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*) The equivalent form of the theory - introduction of complex phases in the expression for the weak current

$$j_W = \bar{e} O \nu + \bar{\mu} O \mu_0 e^{i\phi_1} + \bar{n} O p e^{i\phi_2} + \frac{g_{W\lambda}}{g_W} \bar{\lambda} O p e^{i\phi_3} \ldots,$$

$$\phi_3 - \phi_2 = \pi/2. \tag{2}$$

FRAGMENT ANGULAR DISTRIBUTION IN THE FISSION OF Th^{232} BY 1.6-MeV NEUTRONS

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Henkel and Brolley [1], in a study of the angular anisotropy of the fission of Th^{232} by neutrons, were in fact the first to obtain weighty evidence in favor of the hypothesis of A. Bohr [2], that the fissioning nucleus is strongly cooled in the transition state, as a result of which the fission reaction proceeds at low excitations via a small number of accessible channels. Wilets and Chase [3], analyzing the angular distribution $W(\theta)$ of the fragments, obtained in [1], established that the fission of Th^{232} by neutrons of energy $E_n = 1.6$ MeV proceeds predominantly via a band of fission channels with $K = 3/2^-$ (K = projection of total angular momentum J of the compound nucleus on the fission axis). They represented the distribution $W(\theta)$ in the form

$$W(\theta) = a_0 + \sum_{J=3/2}^{7/2} a_J W_{KJ}(\theta), \tag{1}$$

where $W_{KJ}(\theta)$ are the fragment angular distributions in fission via channels with characteristics $K = 3/2^-$ and $J > K$; the coefficients a_0 and a_J were determined by least squares. Later Strutinskii [4] and Hittmair [5] have shown that good agreement can be attained with experiments by using a more consistent calculation based on the probability of formation of a compound nucleus in the optical model. In particular, the authors of [4,5] have noted that the agreement with experiment does not become worse if the contribution of the band with $K = 1/2$ is assumed in lieu of the isotropic component in $W(\theta)$. The predominance of the states of the transition Th^{232} nucleus with $K = 1/2$ at lower values of E_n was established experimentally [6]. On the basis of measurements of the angular anisotropy $W(0°)/W(90°)$ of fragment emission, Lamphere [6] proposes the sequence $1/2^+$, $3/2^-$, and $1/2^-$ for the fission channel bands K^π that are possible in the $Th^{232}(n, f)$ reaction.

To obtain more detailed information for the channel analysis of the $Th^{232}(n, f)$ reaction, we have undertaken a detailed investigation of the energy dependence of $W(\theta)$ in the vicinity of the fission threshold. The published literature contains only the data discussed above concerning the angular distribution of the fission fragments at $E_n = 1.6$ MeV, which by now have become the classical demonstrations of the effects of the quantum structure of the states of a transition nucleus. We present here the results of more accurate and detailed measurements of $W(\theta)$ for just this neutron energy ($E_n = 1.60 \pm 0.02$ MeV).

$W(\theta)$ was measured with an electrostatic generator by registering the fission fragments in glass [7]. A double layer of ThO_2 of thickness ~1 g/cm^2 was used. The arrangement of the fragment detectors on both sides of a target made of fissioning matter has made possible simultaneous registration of the fragments in twenty intervals of the angle θ, from 0 to 180°, with a resolution $[(\theta - \bar{\theta})^2]^{1/2} \simeq 4°$. The procedure of such measurements was described in detail in [8].

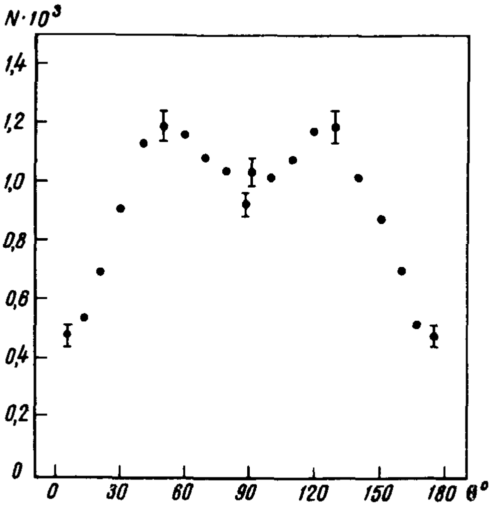

Fig. 1. Number of counts as a function of the effective angle θ.

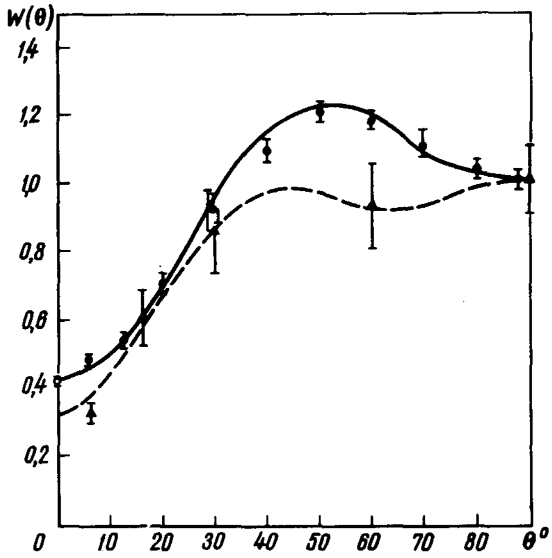

Fig. 2. $W(\theta)$ obtained in this work (●), in [1] (▲), and in [6] (o). The dahsed curve shows the results of Hittmair's calculations under the assumption $K = 3/2^-$. The solid curve shows the distribution (3).

