre, University of Sussex*

Abstract

Thanks to the efforts of both the Hubble Space Telescope and ground based facilities thousands of galaxies have now been identified at high-redshift, with the first samples recently established at z $\sim$ 10. Key to understanding this population is the accurate determination of their intrinsic star formation rates. This is achieved, ideally, by combining measurements of the rest-frame UV (which probes unobscured star formation) with infrared measurements.

While most of these galaxies lie in fields with Herschel coverage (predominately from HerMES) most are too faint to detected individually. By combining measurements of large numbers of galaxies however, we can statistically determine the far-IR properties of the population, thus allowing us to determine the average contribution of dust obscured star formation.

In this talk we introduce XID+, a novel code which uses a Bayesian approach to determine the far-IR fluxes of known objects using the Herschel maps. Underpinning XID+, is the philosophy that full probabilistic models for known galaxy samples can be constrained on Herschel maps, using an efficient Hamiltonian Monte Carlo technique.

Rather than the traditional method of stacking, XID+ models the sample of high redshift galaxies with a hierarchical Bayesian statistical model. By using a hierarchical model, our fits provide simultaneous inference on both the far infrared flux for each galaxy, as well as the mean and dispersion of the population.

We demonstrate the power of XID+ by showing the results of its application to Herschel observations using samples of UV selected high-redshift galaxies.