Rapid evolution in the bright end of the galaxy luminosity function between z = 5, 6 and 7

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Abstract

At very high redshift ($z > 6$), the shape of the bright-end of the luminosity function (LF), be it plunging exponentially or a more gentle power law decline, depends on the onset of feedback and/or dust obscuration that acts to quench or obscure the most massive galaxies. Unfortunately, the *HST* surveys typically used to select samples of $z = 5$–8 Lyman-break galaxies have insufficient area to well constrain the number densities of the brightest (and rarest) objects, and instead wider-area ground-based surveys are required. We have used the combined $1.7\,\mathrm{deg}^2$ of deep multi-wavelength data in the COSMOS/UltraVISTA and UDS/SXDS surveys, the largest area of appropriate depth near-infrared imaging available to date, to provide the best constraints on the bright-end of the LF at $z = 6$ and 7. The samples includes the brightest known $z \simeq 6$ and $z \simeq 7$ galaxies with $M_{\mathrm{UV}} \sim -23.0$, and SED fitting to the comprehensive multi-wavelength photometry available shows that they are also some of the most massive, with stellar masses of $\log(M/M_{\mathrm{solar}}) = 10.5$. Our determination of the rest-frame UV luminosity function shows a gradual steepening of the bright-end slope from $z = 7$ to $z = 5$, accompanied by brightening of the characteristic magnitude by ~ 0.5 mag. When compared to the underlying dark matter halo mass function, these results are consistent with the onset of mass quenching of the most massive galaxies from z = 7 to z = 5 or the rise of significant dust obscuration in the brightest objects.