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V1 flow componet at LHC

Substantial collective flow is observed in collisions between Lead nuclei at LHC as evidenced by the azimuthal correlations in the transverse momentum distributions of the produced particles.

We perform simulations [1] of the Pb+Pb heavy ion collisions at LHC at 1.38 + 1.38 TeV/nucl within the three module model. The initial stages of the reaction, before the thermal equilibrium is reached, are simulated in terms of effective string rope model [2], based on longitudinally expanding strings of the color-magnetic field. The produced initial state is tilted, and, thus, the direction of the largest pressure gradient is pointing in the "anti-flow" direction, what resulted in anti-flow peaks in simulations for RHIC and SPS [3]. However, one should not forget that this initial state also has a flow velocity distribution, which tends to further rotate it, and, thus, the direction of the strongest pressure gradient will change with time. The intermediate stages of the reaction are simulated with a (3+1)-dimensional fluid dynamical model, using the Particle in Cell (PIC) method adapted to ultra-relativistic heavy ion collisions. The matter expands until it reaches freeze-out, which is treated in the third module of our model.

The resulting elliptic flow, v2, is in reasonable agreement with the data [4]. Furthermore, our calculations also indicate that the v1-flow, which was rather weak at RHIC and SPS, and peaked at negative rapidities (named as 3rd flow component or anti-flow), now at LHC is expected to peak at forward rapidities (at the same side and direction as the projectile residue), and it may become stronger [1].

Thus, v1-flow provides a sensitive barometer to estimate the pressure and transport properties of the Quark-Gluon Plasma. In order to better study the transverse momentum flow dependence we suggest a new "symmetrized v1s" flow component, and make predictions for it.

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