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Affiliation: University of Florida

Poulami Dutta Roy

Search for Gravitational-Wave Burst Candidates in LIGO–Virgo-KAGRA O4a Using the cWB-XP Pipeline

Abstract

Gravitational wave searches are broadly classified into modelled and unmodelled searches. While modelled search correlates data with known waveforms (templates) through match-filtering, they might not be optimal for detecting gravitational wave signals not covered by templates or signals affected by non-Gaussian noise. In this talk, we focus on the unmodelled burst search pipeline coherent WaveBurst-XP (cWB-XP), which incorporates machine-learning based classification to enhance the identification of both high-frequency short-duration and long-duration burst signals in the first phase of the LIGO–Virgo–KAGRA fourth observing run (O4a). Both searches showed good agreement with expected background, with no candidates rising above the inverse false-alarm rate (IFAR) significance threshold. We also evaluate the sensitivity of the pipeline using a range of simulated injection waveforms. For the high-frequency search, the best detection efficiency at an IFAR of 100 years is $\sim 2 \times 10^{-22} \, \rm{strain/\sqrt{Hz}}$ for a particular sine-Gaussian elliptical signal. For long-duration signals, most injected waveform families are recovered with efficiencies of $\sim \mathcal{O} (10^{-22}) \, \rm{strain/\sqrt{Hz}}$ at an IFAR of 50 years.