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Corona effect in AA collisions at LHC

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Over the last 17 years of relativistic nucleus-nucleus collisions at RHIC and LHC, a set of observables was found which confirms the formation of high energy and high density matter. In a previous publication based purely on experimental data at RHIC, a simple model was proposed [1] to explain the centrality and angular dependence in the reaction plane of the nuclear modification factor R_{AA}. There is one free parameter of about 2.3 fm/c which was interpreted as plasma formation time at the low density corona region. This time should be proportional to the mean distance between the interaction or collision points with a color exchange. The picture in some sense is similar to the percolation scenario [2]. The collision density is proportional to centrality and pp hard scattering cross section. In "The last call for prediction" published prior to the start of LHC we also proposed some features which should be observed at LHC [3] (see pp. 119–121 and figs. 99–100 in the e-print version). We estimate $T = 1.2\,\mathrm{fm}/c$ near the corona region at around 5 TeV of LHC energy. Calculations show a constant $R_{AA} = 0.1$ in the central collisions.

Predictions made in [3] assume that the core of the produced matter is opaque, but LHC experimental data for Pb+Pb collisions show that R_{AA} is continuously rising at high p_t. It is natural to assume that the parton loses some portion of its energy. A constant energy loss of 7 GeV describes well the data for R_{AA} versus p_t for different centrality. In Fig. 1 we present results for the R_{AA} versus p_t from CMS data [4] and our calculations for most central collisions. There are two contributions: a constant value of 0.1 for a particle from the corona region, as was predicted in Ref. [3], and a new momentum dependent component for fast parton, which loses 7 GeV. This provides excellent agreement with the data. There is an indication that particles with energy loss of 7 GeV become visible at RHIC at particle momentum above $15\,\mathrm{GeV}/c$.

Nearly 10 years ago we did a prediction for v_2 at LHC [3]. It seems that the prediction is valid. Comparison of our estimations [3] with CMS results at $p_t = 15\,\mathrm{GeV}/c$ [5] confirms that. Within our model the energy loss of 7 GeV does not depend on momentum, centrality, energy density, and, probably, on beam energy.

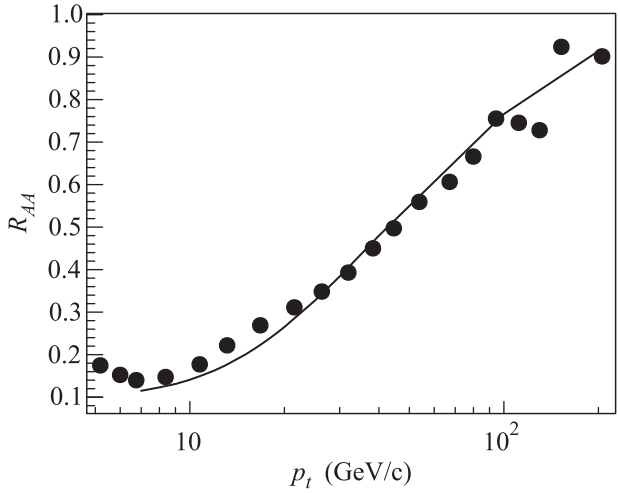

Fig. 1. The dependence of single particle R_{AA} versus transverse momentum p_t. The points are data from the CMS collaboration for the most central 0–5 % PbPb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV [4]. The line is our estimation

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