Form 8

Research Result Report
ICRR Inter-University Research Program 2024

Research Subject: Gravitational Wave Noise Identification Using Particle Swarm Optimization (PSO)
Principal Investigator: Hyung Won Lee
Participating Researchers: Hyung Won Lee
Summary of Research Result : This project aims to enhance the identification and characterization of noise sources in gravitational wave (GW) data through the application of Particle Swarm Optimization (PSO)—a population-based, stochastic optimization technique inspired by the collective behavior of bird flocks. The primary motivation lies in the growing demand for robust denoising tools to effectively isolate authentic GW signals, particularly as detector sensitivities continue to improve in current and next-generation observatories. At the request of Prof. Tagoshi, the project's focus shifted from Compact Binary Coalescence (CBC) parameter estimation to the identification of noise features, reflecting a more pressing need within the collaboration. To date, no published results are available. However, progress is on track, and final outcomes are anticipated by the end of 2025. The foundational study of noise identification methodologies has been completed. Based on an extensive literature survey and evaluation of existing techniques, the appropriate loss function for noise identification has been selected, and a tailored PSO-based algorithm has been developed to optimize it. The primary implementation phase of the codebase is complete, and the project has now entered the stage of applying the solution to real observational data.

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