Redshift Calibrations for Next Generation Surveys

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Objectives

The nature of dark matter and dark energy are two of the greatest mysteries physicists face today. In order to research these cosmological mysteries, we need extremely accurate and large- scale data on the obseervable universe. This is starting to become possible with DESI (the Dark Energy Spectroscopic Instrument), which takes spectroscopic imaging on a scale previously only feasible for photometric surveys.

We are working to calibrate the DESI data against older photometric data in order to reduce our errors and gain the most accurate possible information about the universe. We can do this by analyzing weak gravitational lensing between different redshift bins.

Methods

The cosmic shear correlation function takes into account the gravitational shear, as well as the intrinsic alignment of galaxies, to provide an accurate measurement of weak lensing:

$$\gamma_t(\theta) = \Sigma \frac{2l+1}{4\pi l(l+1)} P_l^2(\cos(\theta)) C_{gm}(l)$$

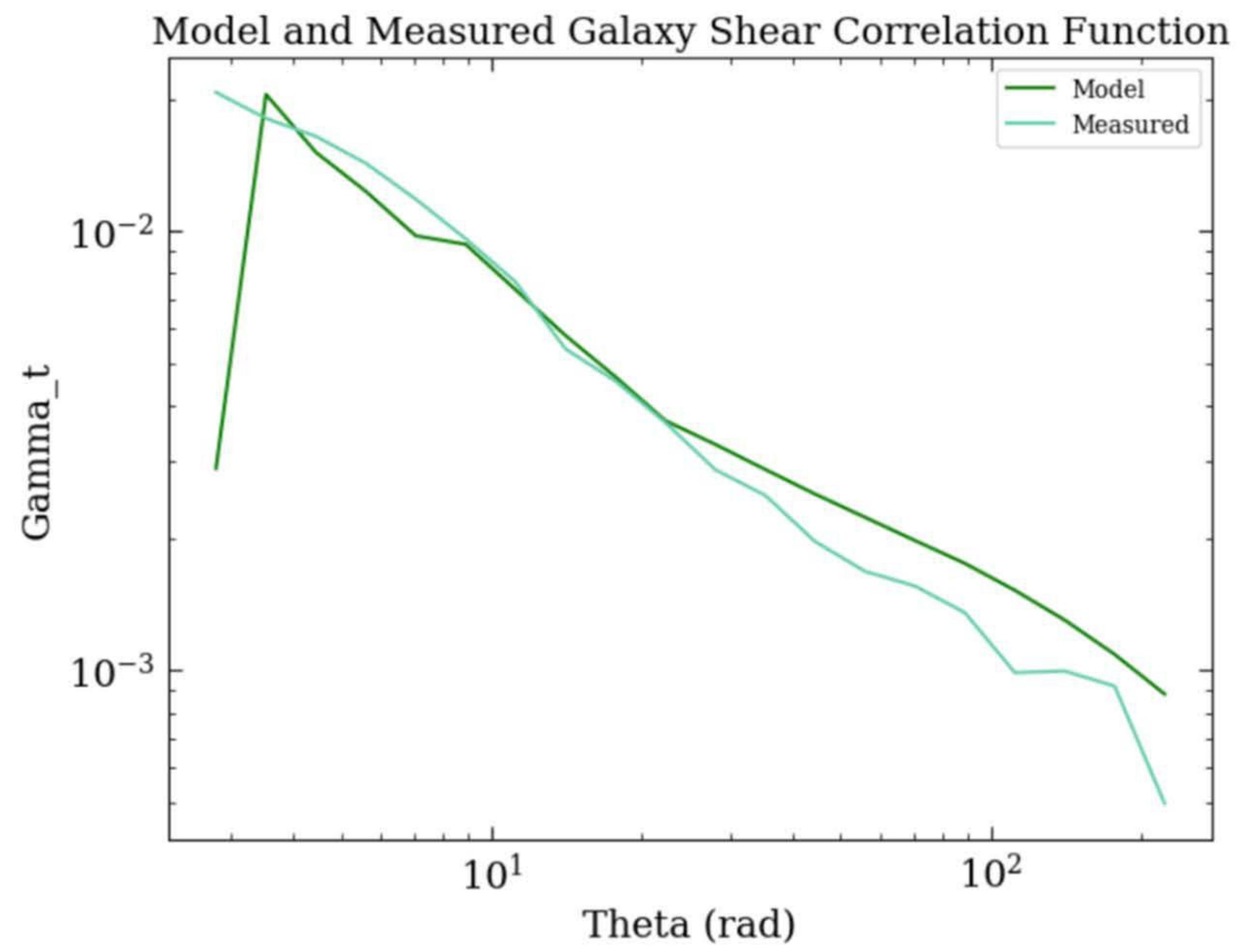
Using treecorr, we were able to get an accurate measurement of gamma from the data, as well as a covariance matrix. We used both of these to conduct an MCMC fitting using the emcee package to test our models against the data and calculate the shear bias and intrinsic alignment amplitude within gamma. Since gamma is the correlation function for galaxy-galaxy lensing, we repeated this process for the galaxy clustering and cosmic shear correlation functions, omega and xi.

