

Gravitational Lensing of Gravitational Waves and Precision Cosmology

Prof. Zong-Hong ZHU, Department of Astronomy, Beijing Normal University

The standard siren approach of gravitational wave cosmology appeals to the direct luminosity distance estimation through the waveform signals from inspiralling double compact binaries, especially those with electromagnetic counterparts providing redshifts. It is limited by the calibration uncertainties in strain amplitude and relies on the fine details of the waveform.

We will show the next generation detector, e.g., the Einstein Telescope, is expected to produce $10^4 - 10^5$ gravitational wave detections per year, 50–100 of which will be lensed. Then we report a waveform-independent strategy to achieve precise cosmography by combining the accurately measured time delays from strongly lensed gravitational wave signals with the images and redshifts observed in the electromagnetic domain.

We demonstrate that just 10 such lensing systems can provide a Hubble constant uncertainty of 0.68% for a flat Lambda Cold Dark Matter universe in the era of third generation ground-based detectors.