Contribution ID: **101** Type: **not specified**

Momentum anisotropy in the quark-gluon plasma

Monday, 18 September 2017 17:30 (30 minutes)

The quark-gluon plasma (QGP) created in heavy-ion collisions possesses a high degree of momentum-space anisotropy in the local rest frame due to rapid longitudinal expansion. The degree of momentum-space anisotropy is largest at early times after the initial nuclear impact, e.g. P_L/P_T ˜ 0.2-0.3, and only slowly relaxes toward unity in the center of the fireball. Additionally, large momentum-space anisotropies persist for longer and eventually never approach unity as one moves toward the transverse and longitudinal edges of the QGP. As a consequence, traditional viscous hydrodynamics approaches which rely on linearization around an isotropic background can result in particle distribution functions which violate positivity. In order to address this and other issues related to the high-degree of QGP momentum-space anisotropy, I will discuss recent progress in anisotropic hydrodynamics, which is a reorganization of traditional viscous hydrodynamics that takes into account momentum-space anisotropies from the outset and guarantees, for example, positivity of the one-particle distribution function.

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Session Classification: Introductory / Overview Talks III