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Shear Viscosity of the QGP in Central A-A Collisions at RHIC and LHC Energies in the Color String Percolation Approach

The high-energy heavy ion collisions at RHIC energies have shown evidence of a new state of matter with very low viscosity to entropy density ratio η/s similar to that of a nearly ideal fluid. The η/s is obtained for the QGP with in the context of the Color String Percolation Model (CSPM) using data produced in Au-Au collisions at $\sqrt{s_{NN}}$ = 200 A GeV at RHIC and Pb-Pb at $\sqrt{s_{NN}}$ = 2.76 TeV at LHC [1]. The relativistic kinetic theory relation for η/s is evaluated using CSPM values for the temperature and the mean free path of the QGP constituents [2].
The experimental transverse momentum spectrum is used to measure the percolation density parameter ξ in Au-Au collisions (STAR)[3]. For Pb-Pb at $\sqrt{s_{NN}}$ = 2.76 TeV, ξ values are obtained from the extrapolation at RHIC energy. The value of η/s is 0.184 and 0.278 at the CSPM initial temperature of 193.6 MeV (RHIC) and 262.2 MeV (LHC), respectively. These values are 2.3 and 3.5 times the AdS/CFT conjectured lower bound $1/4\pi$. We compare the CSPM $\eta/s(T/T_c)$ analytic expression with weak coupling (wQGP) and strong coupling (sQGP) calculations. This indicates that the QGP is a strongly coupled fluid in the phase transition region.

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