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Tracking the baryon quantum number in heavy ion collisions with the STAR experiment and UrQMD model

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In QCD, the baryon number is a conserved quantity that is conventionally assumed to be distributed evenly among valence quarks. An alternative theory suggests that the baryon number may be carried by a non-perturbative topology of gluons, known as the baryon junction, which has a different distribution than valence quarks. Since the charge is carried by the quarks, the theory can be tested by examining the net-baryon and net-charge produced in heavy-ion collisions. The dataset of Ru+Ru and Zr+Zr at √sNN = 200 GeV presents a good opportunity for such a test. Meanwhile, the results in the UrQMD model will provide a reference based on traditional assumptions. The ratio of net baryon to net-charge difference between the two isobaric collisions is found to be significantly larger in experimental data than in UrQMD model. This poses a challenge to the traditional hypothesis of baryon number. In collision systems with larger Z/A ratios and significant scale differences, these factors will also influence the acceptance and rejection of baryon junction signals. In the future, further evidence supporting the baryon junction hypothesis will be sought in O+O and Au+Au at √sNN = 200 GeV.

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