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Search for short-range correlation in atomic nuclei

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Atomic nucleus is a unique many-body quantum system in which nucleons/hadrons interact via the forces that origins from fundamental strong interaction. The nucleon-nucleon interaction is a result of the interplay between the long-range attraction and the short-range repulsion. Due to the complex nature, the understanding of interaction among nucleons (protons and neutrons) is still challenging. Conventionally, nucleons are approximated as independent particles subjected to a mean field in nucleus and all the nucleons have momenta are lower than the fermi momentum. However, as revealed by the electron-scattering experiments, about 20%, as a result of density fluctuations in nuclei, two nucleons come close enough to form a short-range correlated (SRC) pair that defies the mean-field description. The momentum of the SRC pair is higher than the fermi momentum, resulting a high-momentum tail in the momentum distribution. Moreover, the existence of SRC pair shows that two-body interaction, which is missing in the conventional understanding, is expected to be the key ingredient to describe how nuclear matter is bound. Despite such great importance of SRC pair, experimental data are however very limited. So far, studies on SRC pairs are only for stable nuclei with inclusive measurements. Aiming at bringing new insights from experimental investigations on the short-range correlated pair in the nuclear systems with an extreme of neutron-proton asymmetry, we present here a new experimental method, which will use proton as a probe to directly tag the SRC pair by measuring the whole kinematics using beams of exotic nuclei in inverse kinematics via proton-induced reaction. The experiment will be performed at SAMURAI spectrometer at RIKEN RI beam factory. In this talk, the detailed consideration for the new method as well as the design of the experiment and development on the new detection system will be presented.

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