Photometric redshift requirements for lens galaxies in galaxy-galaxy lensing analyses

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Weak gravitational lensing is a valuable probe of galaxy formation and cosmology. Here we quantify the effects of using photometric redshifts (photo-z) in galaxy-galaxy lensing, for both sources and lenses, both for the immediate goal of using galaxies with photo-z as lenses in the Sloan Digital Sky Survey (SDSS) and as a demonstration of methodology for large, upcoming weak lensing surveys that will by necessity be dominated by lens samples with photo-z. We calculate the bias in the lensing mass calibration as well as consequences for absolute magnitude (i.e., k-corrections) and stellar mass estimates, for a large sample of SDSS Data Release 8 (DR8) galaxies. The redshifts are obtained with the template based photo-z code ZEBRA on the SDSS DR8 ugriz photometry. We assemble and characterise the calibration samples (~9k spectroscopic redshifts from four surveys) to obtain photometric redshift errors and lensing biases corresponding to our full SDSS DR8 lens and source catalogues. Our tests of the calibration sample also highlight the impact of observing conditions in the imaging survey when the spectroscopic calibration covers a small fraction of its footprint; atypical imaging conditions in calibration fields can lead to incorrect conclusions regarding the photo-z of the full survey. For the SDSS DR8 catalogue, we find sigma_z/(1+z)=0.096 and 0.113 for the lens and source catalogues, with flux limits of r=21 and r=21.8, respectively. We also explore the systematic uncertainty in the lensing signal calibration when using source photo-z, and both lens and source photo-z; given the size of existing training samples, we can constrain the lensing signal calibration (and therefore the normalization of the surface mass density) to within 2 and 4 per cent, respectively. [ABRIDGED]

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