# Joint cosmological inference of standard sirens and gravitational wave weak lensing

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## Abstract

Gravitational waves from sources at cosmological distances can be weakly lensed by the large scale structure. This is particularly true for observations that will be made by LISA or ET (median $z \sim 2$), and marginally true also for LIGO-VIRGO ($z \sim 0.1$). Techniques have been developed over the years to account for this extra error in standard siren analysis, and possibly correct for it. Here a new method is proposed to combine, for the first time, standard sirens (which is sensitive to geometry parameters, i.e. $H_0$, $\Omega_m$, and $\Omega_\Lambda$), and gravitational wave weak lensing (GW-WL) (which is sensitive to clustering and geometry, i.e. $\sigma_8$, $\Omega_m$, $H_0$, and $\Omega_\Lambda$). We show that this would allow us to break the key $\Omega_m$-$\sigma_8$ degeneracy in lensing and standard sirens. Assuming 1 source/ deg$^2$ combined GW catalogue, 1% detection errors, and spectroscopic redshifts, we predict percent level errors on all cosmological parameters, jointly measured by standard sirens and GW-WL. With much less calibration requirements, this is a new independent cosmological probe that might help solve the tensions currently observed between other cosmological probes (CMB, galaxy lensing, and Type Ia SNs), and distinguish between residual systematics and new physics. For more details see arXiv:1812.02730.

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