Contribution ID: **379** Type: **Oral report**

TAGS SPECTRA ANALYSIS AND BETA DECAY STRENGTH FUNCTION STRUCTURE

Friday, 16 October 2020 16:45 (25 minutes)

Successful applications of the total absorption γ-spectroscopy ($TAGS$) for the β-decay strength function $S_\beta(E)$ resonance structure study, methods of $TAGS$ spectra interpretation, and results of analysis of $S_\beta(E)$ structure for the Gamow-Teller (GT) β^+/EC and β^- -decays were summarized in [1,2]. Development of experimental technique allows application of methods of nuclear spectroscopy with high energy resolution for $S_\beta(E)$ fine structure measurement [2-4]. First results of the $S_\beta(E)$ fine structure study were summarized in [2,3].The combination of the $TAGS$ with high resolution nuclear spectroscopy may be applied for detailed decay schemes construction [2]. It was shown [2-4] that the high-resolution nuclear spectroscopy methods give conclusive evidence of the resonance structure of $S_\beta(E)$ for GT and first-forbidden (FF) β-transitions in spherical, deformed, and transition nuclei. High-resolution nuclear spectroscopy methods [2-5] made it possible to demonstrate experimentally the reveal splitting of the peak in the $S_\beta(E)$ for the (GT) β^+/EC-decay of the deformed nuclei into two components.

The operating principle of a total-absorption γ-spectrometer is based on summation of the energies of the cascade γ-rays produced after β-decay to excited levels of the daughter nucleus in 4π-geometry. There are two methods of the $TAGS$ spectra analysis [1]. In the first one it is necessary to identify the total absorption peaks in $TAGS$ spectra and have 4π-spectrometer with exponential energy dependence of the photoefficiency (i.e., the ratio of the number of pulses in the total absorption peak to the number of γ-ray incident on the detector) for γ-ray registration. Only in this case the efficiency of $TAGS$ peak registration does not depend on the details of decay scheme [1,3]. This method gives good results, but can be applied for nuclei with total β-decay energy Q_β less than $5-6MeV$. Quantitative characteristics may be obtain as a rule only for one (β^--decay) peak and for two peaks (β^+/EC-decay) in $S_\beta(E)$ [1-3].

The second method is based on so called response function application, but a lot of assumption must be done for extraction the $S_\beta(E)$ shape from the $TAGS$ spectrum shape. Analysis depends on the assumptions [1] about the decay scheme which as a rule is not known. It is very difficult to estimate the associated systematic errors of such analysis [1] and only qualitative information about $S_\beta(E)$ may be obtained.

$TAGS$ can't distinguish the GT and FF transitions and don't take into account the conversion electron emission, which give the systematic uncertainties, especially for high Z.

In this report some results of $TAGS$ spectra analysis are considered. It is shown that only combination of $TAGS$ with high resolution nuclear spectroscopy methods may give the quantitative information about $S_\beta(E)$.

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Session Classification: Section 1. Experimental and theoretical studies of the properties of atomic nuclei

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