Form 8

Research Result Report
ICRR Inter-University Research Program 2024

Research Subject: Implementing Sophisticated Data Analysis Methods on KAGRA Data

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Summary of Research Result :

In this project, we are working with another KAGRA team from Chungnam National University in Korea to develop with an autoregressive integrated moving-average model (ARIMA) for gravitational wave signal detection. Under this framework, we can denoise the strain data effectively to improve the signal-to-noise ratio. We also demonstrate that ARIMA can provide better performance comparing with typical whitening method. The paper was just published in the Physical Review D (Kim et al. 2024, PRD, 109, 102003). Currently, we are now testing the algorithms with the O4 LVK data.

Furthermore, we are developing the SPIIR sky localization capabilities with KAGRA data and we demonstrate the transformative impact of including data from the KAGRA detector. Specifically, we simulated over hundreds of binary neutron star merger gravitational wave events for LVK detection and the average 90% credible localization area is reduced by a factor of ~3 by combining KAGRA data even though the signals in the KAGRA detector are not significant. This is a very significant improvement for multi-wavelength rapid follow-up observations.

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