The Evolution of Galaxy Dust Properties for $1 < z < 2.5$

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Abstract

We investigate the properties of the extinction curve in the rest-frame UV for 108 massive, star-forming galaxies at $1 < z < 2.5$, selected from the FORS Deep Field spectroscopic survey, the K20 survey, and the GDDS. Using a new parametric description of the rest-frame UV spectral energy distribution, we find that the extinction curves of our sample galaxies range between those typical of the Small and Large Magellanic Clouds (SMC and LMC, respectively). For the majority of strongly reddened objects the UV spectra show a significant broad absorption feature at 2175 Å, indicating an LMC-like extinction curve. On the other hand, the UV continua of the least reddened objects are mostly consistent with SMC-like extinction curves, lacking a significant 2175 Å bump, as for the Calzetti et al. sample of local starbursts and as for Lyman-break galaxies at $z \sim 3$. Strong 2175 Å features are mainly found among UV-bright $z \sim 2.4$ galaxies and actively star-forming NIR-bright $z \sim 1.2$ galaxies. The latter have similar sizes but distinctly lower masses and star-formation rates than the former. At any redshift the most reddened galaxies tend to be more metal rich, more massive, and larger than the least reddened systems. At least for $z \sim 2.4$ the presence of the UV bump seems to be associated with large equivalent widths of prominent interstellar absorption lines, suggesting a link between the strength of the UV bump and the topology of the interstellar medium. Dust self-shielding seems to be crucial for the survival of the carriers of the UV bump in the harsh environments of the ultraluminous $z \sim 2.4$ galaxies. The obviously less vigorous star-formation in the $z \sim 1.2$ galaxy population appears to help the survival of the UV-bump carriers.