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COLLIDER PHYSICS

PHENIX Results on Hadron Production in Large Collision Systems

Y. A. Berdnikov[1], A. Y. Berdnikov[1], D. O. Kotov[1], and D. M. Larionova[1*]
(for the PHENIX Collaboration)

[1] *Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia*

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Abstract—The paper presents recent PHENIX results on hadron production in heavy ion collisions. Comparison of light hadron (π^0, $\pi^{\pm}$, K_s, $K^{\pm}$, K^*, $(p+\bar{p})/2$, η, ϕ, ω) nuclear modification factors in Au + Au, Cu + Au collisions at $\sqrt{s_{NN}} = 200$ GeV and U + U collisions at $\sqrt{s_{NN}} = 192$ GeV will be discussed.

Keywords: heavy ions, hadrons, QGP, nuclear modification factors

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1. INTRODUCTION

Studying of quark-gluon plasma (QGP) properties in heavy ion collisions is the main part of PHENIX [1] experiment physics program. One of the common ways to study signatures of QGP formation in heavy-ion collisions is measurement of nuclear modification factors (R_{AB})—a quantitive characteristic of difference in hadron production in proton-proton ($p + p$) and nuclei-nuclei (A + B) collisions [2]. The paper presents comparison of light hadron R_{AB} in Cu + Au collisions at $\sqrt{s_{NN}} = 200$ GeV.

2. RESULTS AND DISCUSSION

Figure 1 presents different light hadron (π^0, $\pi^{\pm}$, K_s, $K^{\pm}$, K^*, $(p+\bar{p})/2$, η, ϕ, ω) R_{AB} measured in Cu + Au collisions at $\sqrt{s_{NN}} = 200$ GeV. At intermediate transverse momentum ($2 < p_T < 5$ GeV/c) the ordering can be seen: $R_{AB}^{\pi^0,\eta,\omega} < R_{AB}^{K^{\pm},K^*,\phi} < R_{AB}^{p}$. At high p_T ($p_T > 5$ GeV/c) R_{AB} values of all measured mesons are equal within uncertainties and much lower, than unity ($R_{AB} \approx 0.5$). Previously similar R_{AB} patterns were observed in symmetric Au + Au collision system and were interpreted as signatures of QGP formation (baryon enhancement [2], strangeness enhancement [3] and jet quenching [3]). Hadron R_{AB} values in symmetric Au + Au, asymmetric Cu + Au collisions and collisions of deformed U + U nuclei were found to be in agreement at the same number of participant nucleons (N_{part}). As representative example Fig. 2 presents comparison of proton $\langle R_{AB} \rangle$ as a function of N_{part} in Cu + Au, Au + Au, and U + U collisions.

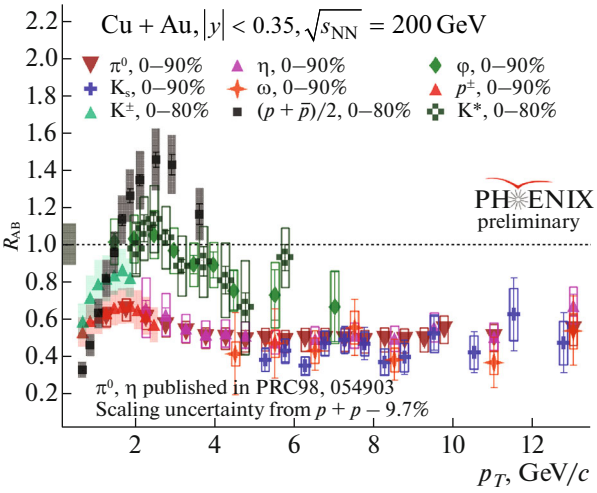

Fig. 1. Comparison of light hadron (π^0, $\pi^{\pm}$, K_s, $K^{\pm}$, K^*, $(p+\bar{p})/2$, η, ϕ, ω) R_{AB} values in Cu + Au collisions at $\sqrt{s_{NN}} = 200$ GeV.

*E-mail: dashalario@gmail.com

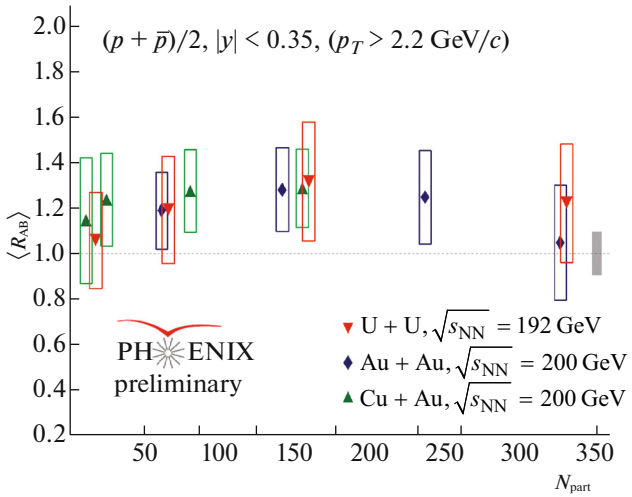

Fig. 2. Comparison of proton $\langle R_{AB} \rangle$ in Au + Au, Cu + Au collisions at $\sqrt{s_{NN}} = 200$ GeV and U + U collisions at $\sqrt{s_{NN}} = 192$ GeV.

3. CONCLUSIONS

Recent PHENIX results on hadron production in Cu + Au collisions at $\sqrt{s_{NN}} = 200$ GeV and U + U collisions at $\sqrt{s_{NN}} = 192$ GeV have been presented. Signatures of QGP formation (baryon enhancement, strangeness enhancement and jet quenching) have been observed and found to be similar to previous Au + Au results at the same N_{part} values. That might indicate that light hadron production scales with the average size of the nuclear overlap region and do not depend on the details of its shape.

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CONFLICT OF INTEREST

The author declares that he has no conflicts of interest.

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