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Testing the concept of isospin splitting of giant dipole resonance in reactions (γ,p) on nuclei 74,77,78,80Se

In this study experiments were performed at bremsstrahlung end-point energies of 10-23 MeV with the beam from the MT-25 microtron using of the γ-activation technique. The electron energies were in range of 10-23 MeV with an energy step of 1 MeV. To produce gamma radiation, a radiator target made of tungsten, which is a common convertor material, was used. To remove the remaining electrons from the bremsstrahlung beam, a 30 mm thick aluminum absorber was placed behind the tungsten converter. The target of natural selenium was at a distance of 1 cm from the converter. After irradiation, when the radiation levels in the experimental hall became safe, the targets were transferred to a separate measuring room, where the induced activity in the irradiated target was measured using a high purity germanium γ-detector. The experimental yields of the reactions were normalized to the yield of reaction 82Se(γ,n)81m+gSe.

The experimental values of relative yields were compared with theoretical results obtained on the basis of TALYS with the standard parameters [1] and the combined model of photonucleon reactions [2]. On Fig. 1 are shown the relative yields of natSe(γ, p) reactions as a function of bremsstrahlung end-point energy from the literature data (open rectangle) [3] and present work (solid rectangles), and the simulated values using CMPR (solid line) and TALYS code (dashed line) based on monoenergetic photons. Also the contribution of the T< (dash dot) and T> components (dot) simulated values using CMPR to the theoretical relative yields for photoproton reactions on a natural mixture of selenium isotopes are shown in Fig. 1.

In the case of the 74Se(γ,p) reaction, theoretical calculations and experimental results are in good agreement with each other. In the case of relative yields for photoproton reactions on the heavy selenium isotopes, the theoretical values calculated using the CMPR are much larger than the TALYS results.

For photoproton reactions on the isotopes of 77Se, 78Se, and 80Se, the ratios of theoretical relative yields YrelCMPR / YrelTALYS with increasing energy increase in the ranges of 2-5, 3-11, and 11-23, respectively. The experimentally obtained results lie closer to the theoretical curve according to the CMPR code. Including isospin splitting in the CMPR allows to describe experimental data on reactions with proton escape in the energy range from 10 to 23 MeV. At the energy region above 25 MeV, in addition to isospin splitting, quadrupole resonance, the overtone of the giant resonance, and the quasideuteron mechanism make a significant contribution to the cross sections [3].

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Section

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