

A STUDY OF ISOMERIC YIELD RATIOS IN THE $^{124}\text{Te}(\gamma, n)^{123\text{m}}\text{Te}$ REACTION IN THE GIANT E1-RESONANCE REGION

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The difficulty of measuring the isomeric yield ratios $d=Y_m/Y_g$ in the $^{124}\text{Te}(\gamma, n)^{123\text{m}}\text{Te}$ reaction stems from the stability of the ground state of the ^{123}Te nucleus, which disallows the simultaneous measurement of the isomeric Y_m and ground Y_g states excitation. To estimate the isomeric ratio we used the yield of the (γ, n) reaction, Y_n of the neighbouring nucleus ^{122}Te measured at the same time as the yield Y_m of the $^{123\text{m}}\text{Te}$ isotope. Since the characteristics of the giant dipole resonance in the tellurium isotopes changes slowly from nucleus to nucleus, such a procedure leads to the errors not worse than 2–3%. During measurements the activation technique was applied. To identify the decay of the isomeric state with $J^\pi=11/2^-$ of the nucleus $^{123\text{m}}\text{Te}$ ($T_{1/2}=119.2$ days) the $E=247$ keV gamma-line was used. The research was conducted on the bremsstrahlung gamma-beam of the microtron M-30 of IEP, NAS of Ukraine, in the region of 10–18 MeV.

The natural mixture of the tellurium isotopes comprises 0.8% of the stable ^{123}Te isotope. Therefore, though, in general, the $(\gamma, \gamma')^m$ reaction cross section is two orders of magnitude smaller than that of the (γ, n) reaction, we have made in the threshold region of the $^{124}\text{Te}(\gamma, n)^{123\text{m}}\text{Te}$ reaction a correction for the contribution of the $^{123}\text{Te}(\gamma, \gamma')^{123\text{m}}\text{Te}$ reaction, the yield of which was estimated separately.

As a result of measurements at the energies $E_{\gamma\text{max}}=11.5$ MeV, 12.5 MeV, 13.5 MeV, 14.5 MeV, 15.5 MeV, 16.5 MeV, 17.5 MeV, we have obtained the following values of the isomeric yield ratios $\eta=Y_m/(Y_m+Y_g)$, respectively: 0.040 ± 0.004 , 0.087 ± 0.004 , 0.105 ± 0.006 , 0.142 ± 0.005 , 0.156 ± 0.005 and 0.179 ± 0.007 .

Theoretical calculations of the isomeric yield ratios of the $^{124}\text{Te}(\gamma, n)^{123\text{m}}\text{Te}$ reaction were carried out. Computations were performed using the TALYS-1.4 code. Comparison of calculated and experimental data indicates a satisfactory agreement.