Contribution ID : **15** Type : **not specified**

Exploring Graviton Mass through Strongly Lensed Gravitational Waves

Thursday, 9 January 2025 09:15 (60)

Recent advancements in time-domain surveys have significantly increased the detection of various explosive transient events across the universe, including supernovae, gamma-ray bursts, fast radio bursts, and gravitational waves (GWs). Some of these events can manifest as multiple images due to gravitational lensing. While numerous strongly lensed distant galaxies and quasars have been cataloged, the strong lensing of explosive transients offers new scientific possibilities. These opportunities range from refining measurements of cosmological parameters and detecting dark matter, to testing fundamental physics. Particularly, the long wavelengths of GWs suggest that wave optics effects are crucial in some instances, potentially leading to novel uses of these lensing phenomena. With the next generation of GW detectors expected to enhance sensitivity tenfold, the observable volume of the universe could expand by a thousandfold, substantially increasing detection rates of lensed GW signals. This surge in data provides a unique platform to examine critical physical theories, such as the properties of gravitons, by studying strongly lensed gravitational waves.
In this work, we investigate constraints on the graviton mass by analyzing strongly lensed GW signals from typical binary black hole mergers. We simulate the response of next-generation ground-based GW detectors, such as the Einstein Telescope, to better gauge the potential of upcoming observations. Our analysis assesses the capacity of future GW data to place meaningful constraints on graviton mass, thereby offering fresh perspectives on the nature of gravity at cosmic scales. This study underscores the critical role of gravitational lensing in enhancing GW astronomy's capability to address fundamental physics questions, with broad implications for our understanding of the universe's fundamental structure

Presenter(s) : GENG, Shuaibo (National Center for Nuclear Research)