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Charged Particle's elliptic flow in 2+1D viscous hydrodynamics at LHC (√s=2.76 TeV) Energy in Pb+Pb collision. and QGP viscosity

The azimuthal correlation of produced particles in the reaction plane or elliptic flow in heavy ion collision is a sensitive probe to (i) degree of thermalization (ii) transport coefficient and (iii) the equation of state (EoS) of the medium. Recently, ALICE collaboration measured (differential) elliptic flow in √s=2.76 TeV Pb-Pb collision [1]. We have analyzed the elliptic flow data to obtain an estimate of viscosity to entropy ratio η/s at LHC energy. Details can be found in [2]. In Israel-Stewart's second order theory of hydrodynamics, we have simulated elliptic flow in 2.76 TeV Pb+Pb collisions. We have assumed that initial Pb+Pb collisions produces a QGP fluid which thermalizes in the time scale, τ_i=0.6 fm/c. Hydrodynamical evolution of the fluid is governed by a lattice motivated equation of state with confinement-deconfinement cross-over transition at Tc=174 MeV. The initial condition of the fluid was fixed to reproduce ALICE measurements for charged particles multiplicity in 0-5% collisions. Ideal QGP fluid require rather large initial energy density, ei=90 GeV/fmˆ3. Initial energy density is reduced if the fluid is viscous, e.g. ei =78, 70, 60 GeV/fmˆ3 for viscosity to entropy ratio η/s=0.08, 0.12 and 0.16 respectively. ALICE data for charged particles elliptic flow in 20-30%, 30-40% and 40-50% collision are best explained for fluid viscosity η/s=0.08. In very central 10-20% collisions however, ALICE data prefer ideal fluid rather than a viscous fluid. We conclude that nearly perfect fluid is consistent with the ALICE data for elliptic flow in 2.76 TeV Pb+Pb collisions.

[1] K.Aamodt et al. arXiv: 1011.3914[nucl-ex].
[2] Victor Roy and A.K. Chaudhuri , [arXiv: 1103.2870[nucl-th]].

Author: Dr CHAUDHURI, Asis (Variable Energy Cyclotron Centre)

Co-author: Mr ROY, Victor (Variable Energy Cyclotron Centre)

Presenter: Dr CHAUDHURI, Asis (Variable Energy Cyclotron Centre)

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