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STRUCTURE OF β-DECAY STRENGTH FUNCTION Sβ(E) IN HALO NUCLEI

The strength function Sβ(E) governs [1,2] the nuclear energy distribution of elementary charge-exchange excitations and their combinations like proton particle (πp)–neutron hole (νh) coupled into a momentum Iπ : [πp ⊗ νh]Iπ and neutron particle (νp)–proton hole (πh) coupled into a momentum Iπ : [νp ⊗ πh)]Iπ. The strength function of Fermi-type β-transitions takes into account excitations [πp ⊗ νh]0+ or [νp ⊗ πh]0+. Since isospin is a quite good quantum number, the strength of the Fermi-type transitions is concentrated in the region of the isobar-analogue resonance (IAR). The strength function for β-transitions of the Gamow–Teller (GT) type describes excitations [πp ⊗ νh]1+ or [νp ⊗ πh]1+. At excitation energies E smaller than Qβ (total β-decay energy), Sβ(E) determines the characters of the β-decay. For higher excitation energies that cannot be reached with the β-decay, Sβ(E) determines the charge exchange nuclear reaction cross sections, which depend on the nuclear matrix elements of the β-decay type. From the macroscopic point of view, the resonances in the GT β-decay strength function Sβ(E) are connected with the oscillation of the spin–isospin density without change in the shape of the nucleus [1,3].
When the nuclear parent state has the two-neutron Borromean halo structure, than IAR and configuration states (CSs) can simultaneously have nn, np Borromean halo components in their wave functions [4]. After M1 γ-decay of IAR with np Borromean halo structure or GT β- - decay of parent nuclei with nn Borromean halo structure, the states with np halo structure of tango type may be populated [5-7].
In this work the structure of resonances in the GT β-decay strength function Sβ(E) for halo nuclei is discussed. It is shown that when the parent nucleus has nn Borromean halo structure, then after GT β- -decay of parent state or after M1 γ-decay of IAR the states with np tango halo structure or mixed np tango + nn Borromean halo structure can be populated. Or, in other words, resonances in the GT β-decay strength function Sβ(E) of halo nuclei, may have np tango halo structure or mixed np tango + nn Borromean halo structure. Structure of Sβ(E) may be studied both in experiments on M1 γ-decay of (or on) IAR and in experiments on Sβ(E) measurements in charge exchenge nuclear reactions or in β-decay [1,2]. Since the operators of GT β-decay and M1 γ-decay have no spatial components, GT β-transitions and M1 γ-transitions between states with similar spatial shapes are favoured. Data of 6He (Borromean nn halo) ground state (g.s., Iπ=0+) GT β-decay and M1 gamma decay of its IAR (Borromean np halo, resonans in 6Li, E=3.56 MeV, Iπ=0+) were analysed. The enhancement of the M1 gamma transition from the IAR to the ground state of the 6Li nucleus (Iπ=1+) complies the presence of an np tango halo in 6Li g.s.

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Summary

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