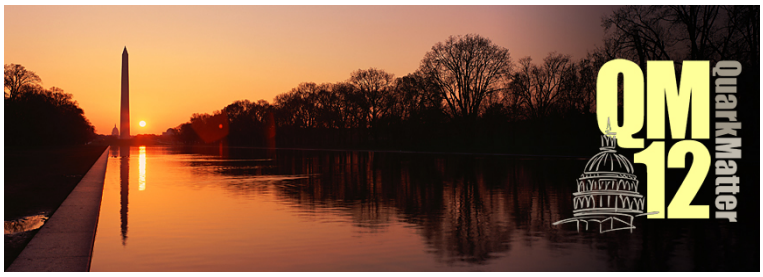

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Relation Between the Trace Anomaly and Shear Viscosity in Clustering of Color Sources and the Equation of State of the QGP

Thursday 16 August 2012 16:00 (2 hours)

The major challenge in heavy ion physics is to extract the equation of state and the shear viscosity to entropy ratio η/s from the data. In the clustering of color sources (CSPM) the charged particle transverse momentum spectrum is used to measure the percolation density parameter ξ, which determines the initial temperature T, energy density ϵ, and the η/s ratio versus T in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV .
For 0.9 $T_c < T <$1.2 T_c (T_c = 167.7 MeV), the sound velocity C_s^2 from the mass less non interacting constituent version of CSPM agrees with Lattice QCD (LQCD)C_s^2 values . For T> 1.2T_c there is a significant difference with the LQCD values\cite{eos}.

The measured CSPM value for η/s = 0.20, at 1.15T_c is consistent with a strongly coupled QGP and increases with T. The Trace Anomaly $\triangle$ is defined as $(\epsilon - 3p)/T^4$.
Above T_c, the LQCD $\triangle$ and the reciprocal of η/s fall off with 1/T. At T_c , s/η has a magnitude of ∼5.5 , non interacting - CSPM has a $\triangle \sim$ 5.5 and LQCD $\triangle$ ∼5.5. The change in $\triangle$ and s/η with 1/T describes the transition from a strongly to weakly coupled QGP. Above T_c, s/η and the LQCD $\triangle$ may have the same underlying structure. The C_s^2 values for the QGP obtained using the $s/\eta \sim 5.5$ version of CSPM above T_c are in excellent agreement with LQCD \cite{wupp, hotqcd}.
The CSPM predictions for Pb-Pb and p-p collisions at LHC energies will be presented.

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