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Photometric Redshift Biases from Galaxy Evolution

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Proposed cosmological surveys will make use of photometric redshifts of galaxies that are significantly fainter than any complete spectroscopic redshift surveys that exist to train the photo-z methods. We investigate the photo-z biases that result from known differences between the faint and bright populations: a rise in AGN activity toward higher redshift, and a metallicity difference between intrinsically luminous and faint early-type galaxies. We find that even very small mismatches between the mean photometric target and the training set can induce photo-z biases large enough to corrupt derived cosmological parameters significantly. A metallicity shift of ~ 0.003 dex in an old population, or contamination of any galaxy spectrum with $\sim 0.2\%$ AGN flux, is sufficient to induce a 10^{-3} bias in photo-z. These results highlight the danger in extrapolating the behavior of bright galaxies to a fainter population, and the desirability of a spectroscopic training set that spans all of the characteristics of the photo-z targets, i.e. extending to the 25th mag or fainter galaxies that will be used in future surveys.

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