

## The 234th HENPIC seminar by Xiang-Yu Wu (吴祥宇): Studying Heavy-Ion Collisions with Electromagnetic Probes

### Abstract:

Electromagnetic (EM) probes—namely real and virtual photons (dileptons)—are emitted throughout all stages of relativistic heavy-ion collisions and interact only minimally with the medium. Due to this property, they offer clean access to the space–time evolution of the strongly interacting matter, particularly during the early stages.

The first part of this talk presents results for dilepton invariant-mass spectra and anisotropic flows during the pre-equilibrium and hydrodynamic stages of Pb+Pb collisions at LHC energies. The space–time evolution of the medium is simulated using the iEBE-MUSIC framework, and dilepton emission is calculated based on the next-to-leading-order (NLO) QCD production rate. We examine the role of early-time chemical equilibration and quantify its impact on dilepton observables by comparing contributions from the QGP and Drell–Yan processes. The second part focuses on dilepton polarization. Within the same dynamical framework, we find that using leading-order (LO) versus NLO dilepton production rates gives significantly different polarization coefficients: both magnitude and sign. This highlights the importance of including NLO dilepton production channels in such studies. In the final part, I will discuss extending this framework to RHIC Beam Energy Scan (BES) energies, where the medium evolution is constrained by an established (3+1)D Bayesian analysis calibrated to hadronic data. Complementary to hadron-based observables, this study demonstrates how EM probe measurements can potentially provide additional constraints on the QCD phase structure at finite baryon densities.

Brief introduction about the speaker:

Xiang-Yu Wu received his Ph.D. from Central China Normal University in 2023. He subsequently joined the Department of Physics at McGill University as a postdoctoral researcher. His research focuses on relativistic hydrodynamic simulations and their applications to the quark-gluon plasma in heavy-ion collisions, including electromagnetic probes and spin polarization phenomena.

### Summary