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On the pair correlations of neutral K, D, B and B_s mesons with close momenta produced in inclusive multiparticle processes

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Summary

The phenomenological structure of inclusive cross-sections of the production of two neutral K mesons in hadron–hadron, hadron–nucleus
and nucleus–nucleus collisions is theoretically investigated taking into account the strangeness conservation in strong and electromagnetic
interactions. Relations describing the dependence
of the correlations of two short-lived and two long-lived neutral kaons $K^0_S K^0_S$,
$K^0_L K^0_L$ and the correlations of "mixed" pairs $K^0_S K^0_L$ at small relative momenta upon the space-time parameters of the generation region of K^0 and $\bar{K}^0$ mesons, involving the contributions of Bose statistics and S-wave strong final-state interaction, have been obtained. It is shown that under the strangeness
conservation the correlation functions of
the pairs $K^0_S K^0_S$ and $K^0_L K^0_L$, produced in the same inclusive process, coincide, and the difference between the correlation functions of the pairs $K^0_S K^0_S$ and
$K^0_S K^0_L$ is conditioned exclusively by the production of the pairs of non-identical neutral kaons $K^0 \bar{K}^0$.

For comparison, the theoretical analysis of analogous correlations for the pairs of neutral heavy mesons D^0, B^0 and B^0_s, generated in multiple inclusive processes with charm (beauty) conservation, is performed as well (neglecting, just as for the case of K^0 mesons, the weak effects of CP violation). These correlations are described by quite similar expressions: in particular, just as for K^0 mesons, the correlation functions for the pairs of states with the same CP parity
($R_{SS} = R_{LL}$) and with different CP parity (R_{SL}) do not coincide, and the difference between them is conditioned exclusively by the production of pairs $D^0 \bar{D}^0$,
$B^0 \bar{B}^0$ and $B^0_s \bar{B}^0_s$.
However, contrary to the case of K^0 mesons, here the distinction of CP-even and CP-odd states encounters difficulties – due to the insignificant differences of their lifetimes and the relatively small probability of purely CP-even and CP-odd decay channels. Nevertheless, one may hope that it will become possible at future colliders.

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