reduction in unit cell dimensions. The maximum reduction in volume of the unit cell was ~ 0.8% of the cell volume of the 48.3 wt % Pt alloy, obtained with an alloy containing 45 wt % Pt, quenched from 950° C (~ 200° above the liquidus line).

The difference in superconducting properties of various alloys prepared from bismuth and platinum and corresponding to the composition BiPt or close to it, is most likely due to the formation of a defect structure based on the BiPt structure. This is probably produced because of the high rate of cooling the liquid alloy, when on crystallizing into the NiAs structure all the vacant sites are not occupied by bismuth or platinum atoms. The defect structure is apparently formed with platinum deficiency. The decrease in unit cell dimensions leads to a reduction in the minimum bismuth-bismuth interatomic distance, which produces a change in T_c. This agrees well with the previously noted[7] increase in T_c with decreasing minimum bismuth-bismuth interatomic distance in superconducting bismuth compounds with the AsNi structure.

We are grateful to Professors G. S. Zhdanov and N. E. Alekseevskiĭ for discussion of the results.

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Translated by R. Berman
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ON THE MAGNETO-ELECTRICAL EFFECT IN ANTIFERROMAGNETS

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Submitted to JETP editor June 17, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) **37**, 881-882 (September, 1959)

LANDAU and Lifshitz[1] have shown that there may occur in some antiferromagnetic crystals a peculiar phenomenon, namely that if a crystal is placed in a constant magnetic (or electric) field, an electric (or magnetic) moment proportional to the field is produced in the crystal.

This phenomenon, which can naturally be called the magnetoelectric effect, is intimately connected with the magnetic symmetry of the substance. Indeed, the thermodynamic potential of such a solid must contain terms proportional to the product of the first powers of the electrical and magnetic field components ($\Phi \sim EH$). It is at once clear that this is impossible in a paramagnetic crystal, since its thermodynamic potential is invariant with respect to a change in the time direction ($t \rightarrow -t$, R-transformation) in which, as is well known, the magnetic field changes sign while the electrical field does not. The position is, however, essentially altered for substances which have a magnetic structure. The magnetic-symmetry group of such solids may either not contain the R-transformation at all, or may contain it only in the form of a combination with other symmetry elements, so that the appearance of terms proportional to EH in the thermodynamic potential turns out to be possible.

We should like to show here that among the well-known antiferromagnetic substances there is one, namely Cr_2O_3, where the magneto-electric effect should occur from symmetry considerations. The magnetic structure of Cr_2O_3 is well known from the neutron-diffraction studies of Brockhouse[2] and the susceptibility data (McGuire et al.[3]). It is easy to verify that the magnetic symmetry class of Cr_2O_3 consists of the following elements:

$$2C_3,\quad 3U_2,\quad IR,\quad 2S_6R,\quad 3\sigma_dR,$$

where C_3 is vertical axis of symmetry of third order, U_2 a horizontal symmetry axis of second order, I an inversion, S_6 a mirror axis of the sixth order, and σ_d a plane of symmetry.

The transformations of this class are invariants of two expressions linear in **E** and **H**: E_zH_z (the z axis is along the crystal axis) and $E_xH_x + E_yH_y$. The thermodynamic potential of Cr_2O_3 has therefore as a function of **E** and **H** the form

$$\Phi = -\frac{1}{8\pi}[\varepsilon_{\parallel}E_z^2 + \varepsilon_{\perp}(E_x^2 + E_y^2)]$$
$$-\frac{1}{8\pi}[\mu_{\parallel}H_z^2 + \mu_{\perp}(H_x^2 + H_y^2)]$$
$$-\frac{1}{4\pi}\alpha_{\parallel}E_zH_z - \frac{1}{4\pi}\alpha_{\perp}(E_xH_x + E_yH_y),$$

where $\epsilon_{\parallel}$ and $\epsilon_{\perp}$ are the longitudinal and perpendicular dielectric constants, $\mu_{\parallel}$ and $\mu_{\perp}$ the magnetic susceptibilities, and $\alpha_{\parallel}$ and $\alpha_{\perp}$ constants describing the magneto-electrical effect. Using the thermodynamic relations $4\pi\partial\Phi/\partial\mathbf{E} = -\mathbf{D}$ and $4\pi\partial\Phi/\partial\mathbf{H} = -\mathbf{B}$ we get the relations between the inductions and the field strengths:

$$D_z = \varepsilon_{\parallel}E_z + \alpha_{\parallel}H_z, \quad D_x = \varepsilon_{\perp}E_x + \alpha_{\perp}H_x,$$
$$D_y = \varepsilon_{\perp}E_y + \alpha_{\perp}H_y; \quad B_z = \mu_{\parallel}H_z + \alpha_{\parallel}E_z,$$
$$B_x = \mu_{\perp}H_x + \alpha_{\perp}E_x, \quad B_y = \mu_{\perp}H_y + \alpha_{\perp}E_y.$$

