In Pursuit of New Physics with K^+-Mesons Scattering on Nuclei: Anomalous Strangeness Transparency?

S.M. Eliseev

Bogoliubov Laboratory of Theoretical Physics ,
Joint Institute for Nuclear Research, 141980 Dubna, Russia

The contemporary theory of strong interaction-Quantum Chromodynamics (QCD) predicts, that *at high nuclear density* a new state of matter (quark-gluon plasma-QGP) will be formed. One of the principal motivation for the ultrarelativistic heavy ion experiments is the study of the signals of the existence of QGP. In this new stage of matter deconfinement of quark takes place and hadron masses are reduced to zero (partial restoration of chiral symmetry (PRCS) takes place). In addition, EMC effect shows that the quark momentum distribution in a nucleon is modified in the nucleus. In the last years a lot of theoretical and experimental work has been devoted to the search of a signals of such anomalous properties of hadrons in the nuclear environment (in-medium effects). The renormalization of mass in the nuclear medium should be taken as a signature of PRCS [1] in ground state nuclei. The most complete information about the in-medium effects was obtained in the experiments performed by physicists from Japan at GSI (see [2] and references therein). The deeply bound π states in nuclei have been discovered, as predicted by Toki et al. [3-4], and the mass shift of π^- in Pb nucleus was obtained. However, the problem of the investigation of the changing of masses of particles is rather complicated. In that situation it is helpful to attack the discussed problem by studding different nuclear reactions, to find others occasions without doubt . The K^+-meson is regarded as a unique probe due to its long mean free-path in the nuclear matter [5]. A detailed analysis of the cross sections of K^+-nuclei interactions at intermediate energy is presented. In the Glauber approach for nuclear collisions are introduced different corrections. We utilize the same principal Glauber assumptions which were used in the non-QGP model for the J/ψ suppression (see, e.g., [6]). We shown that there is an universal discrepancy between the theoretical models and data for particles (K^+–mesons) interacting in deep region of the nucleus. The discrepancy between the calculations and data on K^+–nuclei scattering my be regarded as like the hint at an anomalous strangeness (S=+1) transparency of nuclei. (On the analogy of [7], where it was observed that nuclear medium looks transparent for a hard struck proton.) The meaning of the "swelling" phenomena [5] in the nuclear interior and the renormalization of K^+-N interaction in nuclei will be discussed.

References

[1] G.E. Browm, M. Bubala, and M. Rho, Nucl. Phys. **A609** (1996) 519.
[2] H. Geissel *et al.*, Phys. Rev. Lett. **60** (2002) 122301.
[3] H. Toki, T. Yamazaki, Phys. Lett. B **213** (1988) 129.
[4] H. Toki, S. Hiresaki, T. Yamazaki, R.S. Hayano, Nucl. Phys. A **501** (1989) 653.
[5] G.E. Browm *et al.*, Phys. Rev. Lett. **60** (1988) 2723.
[6] A. Capella, G.E. Fereiro, and A.B. Kaidalov, Phys. Rev. Lett. **85** (2000) 2080.
[7] A.S. Carrol *et al.*, Phys. Rev. Lett. **61** (1988) 1698.