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شبكة المعلومات الجامعية

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Study of Isomeric States Formation by Nuclear Reaction of Light Particles on Some Nuclei

Thesis submitted for the partial fulfillment of Ph. D. Degree in Physics (Nuclear Physics)

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Abstract

Abstract

In the present work the effects of isomeric state formation on the measurement of thermal neutron cross section and its associated resonance integral on neutrons reaction are discussed.

The isomeric thermal neutron cross section and isomeric resonance integral of ^{109}Ag (n, γ) ^{110m}Ag, ^{133}Cs (n, γ) ^{134m}Cs and ^{134g}Cs, and ^{136}Ba (n, γ) ^{137m}Ba, ^{68}Zn (n,γ)^{69m}Zn, ^{79}Br(n,γ)$^{80m+g}$Br and ^{81}Br(n,γ)$^{82m+g}$Br reactions were investigated together with ^{115}In (n, γ) ^{116m}In monitor reaction. These residual nuclei have broad half-life time scale suitable for our investigation; (isomeric states having different half-life time from 2.5 min to 2 year).

Moderated neutrons from steady Am-Be sources were used for neutron activation. Field was monitored and mapped using gold and indium activation.

The k_0-factor was measured for some residual nuclei, hence the k_0-factor for ^{137m}Ba was measured for the first time. The isomeric thermal neutron cross section and resonance integral for ^{115}In (n, γ) ^{116m}In were evaluated to be 162.6 b and 2585 b. These data were used to measure the k_0-factors; and compared to reported values to confirm the present procedure.

The thermal neutron cross section and resonance integral for ^{133}Cs (n, γ) ^{134m}Cs were found to be 2.64±0.11 b and 42±1.7 b, respectively; while those of the ^{109}Ag (n, γ) ^{110m}Ag reaction were 4.09±0.35 b and 68±6 b.

Thermal neutron cross section for ^{136}Ba (n, γ) ^{137m}Ba was identified as 0.032±0.003 b, while the resonance integral could not be evaluated as a result of interfering reactions.

The thermal cross section and resonance integral for ^{79}Br (n,γ)$^{80m+g}$Br was identified as $\sigma^{m,g}_{Br,0}$ = 10.05±0.3 b and $I^{m,g}_{Br,0}$=89.38±2.68 b and for ^{81}Br (n,γ)$^{82m+g}$Br was identified as $\sigma^{m,g}_{Br,0}$ = 2.12±0.06b and $I^{m,g}_{Br,0}$= 46.03±1.38b.

Model calculations were done using EMPIRE code to simulate isomeric ratio and compared with the experimental results. Steady neutron field could be retained with isotopic neutron source with moderation setup and geometry of suitable homogeneity and isotropy.

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