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MACH-LIKE STRUCTURE IN A PATRONIC-HARONIC TRANSPORT MODEL AT RHIC ENERGIES

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Abstract

Recent RHIC experimental results indicated an exotic partonic matter may be created in central Au + Au collisions at $\sqrt{s_{NN}}$=200 GeV. When a parton with high transverse momentum (jet) passes through the new matter, jet will quench. The lost energy will be redistributed into the medium. Experimentally the soft scattered particles which carry the lost energy have been reconstructed via di-hadron angular correlations of charged particles and a hump structure on away side in di-hadron $\Delta\phi$ correlation has been observed in central Au + Au collisions [1,2]. Some interpretations, such as Mach-cone shock wave and gluon Cherenkov-like radiation mechanism etc, have been proposed to explain the splitting behavior of the away side peaks. However, quantitative understanding of the experimental observation has yet to be established.

In this work, we use a multi-phase transport (AMPT) model to make a detailed simulation for di-hadron or tri-hadron azimuthal correlation for central Au + Au collisions at $\sqrt{s_{NN}}$ =200 GeV. The hump structure on away side (we called Mach-like structure later) in the di-hadron and tri-hadron azimuthal correlations has been observed [3,4,5]. Furthermore, the time evolution of Mach-like structure is presented [6]. With the increasing of the lifetime of partonic matter, Mach-like structure develops by strong parton cascade process. Not only the splitting parameter but also the number of associated hadrons (N_{h}^{assoc}) increases with the lifetime of partonic matter and partonic interaction cross section. Both the explosion of N_{h}^{assoc} following the formation of Mach-like structure and the corresponding results of three-particle correlation support that a partonic Mach-like behavior can be produced by a collective coupling of partons beacuse of the strong parton cascade mechanism. Therefore, the studies about Mach-like structure may give us some critical information, such as the lifetime of partonic matter and hadronization time.

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