LEFT-RIGHT ASYMMETRY OF LIGHT FRAGMENT EMISSION IN ^{239}Pu FISSION BY TRANSVERSALLY POLARIZED NEUTRONS WITH ENERGIES $0.03 \leqslant E_n \leqslant 8$ eV

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The appearance of odd spherical harmonics in the angular distributions of slow neutron fission fragments can be the result of space parity violation or of s- and p-wave interference in neutron capture. The corresponding asymmetry coefficients are functions of the weak interaction matrix elements (P-odd effects), neutron and fission width amplitudes and have the characteristic dependences on neutron energies especially in the vicinities of p-resonances.

Thus a new way to study fission characteristics and the properties of compound levels in heavy excited fissioning nuclei is evident.

In this work the P-even left-right asymmetry of a fission fragment emission has been measured in ^{239}Pu fission by transversally polarized neutrons with various energies.

The results of this investigation together with the results of P-odd asymmetry coefficient measurements /1/ are shown in fig. In the investigated energy range the fission cross section of ^{239}Pu is determined mainly by the contribution of three s-resonances: $E_1 = -0.576$ eV ($I^\pi = 0^+$), $E_2 = 0.297$ eV ($I^\pi = 1^+$) and $E_3 = 7.82$ eV ($I^\pi = 1^+$). The numbers and the main parameters of the admixed p-resonances are unknown.

If we suppose that the P-odd and P-even effects observed in the experiment can be described in the framework of the simplest two level approximation with the same p-resonance parameters, one can get /2/:

$$\alpha^{observed} = \alpha(0.297\ eV;\ I^\pi = I^+)\ \frac{\sigma_f(0.297\ eV)}{\sum_i \sigma_{fi}}, \quad \begin{matrix} \alpha_{nf}(0.297\ eV) = Const. \\ \alpha_{nf}(-0.576\ eV) = 0 \end{matrix},$$

$$\alpha_{nf}^{LR} = \sqrt{\frac{\Gamma_p^f \times \Gamma_p^n}{\Gamma_s^f \times \Gamma_s^n}} \times Im \left\{ \frac{(E - E_s) + i\Gamma_s/2}{(E - E_p) + i\Gamma_p/2} \cdot exp(-i(\varphi_p - \varphi_s)) \right\}. \qquad (1)$$

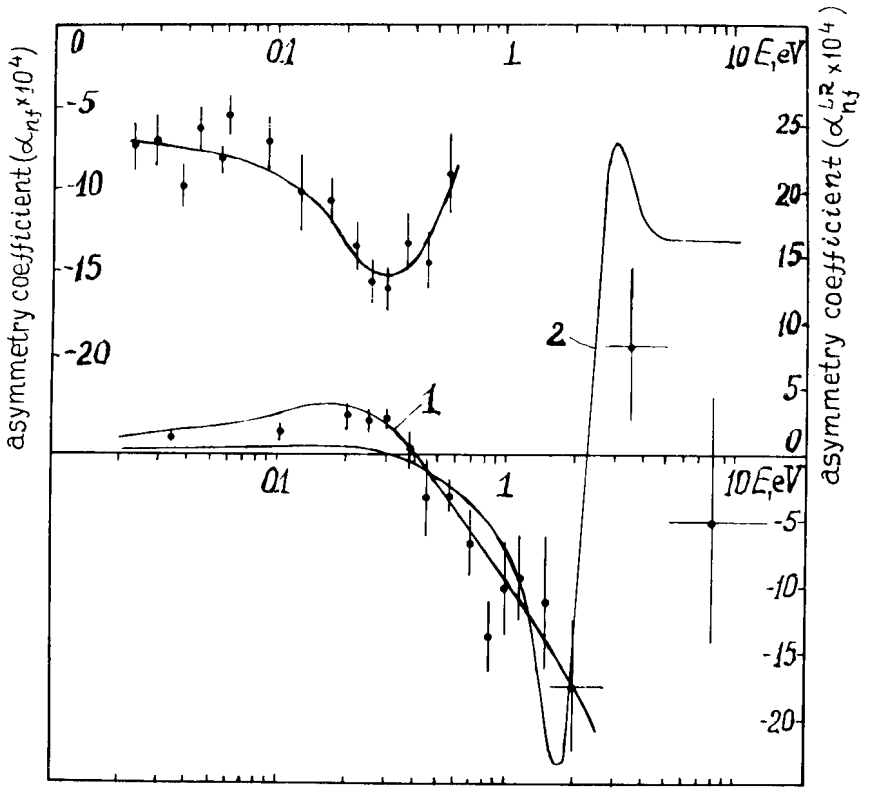

Fig. Energy dependence of P-odd (top) and P-even left-right (bottom) asymmetry coefficients in ^{239}Pu fission. Solid curves are results of theoretical equation (1) fitting to experimental points (for other details see text)

The best fit for the α_{nf}^{LR}-coefficient has been obtained with p-resonance parameters: $E_p = -(2.4 \pm \pm 1.8)$ eV, $\Gamma_p = 0.2$ eV, $\varphi_p - \varphi_s = (2.7 \pm 0.1)$ rad. With these parameters the following estimation for the weak interaction matrix element can be obtained:

$$V \sim 1.4\ 10^{-3}\ eV\ .$$

The attempt to describe the experimental results supposing the existence of p-resonance in the energy range of $0 < E_n < 8$ eV has not been successful (curve 2 in fig.).

It is important to point out that the ^{239}Pu fission case is especially convenient for comparison with the theory because of its relatively low value of level density as compared with other fissioning heavy nuclei.

REFERENCES

1. *Alexandrovich A. Ya., Valskii G. V. et al.* Sov. Nucl. Phys., 1987. V. 45. P. 124.
2. *Sushkov O. P., Flambaum V. V.* Sov. Usp. Fiz. Nauk., 1982. V. 126.P. 4.