NUCLEAR DECAY STUDY USING TOTAL ABSORPTION γ-RAY SPECTROSCOPY

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The total absorption γ-ray spectroscopy (TAGS) is based on summation of cascade gamma quantum energies in the 4π geometry [1,2]. The TAGS may be applied for β-decay strength function $S_\beta(E)$ measurement, for total β-decay energy Q_β determination and for decay scheme completeness testing. The total absorption spectrometers (TAS) are used in many laboratories [1,2]. Applications of the total absorption γ-ray spectroscopy (TAGS) and it's combination with high resolution nuclear spectroscopy methods for $S_\beta(E)$ fine structure measurement, for total β-decay energy Q_β determination and for decay scheme completeness testing are presented.

By comparison of the TAGS spectra with the existing decay schemes data one may estimate the degree of the decay scheme completeness. It is shown that more than 30%-50% of the beta decay strength to the nuclear levels with more than 2 MeV-3 MeV excitation energy in the medium and heavy nuclei may not been identified in decay schemes [1,2]. The principles of the more complete decay schemes construction by using the combination of the TAGS spectroscopy with high resolution gamma spectroscopy are presented both for neutron-deficit (β^+/EC-decay) and neutron-rich nuclei (β^--decay). The possibilities of TAGS applications for fission products decay schemes completeness testing and more complete data using for decay heat [2,3] calculations are discussed.

The experimental measurement data on the fine structure of $S_\beta(E)$ in spherical and deformed nuclei are analyzed. Modern nuclear spectroscopy methods allowed the split of the peaks caused by nuclear deformation to be revealed in $S_\beta(E)$ for transitions of the Gamow–Teller (GT) type [2]. The resonance nature of $S_\beta(E)$ for first-forbidden (FF) transitions in both spherical and deformed nuclei is experimentally proved. It is shown that at some nuclear excitation energies FF transitions can be comparable in intensity with GT transitions.

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