Photoneutrons from Al.

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Summary. — The energy spectra of photoneutrons emitted at 90° from Al under bremsstrahlung of 24 and 30 MeV maximum energy were investigated by means of the recoil protons in photoemulsions. The difference between the two spectra shows that above 24 MeV photon energy the neutrons are emitted mainly by a direct process. This process gives a relevant contribution (> 25%) to the photoneutron yield, at 30 MeV.

1. - Introduction.

The energy spectra of photoneutrons have been investigated for a number of elements by many authors: Cu (1); Ag (2); Bi (2); Cr (2); Ta (2); Pb (4); Au (6); Ca (6); Rh (6).

The spectra from heavy elements are in general agreement with the statistical evaporation theory with the exception of a high energy tail which generally accounts for about 10% of the total yield.

This tail is attributed to a «direct» process (Courant (7), Wilkinson (8),

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The investigation of photoneutrons from light elements is somewhat difficult because of the small ($\gamma$, n) cross-sections. However, we found it worth while to examine the behaviour of a selected number of light nuclei in order to extend the range of known photoneutron spectra.

In the present paper the Al spectrum is reported and compared with other known spectra. A short account of the present work was given at the S.I.F. Conference (10). Similar results about the Al neutron spectrum from 70 MeV bremsstrahlung were communicated by Revzen and Sargent at the Washington Photonuclear Conference (11).

2. - Experimental procedure.

The experimental procedure was described in a previous paper (3).

A 19 g aluminum target was irradiated with a collimated bremsstrahlung beam from the Brown-Boveri Betatron of Turin. Two exposures were made respectively at 24 and 30 MeV $E_{\gamma_{\text{max}}}$. The photoneutrons emitted at angles of $\theta \sim 90^\circ$ with the photon beam were detected by means of the proton recoil tracks inIlford 200 $\mu$m thick C-2 emulsions. The plates were scanned and screened as in the previous work (2). Exposure and scanning data are summarized in Table I.

<table>
<thead>
<tr>
<th>$E_{\gamma_{\text{max}}}$ (MeV)</th>
<th>24</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>($\varphi &lt; 15^\circ$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of tracks $E_n &lt; 5$ MeV</td>
<td>323</td>
<td>570</td>
</tr>
<tr>
<td>Number of tracks $E_n \geq 5$ MeV</td>
<td>63</td>
<td>136</td>
</tr>
<tr>
<td>($15^\circ &lt; \varphi &lt; 30^\circ$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of tracks $E_n &gt; 5$ MeV</td>
<td>86</td>
<td>163</td>
</tr>
</tbody>
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