

Cosmology with dark gravitational wave sources

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Several observations using electromagnetic signal have led to a paradigm shift in our understanding of the Universe, with the realization that two unknown quantities - namely dark matter and dark energy - constitute about 95% of the Universe, even though their existence could not be explained by the known laws of physics and fundamental particles discovered until now. Moreover, measurements of the current expansion rate of the Universe, known as the Hubble constant - using several independent methods based on observations of different cosmological probes have reached an enigmatic and startling conclusion. These Hubble constant measurements are strongly inconsistent with each other. This discrepancy has led us to question the foundations of cosmology, indicating either an entirely new physics or unknown systematics. I will discuss how the gravitational wave observations can play a pivotal role in resolving the tension in the value of the Hubble constant and provide a better understanding of the constituents of the Universe. I will explain novel techniques that will enable us to map the expansion history of the Universe up to high redshift using binary black holes and how it can peer into new territories of fundamental physics that are currently unexplored from electromagnetic observations.

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