

The 191th HENPIC seminar by Prof. Shuzhe Shi

Title: Real-time non-perturbative dynamics of jet production: quantum entanglement and vacuum modification

Abstract: The production of jets should allow to test the real-time response of the QCD vacuum disturbed by the propagation of high-momentum color charges. Addressing this problem theoretically requires a real-time, non-perturbative method. As a step in developing such an approach, we report here on fully quantum simulations of a massive Schwinger model coupled to external sources representing quark and antiquark jets as produced in electron-positron annihilation. It is well known that the Schwinger model [QED in (1+1) dimensions] shares many common properties with QCD, including confinement, chiral symmetry breaking and the existence of vacuum fermion condensate. This allows us to study, for the first time, the modification of the vacuum chiral condensate by the propagating jets, and the quantum entanglement between the fragmenting jets. Our results indicate strong entanglement between the fragmentation products of the two jets at moderate rapidity separations that can potentially be studied in experiment. In this talk, I will also mention the application of quantum computation methods in studying phase structure and non-linear wave propagation in Schwinger model. [ref: 2301.11991; see also 2305.00996, 2305.05685]

Summary