Anomalous baryon production in $p+p$ and Pb+Pb collisions at the LHC.

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The LHC data on nucleus-nucleus $(A+A)$ collisions may lead to an improved theoretical understanding of ultra-dense multiparton plasma based on a Quantum Chromodynamics (QCD) approach. With the HIJING/B$\bar{\text{B}}$ v2.0 heavy ion event generator [1], [2], we explore the phenomenological consequences of several high parton density dynamical effects predicted in $p+p$ and central Pb+Pb collisions at the LHC energies. In heavy ion collisions, the novel "nuclear physics" is due to the nuclear modification of the parton distribution functions, the possibility of multiple longitudinal flux tube overlapping leading to strong longitudinal color field (SCF) effects refered to as color ropes or glasma. Strong fields also lead to enhanced baryon and (multi)strange hyperon production [3]. The results presented here are obtained using the set of model parameters discussed in Refs. [1], [2]. The model predictions at LHC

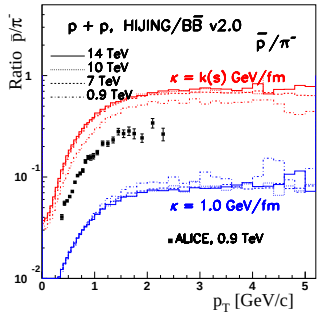

Figure 1: Predictions of ratios $(\overline{p}/\pi^-)$ at LHC energies. The upper curves include SCF and J$\bar{\text{J}}$ loops effects. The lower curves are results without SCF effects. The calculations are at 0.9 TeV (dot dashed-histograms), at 7 TeV (dashed histograms), at 10 TeV (dotted histograms) and at 14 TeV (solid histograms). The data at 0.9 TeV are from ALICE Collaboration [4].

energies for the p_T dependence of the $\overline{p}/\pi^-$ ratio are shown in Fig. 1. An enhancement up to the highest LHC energy and a weak energy dependence, with a saturation that sets in for a c.m.s. energy $\sqrt{s} > 2.36$ TeV, is predicted. The model results, with

SCF effects included are qualitatively consistent with the $\overline{p}/\pi^-$ ratio derived from the spectra reported by ALICE at 0.9 TeV in Ref. [4].

The SCF mechanism strongly modifies the fragmentation processes (strangeness suppression factors) and thus results in a huge increase of (strange)baryons, that leads to high values of B/M ratios (baryon-to-meson anomaly). With the best set of parameters used to describe charged particle production in central (0-5%) and peripheral (70-80%) Pb+Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV [2] we present in Fig. 2 the model predictions for centrality dependence of the non-strange baryon/meson ratio (left panel) and of strange baryon/meson ratio (right panel). Our model predicts that these ratios does not depend strongly on energy and centrality. The model also predicts that the baryon/meson anomaly will persist up to high p_T. The large

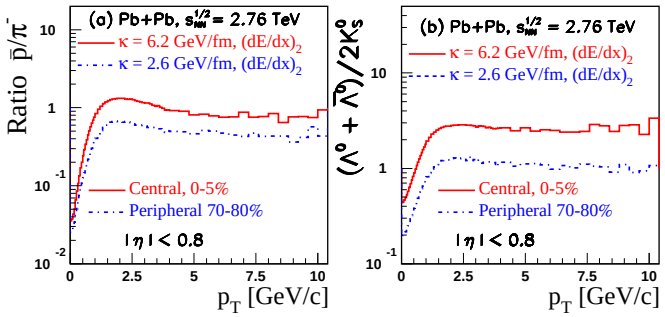

Figure 2: Predictions for centrality dependence of (non)strange baryon/meson ratios from HIJING/B$\bar{\rm B}$ v2.0. The results include SCF effects and J$\bar{\rm J}$ loops. In each figure the histograms correspond to two value of centrality and the associated string tension.

enhancement of the baryon-to-meson ratios demonstrates that SCF could play an important role in multiparticle production in $p + p$ and Pb+Pb colisions at LHC energies.

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References

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