THE MONOENERGETIC GAMMA-RAY EMISSION VIA ELCTRONIC INTERMEDIATE STATES

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Effects of the electronic environment of the nucleus on the transition probability of gamma emission were found by Tralli and Goertzel in the third-order terms of perturbation theory. An exhaustive treatment including terms of any order of perturbation theory was given by Krutov. The third-order matrix elements involve virtual electronic states and there are several well known phenomena of this type. If the final state of the electron is a bound state, the emitted photon is monoenergetic, and according to Krutov this effect is called "electronic bridge". The energy of the emitted photon depends on the initial and final electron states.

In our experiment the probability for the "electronic bridge" process on L-shell electrons for the metastable 30.7 keV state in ^{93}Nb was investigated. High-purity germanium detector 0.4 cm thick and 0.62 cm in diameter was used to detect photons of approximately 28.3 keV. The system had a resolution of 340 eV for the 16.6 keV K_{α} x-ray from ^{93}Nb. Data were collected in the period of 277 hours. No gamma-ray peak was observed at the expected energy and we were able to derive an upper limit only of less than 7.5×10^{-8} "electronic bridge" transitions from L-shell per nuclear decay.