

STUDIES OF DEPENDENCE OF ISOMERIC YIELD RATIOS ON THE GAMMA QUANTA ENERGY IN THE $^{140}\text{Ce}(\gamma, n)^{139\text{m,g}}\text{Ce}$ REACTION

Mazur V.M., Symochko D.M., Marinets T.I., Derechkey P.S.

Institute of Electron Physics, Ukrainian National Academy of Sciences, Uzhhorod

E-mail: derecskei89@gmail.com

The ^{140}Ce nucleus under consideration is a magical one having a neutron number $N=82$ and a completely filled $1h_{11/2}$ shell. Here we present the experimental results of studying the isomeric yield ratios $d=Y_m/Y_g$ in the $^{140}\text{Ce}(\gamma, n)^{139\text{m,g}}\text{Ce}$ reaction in the giant dipole resonance region. The experiments were carried out with the bremsstrahlung gamma-beam of the microtron M-30 of IEP, NAS of Ukraine, in the region of 10–18 MeV with a step of $\Delta E=0.5$ MeV. The energy spread of the accelerated electron beam was not worse than 40 keV at the average $5\mu\text{A}$ current. In the experiments, the activation technique was applied. To study the decay of the isomeric $^{139\text{m}}\text{Ce}$ state ($T_{1/2}=54.8$ s) the $E=754$ keV gamma-line was used, while for the ground $^{139\text{g}}\text{Ce}$ state ($T_{1/2}=137.6$ days) – the 165.8 keV line. The measurements were carried out with a gamma-spectrometer on the basis of a semiconductor HPGe-detector with the 175 cm^3 volume.

The resulting experimental curve of the dependence of the isomeric ratios $d=f(E_{\gamma\text{max}})$ on the maximum energy of the bremsstrahlung spectra starting from the threshold has a growing trend and in the region of 18.0 MeV it reaches the value $d=0.103(5)$. Experimentally the dependence of the isomeric ratios $d=f(E_{\gamma\text{max}})$ was approximated by a Boltzmann curve using the least-square method:

$$d=A+(B-A)/[1+\exp((E-E_0)/\Delta E_1)],$$

here A , B , E_0 , ΔE_1 being parameters. As a result of approximation the following values were obtained for the parameters: $A=-0.0253\pm 0.010$, $B=0.1123\pm 0.0087$, $E_0=13.67\pm 0.32$ and $\Delta E_1=1.66\pm 0.33$.

The experimental isomeric ratios of the $^{140}\text{Ce}(\gamma, n)^{139\text{m,g}}\text{Ce}$ reaction were compared with the those measured earlier for the $^{138}\text{Ce}(\gamma, n)^{137\text{m,g}}\text{Ce}$ reaction [1]. The results obtained will be discussed at the Conference.

1. V.M.Mazur, D.M.Symochko, Z.M.Bigan, P.S.Derechkey // Book of abstracts LXIII meeting on nuclear spectroscopy and nuclear structure, Moscow, 2013. St.-Pb, 2013. P.142.