$$K(x, y) = n^2 + G_c(y, x)\, G_c(x, y)$$
$$= n^2 + \frac{1}{(2\pi)^6}\int dk\,dk' \exp\left\{ i(\mathbf{k}-\mathbf{k}', \mathbf{x}-\mathbf{y}) - i\left(\frac{k^2}{2m} - \frac{k'^2}{2m}\right)(x_0 - y_0)\right\}$$
$$\times\, \theta\left(\frac{k^2}{2m} - W_F\right)\theta\left(-\frac{k'^2}{2m} + W_F\right). \qquad (13)$$

A spectral representation analogous to (7) and (12) is easily derived for all other Green's functions.

We wish to express our great thanks to N. N. Bogoliubov for discussion of this work and for valuable advice.

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Concerning the Existence of a Transition Layer on a Liquid Surface

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IN connection with the recent appearance of some work of Sivukhin,[1] we present several results of our investigations.

The black dots in Figs. 1 and 2 show our values for the ellipticity ρ of reflected light for four wavelengths and for a few homogeneous nonabsorbing liquids, for light incident at Brewster's angle. Figure 3 shows the dependence of the phase difference between the components of the reflected light on the angle of incidence φ for o-xylol at $\lambda = 5460$ A.

The general method is described in an earlier work,[2] and the experimental details, elsewhere.[3] Various methods of calculation, based on the assumption that there exists a transition layer on the surface, with no other hypotheses and without making any special assumptions as to the molecular structure of the layer, lead to the expressions[1,2]

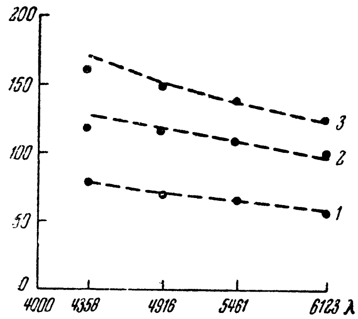

FIG. 1. The dependence of ellipticity on wavelength: *1*—ethylene glycol, *2*—*m*—xylol, *3*—CCl_4.

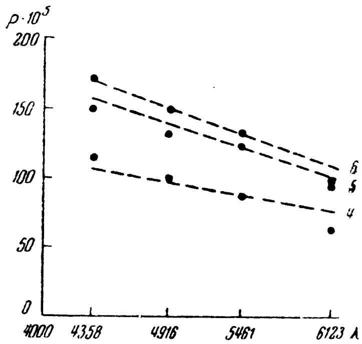

FIG. 2. The dependence of the ellipticity on wavelength for nitro benzene: *5*—cyclohexanol, *6*—chlorobenzene.

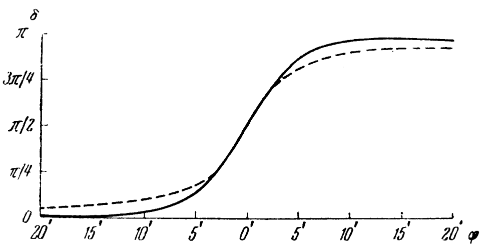

FIG. 3. The dependence of the phase difference between the components of the reflected light on the angle of incidence (Brewster's angle is taken as zero).

$$\rho = (\pi/\lambda)\sqrt{n^2+1}\,(\gamma_z - \gamma_x), \qquad (1)$$

$$\operatorname{tg}\delta = 4(\pi/\lambda)(\gamma_z - \gamma_x) \qquad (2)$$
$$\cos\varphi \sin^2\varphi/(\sin^2\varphi - \cos^2\psi),$$

where n is the index of refraction in the region, ψ is the angle of refraction, and $(\gamma_z - \gamma_x)$ is a parameter, effectively independent of λ, which characterizes the properties of the layer. The values of n were determined for the given compounds.

The parameter $(\gamma_z - \gamma_x)$ was determined according to Eq. (1) from the results of very many and very accurate measurements at $\lambda = 5460$ A, and this value was used in calculations for other values of λ. The results of the calculations according to Eqs. (1) and (2) are shown by dotted lines. The measurements of δ for other wavelengths are somewhat less accurate as a result of great experimental difficulties. As can be seen, the experiment agrees sufficiently well with theory. It should be noted that measurements in the neighborhood of 0 and π are somewhat less accurate.

The existence of a transition layer on the surface seems unquestionable; this idea has been accepted in physics and physical chemistry for a relatively long time, and as far as we know has met up with no particular objections. The core of the problem, it seems to us, is in establishing a molecular mechanism for the creation of such a layer.

Measurements have been performed in which the liquid being investigated has been carefully purified by chemical methods, multiple distillation and recrystallization, and further distillation in evacuated ampoules by Martin's method. This guaranteed the absence of impurities in the liquid and on its surface or of chemical reactions on the latter. The ellipticities obtained in this way differ from those measured with the proper precautions for an uncovered surface by a negligible amount — from 5 to 10 per cent. This shows that the existence of a surface layer is not caused by impurities, but by the surface structure.

We have obtained several data establishing the connection of the ellipticity and its temperature dependence with parameters that characterize the liquid and its structure, the course of the crystallization process, etc.; all this also supports the above assumption. Details of these measurements will be published separately.

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A Theorem on the Equality of the Cross Sections for Photoproduction of Charged π-Mesons on Nuclei with Isotopic Spin Zero

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THE interaction Hamiltonian H_{int} of nucleons and π-mesons with the electromagnetic field can be represented as the sum of a scalar S and the third component of a vector V_3 with respect to the group of rotations in isotopic spin space:[1]

$$H_{int} = S + V_3; \quad S = -\frac{ie}{2}\sum_{\nu} \mathbf{v}^{\nu}\mathbf{A}(x_{\nu}); \qquad (1)$$

$$V_3 = ie\left[\sum_{\nu} T_3^{\nu}\mathbf{v}^{\nu}\mathbf{A}(x_{\nu}) + \sum_{\mu} T_3^{\mu}\mathbf{v}^{\mu}\mathbf{A}(x_{\mu})\right].$$

Here $\mathbf{v}^{\nu}$ is the velocity operator, T_3^{ν} is the projection operator for the isotopic spin of the νth nucleon; v^{μ}, T_3^{μ} are the same quantities for the μth meson.

From (1) we obtain[1] the conservation law for the projection of the isotopic spin of the system of nucleons and π-mesons on the 3-axis (charge conservation law) and the following selection rules for the total isotopic spin T of the system

$$\Delta T = 0, \pm 1. \qquad (2)$$

We note that the matrix elements of the operators which correspond to transitions in which the number of nucleons is conserved are invariant under the group P_n of permutations only of the isotopic spin variables of the nucleons. Therefore the matrix element of an operator differs from zero when its direct (Kronecker) product with the representation of the group P_n (according to which the wave functions of the initial and final states transform) contains the unit representation.

We shall show that for photoproduction of charged mesons on nuclei with isotopic spin