acter of the angular distribution of the components of the transitions ±1/2 (3/2) → ±1/2 (1/2) [3]. In an external magnetic field there is observed a clear-cut increase of the splitting of the components of the Mossbauer spectra. Consequently, the internal magnetic field at the tin nuclei coincides in direction with the applied external field. Since, as already mentioned, the ferrite is completely polarized in an external field of 15 kOe, the larger of the magnetic moments of its two sublattices - the moment of the tetrahedral sublattice - is oriented parallel to the applied field, and the smaller moment, that of the octahedral sublattice, antiparallel. The ferrimagnetic ordering, i.e., the antiparallel alignment of the moments of the two sublattices, is conserved in this case, since the molecular Weiss field in ferrites amounts to hundreds of kOe and is many times larger than the external applied field. Since the internal magnetic field at the iron nuclei is always negative relative to the magnetic moment of its ion [3,4], we can conclude that the fields of the nuclei, both tin and iron, situated in the same (octahedral) sublattice of the yttrium iron garnet, have the same sign. We shall consider in the future several possible explanations of this fact.

In conclusion, we are deeply grateful to Yu. S. Sherbinin for making possible the operation of the apparatus, and Yu. B. Baidarovtsev for supplying the magnet.

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CALCULATION OF THE DIRECT REACTION $C^{12}(n,n')C^{12*}(2+)$ BY THE DISPERSION METHOD

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In describing direct nuclear reactions, the effects of virtual scattering of the initial and final particles are apparently essential in many cases. Allowance for these effects can be made within the framework of the dispersion method [1,2]. The amplitude of the reaction is expressed in this case in terms of an amplitude that describes the mechanism of the process without account of the virtual-scattering effects, and in terms of the scattering phases of the initial and final particles.

We present in this note the results of a calculation, by the dispersion method, of the anglular distribution of inelastically scattered neutrons in the reaction $C^{12}(n,n')C^{12*}(2+)$ (E_n = 14 MeV), with allowance for the interaction in the initial and final states, i.e., the sought reaction amplitude is expressed in terms of the amplitude without allowance for the effects of virtual scattering and of the scattering phase in the physical region.

As the initial approximation describing the mechanism of the process we consider the

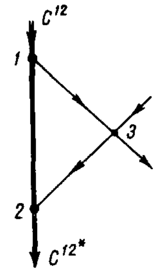

Fig. 1

amplitude corresponding to the triangular knock-on diagram (Fig. 1). Such a diagram has a singularity in the momentum transfer at $q_0^2 = 2.9\ F^{-2}$ if the vertex 1 corresponds to the virtual decay $C^{12} \to B^{11} + p$. If a C^{11} nucleus is present in the intermediate state, then the triangular singularity is located farther ($q_0^2 = 3.6\ F^{-2}$). If we substitute the Butler form factors in the vertices 1 and 2, the dependence of the vertex parts on the momentum transfer q^2 will be determined by the quantity $1/R_0$ ($R_0 = 3.5$ F is the cutoff radius in the Butler form factors). Since $q_0^2 \gg (1/R_0)^2 = 0.08\ F^{-2}$, we can neglect at small momentum transfers the dependence of the amplitude under consideration on the momentum transfer, connected with the triangular singularity, compared with the corresponding dependence of the vertex parts. In this approximation the initial amplitude with constant vertex part 3 can be written in the form

$$B(q^2) = Nj_2(qR_0). \tag{1}$$

Here $j_2(qR_0)$ is a spherical Bessel function, $q^2 = (\vec{k}_2 - \vec{k}_1)^2$, $\hbar\vec{k}_1$ and $\hbar\vec{k}_2$ are the c.m.s. momenta of the incident and emitted neutrons, and N is a spectroscopic factor containing the reduced vertex parts for vertices 1 and 2.

