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Tensor correlation in light nuclei studied with the tensor optimized shell model

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In the nuclear force, the tensor force coming from the pion exchange plays an important role in the nuclear structure. In the wave function, the 2p2h excitations involving high momentum component is important to describe the strong tensor correlation. In this study, we investigate the role of the tensor correlations in the light nuclei.

We employ a shell model type prescription, in which the 2p2h configurations are extended to include the high momentum component until the convergences of the tensor force contribution. We call this method as "Tensor Optimized Shell Model" (TOSM). We further describe the short-range correlation using the unitary correlation operator method (UCOM). In UCOM, the unitary operator is introduced to reduce the amplitude of the short-range relative wave functions in nuclei. Using "TOSM+UCOM" as the basis states, we describe the tensor and short-range correlations in nuclei starting from the bare nuclear interaction [1].

1.We show the results of He isotopes using the Argonne bare interaction with TOSM+UCOM approach. We get a good results of ^{4}He. The major 2p2h state is the excitations from $s_{1/2}$ to $p_{1/2}$ orbits of a proton-neutron pair induced by the tensor force. This is a pionic 0-type excitation from the $s_{1/2}$ orbit. This specific 2p2h excitation causes the Pauli-blocking in ^{5}He and ^{6}He for the $p_{1/2}$ orbit of the extra neutrons, which contributes to the observed LS splitting energies.

1.We applied TOSM to Li isotopes, in particular, the problem of the neutron halo formation in ^{11}Li [2]. The halo structure of ^{11}Li indicates a large $(1s)^2$ component for last two neutrons, namely, the magic number breaking of N=8. We solved this problem of the N=8 shell gap by treating the tensor correlation. Based on the three-body model with the ^{9}Li core described in TOSM, the Pauli-blocking on the tensor correlation produces the energy loss in the p-wave configuration of ^{11}Li. As a result, the magic number breaking in ^{11}Li was naturally explained.

[1] T. Myo, H. Toki, K. Ikeda, Prog. Theor. Phys.121 (2009) 511.
[2] T. Myo, K. Kato, H. Toki and K. Ikeda, Phys.Rev. C76 (2007) 024305.

The seminar will be given in English.

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