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Bridging Gravitational Wave and High-Energy Physics Software

Thursday 11 September 2025 17:40 (20 minutes)

Gravitational Wave (GW) Physics has entered a new era of Multi-Messenger Astronomy (MMA), characterized by increasing detections from GW observatories such as the LIGO, Virgo, and KAGRA collaborations. This presentation will introduce the KAGRA experiment, outlining the current workflow from data collection to physics interpretation, and demonstrate the transformative role of machine learning (ML) in GW data analysis.

This talk also bridges advancements in computational techniques between fundamental research in Astrophysics and High-Energy Physics (HEP). Innovative solutions for addressing next-generation data analysis challenges will be presented, with a focus on the use of modern ML tools within the ROOT C++ Framework (CERN) and introducing Anaconda HEP-Forge for rapid software deployments. These tools, available as simple libraries, integrate key requirements for typical astrophysical analysis —such as vector manipulation, KAFKA & other Cloud data transfers, and complex tensor computations—enabling efficient ML training & inference on both CPU and GPU technologies.

References

https://arxiv.org/abs/2503.14292

Significance

This talk, to be presented on behalf of the LIGO-Virgo-KAGRA collaboration, is a continuation of the plenary presentation delivered at ACAT2024. GW collaborations are currently undergoing a technological transformative phase. This presentation will explore how the HEP and GW communities can mutually benefit from further collaborations —from sharing scientific methodologies to advancing computing frameworks together.

Experiment context, if any

LVK, LIGO, VIRGO, KAGRA

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