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Jet Transport Coefficient in a Colour String Percolation Approach

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The primary goal of tera-electron volt energy heavy-ion collisions is to produce a Quark-Gluon Plasma (QGP), which is the unconstrained state of quarks and gluons, by inducing extremely high temperatures and/or high energy densities, as might have occurred within a few microseconds of the universe's creation. As hard probes for QGP, jets—the collimated emission of many hadrons resulting from hard partonic scatterings—play a significant role. When contrasted to predictions based on considering heavy ion collisions as an incoherent superposition of individual nucleon-nucleon collisions, it is discovered that all the measured observables are dramatically affected in centre heavy-ion collisions relative to minimal bias proton-proton collisions. In the current research, q and its relationship with several thermodynamic features of the QCD matter are investigated within the context of the QCD-inspired Colour String Percolation Model (CSPM). This is comparable to the Glasma method and can be used as an alternative to Colour Glass Condensate (CGC). The number of strings rises, and they begin to interact to form clusters in the transverse plane as the collision energy and nuclei's sizes increase. The 2-dimensional percolation theory's discs and this process are extremely similar. In addition, the estimation of several thermodynamic and transport properties of the matter generated in ultra-relativistic energies has also been highly successful using CSPM.

In this study, the colour string percolation model is used to analyse the thermodynamic and transport features of the matter created in proton-proton (pp) and heavy-ion (AA) collisions at energies from the Large Hadron Collider (LHC) (CSPM). The initial percolation temperature (T), energy density (), and jet transport coefficient (q) are then determined.

The percolation density parameter is retrieved by fitting transverse momentum spectra within the CSPM.

The jet transport coefficient of hot QCD matter created at the LHC energies is examined in the current research for the first time using the colour string percolation approach as a function of final state charged particle multiplicity (pseudo rapidity density at midrapidity). When multiplicity is very low, q exhibits a strong increase, and when multiplicity is big, this dependency is weak (energy density). This behaviour shows that the system is not dense enough to highly quench the partonic jets at lower multiplicity, whereas the quenching of the jets becomes more pronounced at higher multiplicity. Such an experimental investigation will make LHC pp collisions distinct, and the current study of jet transport coefficient as a function of final state multiplicity, beginning temperature, and energy density will prepare the road for it.

JOURNAL REFERENCE

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