## **ACTIVATION LEVELS AND PROBABILITIES OF ELECTROMAGNETIC** $\gamma\text{-}$ TRANSITIONS IN THE REACTION $\left(\gamma,\gamma'\right)^m$ ON AVERAGES AND HEAVY NUCLEI

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In the experimental determination of the outputs of reactions  $(\gamma, \gamma')$  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 <sup>77</sup>Se, <sup>79</sup>Br, <sup>89</sup>Y, <sup>103</sup>Rh and <sup>111</sup>Cd 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 <sup>137</sup>Ba, <sup>179</sup>Hf, <sup>197</sup>Au and <sup>199</sup>Hg 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  $\gamma$ - transitions can be approximately calculated from the formulas [5]:

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

where  $\lambda = \hbar c / E_{\gamma}$  - the wavelength for the emitted or absorbed  $\gamma$ - quanta's; J - multipolarity; EJ and MJ - the electric and magnetic  $\gamma$ - 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 <sup>77m</sup>Se are shown in Table 1, where the ratio of the  $\gamma$  transitions is indicated

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

λ, m	$E_{\gamma}$ , keV	J	$W(EJ), \mathrm{m}^{-1}$	$W(MJ), \mathrm{m}^{-1}$	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

Table 1. Transitions to the isomeric level <sup>77m</sup>Se

Similar calculations of the probability ratio of electromagnetic  $\gamma$ - transitions can be made for nuclides <sup>89m</sup>Y, <sup>103m</sup>Rh, <sup>179m</sup>Hf and others.

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