A consistent view on normal star-forming galaxies from $z \sim 1.5$ to 8 from multi-wavelength observations and SED modeling

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Abstract

We present new results from a multi-wavelength analysis of normal/typical star-forming (SF) galaxies combining our sample of strongly lensed galaxies at $z \sim 1.5-4$ and $z \sim 6-7$ (from the Herschel Lensing Survey and others) with a large sample of LBGs from$z \sim 3-8$ and a Herschel-selected sample at $z \sim 1.5-3$ (primarily from the GOODS fields). The observations include deep ground-based, HST, Spitzer, and Herschel imaging, plus LABOCA/SCUBA2 data, IRAM and ALMA dust continuum observations for some of the objects. We also include CO and [CII] 158 micron line measurements our group and others have recently obtained.

The observed SEDs are modeled with our SED fitting tool including nebular emission for the stellar part, and allowing for energy-conserving global SED fits including also dust emission.

We present direct constraints on dust attenuation from IR and UV measurements, yielding new information on the dependence of attenuation on galaxy mass and on its redshift evolution. Both the empirical data and our modeling shows that the UV attenuation at $z > 3$ may be larger than commonly thought, with implications on the global history of star formation (SFR density) at high redshift.

We also present evidence for variable star formation histories in high-z galaxies and discuss important implications on the specific SFR, its redshift evolution, the SF main sequence at high redshift, and other related issues.

Finally, we also show the empirical behavior of gas, dust, and stellar properties of $z \sim 1.5-3$. galaxies of normal/typical SF galaxies at these redshifts, as found from combination of lensed and unlensed galaxy samples, and discuss the consistent picture of high-z star-forming galaxies obtained in this way.