Galaxy-galaxy lensing tests for KiDS-1000 vs. BOSS/2dFLenS

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Goals

Investigate implementation of galaxy-galaxy lensing component of KiDS-1000 Phase 1

- Can galaxy-galaxy lensing around BOSS and 2dFLenS be consistently combined?

- What are the key systematics to address?

- Should any weights be applied to reduce systematic bias, or optimize statistical error?
• Use KiDS-1000 source catalogues downloaded 29/10/18 (K1000_N/S_9band_mask_BLINDDED.cat)

• Measure galaxy-galaxy lensing $\Delta \Sigma(R)$ around BOSS/2dFLenS LRGs in redshift ranges $0.15 < z < 0.43$ and $0.43 < z < 0.7$. Note: I call these LOWZ/CMASS and 2dFLoZ/2dFHiZ

• Cut sources to $0.1 < z_B < 1.2$ and source/lens samples to KiDS tiles which contain lenses

• Default analysis: subtract $\Delta \Sigma_{\text{rand}}(R)$ using random lenses, include boost correction, no multiplicative bias correction, use jackknife errors with KiDS tiles as JK regions

• Default linear bias fits: use KV-450 source N(z), Planck-like fiducial cosmology, fit to scales $R > 3 \ h^{-1} \ Mpc$
Overlap (KiDS-1000)

Blue=2dFLenS  Red=BOSS  Grey=KiDS tiles
Overlap (KiDS-450)

Blue=2dFLenS  Red=BOSS  Grey=KiDS tiles
Are BOSS and 2dFLenS consistent?

- These are measurements of $\Delta \Sigma(R)$ for BOSS/2dFLenS LRGs, in redshift ranges 0.15-0.43 and 0.43-0.7

- There is evidence for some differences on 1-halo scales ($R < 3 \, h^{-1} \text{ Mpc}$), particularly for 0.43-0.7, but on larger scales the amplitudes are consistent

- **Note:** not much GGL signal on scales $R > 10 \, h^{-1} \text{ Mpc}$
Are BOSS and 2dFLenS consistent?

- Here are the posterior probability distributions of the linear bias fits to $\Delta \Sigma(R)$ (the fits are to scales $R > 3 \, h^{-1} \, \text{Mpc}$)

![Probability distribution graphs for different redshift ranges and survey samples.](image-url)
I have matched BOSS and 2dFLenS galaxies to the KiDS-1000 source catalogue (use “MAG_GAAP” values?)

Key colours/magnitudes for LRG selection are: $g - r$, $r - i$, $i$. This plot compares their distributions for CMASS/2dFHiz. (Could weight sources to match these distributions).

Note: there are almost no matches for LOWZ selection
Methods for measuring $\Delta \Sigma(R)$

- My code agrees closely with SWOT (similar methods) and with the Leiden KiDS-GGL pipeline (different method) – although this latter shows some large-scale fluctuations (?)
Errors in the $\Delta \Sigma(R)$ measurements

- JK generally agrees with SLICS60 errors on small scales, SLICS60 predicts a smaller error on large scales. I am working on analytic covariance (with Leiden help!)
Dependence on seeing?

- Does $\Delta \Sigma (R)$ depend on the seeing (PSF_FWHM) of the target imaging from which BOSS LRGs are selected?

- These plots show $\Delta \Sigma (R)$ for LOWZ/CMASS sub-samples, above and below the median PSF_FWHM.

- I find no evidence for a variation of $\Delta \Sigma (R)$ with seeing.
• I therefore don’t reproduce the 20% effect seen in Alex’s slide (below). I have not yet succeeded in obtaining Alex’s data to test this result further.
Dependence on seeing?

- In any case, the distribution of PSF_FWHM is only slightly different between the full BOSS area and the K1000 area.
Dependence on BOSS weights?

- BOSS provides various possible galaxy weights
- These plots are $\Delta \Sigma(R)$ for LOWZ/CMASS sub-samples, using completeness weights [default case], all weights=1, completeness and FKP weights
- Whether or not we use completeness weights does not have a significant effect on $\Delta \Sigma(R)$
• Here are measurements of the projected clustering $w_p(R)$ of BOSS and 2dFLenS (using the whole BOSS NGP region, errors from mock catalogues).

• The smaller errors reveal some more differences in the large-scale clustering amplitude, although this will not affect the intended analysis (since 2dFLenS clustering will not be used).
Effective galaxy bias

- The key test is whether the same galaxy bias or effective redshift can describe both $\Delta \Sigma(R)$ and the projected clustering $w_p(R)$ for BOSS, here is that comparison:
Effective galaxy bias

- The comparison between these bias measurements is acceptable, given the noise in the $\Delta \Sigma(R)$ measurements.

- This investigation could be extended using simulations – Buzzard, MICE or SLICS mocks? (example below for Buzzard)
Summary so far

- KiDS-1000 offers significantly improved overlap with both BOSS and 2dFLenS lenses

- BOSS and 2dFLenS show consistent amplitudes (errors are \( \sim 10\% \)) of galaxy-galaxy lensing on scales \( R > 3 \, h^{-1} \, \text{Mpc} \)

- No current evidence in my measurements for a systematic due to PSF_FWHM in the BOSS LRG target selection

- BOSS completeness weights do not have a strong effect

- Same linear bias can describe both \( \Delta \Sigma(R) \) and the projected clustering \( w_p(R) \) for BOSS (errors are \( \sim 10\% \), driven by \( \Delta \Sigma \))