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Multi-particle correlations for the new decade of QGP studies

Wednesday 4 January 2023 17:55 (15 minutes)

Multi-particle correlations have been compelling tools to probe the properties of the Quark-Gluon Plasma (QGP) created in the ultra-relativistic heavy-ion collisions. In this seminar, I will present a generic recursive algorithm for multi-particle cumulants, which enables the calculation of arbitrary order multi-particle cumulants. Among them, I will emphasize a particular series of mixed harmonic multi-particle cumulants, which measures the general correlations between any moments of different flow coefficients. The study of these new multi-particle cumulants in heavy-ion collisions will significantly improve the understanding of the initial event-by-event geometry fluctuations and the hydrodynamic response in the final state. This will pave the way for more stringent constraints on the initial state and help extract more precise information on how the created hot and dense matter evolves. Last but not least, I will show the most recent study of correlations between anisotropic flow and mean transverse momentum in terms of multi-particle correlations/cumulants. I will show how we can directly access the initial conditions of heavy-ion collisions using the latest experimental measurements at the LHC and discuss the critical challenge of the state-of-the-art QGP studies via Bayesian analyses.

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