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Multi-particle quantum-statistical correlation functions in a Hubble-expanding hadron gas

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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 and hence, the spatio-temporal evolution of the fireball. Out of the several final state effects which may modify the measured femtoscopic correlation functions; one may be the interaction of the investigated particles with the expanding hadron gas, constituted by 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 study, 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 observed that, in case of sufficiently large source density, this effect may play a non-negligible role.

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