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Report on the thesis dissertation of Jude Vijayanga Wijesekera:

The Assembly of star-Forming Galaxies:
evolution of the Main Sequence and Dust Obscuration out to z~6

The dissertation consists of a first chapter of 42 pages introducing the background and the basic concepts related to the PhD project. Then three articles, one published and two submitted, with a contribution of the candidate to each of them.

Introduction

This chapter is clearly presented, well written and pleasant to read. It starts with a definition of star forming galaxies, quickly restricted to dusty systems observed in FIR and submm. A large fraction of the chapter is devoted to observations and their analysis. I have particularly appreciated the compilation of surveys conducted in far infrared (FIR) and submm with single dish facilities. The identification of counterparts, in radio and mid-IR, to the sources detected in FIR-submm with the issue of their very low spatial resolution is briefly introduced. The analysis of maps to extract fluxes is more detailed with the estimation of fluxes and the main caveats related to this estimation.
The stacking method, essential in FIR-submm to estimate fluxes of populations of undetected sources is developed in a separate section (1.4) which is justified since it is central to the thesis work. This stacking method is a major skill acquired by the candidate and represents their contribution as co-author of two of the three papers presented in this dissertation. It is quickly described in the articles, the full stacking process, including mock tests, being only mentioned. Thus a more complete description of this method would have been very useful, in particular about the difficult issue of confusion and clustering inside the beam size and the method adopted to correct for these effects.
Astrophysical concepts and methods are then presented in the next sections. In section 1.3 with the modelling and the fits of multi-wavelength data, mostly in infrared, and the estimation of redshifts. While the fitting methods presented are based on UV to FIR spectral energy distributions (SED), detailed descriptions are only given for the FIR-submm domain. A short but complete presentation of the principle of SED fitting methods covering UV to NIR or FIR and used to derive redshifts and stellar masses (and in numerous studies star formation rates) should have been very useful here. Indeed, these methods are used(but not detailed) in the three articles presented in this dissertation.
Section 1.5 is devoted to molecular gas content. In section 6, physical parameters and astrophysical relations are introduced. The measures of stellar masses and star formation rates are presented to then introduce the main sequence of star forming galaxies and the related specific star formation rate. The methods presented to estimate star formation rates are based on single 'monochromatic' data, highlighting the link of each of these emissions to recent star formation. However, the underlying assumptions on the star formation history are not explained, neither the different timescales of each of these 'monochromatic' tracers.

Putting these classical methods into perspective alongside SED fitting would have provided a more up-to-date understanding of how to measure the SFR of galaxies.
Relations involving the infrared to ultraviolet flux ratio (IRX) are introduced. The section 1.6 ends with the derivation of luminosity functions and star formation rate density and their evolution with redshifts.

Detailed remarks on the introduction section

Section 1 page 1: high redshift star forming galaxies are not restricted to dusty star-forming sources. A general introduction of star forming galaxies and a clear statement that the introductory chapter will be devoted to DSFG should be added here.

Section 1.2.5: the parametrization of number counts and luminosity functions in FIR-submm is also commonly presented as a double power law, both functions could be introduced.

Over the 108 references for the introduction section, only 10 are published in 2016 and later (and 6 out of these 10 include close collaborators who co-signed the 3 articles included in the dissertation). Although it is essential to build on previous work and older studies, an update of the bibliography seems necessary here to include major findings from the past ten years

Articles

-Article A: 'Charting the main sequence of star forming galaxies out to redshifts z ≤ ~ 5.7' was published in 2024 in the review, Astronomy and Astrophysics (A&A). The first and main author is the supervisor of the PhD project, M. P. Koprowski, with 6 co-authors including the PhD candidate, whose contribution is stated to be 15% (page 60). This contribution is based on the stacking procedure and the visualization of the results'.

The implication of the candidate in this first article is relatively limited, and its publication attests of its quality, reliability and impact of this work, so my report focuses only on specific points. The sample of galaxies analysed is the same in the three papers, and, to my point of view, makes the strength of the analyses reported in this dissertation. It consists in ~100 000 galaxies selected in K band optical-NIR catalogues of two deep extragalactic fields: the UKIDSS Ultra Deep Survey and the COSMOS field. This K-band selection allows to build mass-complete, well controlled, samples over a large range of redshifts. These samples were already published by McLoed et al. 2021 (Mc Loed being co-author of the three papers). The selection of star forming galaxies is based on NUV,r, J rest frame colours. No detail is given on the estimation of the fluxes in these 3 bands and more generally in the UV-NIR range. Stacking is performed to add FIR-submm information along the Main Sequence in stellar and redshift bins from Herschel/SPIRE maps at 250, 350 and 500 μm. The contribution of clustered sources in the FIR beam is modelled and subtracted and the errors on fluxes estimated with bootstrapping. As mentioned above, a more complete and detailed description of the stacking analysis would have been very useful in the context of this dissertation. The authors confirm the linear relation between star formation rate and stellar masses with a flattening at high stellar masses at high redshifts. The dust temperature increases linearly with redshift, with an impact on star formation rates derivation and on the shape of the Main Sequence.

