Photonuclear Reaction Cross-Section Calculations of Sn Isotopes

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Abstract:

Although the atomic nucleus has a history of more than a century, the interactions of the nucleons that make up the nucleus are not yet fully understood. It is possible to better understand the interactions in the nuclear structure by removing nucleons from the nucleus by using photons as projectile particles. The interaction of the atomic nucleus with the photon is energy-dependent due to the wavelength change of the incident photon. Depending on the incident photon's energy, different resonance states may occur in the nucleus. A photon with energy below 30 MeV follows the giant dipole resonance (GDR) mechanism. In this process, the photon energy is transferred to the nucleus by the oscillating electric field of the photon, which causes oscillations between the nucleons inside the nucleus. The reaction cross-section-energy curves of the giant dipole resonance mechanism exhibit the Lorentzian function. The reaction cross-section in the GDR region is calculated by using the Lorentzian function, where resonance cross-section, full width half maximum, resonance energy, and incident photon energy are used. Resonance cross-section, full width half maximum, and resonance energy are called GDR parameters. In this study, photo-nuclear reaction cross-sections of various Sn isotopes have been calculated by using TALYS 1.96 code. GDR parameters, which we found using artificial neural networks in our previous studies, were used in the calculations. Computation results have been compared with the experimental data in the literature.

Keywords: Photo-nuclear reaction, cross-section Giant dipole resonance parameters, TALYS 1.96.