Differentiating (5) (with $\Gamma_{\lambda s}/k = \text{const}$) and comparing with (4), we get (1) and the estimates of accuracy given above. The latter are unchanged if we include the contribution of p neutrons to the scattering and capture.

For $E < 10$ keV and $|E - E_0| > 10\Gamma$, relation (1) is accurate to better than 1%, if interference of resonances is completely absent in the radiative capture. The interference terms can give a relative contribution of $\sim 1/\sqrt{N}$ to (4), where N is the number of channels for radiative capture. For $N = 100$, the error in (1) can therefore amount to $\sim 10\%$.

Relation (1) can be used to determine radiation widths and capture cross sections from measurements of total cross sections of even-even nuclei. In some cases using (1) may give valuable information for odd nuclei also. Thus, it has been applied to get the radiative widths of Cl^{35} and Sc^{45}.

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MAGNETIZATION OF A FERROMAGNETIC METAL BY THE MAGNETIC FIELD OF LIGHT WAVES

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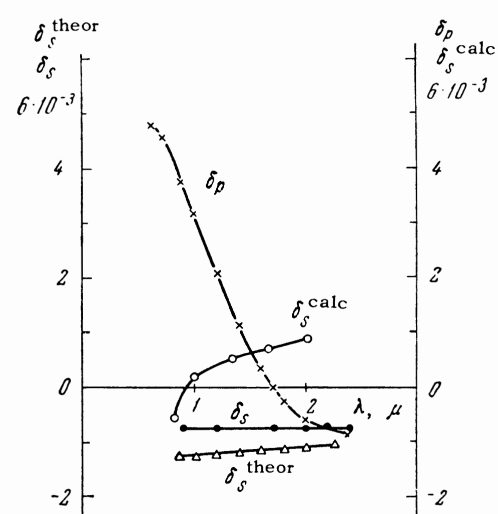
It has been shown[1] that to measure the permeability of a ferromagnet at optical frequencies we can use the equatorial Kerr effect $\delta = \Delta J/J_0$, where ΔJ is the change in the intensity of the reflected light due to the magnetization of the ferromagnet. The magnitude of this effect, δ_s, for the s-wave of linearly polarized light (the magnetic vector of the light wave perpendicular to the magnetization vector of the sample) is determined by the nondiagonal component of the permeability tensor, and for the p-wave (δ_p) it is determined by the nondiagonal component of the permittivity tensor. From previous measurements, it follows that for pure ferromagnetic metals δ_s is at least two orders of magnitude smaller than δ_p, i.e., $\delta_s \lesssim 10^{-5}$.

The construction of the experimental apparatus to record the reflected-light intensity changes $\Delta J/J_0$ of the order of 10^{-5}–10^{-6},[2] made it possible to measure directly the gyromagnetic Kerr effect δ_s and to determine the permeability of iron in the wavelength region 0.9–2.4 μ. The iron sample was made in the form of a thin-walled toroid (60 mm in diameter and having a cross section of 0.5 × 24 mm) in order to reduce induction. The working part of the toroid surface, measuring 24 × 30 mm and free of the magnetizing winding, was first polished mechanically and then annealed in vacuum at 1100° C for 6 hours and then polished electrolytically.

The results of measurements for the s- and p-components of linearly polarized light are shown in the figure. The values of the gyromagnetic Kerr effect were approximately 100 times smaller than those of the gyroelectric Kerr effect. The negative sign of δ_s was determined as follows: with the polarizer oriented for the s-component in the region where $\delta_p > 0$, the total effect could be reduced to zero by rotating the polarizer to the left or right by some angle; the value of this angle decreased



Equatorial Kerr effect in iron for $\varphi = 45°$: δ_p is the gyroelectric effect, δ_s is the gyromagnetic effect, δ_s^{theor} is the gyromagnetic effect calculated using Eq. (1), δ_s^{calc} is the gyromagnetic effect according to [4].

as δ_p increased. The figure also shows the theoretical curve δ_s^{theor}, calculated from the formula

$$\delta_s^{theor} = -\sin 2\varphi \frac{8\pi\gamma\varepsilon_2}{(1-\varepsilon_1)^2+\varepsilon_2^2}\frac{I}{\omega}, \qquad (1)$$

obtained from the formulas quoted in [1] for the following value of the nondiagonal component of the permeability tensor [3]

$$M_1' = 4\pi\gamma I / \omega$$

$$(\gamma = e/mc, \quad \omega \gg \omega_{res}, \quad \mu_1 = 1, \quad \mu_2 = 0).$$

From the cited data, it is evident that the experimental values of δ_s agree well in magnitude and sign with the theory of the Landau–Lifshitz ferromagnetic resonance even in the optical range of frequencies, where the nondiagonal component of the permeability tensor of iron varies within the limits $(1-3) \times 10^{-4}$ in the wavelength range 0.9–2.4 μ. It should be noted that the systematically lower experimental values compared with theory are obviously due to the fact that during the measurements the sample failed to reach saturation by 10-20% (this also reduced the gyroelectric effect δ_p).

In conclusion, we note that the results of our measurements contradict the recently published conclusion[4] that the permeability of pure ferromagnetic metals plays the same role in magnetooptics as the permittivity. The figure gives a curve δ_s^{calc}, calculated from values of M_1' obtained in [4]. The calculated values of δ_s are larger by about two orders of magnitude than the experimental values and have a wrong sign in the $\lambda > 0.9\,\mu$ region. The authors of that work[4] determined the permeability of ferromagnetic metals M_1' indirectly on the assumption that the difference between the magnetooptical characteristics obtained from the Faraday effect and from the polar Kerr effect is associated with the large values of the components of the tensor μ in the optical region. Our direct measurements of the gyromagnetic Kerr effect did not confirm this assumption.

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A NEW PHOTOPIEZOELECTRIC EFFECT IN SEMICONDUCTORS

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In an investigation of the influence of unidirectional pressure on the anisotropic properties of germanium single crystals, we discovered an effect which, to the best of our knowledge, is new. We describe below the tests which illustrate the essence of this new effect, which we shall call the photopiezoelectric effect (PPE).

A single crystal of n-type germanium was cut in the form of a rectangular parallelepiped measuring 2×2×10 mm. Copper electrodes were soldered along the sample perimeter about one millimeter from each of the ends. The sample was placed in a special press in which it could be compressed along its length. The sample was illuminated from one side with a weakly convergent beam of light. A normal 500W incandescent lamp with a nominal working voltage of 110 V, connected to an ac supply of 60 V, was used at the source of light. It was found that the application of pressure to an illuminated sample gave rise to a potential difference between the electrodes, which could easily be recorded with a galvanometer. This was the PPE.

In an unilluminated sample, the application of a mechanical force produced, as expected, no electrical effects. Illumination of a sample which was not under load also produced practially no potential difference between the electrodes. In these tests, special measures were taken to screen the electrodes from direct or scattered light in order to avoid all contact photoelectric effects. Only the middle part of the sample was illuminated, the length of this section being approximately 0.7 of the total sample length. The figure shows the dependence of the PPE potential difference V on the pressure (stress) P; this in-