

Assessing the Impact of Source Confusion for GREX-PLUS based on Deep JWST NIRCam Imaging

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We investigate the effects of source confusion expected in observations with GREX-PLUS, a JAXA L-class space infrared telescope mission candidate with a wide-field infrared camera covering 2-8 μm with a field of view of 0.50 deg^2 . For the deep imaging band near 4 μm , we calculate the GREX-PLUS PSF and ghost based on the latest optical design, and consider two representative imaging performance cases with PSF FWHM values of 0.9 and 1.2 arcsec. We construct simulated GREX-PLUS images at different depths by convolving JWST NIRCam imaging data from JADES, GLASS, CEERS, and COSMOS-Web with the PSF+ghost kernel. Comparing the limiting magnitudes estimated from random aperture photometry using the same aperture sizes, we find that the simulated GREX-PLUS images are shallower than the original JWST images, with larger deviations for deeper original JWST images. This likely reflects unresolved faint sources and extended PSF+ghost wings from bright sources, which elevate background fluctuations in blank regions. Nevertheless, the limiting magnitudes continue to improve with increasing integration time down to ~ 27 mag, without a clear plateau at depths comparable to the planned GREX-PLUS deep survey, although the improvement becomes progressively less efficient toward longer integrations. Based on Monte Carlo simulations, we estimate detection completeness and correct the number counts for magnitude bias and incompleteness, finding that confusion-induced blending can reduce the completeness even at magnitudes well above the nominal 5-sigma depth. The completeness-corrected number counts agree well with the JWST-based number counts down to around the detection limit. Overall, our results suggest that statistical studies of faint galaxies remain feasible for GREX-PLUS; however, survey planning should account for less efficient depth improvement toward longer integrations due to source confusion.