

Research Result Report

ICRR Inter-University Research Program 2025

Research Subject: Noise Subtraction of KAGRA Data using Machine Learning Method: DeepClean
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Summary of Research Result : During the LVK O4 observation run, KAGRA operated from May 25, 2023 to June 21, 2023 (O4a) and from June 12, 2025 to November 19, 2025 (O4c). We have analyzed the coherence between the strain channel and the selected auxiliary channels which have the potential to be used for the noise subtraction on the strain channel. For O4a data, we have identified 11 noise subtraction problems. Noise subtraction problems are defined by the target frequency bands and the auxiliary channels that have the highest coherence to the strain channel in the bands. We call these chosen auxiliary channels “witness channels” which will be used for the noise subtraction by DeepClean pipeline. For O4c data, we have identified 13 noise subtraction problems. The witness channel list for a subtraction problem may change in different times. We built the witness channel lists of all subtraction problems of KAGRA’s O4a data and O4c data every 2048 second. The details of the noise subtraction problems of KAGRA O4 data and their witness channel lists are summarized here: https://ldas-jobs.ligo.caltech.edu/~shuwei.yeh/ We have established the machine learning based noise subtraction pipeline DeepClean and identified the subtraction problems for KAGRA’s O4a and O4c data. The next step is to apply noise subtraction on KAGRA’s O4 strain channel and evaluate the performance of DeepClean by the following: 1. Estimating the improvement of Binary Neutron Star range of KAGRA’s strain after cleaning. 2. The difference of the posterior distributions of the parameter estimation on the Mock Data Challenge (MDC). MDC is the data of the simulated Compact Binary Coalescence waveforms injected into KAGRA’s O4 strain channel.
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