Contribution ID: **55** Type: **Poster**

New frontiers in cosmology using gravitational waves

Cosmic microwave background and large scale structure missions have played a crucial role in constructing the standard model of cosmology. The upcoming missions in astrophysics and cosmology are going to explore the Universe over a wide range of redshifts using both electromagnetic waves and gravitational waves. I will introduce a few new frontiers in cosmology which will open-up from the gravitational wave missions and which will be capable to probe a broad range of topics in fundamental physics. In the first part of my talk, I will discuss the provision of precision measurement of Hubble constant using gravitational wave sources with or without electromagnetic counterpart by exploiting the spatial correlation of the astrophysical gravitational wave sources with the galaxy distribution. In the latter part of my talk, I will discuss the imprints of cosmological density field on the strain of the astrophysical gravitational waves and will introduce new cross-correlation techniques between electromagnetic sector and gravitational wave sector to measure the imprints of cosmological perturbations from the upcoming missions. These new techniques are going to open an era of multi-messenger cosmology and will open a discovery space to understand the theory of gravity, nature dark energy and the properties of dark matter in a unique way which was not possible until now.

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Session Classification: Coffee+Posters session