PHOTONEUTRON CROSS SECTIONS ON NICKEL ISOTOPES

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A neutron detector consisting of BF_3 counters and a 64-channel system based on the LP-4050 analyzer was used to obtain the yield curves of the photoneutron reactions for two nickel isotopes, Ni^{58} and Ni^{60}. The work was performed with the betatron of our institute.

The measurements were made in the gamma-quantum energy range from 7.5 to 33.0 MeV in steps of 0.1 MeV. The data from the analyzer were fed to the M-20 computer of the Moscow State University Computer Center, where they were reduced by a special program and the effective cross sections were obtained by the Penfold-Leiss method. The corresponding cross sections $\sigma(\gamma, Tn) = \sigma(\gamma, n) + \sigma(\gamma, np) + 2\sigma(\gamma, 2n)$ are shown in Figs. 1 and 2. The cross

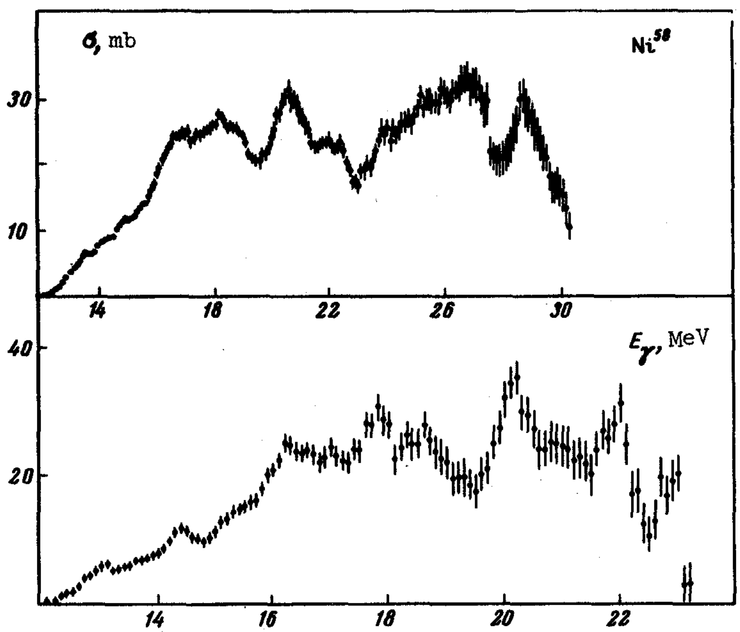

Fig. 1. Effective cross section of the reaction $Ni^{58}(\gamma, Tn)$. Upper figure - analysis in steps of 1 MeV, lower - in steps of 0.5 MeV.

sections were calculated in steps of 1 MeV up to E_γ = 30 MeV and in steps of 0.5 MeV to E_γ = 23 MeV.

The cross sections reveal a distinct structure for both isotopes, with a broad maximum having a center of gravity at 18 MeV (analysis in steps of 1 MeV), breaking up into three maxima in the 16 - 19 MeV region when the analysis is made in steps of 0.5 MeV. There is also a pronounced maximum at 20 - 23 MeV, which breaks down into two maxima when the analysis is in steps of 0.5 MeV. In addition, maxima at 14.5 and 28 - 30 MeV are distinctly resolved in both cross sections. In the 23 - 28 MeV region, the cross section curve consists apparently of a number of narrower resonances.

The integral cross sections of the (γ, Tn) reaction for Ni^{58} and Ni^{60} differ greatly from each other. Thus, σ_{int} = 38 ± 30 mb-MeV for Ni^{58} and 800 ± 50 mb for Ni^{60}. An estimate based

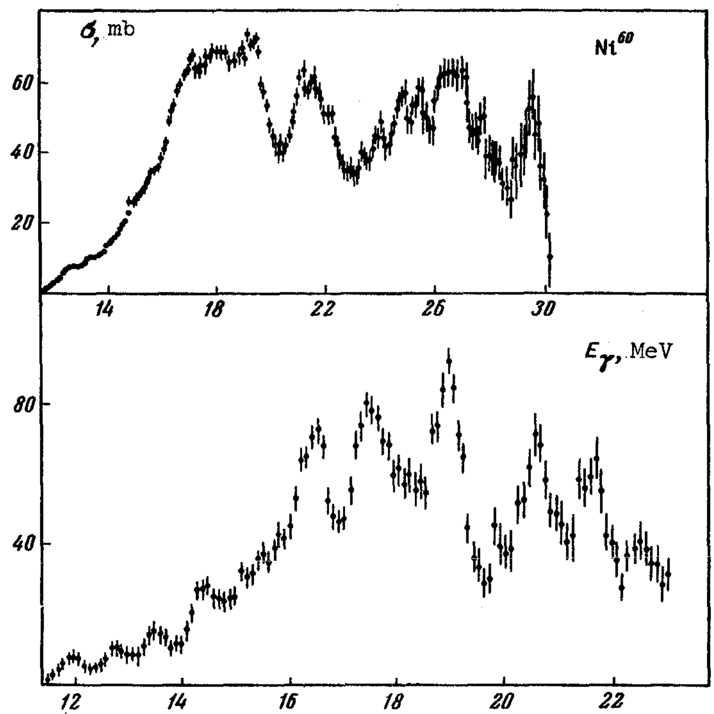

Fig. 2. Effective cross section of the reaction $Ni^{60}(\gamma, Tn)$. Upper figure - analysis in steps of 1 MeV, lower - in steps of 0.5 MeV

on the formula for the dipole sum rule σ_{dip} - 60 NZ/A mb-MeV yields for both nuclei approximately the same value ∿ 870 mb-MeV. The integral cross sections in the 23 - 30 MeV region were 180 ± 10 mb-MeV and 330 ± 17 mb-MeV, respectively.

The appreciable value of the cross section in the region $E_\gamma > 23$ MeV is due the the contribution of the $(\gamma, 2n)$ reaction. The lack of reliable information concerning this reaction for Ni^{58} and Ni^{60} makes it difficult to estimate the integral cross section of the reaction $(\gamma, n) + (\gamma, np) + (\gamma, 2n)$.

The fact that the cross sections for Ni^{58} and Ni^{60} are quite close in form indicates that an important role is played by excitation of the internal nucleons in processes involving the emission of photoneutrons from either nucleus.

There are as yet no calculations capable of adequately explaining the obtained structure.

CONCERNING THE SHUBNIKOV - DE HAAS EFFECT IN TELLURIUM

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It is known that the Shubnikov - de Haas (SH) effect makes it possible to determine the form of the Fermi surface of the carriers in a conductor. This effect was investigated in [1 - 3] at helium temperatures for the valence band of tellurium. Owing to the anisotropy of the hole effective mass, the period of the quantum oscillations in the reciprocal field