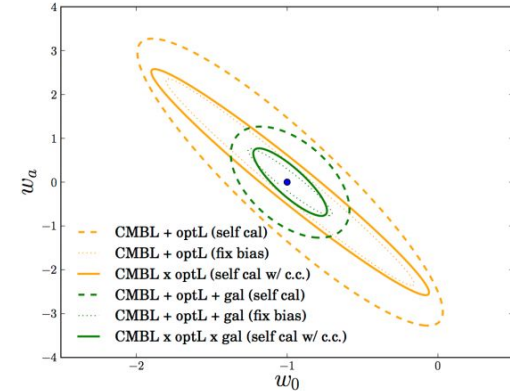
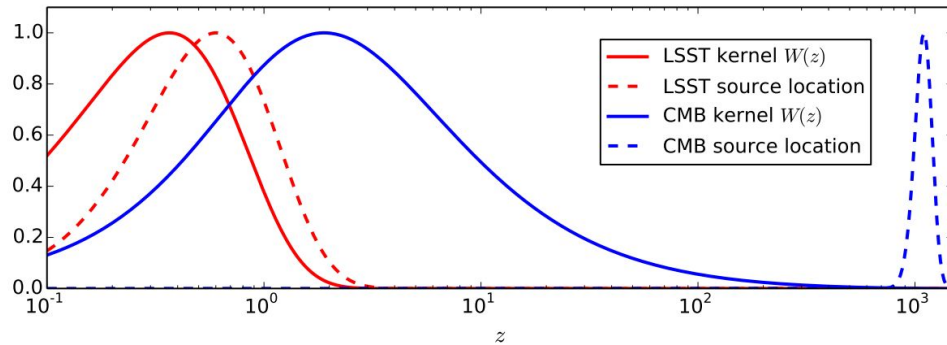


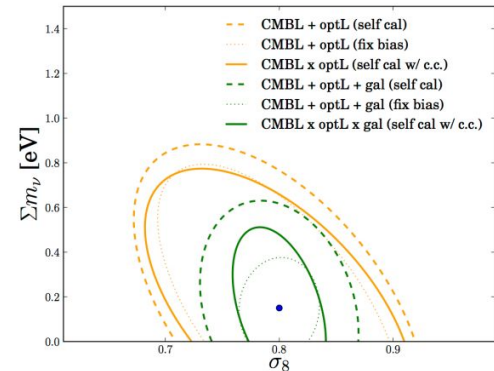
CMB kappa x galaxy kappa

- measure matter density as a function of z -- tomography can help with $w(z)$



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- calibrate LSST shear without sims (but need spec- z foreground sample)
 - insensitive to spec- z galaxy bias!
 - Stage III $>0.25\%$ calibration
 - LSST requirement $\sim 0.1\%$
 - S4 could provide this
- Also tightens neutrino mass



Forecasting

- S4 kappa + LSST shear + DESI galaxies
- Quick and dirty Fisher with z-bins

$$C_{\ell}^{XY} \equiv \left\{ \begin{array}{l} C_{\ell}^{\kappa_{\text{CMB}}\kappa_{\text{CMB}}}, \underbrace{\{C_{\ell}^{\kappa_{\text{CMB}}\kappa_{\text{opt}}}\}}_{N_{\text{opt}} \text{ spectra}}, \underbrace{\{C_{\ell}^{\kappa_{\text{CMB}}\Sigma}\}}_{N_{\text{f}} \text{ spectra}}, \\ \underbrace{\{C_{\ell}^{\kappa_{\text{opt}}\kappa_{\text{opt}}}\}}_{N_{\text{opt}}(N_{\text{opt}}+1)/2 \text{ spectra}}, \underbrace{\{C_{\ell}^{\kappa_{\text{opt}}\Sigma}\}}_{N_{\text{opt}}N_{\text{f}} \text{ spectra}}, \\ \underbrace{\{C_{\ell}^{\Sigma\Sigma}\}}_{N_{\text{f}}(N_{\text{f}}+1)/2 \text{ spectra}} \end{array} \right\}.$$

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2013

- Likelihood-based approach? (ref: Emmanuel Schaan, CosmoLike...)
- **Summary:** We should highlight the complementarity with LSST/DESI and show numbers for shear calibration, w and Mnu