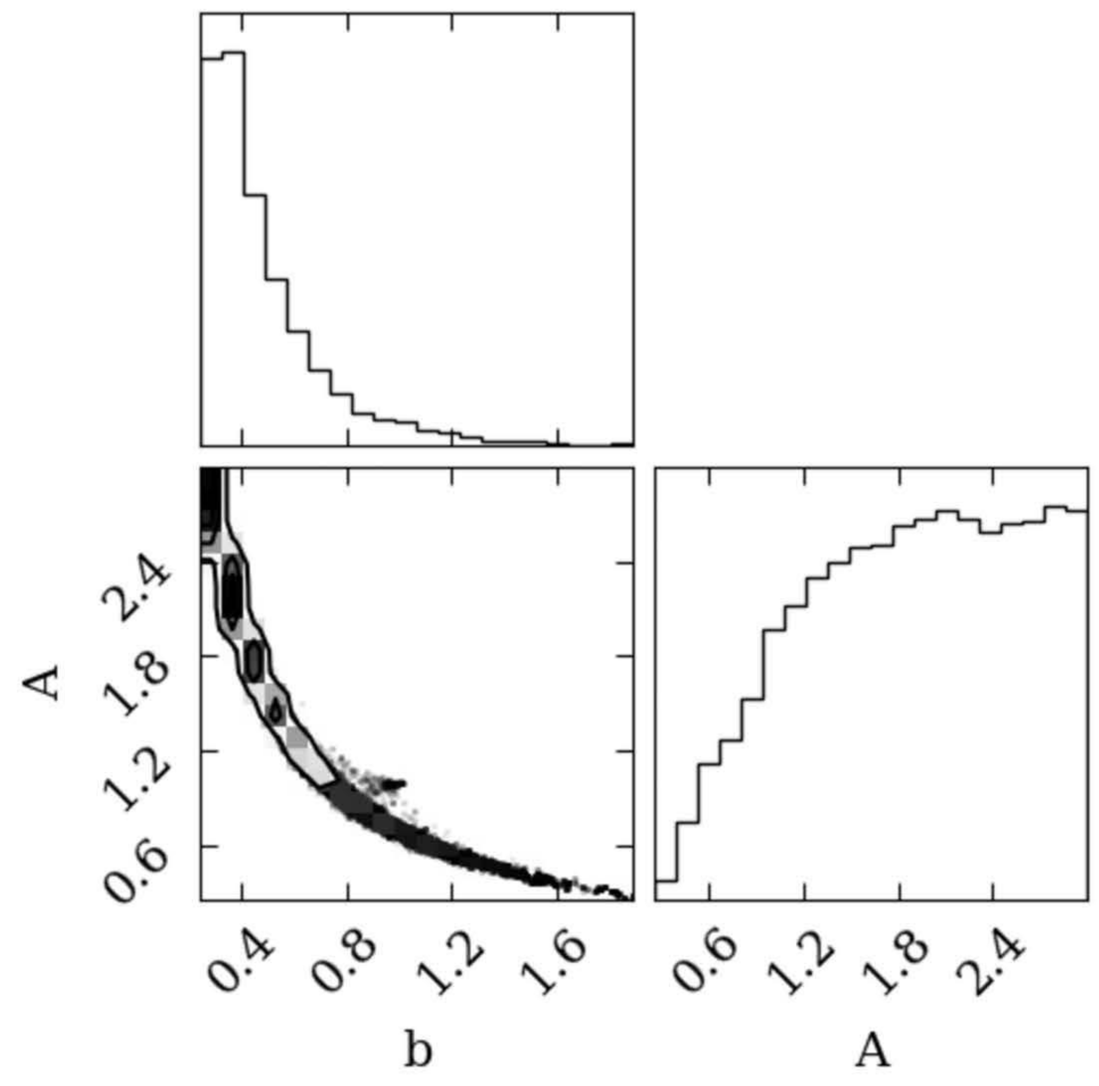
$$w^i(\theta) = \sum_\ell \frac{2\ell+1}{4\pi} P_\ell(\cos\theta) C^{ii}_{\delta_{l,\mathrm{obs}}\delta_{l,\mathrm{obs}}}(\ell) \, , \qquad (17)$$

$$\gamma_t^{ij}(\theta) = \sum_\ell \frac{2\ell+1}{4\pi\ell(\ell+1)} P_\ell^2(\cos\theta) C^{ij}_{\delta_{l,\mathrm{obs}}\mathrm{E}}(\ell) \, , \qquad (18)$$

$$\xi_\pm^{ij}(\theta) = \sum_\ell \frac{2\ell+1}{2\pi\ell^2(\ell+1)^2} [G^+_{\ell,2}(\cos\theta) \pm G^-_{\ell,2}(\cos\theta)] \times \left[C^{ij}_{EE}(\ell) \pm C^{ij}_{BB}(\ell)\right] \, , \qquad (19)$$

Results/Conclusions





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References:
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