中国高能核物理网络论坛
HIGH ENERGY NUCLEAR PHYSICS IN CHINA

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The 223th HENPIC Seminar

QCD Speed of Sound and Thermalization

Speaker: Li Yan (Fudan U)

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Abstract:

The thermalization of QGP created in heavy-ion collisions is crucial for understanding its behavior as a relativistic fluid and the thermodynamic properties of the QCD. For instance, QGP thermalization plays a significant role in the search of QCD critical point in the beam energy scan program of heavy-ion collisions. This talk presents the investigation of the role of fluctuations in the relationship between transverse momentum and particle multiplicity, with a particular focus on their impact on extracting the QCD speed of sound. In a thermalized systems display non-Gaussian fluctuations, reflecting the breakdown of thermalization. By leveraging the Gaussianity condition of quantum fluctuations, the physical value of the speed of sound can be extracted statistically, even in the presence of significant event-by-event fluctuations. This framework provides a robust diagnostic tool for probing thermalization and extracting thermodynamic properties of QCD in both large and small collision systems. QGP, fluctuations are dominantly quantum in origin and follow a Gaussian distribution due to their independence from the thermodynamic response. In contrast, non-thermalized systems display non-Gaussian fluctuations, reflecting the breakdown of thermalization. By leveraging the Gaussianity condition of quantum fluctuations, the physical value of the speed of sound can be extracted statistically, even in the presence of significant event-by-event fluctuations. This framework provides a robust diagnostic tool for probing thermalization and extracting thermodynamic properties of QCD in both large and small collision systems.

About the speaker:

Li Yan is currently an Assistant Professor at Fudan University. He obtained his PhD in 2013 from Stony Brook University. Afterward, he joined the Institude Physique Théorique (IPhT) at Saclay, France, in 2013, and later at McGill University in 2016 as a postdoc. His research focuses on relativistic hydrodynamics and its application to QGP in high-energy heavy-ion collisions, the electromagnetic properties of QGP, and non-equilibrium systems.

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