Allowance for the interaction in the intial and final states reduces to the Omnes-Muskhelishvili equation for the partial amplitudes. The solution of this equation is [1,2]:

$$M_{\ell_2\ell_1}(E) = B_{\ell_2\ell_1}(E) + [\pi F_{\ell_1}(k_1)F_{\ell_2}(k_2)]^{-1}$$

$$\times \left\{\int_0^{\infty} \frac{dE'}{E' - E - i\epsilon}\,[B_{\ell_2\ell_1}(E')\exp[i(\delta^*_{\ell_2} + \delta_{\ell_1})]\sin(\delta^*_{\ell_2} + \delta_{\ell_1})]F_{\ell_1}(k_1')F_{\ell_2}(k_2') \right. \tag{2}$$

$$\left. + \int_{-Q}^{0} \frac{dE'}{E' - E - i\epsilon}\,B_{\ell_2\ell_1}(E')\exp(i\delta_{\ell_1})\sin\delta_{\ell_1}F_{\ell_1}(k_1')F_{\ell_2}(k_2')\right\}$$

$\epsilon \to +0.$

Here E is the c.m.s. kinetic energy of the emitted neutron, Q = 4.43 MeV the excitation energy of the final nucleus, ℓ_1 and ℓ_2 the relative orbital angular momenta of the initial and final particles, and $F_\ell(k)$ the Jost function. The partial amplitude $B_{\ell_1\ell_2}(E)$ corresponding to the initial amplitude (1) is

$$B_{\ell_2\ell_1}(E) = (-1)^{\frac{\ell_1 + \ell_2}{2}}(2\ell_1 + 1)(2\ell_2 + 1)j_{\ell_1}(k_1R_0)j_{\ell_2}(k_2R_0)/k_1^{\ell_1}k_2^{\ell_2}. \tag{3}$$

The kinematic factor $k_1^{\ell_1}k_2^{\ell_2}$ has been separated in order for the partial amplitude $B_{\ell_2\ell_1}(E)$ not to have a discontinuity on the right-hand cut. To determine the scattering phase shifts we took a potential in the form of a square well with parameters V = 42 MeV and R = 3.2 F. The differential cross section is connected with the partial amplitudes by the relation

$$\frac{d\sigma_L(\theta)}{d\Omega} = \text{const} \sum_{l_1 l_2 l_1' l_2' j} C^{Lo}_{l_1 o l_2 o}\, C^{Lo}_{l_1' o l_2' o}\, C^{jo}_{l_1 o l_1' o}\, C^{jo}_{l_2 o l_2' o}\, W(l_1 l_2 l_1' l_2'; Lj)$$

$$\times\ k^{(l_1 + l_1')}\, k^{(l_2 + l_2')}\, M_{l_2 l_1}(E)\, M^{*}_{l_2' l_1'}(E)\, P_j(\cos\theta); \quad L = 2. \qquad (4)$$

The results of the numerical calculation with formulas (2) - (4) are compared in Fig. 2 (continuous curve) with the experimental data of Bouchez et al. [3]. For comparison, the dashed curve shows the results of Glendenning's calculations [4] by the distorted-wave method (DWM) with surface interaction, which also starts out with an amplitude corresponding to a triangular diagram and expressed in form (1). To take into account the virtual scattering, the DWM uses for the scattering a potential model, in which allowance is made for the singularities of the sought amplitude; these singularities are connected with the unphysical singularities of the scattering amplitude and are dependent in essential fashion on the choice of the model for the scattering. Both curves, normalized to the experimental points at small angles, practically coincide over a wide range of angles. The dash-dot curve corresponds to the angular distribution for the amplitude (1). The results show that in the case in question the amplitude with allowance for the virtual-scattering effects can be expressed in terms of the initial amplitude and the scattering phases in the physical region without using a model for the scattering. On the other hand, the results do not exclude the possibility of explaining the experimental data at small angles by considering diagrams that do not take into account the virtual scattering and whose amplitudes differ from zero at $\theta = 0$.

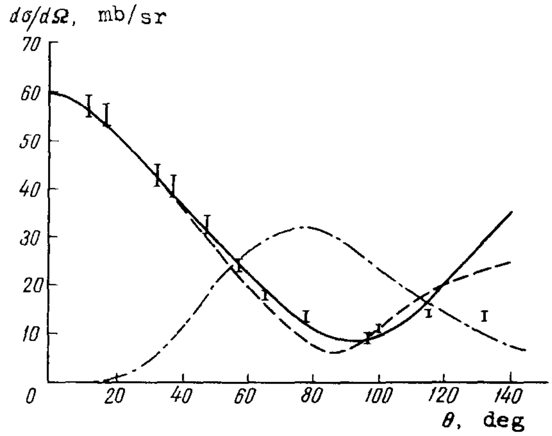

Fig. 2

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