ANTIKAON PRODUCTION AND MEDIUM EFFECTS IN PROTON-NUCLEUS REACTIONS AT SUBTHRESHOLD BEAM ENERGIES

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Abstract

The inclusive K^--meson production in proton-nucleus collisions in the subthreshold energy regime is studied in the framework of an appropriate spectral function approach for incoherent primary proton-nucleon and secondary pion-nucleon production processes, which takes properly into account the nuclear mean-field potential effects on these processes as well as the final state interaction (FSI) among the outgoing nucleons participating in the one-step antikaon creation process. A detailed comparison of the model calculations of the K^- differential cross sections for the reactions $p+Be^9$, $p+Cu^{63}$ and $p+Au^{197}$ at subthreshold energies with the currently available experimental data obtained recently at the ITEP proton synchrotron and at SIS/GSI is given. It is found that the calculations with including the influence both in-medium density-dependent and elementary NN-FSI effects on the K^- production from direct mechanism are able to reproduce the energy dependences of the invariant differential cross sections for "hard" antikaon creation in pBe^9- and pCu^{63}-collisions. It is further shown that the NN-FSI effects play a minor role in describing the data on spectrum of relatively soft K^--mesons from pAu^{197}-interactions at 2.5 GeV incident energy. It is also shown that the relative strength of the proton and pion-induced reaction channels in the subthreshold energy regime is governed by the kinematics of experiment under consideration. The influence of the nucleon, kaon and antikaon mean-field potentials on the K^- yield is explored. It is demonstrated that the K^- optical potential has a very strong effect on this yield at low antikaon momenta, which is greater than those from nucleon and kaon effective potentials. Whereas at high antikaon momenta the K^- yield is found to be mainly determined, along with the elementary NN-FSI effects, by the nucleon mean field and the scenario with zeroth K^+ potential is favourable.