ID de Contribution: **190** Type: **Talk**

Searching for the baryon number carrier with heavy-ion collisions at the STAR experiment

mardi 4 juin 2024 17:10 (20 minutes)

Baryon number is a strictly conserved quantum number, which holds the universe as we know it today. In the quark model, each quark is assigned one third of the baryon number. However, string junctions, non-perturbative Y-shaped topology of gluon fields connected to three quarks, are expected to emerge in dynamical processes and have been proposed as an alternative carrier of the baryon number. Neither of these scenarios have been verified experimentally though. In this contribution, three independent measurements, utilizing heavy-ion collisions recorded by the STAR experiment at RHIC, will be presented, in search for the baryon number carrier. Firstly, the charge and baryon number transport over a large rapidity gap are measured in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV. The results show significantly more baryon transport than charge transport from beam to midrapidity. The second measurement selects γ+Au collisions from Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 54 GeV. The slope of the baryon number transport distribution against rapidity in γ+Au collisions is found to be smaller than those predicted by PYTHIA and HERWIG event generators, which assign baryon number to valence quarks. Thirdly, the slope measurement is extended to hadronic Au+Au collisions with collision energies ranging between 7.7 and 200 GeV. The rapidity slope of the baryon number transport is found to be independent of centrality and also smaller than event generators. All three measurements are incompatible with the scenario of valence quarks carrying the baryon number.

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Classification de Session: Track7-OthTop

Classification de thématique: Strangeness in Astrophysics, Other topics