Highlights on Spanish Astrophysics X, Proceedings of the XIII Scientific Meeting of the Spanish Astronomical Society held on July 16 – 20, 2018, in Salamanca, Spain. B. Montesinos, A. Asensio Ramos, F. Buitrago, R. Schödel, E. Villaver, S. Pérez-Hoyos, I. Ordóñez-Etxeberria (eds.), 2019

Can we use the dust luminosity of galaxies to estimate their star formation rate?

Ciro Pappalardo[1], Maarten Baes[2], Sebastien Viaene[2,3], George J. Bendo[4], Simone Bianchi[5], Jacopo Fritz[6], and Mederic Boquien[7]

[1] Instituto de Astrofísica e Ciencias do Espaço, Universidade de Lisboa, OAL, Tapada da Ajuda, 1349-018 Lisboa, Portugal
[2] Sterrenkundig Observatorium, Universiteit Gent, Krijgslaan 281 S9, B-9000 Gent, Belgium
[3] Centre for Astrophysics Research, University of Hertfordshire, College Lane, Hatfield, AL10 9AB, UK
[4] UK ALMA Regional Centre Node, Jodrell Bank Centre for Astrophysics, School of Physics and Astronomy, The University of Manchester, Oxford Road, Manchester M13 9PL, United Kingdom [5] Osservatorio Astrofisico di Arcetri - Largo E. Fermi 5, I-50125, Florence, Italy
[6] Instituto de Radioastronomía y Astrofísica, IRyA, UNAM, Campus Morelia, A.P. 3-72, C.P. 58089, Mexico
[7] Centro de Astronomía (CITEVA), Universidad de Antofagasta, Avenida Angamos 601, Antofagasta, Chile

Abstract

The huge growth of data available for the scientific community in the last decade allowed, for the first time in astronomy, a truly panchromatic approach. These data shed light on fundamental correlations, linking the dust component of a galaxy with its star formation rate (SFR). However, the relation between the SFR and dust emission is complex, and still it is not clear what mechanism drives it, motivating a further investigation. This poster will re-examine these correlations considering the intrinsic properties of the galaxies dust, and relating them to the SFR. We selected a sample of ∼800 normal star forming galaxies with photometric data between $0.15 < \lambda < 500$ μm, and analyzed them with different spectral energy distribution fitting methods.

The dust luminosities and the SFR show a strong correlation, but for low values of both parameters, the scatter in the correlation increases. We show that introducing a selection based on the fraction of ultraviolet emission absorbed by dust, we can reduce drastically the data scatter. Galaxies with similar absorption coefficients, despite a different SFR, have a similar balance between the fraction of dust heated by the star formation and the interstellar radiation field (IRF). Dust masses and SFR also show a correlation, but weaker with respect to the dust luminosities. Our results indicate that this scatter is due to a different intensity of the IRF produced by stars during late evolutionary stages, and this shifts the galaxies position in the dust mass-SFR plane. The differences in the intensity of the IRF is the origin of the observed scatter, and the correlation becomes stronger once selected galaxies following an IRF based selection criteria.

In the SFR versus stellar mass (M_*) plane these galaxies occupy a region included between local spirals and higher redshift star forming galaxies. These galaxies represent the population that at $z < 0.5$ quenches their star formation activity and reduces their contribution to the cosmic Star formation rate density. The galaxies subsample with the higher masses ($M_* > 3{\times}10^{10}$ $M_\odot$) does not lie on the main sequence, but shows a small offset, as a consequence of the decreased star formation. Low mass galaxies ($M_* < 1{\times}10^{10}$ $M_\odot$) settle in the main sequence with SFR and M_* consistent with local spirals. The multi-wavelength approach allows the identification of a mixed galaxy population, with galaxies still in an assembly phase, or galaxies at the beginning of their passive evolution. We show that if we include in the analysis the internal properties of the dust, the scatter between SFR and dust mass and/or luminosities can be removed. (See poster).