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Dear chairperson and members of the council,

I am pleased to submit my evaluation report on the doctoral thesis of Jude Vijayanga Wijesekera, entitled "*The Assembly of Star-Forming Galaxies: Evolution of the Main Sequence and Dust Obscuration out to z ~ 6*", which I read with great interest.

This PhD thesis is centered on the study of obscured and unobscured star formation in galaxies across cosmic time. In particular, it focuses on the evolution of the main sequence of star-forming galaxies, dust obscuration as a function of various parameters, and the evolution of the cosmic star formation rate density. These are important topics in the galaxy-evolution community, and the candidate presents new, original measurements of several important relations, which he has either led or contributed to as a major co-author.

The thesis starts with an original 42-page general introduction to the scientific background and the main concepts related to the PhD thesis. The first section introduces dusty star-forming galaxies (DSFGs) and single-dish submillimeter surveys, together with the methods used to study them, including counterpart identification and spectral energy distribution fitting. This start is somewhat surprising, as the discussion immediately focuses on a specific population of galaxies and rather technical details.

The second section discusses far-infrared and submillimeter maps and the methods used to extract unbiased information from them, such as Monte Carlo source injection and flux deboosting. The notion of number counts is also briefly discussed, but the treatment is limited to introducing the Schechter form to fit them and explaining that, in reality, the situation is more complex, without discussing this in further detail.

The third section explains how the redshifts and physical properties of galaxies are determined. The various methods of SED fitting are briefly described, including software combining photometry across from the UV to the far infrared and functional forms such as modified blackbodies for the far-infrared only. The various methods used to determine redshifts are also introduced, and the redshift distribution of DSFGs is briefly discussed.

In the fourth section, the candidate describes the stacking method, which is at the core of his work. This section contains only one page, and the details are also not introduced in the papers. This is unfortunate, as it does not allow the reviewer to properly evaluate the candidate's technical knowledge or the level of sophistication of the methods he used.

The fifth section discusses molecular gas and star formation. There is a long description of the various gas tracers that can be used to estimate the gas mass. In contrast, the gas depletion timescale is only briefly discussed, and the more fundamental Kennicutt–Schmidt relation is not discussed. Since molecular gas is not studied in the three papers at the core of the thesis, this list of standard facts in our community feels somewhat extraneous.

Finally, the sixth section provides a long list of methods used to determine physical parameters of galaxies, such as stellar mass, star formation history, star formation rate using various tracers, and specific star formation rate. The cosmic infrared background is mentioned, but the discussion of its anisotropies is not particularly useful, since the connection between galaxies and dark-matter halos is never introduced. Finally, the main sequence of star-forming galaxies and the relations between the infrared excess (IRX) and various other physical parameters are introduced. These are at the core of the work presented in the three papers.

This introduction shows that the PhD candidate knows the main concepts related to his field. However, it suffers from several weaknesses. The text dives directly into technical details and encyclopedic facts before explaining the broader context of the field of galaxy evolution. Overall, it is strongly centered on technical aspects and offers a rather narrow view of the field. The motivation, current context, and questions underlying the three papers of the thesis are barely explained. I am also puzzled by the fact that most of the references are at least five years old, and often much older, while the large number of new results provided by ALMA is almost entirely ignored, even though these results are discussed in the papers. This gives the impression that the introduction is a compilation of concepts found in the main reviews of the field rather than a text specifically tailored to this thesis. Despite these shortcomings, the introduction remains acceptable for a PhD thesis.

The second part of the thesis contains three papers, including one for which the candidate is first author. The candidate's contribution is well described in a short section preceding the papers.

The first paper, "*Charting the main sequence of star-forming galaxies out to redshifts z ~ 5.7*", is published in A&A and was led by the PhD supervisor, with the PhD candidate as second author. The candidate contributed to the analysis through the stacking procedure used to measure the average fluxes of the galaxy population and through the visualization of the results. He estimates his contribution to be 15%.

In this paper, the authors present new measurements of the main sequence of star-forming galaxies up to $z \sim 5.7$, linking stellar mass to star formation rate, with a focus on the bending of the main sequence at high masses. The paper also discusses the evolution of dust temperature and finds an increase in temperature consistent with previous studies.

