Constraining the fraction of compact dark matter from gravitational lensing of gravitational waves

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Abstract

Massive astrophysical compact halo objects (MACHOs) are viable compact dark matter (DM) candidates, the presence of which in the interstellar medium will lead to lensing of electromagnetic (EM)/gravitational-wave (GW) signals. Various EM lensing searches have constrained the DM density fraction, $f_{DM}$, in the form of MACHOs better than $f_{DM} < 10^5$ in the mass range $< 10^{-16} M_\odot$ and $> 10^5 M_\odot$. On the other hand, LIGO-Virgo detectors ($10 Hz < f < 100 Hz$) are well suited to probe MACHOs in the mass range $10^{10} M_\odot$ via GW lensing. The lensed lens waveform will have a frequency dependent magnification/demagnification in the wave-optics limit ($\lambda_{GW} \sim R_{\text{Sch}}$), which is true for MACHOs. In this talk, we will discuss how the search of lensing signature in GW events observed by LIGO-Virgo can be used to put better constraints on $f_{DM}$.