The Slow Evolution of the Specific Star Formation Rate at $z > 2$.

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Abstract

As the Universe evolves, the structures in it grow in mass but the rate of growth has been steadily decreasing since very early on. Dark matter simulations suggest that the specific accretion rate (dark matter accretion rate per unit halo mass) follows a $(1+z)^{2.5}$ law. In most simulations, stellar mass growth follows this law very closely, with a specific star formation rate (sSFR) that decreases monotonically with cosmic time. Observations indicate that this quantity has indeed been steadily decreasing since $z \sim 2$ (by a factor $\sim 10\times$). At $z > 2$, however, the results have been controversial. Initially, the results showed a constant sSFR at $z > 2$ ($=\sim 2$ Gyr^{-1}), in strong disagreement with theoretical expectations. More recently, it has been shown that the effect of rest-frame optical emission lines on the SED modeling of $z > 3.8$ galaxies can have a strong effect on the derived stellar masses, and therefore on the sSFR too. In this presentation, I will show our latest estimates of the sSFR for galaxies at $z \sim$ 4–6 which include deep stacks of the longer wavelength Spitzer/IRAC images at 5.8 and 8.0 μm. The light at these wavelengths is almost completely clean from strong emission lines so our estimates of the sSFR from SED modeling can be considered more reliable. These stacked SEDs support median ages > 300 Myr. They also result in slightly higher sSFR at higher redshifts but the evolution observed is much slower than the decreasing trend seen at $z < 2$, and it is still in tension with theoretical expectations. From the same stacks we can infer the median intensity of lines like Hα which is a popular indicator of the SFR. Comparisons of this SFR estimator with UV based ones show contradictory results and may highlight a problem in the SFR estimates at high redshift.