The results of the experiment are shown in Fig. 1. The measured distribution is symmetrical about $\theta = 90°$, as can be seen from the good agreement between counts made at angles θ and $180° - \theta$. Figure 2 shows a comparison of the results of [1], [6], and the present experiment. Our data differ markedly from the distribution obtained by Henkel and Brolley near 10 and 60°, but agree with the anisotropy determined by Lamphere. From the appearance of the curves in Fig. 3 it follows that the observed disparity in the experimental data is quite appreciable from the point of view of identifying the characteristics K^π of the predominant fission channels. Figure 3 shows the distributions

$$W_{K\pi}(\theta) \sum_{J=3/2}^{7/2} (2J + 1) T_c^J W_{KJ}(\theta) \qquad (2)$$

for two values of K^π, $3/2^-$ and $3/2^+$, and for three variants of calculation of the adhesion coefficients T_c^J in the optical model, as given by Bjorkland and Fernbach, Perey and Buck, and Auerbach and Moore [10]. The noticeable discrepancy of the experimental data on Fig. 3 characterizes the interminacy of the channel analysis, due to the inaccurate knowledge of the compound-nucleus production probabilities, $\sim(2J + 1)T_c^J$. Nonetheless, comparing the data of Figs. 2 and 3, we can readily conclude qualitatively that the character of the distribution $W_{3/2^+}(\theta)$ agrees much better with the results of the present experiment. At the same time, an analysis of the data of [1] enabled Hittmair [5] to choose with assurance the band with $K = 3/2^-$ over that with $K = 3/2^+$. The opposing conclusions of our work and of [5] are due not only to the noticeable differences between the initial experimental data, but also the difference in the employed adhesion coefficients. Hittmair used the less accurate black-nucleus model [11] for the calculation of T_c^J.

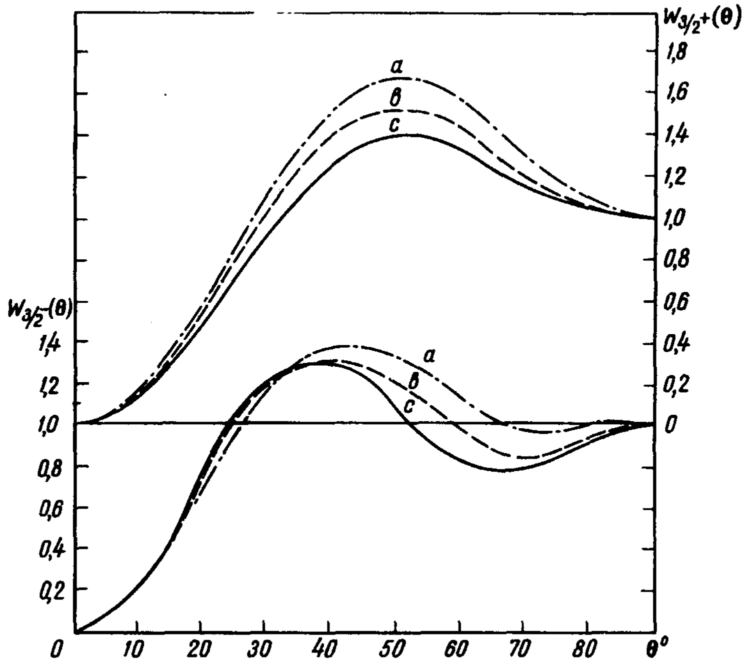

Fig. 3. Distributions $W_{3/2^+}(\theta)$ and $W_{3/2^-}(\theta)$ calculated from formula (2) (see the text).

The solid curve of Fig. 2 shows the angular distribution

$$W(\theta) = 0{,}42 + 0{,}58\, W_{3/2^+}(\theta), \qquad (3)$$

in which curve (c) of Fig. 3 is used for $W_{3/2^+}(\theta)$. It must be noted here that out of the three used sets of T_c^J, preference should be given to the results of calculations with the parameters of Auerbach and Moore [10]. In [10] the parameters of the interaction potential were chosen such as to ensure the best fit of the angular distributions and the excitation functions of the individual levels in the $Th^{232}(n, n')$ reaction up to E_n = 1 MeV. When the component with K = 1/2 is introduced in W(θ) in lieu of the isotropic component, the agreement with experiment becomes much worse. Further investigations of W(θ) in a sufficiently broad region of E_n should help clarify whether this fact is a consequence of the inaccuracy of the employed adhesion coefficients, the use of a larger number of channels K^π, or, finally, the competition of the process (n, n') with the fission via states with different J. The last effect is ignored in relation (2) and also in all the preceding analyses of W(θ) of Th^{232} [3,5].

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ERRATA

In the article "New Resonance Connected with Mutual Dragging of Electrons and Phonons" by F. G. Bass (Vol. 3, No. 9, p. 233) the factor in formula (9) should be 4/3 and not 16/3, and consequently the factors in (10) and (11) should be 3/4 and not 3/16. In the estimate preceding Eq. (12) it is likewise necessary to replace 16/3 by 4/3.

In the article "Singularities of the Faraday Effect in n-InSb in the Millimeter Band" by V. M. Afinogenov et al. (Vol 4, No. 11, p. 300), add to the unnumbered equation following Eq. (1) the definition $s = 1/\omega\tau$. On p. 301, line 3 from the top replace $n = 5.69 \times 10^{13}$ cm^{-3} with $n = 5.69 \times 10^{12}$ cm^{-3}. The curves of Fig. 2 on p. 302 should be numbered I, II, and III reading from top to bottom.