Title: The galaxy star formation stellar mass relation from z~0 to z~6 and environmental dependence

Abstract:

The star formation stellar mass relation (SSR), which is a tight correlation between star-formation rate (SFR) and stellar mass for star-forming galaxies, is also known as the galaxy “main sequence” (MS). The SSR holds over the peak in the cosmic star-formation history, and possibly extends to even earlier epochs. The parameters of the SSR, e.g., its shape, width and evolution encode fundamental information of the nature of SF and stellar mass assembly. To probe the dust obscured star formation, we need far-IR and sub-mm SFR tracers. The deep Herschel-SPIRE maps contain most of the emission in the cosmic infrared background, however it suffers from confusion due to the relatively large beam size.

We have invested major effort in developing techniques which can use very deep optical/NIR prior catalogs to decompose Herschel data, as the full power of Herschel can only be unleashed when combined with detailed knowledge of the physical properties of galaxies. A breakthrough is our development of XID+ (Hurley et al. 2017) - a Bayesian framework in which to include prior information, and uses the Bayesian inference tool Stan to obtain the full posterior probability on flux estimates. Compared to the previous state-of-the-art, we can probe much fainter sources at the same flux accuracy of 10%. Using ALMA data as an independent validation, we have shown, by including informative weak prior on the SED, the performance of XID+ can be improved further at an impressive depth of ~10 times below the confusion limit (Pearson, Wang, van der Tak et al. 2017). Applying this powerful super deblending approach in the COSMOS field, we are able to measure the shape, width and cosmic evolution of the SSR in a self-consistent manner including dust obscured star formation from z~0 to z~6 (Pearson, Wang, Hurley et al., 2018, accepted for publication in A&A).

To investigate if the environment (characterised by the host dark matter halo mass) plays any role in shaping the SSR, we make use of the GAMA survey and associated multiwavelength data. Stellar-mass limited samples are constructed without pre-selecting star-forming galaxies. We found important differences between the environmental effects of the SSR for central and satellite galaxies out to z~0.3.