Photoneutron Cross Sections for Au

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Photoneutron cross sections for Au are regarded as one of the basic data in nuclear physics cited in the classical literature [1]. The cross section was measured with γ rays produced in positron annihilation in flight (PAIF) at LLNL and Saclay [2-4]. Direct neutron counting was carried out with a neutron detector consisting of BF₃ counters embedded in a paraffin moderator at LLNL[2,4] and with a Ga-doped liquid scintillator at Saclay [3]. While the data show rather good agreement near neutron threshold, they show serious discrepancies above 10 MeV toward the peak of GDR. Photoneutron cross sections near neutron threshold also serve a standard for photoactivation measurements in the study of the p-process nucleosynthesis. The photoactivation data near threshold [5] is consistent with the direct neutron-counting data. Recently, photoactivation measurements for Au have been extended from the threshold region to the peak energy region of GDR [6]. Photoneutron cross sections for Au were previously measured with laser Compton-scattering (LCS) γ rays [7]. However, a data reduction with the photon difference method has ended up with large uncertainties.

We measured photoneutron cross sections for Au in the entire energy range of the (γ,n) channel with the LCS γ rays based on a direct neutron-counting technique with a high-efficiency neutron detector consisting of three rings of 4, 8, and 8 ³He proportional counters embedded in a polyethylene moderator. A least-squares method was employed in data deduction to provide photoneutron cross sections at thirty average energies of the LCS γ-ray beam from 8.08 MeV to 13.13 MeV. Results are compared with the past direct neutron-counting data taken with the PAIF γ rays and the photoactivation data taken with bremsstrahlung.

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