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Effects of the Skyrme Tensor Force on the Spin-Isospin Excitations

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Tensor force and its effects on nuclei attract much interest. The effects of the Skyrme tensor force on the ground state properties are widely studied, but it is still difficult to pin down the strengths of the tensor terms, even the sign. The effects of tensor force on the Gamow-Teller (GT) and charge-exchange Spin-Dipole (SD) states are studied by using the self-consisten HF+RPA calculation. For GT excitations, the energies of the main state and the low energy states can be affected dramatically[1]. For SD excitations, the tensor force produce a softening of 1- states, but a hardening of 0- and 2- states, so that to improve the agreement with experiment[2]. Inspired by these strong effects, we systematically studied GT and charge-exchange SD excitation energies in ^{90}Zr and ^{208}Pb to determine the appropriate magnitude of the tensor terms of the Skyrme interactions[3]. It is found that not all Skyrme interactions can meet the criteria $\delta E = |E_{th} - E_{exp}| \leqslant$ 2.5 MeV for the centoid energy of GT and SD modes. Presently, many Skyrme interactions are studied systematically, only few of them can meet $\delta E \leqslant$ 2.5 MeV, and even few of them such as Sly4 can meet the criteria $\delta E \leqslant$ 2 MeV. It is found that when the tensor are added, for instance on top of SLy4, the charge-exchange modes can constrain rather well the value of the tensor-even strength, while the value of the tensor-odd strength is less constrained.

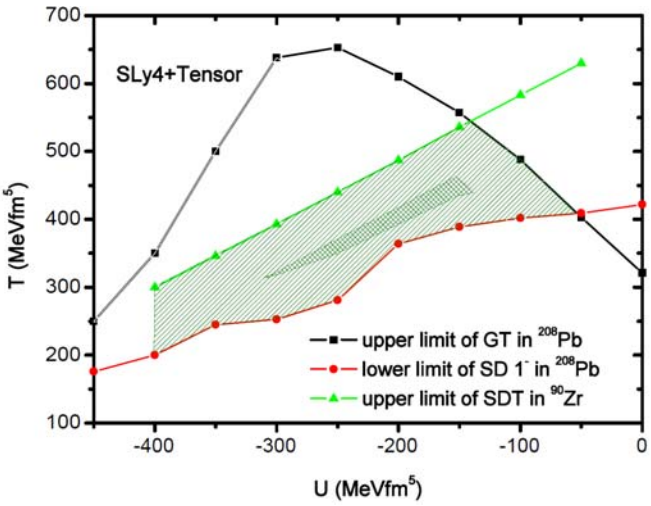

FIG. 1. The region of tensor-even and tensor-odd strengths T and U constrained by the criterion $\delta E \leqslant$2.5 MeV (shaded region) and $\delta E \leqslant$2MeV (double shaded region) for the GT and total SD centroid energies in ^{90}Zr and ^{208}Pb and for the SD 1$^-$ centroid energy in ^{208}Pb. The tensor forces are added on top of SLy4 and used to calculate the centroid energies.

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