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Study of charge and baryon transport in O+O and Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV with STAR experiment

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Baryon number is one of the most rigorously tested conserved quantities in physics. Traditionally, it is thought to be carried by valence quarks, but this view lacks experimental confirmation and is not derived from Quantum Chromodynamics. In the 1970s, an alternative theory was proposed, suggesting the existence of a non-perturbative Y-shaped structure in the gluon field of baryons, known as the baryon junction, which serves as the carrier of baryon number. Due to the significant mass difference between neutral gluons and charged quarks, they tend to stop at mid-rapidity and far from mid-rapidity, respectively. Thus, the correlation of baryon and charge stopping provides a means to explore the carrier of baryon number.

STAR has measured the ratio of mean net-baryon yields to the difference of net-charge yields ($\langle B \rangle / \Delta Q$) at mid-rapidity in Ru+Ru and Zr+Zr collisions, and found the ratio is larger than A to ΔZ ratio, disfavoring the scenario of valence quark stopping at mid-rapidity. While the difference in Z/A between Ru+Ru and Zr+Zr collisions is only about 10\%, it reaches roughly 25\% for O+O and Au+Au collisions. The measurements of the correlation of charge and baryon stopping in O+O and Au+Au collisions are expected to yield a stronger signal and provide new insight into the baryon junction mechanism.

In this presentation, we will show results from O+O and Au+Au collisions at $\sqrt{s_{NN}} = 200GeV$. Using the STAR detector, we measure the transverse momentum spectra of $\pi^{\pm}$, $K^{\pm}$, protons, and antiprotons at mid-rapidity. These results are used to calculate the net-charge and net-baryon stopping at mid-rapidity, thereby investigating the carrier of baryon number. This work will contribute to exploring baryon structure and understanding the baryon transport process in high-energy heavy-ion collisions.

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