Intermediate structure in (p,γ) reactions and in β-decays

Author: Igor Izosimov[1]

[1] *Joint Institute for Nuclear Research*

Corresponding Author: izosimov@jinr.ru

The characteristics of various nuclear processes are rather simple to calculate in statistical model [1-4]. In particular, the transition-width distribution is described by the Porter–Thomas equation, there are no correlations between different partial widths, the strength function of β-transitions $S_\beta(E)$ depends smoothly on energy, and the ratios of the amplitudes for decay via various spin channels follow the Cauchy distribution.

An intermediate structure of resonances in nuclear reactions and in the resonance structure of the

β-decay strength functions $S_\beta(E)$ connected with violation of statistical model in a localized energy region [1,2]. Deviations from the statistical theory have been observed in (p,p'γ) and (p, γ) reactions, β^- and β^+/EC-decays [1-4]. Non-statistical effects are closely related to the symmetry of the nuclear interaction and determined by the non-statistical component of the resonance wave function [1,2].

In this report non-statistical effects manifested in reactions involving low-energy protons and in β- decays are analyzed. Non-statistical effects are closely related to the symmetry of the nuclear interaction. In (p, γ) reactions for nonanalog resonances in $N > Z$ nuclei non-statistical effects are connected with neutron excess and domination of the simple configuration such as proton-particle neutron-hole in the wave function of nonanalog resonances [1-3]. The association of non-statistical effects in (p, γ) reactions and in the β-decays with spin–isospin $SU(4)$ symmetry are discussed. The non-statistical effects taking into account non-statistical correlations in $E2$ and $M1$ γ-transitions for the γ-decay of the non-analog resonances in (p, γ) reactions are analysed.

References

[1] I.N. Izosimov, Physics of Particles and Nuclei, **30**, 131 (1999).
[2] I.N. Izosimov, JINR Preprint E6-2024-14.Dubna, 2024; http:www1.jinr.ru/Preprints/2024/14(E6-2024-14).pdf.
[3] I.N. Izosimov, et al, Phys. Part. Nucl., **42**, 1804 (2011). DOI:10.1134/S1063779611060049
[4] O.E. Kraft, Yu.V.Naumov, V.M. Sigalov, I.V. Sizov, Sov. J. Part. Nucl., **17**, 573 (1986).