Role of the Tensor Correlation on the Spin-Orbit Splitting in Neutron Halo Nuclei

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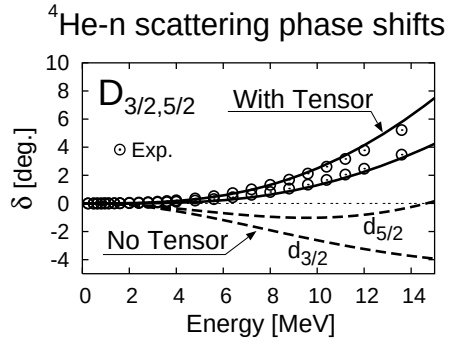
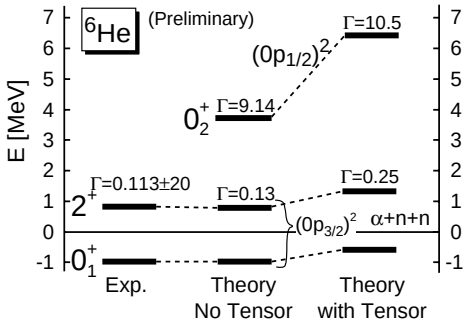
The tensor force is an important ingredient related to the spin in the nuclear force and plays a characteristic role in the nuclear structure. In ^{4}He, the exact calculations show that the contribution of the tensor force in the energy is comparable to the central one.

It is an important problem to understand the effect of the tensor force on the nuclear structure in a physically transparent manner by explicitly describing the tensor correlation. In this talk, we investigate the roles of tensor force for He isotopes, ^{4}He to a halo nuclei ^{6}He, and also ^{11}Li. We start with the extended shell model type model for ^{4}He, which can optimize the tensor correlation of this nuclei. For ^{5,6}He and ^{11}Li, we employ the "Tensor-optimized core cluster"+n(+n) models, and see the effect of the tensor correlations on these nuclei.

We describe ^{4}He within the *2p2h* excitations to converge the solutions for the tensor correlation. The large contribution of the tensor force is obtained as –51 MeV and the $(0s_{1/2})^2(0p_{1/2})^2$ component is largely mixed to be 5% via 0^- coupling of the $0s_{1/2}$–$0p_{1/2}$ orbits. This reflets the pion nature. Next, we analyze the ^{4}He+n scattering in the coupled channel method. Due to the large mixing of $0p_{1/2}$ component in ^{4}He, the Pauli blocking occurs in the ^{5}He($1/2^-$) state and 30% of the observed LS splitting energy of 1/2–3/2 states arises. The tensor correlation also affects the *d*-wave properties of the ^{4}He+n system, which improves the phase shifts shown in Figure. The Pauli-blocking can be seen in the neutron halo nuclei ^{6}He. We show the preliminary energy spectrum of ^{6}He with three-body calculation in Figure. It is found that the 0^+_2 states is affected by the tensor correlation in which two valence neutrons occupy the $0p_{1/2}$ orbit and suppress the tensor correlation in ^{4}He from the Pauli-blocking. Similar blocking effect can contributes to the halo formation in ^{11}Li to mix the $(1s)^2$ configuration.





[1] T. Myo, K. Kato and K. Ikeda, Prog. Theor. Phys.113(2005)763.