

Isomeric Ratios in Some Inverse (γ, n) and (n, γ) Reactions

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Abstract

Two nuclear reactions are so called inverse, when the projectile of one reaction is emission particle of another reaction, for examples (γ, p) and (p, γ); (γ, n) and (n, γ); (γ, α) and (α, γ). Inverse reactions, including photonuclear and thermal neutron capture reactions play important role in astrophysics and study of nuclear structure and nuclear reaction mechanism. It is well known that the isomeric ratio provides diverse information about nuclear structure and nuclear reaction mechanism as well. In this work, we investigate isomeric ratios in some inverse (γ, n) and (n, γ) reactions, which lead to the same residual nucleus with near the same excitation energy by activation method using off-line gamma spectroscopy. Namely, they are $^{138}\text{Ce}(\gamma, n)^{137\text{m.g}}\text{Ce}$ and $^{136}\text{Ce}(n, \gamma)^{137\text{m.g}}\text{Ce}$; $^{116}\text{Cd}(\gamma, n)^{115\text{m.g}}\text{Cd}$ and $^{114}\text{Cd}(n, \gamma)^{115\text{m.g}}\text{Cd}$; $^{116,110}\text{Pd}(\gamma, n)^{109\text{m.g}}\text{Pd}$ and $^{108}\text{Pd}(n, \gamma)^{109\text{m.g}}\text{Pd}$; $^{82}\text{Se}(\gamma, n)^{81\text{m.g}}\text{Se}$ and $^{80}\text{Se}(n, \gamma)^{81\text{m.g}}\text{Se}$. The data analysis and necessary corrections as the self-absorption and summing cascade effects were made in gamma rays radioactivity measurements to improve the precision of the isomeric ratio determination. The results were discussed and compared with those in the existing literature. The experimental results are expected to explain some aspects of nuclear structure and provide the nuclear data for theoretical interpretation.