The main sequence of star forming galaxies: a non evolving relation in slopw and scatter from z~0 to z~2.5

P. Popesso

By using the WISE mid-infrared and Hα star formation rate (SFR) indicators in a local galaxy sample and the deepest available mid and far infrared surveys in the CANDELS and GOODS fields at higher redshift, we study the evolution of the Main Sequence (MS) of star forming galaxies from z~ 0 to ~2.5 at stellar masses larger than $10^{10}\mathbf{M}_{\odot}$. The slope of the relation strongly depends on the combination of SFR indicators and on the method used to identify the MS. In all cases, the local MS shows a bending at high stellar masses. However, the significance of the flattening depends on the indicator of the MS location. While the distribution of galaxies in the upper envelope of the MS is consistent with a log-normal distribution, the lower envelope shows an excess of galaxies, which varies as a function of the SFR indicator used in the analysis. The scatter of the best log-normal relation fitting the upper envelope of the distribution, increases with stellar mass from ~0.3 dex at $10^{10}\mathbf{M}_{\odot}$ to 0.45 at $10^{11}\mathbf{M}_{\odot}$. Beyond this stellar mass limit the location of the MS and the shape of the SFR distribution in the MS region vary significantly as a function of the SFR indicator, becoming very uncertain. At higher redshift, the MS location and the distribution of galaxies around it are consistent with a rescaled version of the local relation and distribution, shifted at higher values of SFR. Thus, the MS does not evolve in slope and scatter but only in its normalization as a function of redshift up to z~2.5, according to the power law $\sim(1 + \mathbf{z})^{3.3\pm0.2}$. This is steeper than the one found for lower mass galaxies, confirming that the star formation activity in high mass galaxies evolve faster than in the low mass counterpart. The upper envelope of the MS is perfectly fitted by a single log-normal distribution including the starburst region at any redshift. We show that the previously reported excess of galaxies in such region are due to a mix of different selection effects, including the combination of different SFR indicators.