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Galaxy Catalog Incompleteness Effects in Standard Siren Cosmology

Galaxy catalogs can be combined with gravitational wave observations to provide cosmological constraints through the dark siren method. However, host galaxies may be missed in the catalogs due to observational effects, potentially weakening the constraints and introducing systematics. At the same time, galaxy catalogs can include galaxy properties - such as the stellar mass - that can be incorporated as hosting probability weights. We extend the standard siren method including completeness and weighting effects and include them in CHIMERA, a hierarchical Bayesian pipeline for joint cosmological and astrophysical population parameter constraints. We generate a mock catalog representative of LIGO-Virgo-KAGRA O5 scenario. We quantify how catalog completeness and host galaxy probability assumptions ultimately impact on H0 constraints, providing key metrics to inform the design of future electromagnetic and gravitational wave facilities. This framework represents a significant advancement in preparing for wide-field spectroscopic surveys, such as WST, which could play a crucial role in gravitational-wave cosmology.

For talks:

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