Strange meson production in Al+Al collisions near threshold

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Strange particles are very sensitive probes of hot and dense nuclear matter formed in relativistic heavy-ion collisions. At beam energies below $2A$ GeV kaons are produced below or close-to threshold, therefore their production is sensitive to the influence of nuclear medium. It is predicted that in nuclear matter the kaon-nucleon (KN) interaction is modified with respect to vacuum [1]. K^+ mesons are expected to feel a repulsive potential, whereas K^- mesons should be attracted. As a result, the effective mass and the production threshold energy for kaons should increase slightly, while the corresponding values for antikaons should decrease substantially [2]. The in-medium modifications of kaon properties have been already reported by several experiments focused on strangeness production at SIS-18 energies [3, 4]. Conclusions were based on the comparisons to the transport models calculations. These models, however, seldom take into account the kaon production channel that involves the creation and decay of $\phi(1020)$ mesons into pair of charged kaons [5]. The ϕ meson production may influence the conclusions about in-medium effects on kaons, as these particles, decaying mainly outside the interaction zone, may affect the measured K^- yield.

The FOPI Collaboration has performed a high-statistics experiment to study strangeness production in Al+Al collisions at $1.9A$ GeV beam kinetic energy. We now report on the measurement of the K^+, K^- and $\phi(1020)$ mesons production. The slope parameter and yield distributions of the $K^\pm$ mesons were obtained and compared to the transport model calculations (HSD). Only calculations, that take into account the *in-medium* modifications of particles, describe these distributions.

The influence of ϕ meson production on K^- yield was found to be significant at the level of $(14 \pm 4)\%$. This result is in agreement with the previous results of the heavy-ion experiments at similar incident beam energies [6, 7]. This implies that ϕ production contributes significantly to the K^- yield and should be taken into account while drawing conclusions about kaon in-medium production.

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