Search for in-medium modifications of properties of strange hadrons

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The modifications of basic properties of strange hadrons, like mass and decay constant inside a hot and dense collision zone of heavy ions have been predicted since 30 years as a consequence of the partial restoration of chiral symmetry [1]. They are a subject of intensive study to date. A particularly promising tool is the investigation of the emission of kaons in the beam energy region near or below the threshold for their production in a free nucleon-nucleon collision. If K^+ or K^0 is produced in the collision zone, its mass is predicted to be higher than the value in vacuum. As the density of medium dilutes, the mass should return to the nominal one. The easiest way to transfer the energy excess for a particle is to accelerate. For K^- and $\overline{K}^0$ the changes are predicted to be opposite.

The effect was demonstrated clearly for K^0 mesons emitted from π^- + A collisions at the momentum of 1,15 GeV/c, carried out by the FOPI Collaboration [2]. The first comparisons of the K^+ and K^- kinetic energy spectra to the predictions of the transport models seemed to confirm this effect [3]. However, the conclusions for K^- have been considerably softened if not withdrawn due to finding of the competing effects of feed down from $\phi \rightarrow K^+K^-$ decays (BR $\approx$ 49%) and, possibly, $\Lambda(1520) \rightarrow pK^-$ (BR $\approx$ 22%) [4].

To advance the study, experiments with high statistics and accuracy are needed. Our group prepares to investigate the emission of kaons as well as ϕ and $\Lambda(1520)$ from Ag+Ag collisions at the beam energy of 1.65 GeV per nucleon, the experiment of HADES Collaboration scheduled for this year. We also participate in the development of the CBM experimental setup at the SIS-100 accelerator at the GSI, Darmstadt. This facility is planned to deliver heavy-ion beams of 2–11 GeV per nucleon at the exceptionally high predicted interaction rate of 10^7 Hz [5].

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