1 - 6 Effect of Tensor Correlations on the Depletion of Nuclear Fermi Sea

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We have investigated the effect of tensor correlations on the depletion of nuclear Fermi sea in symmetric nuclear matter (SNM) within the framework of the extended Brueckner-Hartree-Fock (EBHF) approach by adopting the $AV18$ two-body interaction and a microscopic three-body force (TBF)[1]. The contributions from various partial wave channels including the isospin-singlet $T=0$ channel, the isospin-triplet $T=1$ channel and the $T=0$ tensor $^3SD_1$ channel have been calculated. The $T=0$ neutron-proton correlations play a dominant role in causing the depletion of nuclear Fermi sea. The $T=0$ correlation-induced depletion turns out to stem almost completely from the $^3SD_1$ tensor channel. The isospin-singlet $T=0$ $^3SD_1$ tensor correlations is shown to be responsible for most of the depletion, which amounts to more than 70 percent out of the total depletion in the density region considered. The TBF turns out to lead to an enhancement of the depletion at high densities well above the empirical saturation density and its effect increases as a function of density.

In Fig. 1 we show the contributions from different partial wave channels to the nucleon momentum distribution (NMD) in SNM at three typical densities $\rho=0.17, 0.34$ and 0.51 fm^{-3}, respectively. The results of Fig. 1 are obtained within the framework of the EBHF approach by adopting purely the $AV18$ two-body interaction. It is seen that the nucleon-nucleon correlations may lead to a depletion of the nucleon hole states below the Fermi surface and a partly occupation of the particle states above the Fermi surface. We notice that the depletion of the Fermi sea is mostly induced by the isospin $T=0$ np correlations. In the Table 1, we report the predicted contributions from different channels to the depletion [*i.e.*, $1-n(k=0)$] of the lowest momentum state in nuclear matter. It is seen from the Table 1 that at the lowest momentum ($k=0$), the T=0 channels contribute a 11.5%, 10.8% and 10.2% depletion which amounts to almost 81, 73 and 67 percent to the total 14.2%, 14.8% and 15.3% depletion at $\rho=0.17$, 0.34 and 0.51 fm^{-3}, respectively. It is worth noticing from Fig. 1 that the contribution of the $T=0$ np channel almost completely stems from the SD tensor correlations. Therefore, we may conclude that the depletion of the Fermi sea in SNM is essentially dominated by the SD np tensor correlations. By including a microscopic TBF, we predicted similar conclusions. Inclusion of the TBF turns out to enhance the depletion at densities well above the saturation density and its effect increases with density[1].

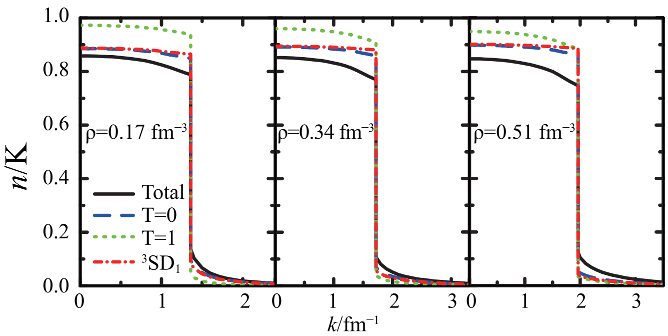

Fig. 1 (color online) Contributions from different partial wave channels to NMD in symmetric nuclear matter.

Table 1 The calculated contributions from different channels to the depletion of the lowest hole state in nuclear matter.

ρ/fm^{-3}	$T=1$	$T=0$	$^3SD_1$	total
0.17	0.027	0.115	0.113	0.142
0.34	0.040	0.108	0.105	0.148
0.51	0.051	0.102	0.099	0.153

Reference

[1] P. Yin, J. M. Dong, W. Zuo, Chin. Phys. C, 41(2017)114102.