

X36a Census for the Rest-frame Optical and UV Morphologies of Galaxies at $z = 4-10$: First Phase of Inside-Out Galaxy Formation

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We present the rest-frame optical and UV surface brightness (SB) profiles for 149 galaxies with $M_{\text{opt}} < -19.4$ mag at $z = 4-10$ (29 of which are spectroscopically confirmed with JWST NIRSpec), securing high S/Ns of 10–135 with deep JWST NIRCам 1–5 μ m images obtained by the CEERS survey. We derive morphologies of our high- z galaxies, carefully evaluating the systematics of SB profile measurements with Monte Carlo simulations as well as the impacts of a) AGNs, b) multiple clumps including galaxy mergers, c) spatial resolution differences with previous HST studies, and d) strong emission lines, e.g., H α and [OIII], on optical morphologies with medium-band F410M images. Conducting Sérsic profile fitting to our high- z galaxy SBs with GALFIT, we obtain the effective radii of optical $r_{\text{e,opt}}$ and UV $r_{\text{e,UV}}$ wavelengths ranging $r_{\text{e,opt}} = 0.05-1.6$ kpc and $r_{\text{e,UV}} = 0.03-1.7$ kpc that are consistent with previous results within large scatters in the size luminosity relations. However, we find the effective radius ratio, $r_{\text{e,opt}}/r_{\text{e,UV}}$, is almost unity, $1.01_{-0.22}^{+0.35}$, over $z = 4-10$ with no signatures of past inside-out star formation such found at $z \sim 0-2$. There are no spatial offsets exceeding 3σ between the optical and UV morphology centers in case of no mergers, indicative of major star-forming activity only found near a mass center of galaxies at $z \gtrsim 4$ probably experiencing the first phase of inside-out galaxy formation.