Characteristic Features of Double and Triple Coincidence Spectra Coupling in Radiative Neutron Decay

Khafizov R.U.[a], Kolesnikov I.A.[a], Nikolenko M.V.[a], Tarnovitsky S.A.[a], Tolokonnikov S.V.[a], Torokhov V.D.[a], Trifonov G.M.[a], Solovei V.A.[a], Kolkhidashvili M.R.[a], Konorov I.V.[b]

[a]NRC «Kurchatov Institute», Russia

[b]Technical University of Munich, Munich, Germany

khafizov_ru@nrcki.ru

The paper uses the example of radiative neutron decay, which we discovered in 2005 at the TUM (Technical University of Munich) reactor [1], to examine the coupling of double and triple coincidence spectra. To this end, special attention is paid to the electronic system for collecting and processing information received from the electron, proton, and gamma-ray detectors. As demonstrated, in the presence of a significant background gamma-ray, the spectrum of triple coincidences will have, apart from the peak of triple coincidences of the beta electron, proton, and gamma-ray quantum, additional peaks which represent responses to the peaks in the spectra of double coincidences of beta electron with proton and beta electron with gamma quantum. After processing the spectra using the response function method, we measured the main characteristic of the radiative beta decay of the neutron, namely its branching ratio. Thus, in this experiment we were the first to measure the branching ratio (B.R.) of radiative neutron decay B.R. = (3.2±1.6)10-3 (where C.L. = 99.7% and gamma quanta energy threshold is equal to 35 Kev) [1]. On the other hand, theoretical calculations of this value according to the Standard Model give 1.5 times lower value [2], so we recorded additional gamma quanta which are structural gamma quanta emitted by the quarks that a neutron consists of.

1. R.U. Khafizov et al. JETP Letters, v. 83(1), 2006, p. 5.
2. Yu.V. Gaponov, R.U. Khafizov. Phys. Lett. B 379 (1996), p. 7.