Consensus on the galaxy UV luminosity functions at z > = 6

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Abstract

Galaxy formation during the first billion years of our Universe remains a challenging problem at the forefront of astrophysical cosmology. Although these z_˜6 galaxies are likely responsible for the last major phase change of our Universe, the epoch of reionization (EoR), detailed studies are possible only for the relatively rare objects bright enough to be observed with modern spectrographs. Characterizing the fainter galaxies which are more representative of the population as a whole is currently done mainly through their number densities as a function of non-ionizing UV luminosity: the UV luminosity function (LF). Observing the faint end of the UV LFs is nevertheless challenging, and current estimates can differ by orders of magnitude. Yet these LFs are critical in constraining galaxy formation models. Here we propose a methodology to combine various high-z UV LFs in a Bayesian framework: Bayesian Data Averaging (BDA). Using a flexible, physically-motivated model, we compute the relative evidence of various z=6 UV LFs within the magnitude range -20 < = M_UV < = -15 which is common to all data sets. Our parametric model, which assumes galaxies reside in dark matter halos with an arbitrary power-law stellar mass / halo mass relation and an arbitrary faint-end suppression, naturally penalizes uneven and jagged data points and those with mis-estimated errors. We then use the relative evidence from BDA to weigh the posteriors obtained from disparate LF observations during the EoR, 6 < = z < = 10. The resulting "concordance" high-z LFs can be used to constrain galaxy formation models.

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