Contribution ID: **19** Type: **not specified**

Parton splitting scales of reclustered large-radius jets in high-energy nuclear collisions

Tuesday, August 9, 2022 3:25 PM (15 minutes)

We carry out the first theoretical investigation on yields and the hardest parton splitting of large-radius jets reclustered from small radius (R = 0.2) anti-kt jets in Pb + Pb collisions, and confront them with the recent ATLAS measurements. The Linear Boltzmann Transport (LBT) model is employed for jet propagation and jet-induced medium excitation in the hot-dense medium. We demonstrate that, with their complex structures, the medium suppression of the reclustered large radius jets at R = 1 is larger than that of inclusive R = 0.4 jets defined conventionally. The large radius jet constituents are reclustered with the kt algorithm to obtain the splitting scale √d12, which characterizes the transverse momentum scale for the hardest splitting in the jet. The large radius jet production as a function of the splitting scale √d12 of the hardest parton splitting is overall suppressed in Pb + Pb relative to p + p collisions due to the reduction of jets yields. A detailed analyses show that the alterations of jet substructures in Pb + Pb also make significant contribution to the splitting scale √d12 dependence of the nuclear modification factor RAA. Numerical results for the medium modifications of the jet splitting angle R12 and the splitting fraction z are also presented

Summary

We have carried out the first detailed theoretical investigation of the medium modification on the reclustered LR jets production as well as its the hardest parton splitting in Pb + Pb collisions relative to that in p + p collisions. The nuclear modification factor of the reclustered LR jets evaluated as a function of jet transverse momentum is a little smaller than the value of inclusive R = 0.4 jets. A quantitative calculation of the absolute amount of the transverse momentum missing in the medium shows that reclustered LR jets will lose larger fraction of its energy than inclusive R = 0.4 jets with the same transverse momentum due to its complex structure. The fraction of energy loss via jet quenching rapidly increases in the region p^jet_T < 80 GeV/c, and smoothly decreases with increasing p^jet_T when p jet T > 80 GeV/c. As a result of which, the nuclear modification factor for reclustered LR jet is a little smaller than that of inclusive R = 0.4 jet and increases smoothly with increasing p^jet_T.

The jet spectrum evaluated as a function of the splitting scale √d12 of the hardest parton splitting obtained from a reclusting procedure is overall suppressed in Pb + Pb collisions relative to p + p collisions and the nuclear modification factor RAA sharply decreases with increasing √d12 for small values of the splitting scale followed by flattening for larger √d12. The suppression is a result of the reduction of jet yields as well as the modification on the jet fragmentation pattern. Jet energy loss dominates the modification in large splitting scale region, while the change of jet fragmentation pattern via different modification mechanism has almost 50% contributions in small splitting scales region. √d12 is strongly correlated to the splitting angle R12 and fragmentation function z. A detailed calculation of the splitting angle R12 and fragmentation function z shows that reclustered LR jet with small splitting angle or small z is less suppressed, which lead to the

$\sqrt{d12}$ dependence of the nuclear modification pattern.

A further investigation on splitting angle R12 from (≥ 2) ⟶ (≥ 2) processes shows that jet yield is suppressed in small R12 < 0.25 region, while is enhanced in 0.25 < R12 < 0.5 region, and keeps unmodified in large R12 region. Further, we find that (≥ 2) ⟶ 1 processes plays a dominant role in the reduction of jet yields in large R12 region. And the contribution of 1 ⟶ (≥ 2) processes is much larger than that from (≥ 2) ⟶ 1 processes in small angle region, which gives the enhancement of jet yield in small R12 region.

Finally, we demonstrate that in (≥ 2) ⟶ (≥ 2) processes the z distribution in Pb + Pb is moderately enhanced in small z region and suppressed in large z region. In addition, contribution from 1 ⟶ (≥ 2) processes is larger than that from (≥ 2) ⟶ 1 processes in the whole region, which may moderately increase the jet yields. The total contributions of these three processes give rise to a large deviation in small z region and moderate difference in large z region in Pb + Pb collisions as compared to p + p collisions, and eventually leading to the $\sqrt{d12}$ dependence of the nuclear modification factors.

Primary author: Dr ZHANG, Shan-Liang (SCNU)

Co-author: Ms YANG, Mengquan (CCNU)

Presenter: Ms YANG, Mengquan (CCNU)

Session Classification: Parallel Session I (3)：Heavy Ion Physics

Track Classification: 重离子物理