

## New probe for non-Gaussianities with primordial black hole induced gravitational waves

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We propose a new probe of primordial non-Gaussianities through the observational window of gravitational waves (GW) being induced by ultra-light ( $M_{\text{PBH}} < 10^9 \text{g}$ ) primordial black holes (PBHs). An existence of primordial non-Gaussianity can leave imprints on the clustering properties of PBHs and the spectral shape of the induced GW signal. Focusing on local-type non-Gaussianities, we find a distinctive double-peaked GW energy spectrum which, depending on the PBH mass  $M$  and the initial PBH abundance at formation time, i.e.  $\Omega_{\text{PBH},f}$ , can lie within the frequency bands of forthcoming GW detectors, including LISA, ET, SKA and BBO, hence rendering this signal promisingly detectable by GW experiments and promoting it as a novel portal probing non-Gaussianities. Moreover, by accounting on BBN bounds on the non-Gaussian GW amplitude we set model-independent constraints on the effective  $\tau_{\text{NL}}$ , denoted as  $\bar{\tau}_{\text{NL}}(k)$ , on scales  $k > 10^5 \text{Mpc}^{-1}$ , which read as  $\bar{\tau}_{\text{NL}}(k) \mathcal{P}_{\text{calR}}(k) < 2 \times 10^{-20} \Omega_{\text{PBH},f}^{-17/9} \left( \frac{M_{\text{PBH}}}{10^4 \text{g}} \right)^{-17/9}$ , where  $\mathcal{P}_{\text{calR}}(k)$  is the primordial curvature power spectrum.

**Presenter:** PAPANIKOLAOU, Theodoros

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