The part on stacking led by the PhD candidate is appropriately described. An appendix describing the modeling of the background-source candidates would have been useful to better understand the details and underlying assumptions. Overall, these are rather standard methods. However, some aspects of the analysis are surprising. For example, in Eq. 5, the authors combine the uncertainties from bootstrap resampling with those from the fitting procedure, whereas a fit could have been performed after each bootstrap realization to estimate the full uncertainty directly, including potential covariance.

The second paper presents the main work of the candidate, entitled "*Evolution of dust attenuation in star-forming galaxies with UV slope, stellar mass, and redshift out to z ~ 5*", recently published in A&A. The candidate is the first author of this paper and carried out the majority of the work. The stacking technique described in the previous paper is used to derive the evolution of IRX, the ratio between infrared and UV luminosity. This quantity is tightly linked to dust attenuation.

Predicting IRX from various physical quantities is essential for observational astronomy, as it can allow dust attenuation to be corrected for and the total star formation rate to be estimated in the absence of far-infrared data. At high redshift, the UV slope, β, and stellar mass are among the most commonly used quantities. In this project, the candidate performs a multivariate calibration and discusses how IRX is physically connected to these two quantities over a wide range of redshifts. To my knowledge, this has never been done before in such a general way. In addition, the stacking approach, including Herschel data, reduces biases associated with variations in dust temperature. The candidate finds that the slope of the relation between dust attenuation at 1600 Å and the UV slope β increases strongly with increasing stellar mass.

Finally, he also introduces redshift into the multivariate analysis and identifies, for the first time, a turnover in the IRX–Mstar relation at high masses below z = 2. This is surprising, since the most massive galaxies are also the most metal-rich, and we might therefore expect this relation to increase monotonically. The authors interpret this as an effect of supersonic shocks suppressing cold-gas accretion and starving galaxies of freshly accreted gas.

This paper is a very nice piece of work. It demonstrates that the candidate is able to combine technical and scientific skills to produce new results of interest to the galaxy-evolution community and to write the associated paper with the help of his co-authors.

The third paper, entitled "*Evolution of the infrared luminosity function and its corresponding dust-obscured star formation rate density out to z ~ 6*", is also published in A&A, with the PhD supervisor as first author and the PhD candidate as second author. The candidate's contribution is substantial, at 35%. This paper aims to combine direct detections of bright sources and stacking to constrain the evolution of the infrared luminosity function and then deduce the evolution of the cosmic star formation rate density. The existence of a major obscured component as early as z = 6 has recently been suggested by various ALMA studies, but it requires independent confirmation. If confirmed, this would be a major result, indicating that star formation was already predominantly dust-obscured as early as one billion years after recombination.

The main contribution of the PhD candidate is the measurement of the low-luminosity end of the luminosity function using a stacking technique to reach galaxy populations well below the individual detection limit of current instruments. He first measures the relation between stellar mass and infrared luminosity and uses this relation to reconstruct the infrared luminosity function from stellar masses. The method is well described in the corresponding section of the paper. It could nevertheless have been interesting to include a discussion of the impact of the scatter in the L_{IR}–Mstar relation on this reconstruction.

The authors then fit the luminosity functions and show that the luminosity of the knee increases with redshift up to $z \sim 4$, while the density remains stable up to $z \sim 2$ before decreasing at higher redshift. This is a classic result, but it provides a useful confirmation. Finally, they estimate the cosmic star formation rate density and find a result consistent with recent ALMA measurements.

Finally, a three-page summary of the results is provided, followed by a page and a half of discussion of future plans. The plan mentions extending the methods used during the thesis preparation to the COSMOS-Web and CANDELS surveys and adding LMT data. However, there is no precise discussion of what additional knowledge could be gained from these data. The separation of the radio continuum into synchrotron and free-free emission is also discussed, but again, the scientific motivations behind it remain unclear. Finally, the candidate discusses the possibility of applying radiative transfer to dust in the SIMBA simulation. This conclusion is good enough for a PhD thesis, but it has weaknesses similar to those of the introduction: it lacks a broad scientific vision and remains focused on technical details.

Overall, the candidate has demonstrated, through the three peer-reviewed papers attached to the thesis, that he is able to produce new scientific results in astrophysics. This level of scientific production meets typical international standards for defending a PhD thesis. The introduction and conclusion are not particularly well written and do not demonstrate a sufficiently broad view of the scientific context on the part of the candidate. However, they remain acceptable. Based on the documents provided, **I therefore recommend that the thesis proceed to the next stage of the oral defense**. This will also give the candidate an opportunity to better explain the broader scientific context of his work.

Yours sincerely,

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