Contribution ID: **252** Type: **Oral**

Recent PHENIX results on identified charged hadron production

Tuesday 2 July 2024 19:00 (15 minutes)

Quark gluon plasma (QGP) is a deconfined state of matter, which exists at the temperatures T>170 MeV and energy densities ϵ~1 GeV/fm^3. Initially it was thought that such conditions can be reached only in the relativistic heavy ion collisions (e.g. Au+Au, Cu+Cu, Cu+Au and U+U collisions), while in small collision systems such as p+Al, p/d/^{3}He+Au conditions are not sufficient for QGP formation. Observation of signatures for QGP formation in p/d/^{3}He+Au collisions by the PHENIX experiment in 2019 has renewed interest in small collision systems and hadronic matter phase diagram studies.
One of the probes for studying the phase transition between hadronic and quark-gluon matter is identified charged hadron ($^{\pm}$, $K^{\pm}$, p, $\bar{p}$) production. Enhancement of proton to π-meson yields ($p/$) measured in the intermediate p_T range (1.5 GeV/c p_T 4 GeV/c) in heavy ion collisions in comparison to the ones measured in p+p collisions is usually attributed to the recombination. Recombination implies the formation of hadrons as a result of combining quarks located nearby in phase space. Formation of QGP in the collision significantly increases the probability of recombination. In collisions where QGP is not formed (p+p collisions), hadrons are mainly produced as a result of string breaking, known as fragmentation.
The talk presents latest PHENIX results on $^{\pm}$, $K^{\pm}$, p and $\bar{p}$ measurements in p+Al, ^{3}He+Au, Cu+Au collisions at the energy of $\sqrt{s_{NN}}$ = 200 GeV and in U+U collisions at $\sqrt{s_{NN}}$ = 193 GeV. It was obtained, that in central Cu+Au, ^{3}He+Au and U+U collisions recombination plays an important role, while in p+Al collisions and peripheral ^{3}He+Au, Cu+Au, and U+U collisions fragmentation dominates over recombination. The conclusions are supported by comparison with theoretical predictions based on the AMPT and PYTHIA models, as well as by comparison with the results of neutral meson production measurements. The possible role of radial flow in particle production at intermediate p_T range will also be highlighted.

Section

Heavy ion collisions at Intermediate and high energies

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Session Classification: Heavy ion collisions at Intermediate and high energies