Double differential cross-section measurement of the ^{197}Au(ɤ,n) reaction for 13 MeV and 17 MeV linearly polarized photon

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Double differential cross-sections (DDXs) of the ^{197}Au(ɤ,xn) reaction for 13 MeV and 17 MeV linearly polarized photon were obtained at NewSUBARU. The dependence of the evaporation and direct components on the energy of the incident photon is discussed in this report.
Keywords: photo-nuclear reaction, polarized photon, 13 MeV, 17 MeV, gold, double differential cross-section.

1. Introduction: Neutron spectrum and angular distribution are useful to evaluate model of the photonuclear reaction. We reported target mass dependency of (ɤ,xn) reaction for 17 MeV polarized photon in previous meeting [1]. In this presentation, we study the incident photon energy dependence on DDXs of) of the ^{197}Au(ɤ,xn) reaction for 13 MeV and 17 MeV linearly polarized photon.

2. Experimental setup: Figure 1 shows experimental setup. The experiment was carried out at NewSUBARU-BL01, Hyogo-Japan. The 13 MeV and 17 MeV linearly polarized photons were generated by the collision of the polarized laser (NdYVO4 laser at 1.064 µm, 20W) and electron bunches of 850 MeV - 23 mA and 982.4 MeV - 30 mA, respectively. The cylindrical NE213 organic liquid scintillators ($12.7^{\phi}\times12.7^{L}$ cm) were set at different angles (30^0 to 150^0). The direction of the incident photon was collimated into the center of Au. The number of the incident photons were counted by the plastic scintillator, 5 mm in thickness. A cylinder pill Au target was chosen to study in this work. The target is made with a small thickness of 1 cm to decrease the self-attenuation effect. The pulse shape discrimination technique was applied to separate neutron-gamma. The neutron energy was observed using the time of flight method.

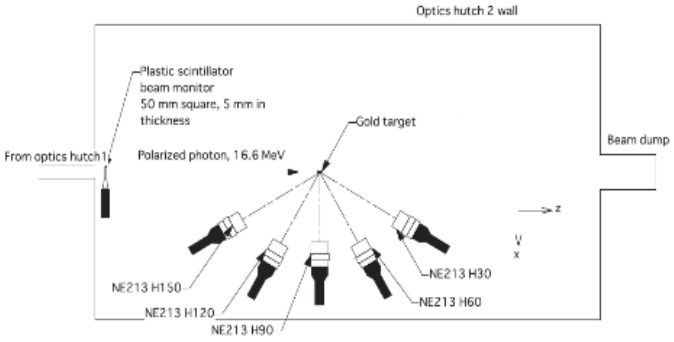

Figure 1. Drawing of the setup

3. Data analysis: The neutron spectrum was obtained by the PSD and TOF method by using the energy threshold of 0.25 MeVee. The detection efficiencies were estimated by measurement with ^{252}Cf and ScinfulQMD calculations. The DDXs were deduced from the spectrum normalized with a solid angle and number of incident photons.

4. Results: The DDX are shown in Fig.2. The black and red points are the DDX data for 17 and 13 MeV, respectively. Both of the spectra indicate evaporation and direct components. The evaporation components are similar, but the incident energies impact the direct component.

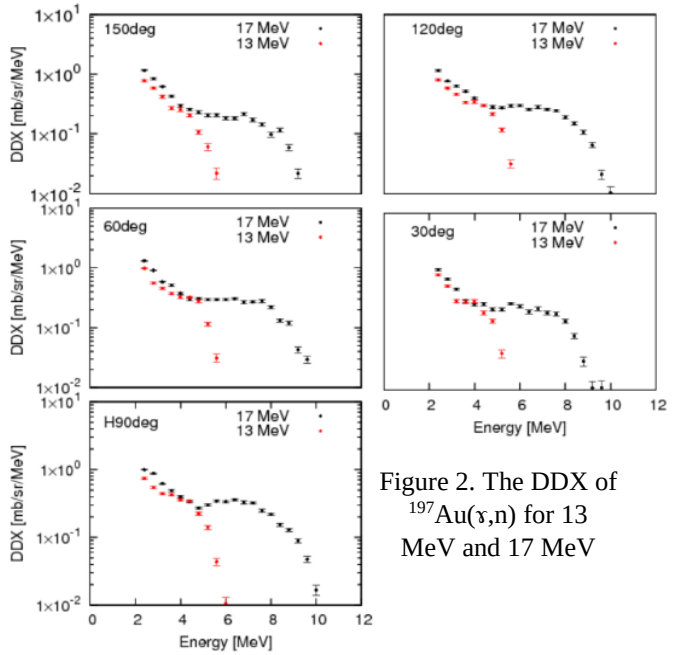

Figure 2. The DDX of ^{197}Au(ɤ,n) for 13 MeV and 17 MeV

References

[1] Tran Kim Tuyet et al., 2019 Fall Meeting of Atomic Energy Society of Japan, Sep. 11-13 2019, Toyama Univ.