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Cosmology with GWxHI Cross-Correlation with Future Observatories

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We explore the potential of cross-correlation between gravitational waves (GWs) and 21 cm intensity mapping (IM) from neutral hydrogen emission (HI), focusing on its role in view of future high-precision observatories, specifically Einstein Telescope (ET) and the Square Kilometer Array Observatory (SKAO). We model the large scale structure evolution by making use of 3D lightcones of the dark matter density distribution up to redshift $z \sim 3$ from both linear perturbation theory and N-body simulations. Assuming that GW and HI are different tracers of the same underlying density field, we infer cosmological parameters from both the angular power spectrum (auto-correlation) and the angular cross-power spectrum (cross-correlation) of these probes. We show that synergies between future GW and HI experiments will significantly improve standard sirens measurements, thanks to increased sensitivity and high-redshift coverage, allowing to constrain cosmological parameters to a level comparable to that of well-established alternative probes, such as Type Ia Supernovae.

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