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# Measurement of photoneutron production cross section for mono-energetic linearly polarized photon/単一エネルギー直線偏光光子に対する光中性子生成断面積の測定

The reaction between photons and nuclei, photonuclear reaction, has been studied in nuclear physics research since the 1950s. The experimental data on its reaction cross-section have been obtained for photons with energies from reaction thresholds to several tens of MeV[1]. In addition, energy and angular distribution have been obtained for the secondary particles from the reaction. The data have been used not only for understanding nuclear structure but also for developing nuclear data and empirical reaction models used to evaluate radiation transport and activation production in applications of electron accelerators.
To measure the data, photons were generated with Bremsstrahlung and positron annihilation in flight techniques that provide mono-energetic photons with subtraction. Since the 1990s, the laser inverse Compton scattering (LCS) technique became available for the experiment, which allowed us to obtain new data for mono-energetic linearly polarized photons, unlike previous experiments. NewSUBARU BL-01 is a unique facility in Japan for studying photonuclear reactions with various energies using the LCS technique[2]. At the facility, for example, polarization dependence on the azimuthal angle was revealed for neutrons from 17 MeV photons on medium-heavy targets[3].
Using the unique photon beam, we conduct experiments to obtain neutrons production double differential cross sections (DDXs) of tens of MeV photons on medium-heavy targets. The data from this experiment can be used to evaluate parameters of nuclear reaction models implemented in codes that handle energetic electron and photon transport, such as general-purpose Monte Carlo code and a code used for nuclear data evaluation. Until now, we obtained DDXs of Ti, Fe, Cu, Sn, Au, Ta, W, Bi, and Pb targets from 13 to 20 MeV photons at horizontal angles ($\theta$) of 30, 60, 90, 120, 180 degrees and vertical angles ($\phi$) of 90 degrees with respect to the incident photon beam axis[4-6]. The data shows two components having different angular dependence, angular independent low energy, and angular dependent high energy components. The angular dependence depends on neutron emission angles and the direction of photon polarization. The dependence is found to be expressed as a function of the angle between polarization and neutron emission. The degree of dependence and amount of high-energy components varies according to both incident photon energy and the mass of target nuclei.
In this talk, an overview of the experimental procedure and results will be given in comparison with that of the previous.

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