$N - \Omega$ interaction from high energy heavy ion collisions

Kenji Morita[1], Akira Ohnishi[1], Tetsuo Hatsuda[2]

[1]Yukawa Institute for Theoretical Physics, Kyoto University, Kyoto 606-8502, Japan

[2]Theoretical Research Division, Nishina Center, RIKEN, Wako 351-0198, Japan

Hyperon-nucleon interaction is one of the central problems in hadron physics. Not only hypernuclear experiments, but also heavy collisions at collider energies can assess the interaction between two baryons through measurements of the momentum intensity correlation function thanks to high multiplicity of baryons including multistrange ones. The two-particle momentum intensity correlation function $C(Q) = W_2(k_1, k_2)/[W_1(k_1)W_1(k_2)]$, where Q is the relative momentum of the two emitted particles, has been used as a sensitive probe for the source size in nucleus-nucleus collisions and recently has been investigated for $\Lambda\Lambda$ pairs to probe their interaction [1].

In this work, we discuss $N - \Omega$ correlation based on the same framework as done in [1]. The $N - \Omega$ system with $S = -3$ is particularly interesting, since it is one of two multiplets in which the Pauli blocking does not take place thus can form a bound state. Indeed, a recent lattice QCD calculation by the HAL QCD collaboration [2] predicts the existence of $N - \Omega$ bound state in the ${}^5S_2(J = 2, S = 2)$ channel. We adopt the $N - \Omega$ interaction potential obtained by the HAL QCD collaboration and use it to calculate the $N - \Omega$ correlation function. Moreover, we also study the variation of the correlation function against the change of the property of the bound state.

We show that the correlation function $C(Q)$ is sensitive to whether the system has a bound state or not, as dipicted by Fig. 1. If the system has a bound state, the behavior of $C(Q)$ at low Q also depends on the binding energy. We discuss how the behavior the scattering wave function can influence the behavior of $C(Q)$ and its interplay with the source size. Our result indicates that high energy heavy ion collisions at RHIC and LHC may provide information on the possible existence of the $N - \Omega$ dibaryon.

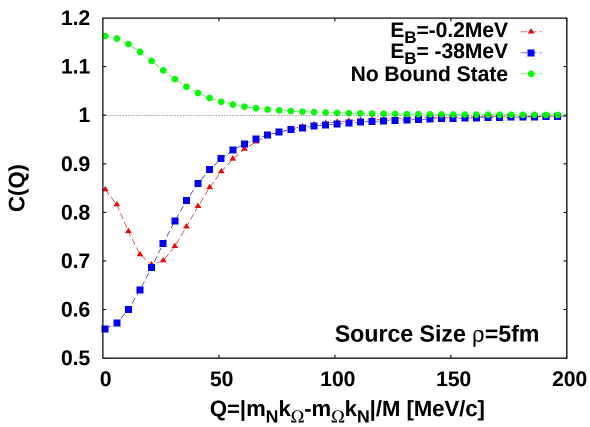

Figure 1: $N - \Omega$ correlation functions for different potentials. The source size is fixed to be 5fm.

[1] K. Morita, T. Furumoto, A. Ohnishi, Phys. Rev. C**91**, 024916 (2015).

[2] F. Etminan, H. Nemura, S. Aoki, T. Doi, T. Hatsuda, Y. Ikeda, T. Inoue, N. Ishii, K. Murano, K. Sasaki, Nucl. Phys. **A928**, 89 (2014).