-Article B :'Evolution of dust attenuation in star-forming galaxies with UV slope, stellar mass and redshift out to z~5' is submitted to the A&A review. The PhD candidate is the first and major author of the paper with a contribution estimated at 50% while the second author, M.P. Koprowski contributed for 30%.

Using the selected galaxy sample and the stacking procedure of article A, the authors investigate the variation of IRX of the slope β of the UV continuum and the stellar mass out to z~5. SED fitting of the optical-NIR data is performed with the CIGALE code to determine the rest frame NUV, r and J fluxes , the UV slopes β and the UV luminosity (necessary to calculate IRX. These parameters are derived from the best-fit models. The authors do not explain why they do not use likelihood-weighted means and standard deviations given by CIGALE than the single best-fit value of the parameters.
A single exponential star formation history is assumed, and the initial values of the age of the stellar population is not given. It would have been interesting. While the estimation of single band fluxes and

of the UV slopes should not be very affected by the SFH is the fits are good, the measured the stellar masses are very sensitive on the old stellar stellar populations and thus on the time to which star formation started.
The quality of the fits is not discussed in the article. The SED based on stacked values and their best fits could have been added to either the article or as supplementary material only for the thesis dissertation.
NUV, r and J rest frame fluxes were also estimated in Article A, it would have been interesting to know if they were identical, similar to or different from the ones derived for Article B.
A comparison between stellar masses estimated with CIGALE with the ones from McLeod (2021) should be useful to test the consistency of the analysis.

IRX values are estimated with the stacking method per bin of β, stellar mass and redshift. Individual IR luminosities are based on SCUBA-2 measurements at 850 µm only, and using Casey 2012 dust emission curve with a varying dust temperature derived from the T(dust)-redshift relation obtained in Article A. When full stacked UV to FIR SEDs are fitted with CIGALE stacked Herschel fluxes are added. It would have been useful to know the IR templates were used for these fits, and if they reflect the T(dust)-redshift relation.
To my knowledge, the analysis performed with these mean data Is new. The authors defined the quantity $dA_{1600}/d\beta$ as the slope of the reddening law and determined its dependence on stellar mass. This method differs of previous studies which considered different or variable attenuation laws. They found a quadratic variation of $dA_{1600}/d\beta$ with stellar mass and re-analyse the monotonic relation between IRX and stellar mass found in many previous studies introducing an intermediate turnover in the high mass regime at redshifts below 3.

-Article C: 'Evolution of the infrared luminosity function and its corresponding dust-obscured star out to z~6'. There is some confusion in the dissertation in the presentation of this work. Page 62 the paper is presented as an ArXiv paper in 2025 with the PhD candidate as first author and its contribution estimated at a level of 15%, However it appears that the paper was published in A&A in February 2026 with M. P. Koprowski as first and main author, the contribution of the PhD candidate being re-evaluated at 35% (section 1.11). This contribution is based on the stacking procedure to probe the faint end of the infrared luminosity functions and on a participation to the rest of the analysis, without much precision. The galaxy sample used here is the same as in paper A and B.
The results of the paper confirm and consolidate previous findings, with a strong evolution of the infrared luminosity with redshift: the characteristic IR luminosity increasig, while the number density of IR-bright galaxies drops rapidly at high redshifts . The corresponding dust-obscured star-formation rate density peaks around z=2 and then decreases toward higher redshifts to contribute less than 25% of the total star formation rate density at z~6, in agreement with a dust poor early universe.

In conclusion, the work presented in this dissertation represents a very substantial contribution to the study of the evolution of star formation and interstellar dust attenuation from low to high redshifts. The candidate has developed a strong expertise in the stacking technique, which is central to astrophysical studies of faint objects. Three articles are presented: two have been published and one has been submitted to the journal *Astronomy & Astrophysics* (A&A), with the candidate making a large contribution to two of them, including one as the lead author.

Based on these achievements, I unreservedly recommend the public defence of this doctoral dissertation.

Marseille, 30 August 2026