Contribution ID: **181** Type: **Oral report**

STANDARD THEORY of SCINTILLATION SPECTROMETERS with ONE PHOTODETECTOR

Saturday, October 17, 2020 9:50 AM (25 minutes)

The current theory of scintillation spectrometers with one photodetector, the quintessence of which is generalized in the book [1], has a number of fundamental drawbacks. The correct mathematical description of the process of converting the energy of a primary particle into the signal at the output of a scintillation spectrometer allows overcoming these drawbacks. In this work, the mathematical model that serves as the basis of the standard theory of scintillation spectrometers with one photodetector was formulated. This theory allows obtaining the formulae for arbitrary moments of the distribution function of the signal at the output of the scintillation spectrometer with one photodetector. In particular, the formulae for the average value of the amplitude and the variance of the signal at the output of the photodetector are obtained. The structure of the formula for the energy resolution of a scintillation spectrometer with one photodetector reveals the contributions of the processes that take place at converting the energy of a primary particle into the output signal, particularly the contribution associated with the nonlinearity of the scintillator light output. It was shown that in the developed standard theory of scintillation spectrometers with one photodetector there are no drawbacks of the current theory of scintillation spectrometers.

1. J.B. Birks The Theory and Practice of Scintillation Counting, 1967

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Session Classification: Section 3. Modern nuclear physics methods and technologies

Track Classification: Section 3. Modern nuclear physics methods and technologies.