Constraining dust obscuration in the most distant galaxies

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Abstract

Measurements of the UV-continuum slopes β can provide valuable constraints on the physical properties of galaxies forming in the early universe, probing the dust reddening, age, metal content, and even the escape fraction. While constraints on these slopes generally become more challenging at higher redshifts as the UV continuum shifts out of the *Hubble Space Telescope* bands (particularly at $z > 7$), such a characterisation actually becomes abruptly easier for galaxies in the redshift window $z = 9.5 - 10.5$ due to the Spitzer/IRAC 3.6μm-band probing the rest-UV continuum and the long wavelength baseline between this Spitzer band and the *Hubble* H_{f160w} band. Higher S/N constraints on β are possible at $z \sim 10$ galaxies than at $z = 8$.

Small samples of candidates in this redshift window have recently been discovered in deep *Hubble Space Telescope* imaging providing the opportunity to constrain the amount of dust attenuation in star forming galaxies when the Universe was only $\sim 500\,\mathrm{Myr}$ old. We find these candidates possess blue β_{obs}'s -2.3 ± 0.2, which is in significant contrast to the UV slopes ($\beta_{\mathrm{obs}} \approx -1.7$) found at $3.5 < z < 7.5$ for galaxies of similar luminosities. Combining these observations with results from large hydro-dynamical models we predict the brightness of these systems at far-IR/sub-mm wavelengths and make predictions for their observability by ALMA.