Recovering the Properties of High-redshift Galaxies with Different JWST Broadband Filters - DTU Orbit (09/11/2017)

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Imaging with the James Webb Space Telescope (JWST) will allow observations of the bulk of distant galaxies at the epoch of reionization. The recovery of their properties, such as age, color excess , specific star formation rate (sSFR), and stellar mass, will mostly rely on spectral energy distribution fitting, based on the data provided by JWST's two imager cameras, namely the Near Infrared Camera (NIRCam) and the Mid Infrared Imager (MIRI). In this work we analyze the effect of choosing different combinations of NIRCam and MIRI broadband filters, from 0.6 to 7.7 μm, on the recovery of these galaxy properties. We performed our tests on a sample of 1542 simulated galaxies, with known input properties, at z = 7–10. We found that, with only eight NIRCam broadbands, we can recover the galaxy age within 0.1 Gyr and the color excess within 0.06 mag for 70% of the galaxies. Additionally, the stellar masses and sSFR are recovered within 0.2 and 0.3 dex, respectively, at z = 7–9. Instead, at z = 10, no NIRCam band traces purely the λ > 4000 Å regime and the percentage of outliers in stellar mass (sSFR) increases by >20% (>90%), in comparison to z = 9. The MIRI F560W and F770W bands are crucial to improve the stellar mass and the sSFR estimation at z = 10. When nebular emission lines are present, deriving correct galaxy properties is challenging at any redshift and with any band combination. In particular, the stellar mass is systematically overestimated in up to 0.3 dex on average with NIRCam data alone and including MIRI observations only marginally improves the estimation.

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