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Coherent Meson Production in Antinucleon Annihilation on Nuclei

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With the study of hadron and meson production in antinucleon-nucleus reactions a broad spectrum of final particle configurations and physics phenomena becomes accessible. The fundamental interactions of the underlying sub-processes are of high interest by itself.
The approach is directed towards investigations of non-strange meson production and strangeness channels, ranging from elementary processes in antiproton-proton interactions and antiproton-nucleus collisions to the production of hypernuclei.
We are investigating coherent meson production in antiproton-nucleus reactions, intended as exploratory studies for the PANDA experiment and, if realized at a later stage of FAIR, also for the nuclear structure-oriented use of high energy antiprotons aimed for by the AIC proposal. Coherent reactions have the distinct advantage of a full quantum mechanical treatment of all parts of the production process. As a concrete and typical example we treat explicitly the case of two pion production. Two different reaction mechanisms are presented including initial and final state interactions. The underlying fundamental antinucleon-nucleon Nbar N and pion-nucleon pi N interactions enter into the optical potentials, which are obtained with Hartree-Fock-Bogoliubov nuclear densities. Existing approaches to pion nucleus interactions have been extended to higher energies beyond the Delta(1232)-resonance. A phenomenological ansatz for the antinucleon-nucleon interaction, describing the whole energy range up to pLab=15 GeV/c is presented. First results for pion and rho-meson production on nuclei are presented. Cross sections are shown for the elementary processes and future experiments at FAIR.

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