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$\Omega - N$ Interaction from Relativistic Heavy Ion Collisions

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We investigate the two-particle momentum intensity correlation function for ΩN pairs $C(Q,K) = \frac{\int dx_1 \int dx_2 S_\Omega(x_1,K) S_N(x_2,K) |\Psi(x_1,x_2;Q)|^2}{\int dx_1 S_\Omega(x_1,k_1) \int dx_2 S_N(x_2,k_2)}$ where Q is the relative momentum of the two emitted particles and $S_i(x,k)$ denote the source function of particle species i.
$C(Q,K)$ has been used as a sensitive probe for the source size in nucleus-nucleus collisions, but recently has been investigated for $\Lambda\Lambda$ pairs to probe their interaction 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 calculate the $N\Omega$ correlation function through the relative wave function $\Psi(x_1,x_2;Q)$. 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 (see figure). 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.

1. K.Morita, T.Furumoto, A.Ohnishi, Phys.Rev.C **91**, 024916 (2015).
2. F.Etiminan et al., (HAL QCD Collaboration), Nucl. Phys. **A928**, 89 (2014).

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Primary author: MORITA, Kenji (Kyoto University)

Co-authors: OHNISHI, Akira (Kyoto University); HATSUDA, Tetsuo (RIKEN)

Presenter: MORITA, Kenji (Kyoto University)

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