THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
SEMINAR

Detectability of Lensed Gravitational Waves in Matched-Filtering Searches

by

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ALL INTERESTED ARE WELCOME
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Abstract

Gravitational lensing by compact, small-scale intervening masses causes frequency-dependent distortions to gravitational-wave events. The optimal signal-to-noise ratio (SNR) is often used as a proxy for the detectability of exotic signals in gravitational-wave searches. In reality, the detectability of such signals in a matched-filtering search requires comprehensive consideration of match-filtered SNR, signal-consistency test value, and other factors. In this work, we investigate for the first time the detectability of lensed gravitational waves from compact binary coalescences with a match-filtering search pipeline. Contrary to expectations from the optimal-SNR approximation approach, we show that the strength of a signal (i.e., higher optimal SNR) does not necessarily result in higher detectability. We also demonstrate that lensed gravitational waves with wave optics effects can suffer significantly, from $~90\%$ (unlensed) to $<1\%$ (lensed) detection efficiency, due to downranking by the signal-consistency test values. These findings stress the need to extend current template banks to effectively search for lensed gravitational waves and to reassess current constraints on compact dark matter scenarios.