Contribution ID: **57** Type: **not specified**

Event-by-event jet-induced hydro response from machine learning

Thursday, 27 November 2025 17:26 (1 minute)

In high-energy heavy-ion collisions, energetic partons traverse the quark-gluon plasma (QGP) and deposit energy into the medium, leading to Mach-cone-like jet-induced medium response which modifies the internal structure of jet and impacts jet substructures, such as jet shape and jet fragmentation function. However, accurately simulating jet-induced medium responses requires a complete model that is capable of describing the concurrent evolution of hard and soft partons, as well as significant computational resources for full-scale simulations. In this study, we trained two generative neural networks using Flow matching model with gamma jet events in 0-10\% Pb+Pb collisions at 5.02 TeV to estimate the final-state effects of jet-induced medium response on the 2D and 3D particle spectra. Our findings indicate that with only the initial jet information, that is, the energy momentum of gamma and the jet, along with their initial positions, the network can conditionally generate the final state particle spectra from hydro response. The marginal distribution of the generated spectra along the η and ϕ direction align well with the marginal distribution of the training data from CoLBT. The difference between the distributions generated by the generative model and the CoLBT model is quantified using K-L divergence method, a common technique in the generative field. A low K-L divergence of 10^{-2} order of magnitude was achieved. Furthermore, our generative model demonstrated a significant computational advantage, running million times faster than the CoLBT model to produce the jet-induced medium response spectra.

Primary author: 吴, 开🄵 (CCNU)

Co-authors: PANG, LongGang (Central China Normal University); YANG, Zhong (Vanderbilt University); WANG, Xin-Nian (Central China Normal University)

Presenter: 吴, 开🄵 (CCNU)

Session Classification: Poster