

XXV International Baldin Seminar on High Energy Physics Problems
"Relativistic Nuclear Physics and Quantum Chromodynamics"



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on High Energy Physics Problems
Relativistic Nuclear Physics & Quantum Chromodynamics

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The possibilities of search for the local strong P-symmetry breaking in decay of charged a_0 meson in $3\pi^\pm$ decay channel

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Currently, there is no experimental evidences of the violation of the spatial parity (P) conservation in strong interactions. However, the in the QCD theory, the P-breaking term (so-called θ -term) can be included, with tight limits on the θ parameter value. However, in the medium with high temperature and at large topological fluctuations [1] of QCD fields, expected in collisions of the heavy ions at high energy, the effects of the local violation of P-symmetry can appear. The contribution to the QCD Lagrangian of the topological charge can play role of an effective θ -term [2]. As a consequence, some hadrons would decay in channels that forbidden by the global parity conservation.

In particular, search for decays of a charged a_0 meson into charged pion and photon has been proposed [3] as a signature of the local parity breaking in the strong interactions. However the expected electromagnetic cross section of the decay $a_0^\pm \rightarrow \pi^\pm + \gamma$ is rather low making the experimental searches quite challenger [4]. In this work we investigate the hadronic analogue of such process, namely, decay of a charged a_0 meson into three charged pions. Both the direct threeparticle decay and a resonance one, with intermediate ρ^0 meson ($a_0^\pm \rightarrow \rho^0 + \pi^\pm \rightarrow \pi^\pm + \pi^\mp + \pi^\pm$) are considered. We study an invariant-mass spectrum of three charged mesons using PYTHIA Monte Carlo generator with enabled required decay channels. To distinguish the peak of mentioned decay from the background the mixed-event subtracting, kinematic cuts and Dalitz plots analysis were used. As a result we have estimated minimal number of pp collision events for significant signal of the P-breaking decay.

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References:

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