

ACTIVATION LEVELS AND PROBABILITIES OF ELECTROMAGNETIC γ - TRANSITIONS IN THE REACTION $(\gamma,\gamma')^m$ ON AVERAGES AND HEAVY NUCLEI

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In the experimental determination of the outputs of reactions (γ,γ') in the small interval of 5-9 MeV with a step up to 0.5 MeV there are points of deviation of the energy dependence of absolute outputs from a monotonically increasing curve [1]. This effect allows you to determine the values of individual or group of activation levels, through which the isomers of the nucleus are populated. In paper [1], the energy dependences of the outputs for reactions $(\gamma,\gamma')^m$ on the ⁷⁷Se, ⁷⁹Br, ⁸⁹Y, ¹⁰³Rh and ¹¹¹Cd nuclei were analyzed for the presence of fractures.

Also, the dependences of the absolute output from energies [2-4] for the reactions $(\gamma,\gamma')^m$ on heavy nuclei ¹³⁷Ba, ¹⁷⁹Hf, ¹⁹⁷Au and ¹⁹⁹Hg are analyzed. The number of detected activation levels in each of these $(\gamma,\gamma')^m$ - reactions ranges from one to three values.

The probabilities for γ - transitions can be approximately calculated from the formulas [5]:

$$W(EJ) \approx \frac{1}{\lambda} \left(\frac{R}{\lambda} \right)^{2J}; \quad W(MJ) \approx \frac{1}{\lambda} \left(\frac{R}{\lambda} \right)^{2J+2}; \quad (1)$$

where $\lambda = \hbar c / E_\gamma$ - the wavelength for the emitted or absorbed γ - quanta's; J - multipolarity; EJ and MJ - the electric and magnetic γ - radiations with parity $P=(-1)^J$ and $P=(-1)^{J+1}$ accordingly; R - the radius of the emitted core.

For the selenium nucleus, the transitions from metastable levels to the isomeric level ^{77m}Se are shown in Table 1, where the ratio of the γ transitions is indicated

$$\alpha = \frac{W(EJ)}{W(MJ)}. \quad (2)$$

Table 1. Transitions to the isomeric level ^{77m}Se

λ , m	E_γ , keV	J	$W(EJ)$, m ⁻¹	$W(MJ)$, m ⁻¹	α
1.48E-11	13.38	8	1.02E-44	1.44E-51	7.12E+06
2.25E-12	87.86	6	2.19E-20	1.33E-25	1.65E+05
1.42E-12	139.22	6	8.70E-18	1.32E-22	6.58E+04
7.12E-13	277.53	6	6.83E-14	4.12E-18	1.66E+04
3.81E-13	518.18	6	2.29E-10	4.82E-14	4.75E+03
2.98E-13	662.51	6	5.58E-09	1.92E-12	2.91E+03

Similar calculations of the probability ratio of electromagnetic γ - transitions can be made for nuclides ^{89m}Y, ^{103m}Rh, ^{179m}Hf and others.

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