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Effects of random phase shifts from multi-particle Coulomb-interactions on Bose-Einstein correlations

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Quantum-statistical correlation measurements in high-energy physics represent an important tool to obtain information about the space-time structure of the particle-emitting source. There are several final state effects which may modify the measured femtoscopic correlation functions. One of these may be the interaction of the investigated particles with the expanding hadron gas, consisting of the other final state particles. This may cause the trajectories – and hence the phases – of the quantum-correlated pairs to be modified, when compared to free streaming. The resulting effect could be interpreted as an Aharonov–Bohm-like phenomenon, in the sense that the possible paths of a quantum-correlated pair represent a closed loop, with an internally present field caused by the hadron gas. In this paper, the possible role of the effect in heavy-ion experiments is presented with analytical calculations and a simple numerical model. The modification of the strength of multi-particle Bose-Einstein correlation functions is investigated and it is found that, in case of sufficiently large source density, this effect may play a non-negligible role.

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