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Translated by D. ter Haar
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NUCLEAR MOMENTS OF THE ODD ISOTOPES OF GADOLINIUM

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Submitted to JETP editor June 19, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) **37**, 882-884 (September, 1959)

THE hyperfine structure of three lines of Gd I: 5015 A (z″G$_9$—a″F$_8$), 5103 A (z″G$_8$—a″F$_7$) and 5251 A (z″G$_8$—a″F$_8$) was investigated by means of a photoelectric spectrometer with a Fabry-Pérot interferometer.[1] The work was carried out using separated gadolinium isotopes of a high degree of enrichment (Gd^{155}—97.3%, Gd^{157}—91.4%). In agreement with paramagnetic measurements[2] it was shown unambiguously that the spin of both isotopes is $I = {}^3/_2$. The value of the ratio of the magnetic moments $\mu_{155}/\mu_{157} = 0.79 \pm 0.02$ and the absolute values $\mu_{155} = -0.32 \pm 0.04$ and $\mu_{157} = -0.40 \pm 0.04$ agree satisfactorily within the indicated limits of error with earlier measurements.[2-4]

For the ratio of the quadrupole moments we obtain the value $Q_{155}/Q_{157} = 0.78 \pm 0.06$ which disagrees with Speck's investigation[4] in which he found that $Q_{155} \geq Q_{157}$. The absolute values of the quadrupole moments calculated from our experimental data ($Q_{155} = 1.6 \times 10^{-24}$ cm^2 and $Q_{157} = 2 \times 10^{-24}$ cm^2) are larger by almost a factor of two than those given by Speck, but it is difficult to estimate the error in the final result since the L-S coupling does not hold very well for the G-terms of gadolinium used by us, and this introduces a large indeterminacy in the estimate of the electronic matrix elements.

The values for the internal quadrupole moment $Q_0^{155} = 8 \times 10^{-24}$ cm^2 and $Q_0^{157} = 10 \times 10^{-24}$ cm^2 recalculated from the above data agree in order of magnitude with the values obtained by the method of Coulomb excitation of gadolinium nuclei.[5,6] The deformation parameters determined from our data are $\delta_{155} = 0.31$ and $\delta_{157} = 0.37$. The ratio $\delta_{155}/\delta_{157} = 0.8$ is directly obtained from the ratio of the quadrupole moments Q_{155}/Q_{157} and does not depend strongly on the possible error in the determination of the electronic wave functions. The values of the deformation parameters given above are in good agreement with the data on the variation of nuclear deformation in the series of rare earth elements obtained by the method of Coulomb excitation of even-even nuclei.[7]

By using these values of δ_{155} and δ_{157} and the values of μ_{155} and μ_{157} given above we made an estimate of g_K and g_R — the gyromagnetic ratios for the internal and the collective motions. The calculation of g_K was carried out in accordance with Nilsson's scheme, and in order to do this the expansion coefficients for the wavefunction of the unpaired nucleon tabulated by Nilsson[8] were extrapolated for the ground state of gadolinium ($N = 5$, $I = {}^3/_2$, $h_{9/2}$) into the region of large nuclear deformations ($0.31 < \delta < 0.41$). As a result it was established that $g_{K155}/g_{K157} = 0.9 \pm 0.1$ and then $(g_R/g_K)_{157} = 1.1\,(g_R/g_K)_{155} \pm 0.2$. These relationships were obtained by utilizing only the relative values of $\delta_{155}/\delta_{157}$ and μ_{155}/μ_{157}, which are determined from the experimental data with a high degree of accuracy. The absolute values of g_K may be found with an accuracy determined by the error in the values of Q_{155} and Q_{157}. Calculations gave the values $g_{K155} = -0.8$ nuclear magnetons and $g_{K157} = -0.9$ nuclear magnetons, from