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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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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 $K_S^0 K_S^0$, $K_L^0 K_L^0$ and the correlations of “mixed” pairs

$K_S^0 K_L^0$ at small relative momenta upon the space-time parameters of the generation region of K^0 and \bar{K}^0 mesons

have been obtained. These relations involve the contributions of Bose-statistics and S -wave strong final-state interaction

of two K^0 (\bar{K}^0) mesons as well as of the K^0 and \bar{K}^0 mesons, and also the additional contribution of transitions $K^+ K^- \rightarrow K^0 \bar{K}^0$, and they depend upon the relative fractions of generated pairs $K^0 K^0$, $\bar{K}^0 \bar{K}^0$ and $K^0 \bar{K}^0$.

It is shown that under the strangeness

conservation the correlation functions of

the pairs $K_S^0 K_S^0$ and $K_L^0 K_L^0$, produced in the same inclusive process, coincide, and the difference between the

correlation functions of the pairs $K_S^0 K_S^0$ and $K_S^0 K_L^0$ is conditioned exclusively by the generation of pairs of non-identical neutral kaons $K^0 \bar{K}^0$.

For comparison, analogous correlations for the pairs of neutral heavy mesons D^0 , B^0 and B_s^0 , produced in multiple inclusive processes with charm (beauty) conservation, are also theoretically analyzed – neglecting, just as for K^0 mesons, the weak effects of CP violation. These correlations have a quite similar character, and they are described by quite similar

expressions: in particular, just as for the case of 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 $B_s^0 \bar{B}_s^0$. However, contrary to the case of K^0 mesons, here the distinction of CP -even and CP -odd

states (and, hence, the experimental observation of respective pair correlations) 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 expect that this will become possible at future colliders.

Collaboration name

Track

Strangeness and Light Flavour

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