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Spin Waves in Ferromagnetics and Antiferromagnetics I

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properties of ferromagnetics and antiferromagnetics. 1) Spin waves in ferromagnetics. Definition of the microscopic theory of spin waves. 2) The phenomenological theory of spin waves. (The spin wave is defined as an oscillation of the magnetic moment of the ferromagnetic). 3) Derivation of the quantum theory of spin waves by proceeding from the phenomenological Hamiltanian of the ferromagnetic. 4) The high-frequency properties of ferromagnetics and ferromagnetic resonance. Here, the natural oscillations of the magnetic moment are investigated in finite samples, whose dimensions are considerably smaller than the damping length. This condition does not apply to massive ferromagnetic metals because of the skin effect, and therefore 5) deals with surface impedance. 6) Coupled magnetic and elastic waves and ferroacoustic resonance. In 7) the energy spectrum of antiferromagnetics is investigated by means of the phenomenological method. 8) Thermal and magnetic properties of ferromagnetics. From the spin-wave spectrum the magnetic moment of the ferromagnetic may be determined as a function of temperature and of the magnetic field, as well as the contribution made by the spin waves to the thermodynamic parameters of the ferromagnetic. In a similar manner, 9) deals with the thermal and magnetic properties of antiferro-

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S/053/60/072/001/001/005
B013/B060

9.4300 (1035,1138,1143)

AUTHORS: Akhiyezer, A. I., Bar'yakhtar, V. G., Kaganov, M. I.

TITLE: Spin Waves in Ferromagnetics and Antiferromagnetics. II

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol. 72, No. 1, pp. 3-32

TEXT: This is the second part of an article published in "Uspekhi fizicheskikh nauk", 1960, Vol. 71, 533, and is devoted to the interaction of spin waves with one another and with lattice vibrations and, furthermore, to the relaxation- and kinetic processes. § 10 deals with the fusion and splitting of spin waves and their scattering on spin waves. The authors restrict themselves to considering electrets and, therefore, take into account, aside from the interaction of spin waves with one another, also their interaction with phonons (Ref. 1). The Hamiltonians of the interaction of spin waves are set up, the use of which is restricted to the temperature range below the Curie temperature. The probabilities of fusion and splitting, as well as the scattering of spin waves, are calculated. § 11 deals with the interaction of spin waves with lattice vibrations. The interaction of spin waves with one

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Spin Waves in Ferromagnetics and Antiferromagnetics. II

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dependence of the photon absorption coefficient on frequency is given (13,20); it can be applied to all limiting cases. The last chapter of the present article (§ 14) deals with the thermal conductivity of electrets. It can be calculated from the spin wave interaction Hamiltonian and the spin wave phonon Hamiltonian, as well as the phonon - phonon interaction Hamiltonian. There are 10 Soviet references.

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S/141/61/004/005/016/021
E032/E114

9,2300 (1139, 1159, 1160, 1331)

AUTHOR: Kaganov, M.I.

TITLE: On the effective coefficient of self-induction of fine wires

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, v.4, no.5, 1961, 968-971

TEXT: The usual equation representing an AC circuit is:

$$\frac{1}{c^2} L \frac{d^2e}{dt^2} + R \frac{de}{dt} + \frac{e}{C} = E \qquad (1)$$

where the notation is the same as that used by L. Landau and Ye. Lifshits (Ref.1: Electrodynamics of Continuous Media, Gostekhizdat, M., 1957). The frequency dependence of the resistance R is often ignored. However, the present author points out that for fine wires it can be taken into account with the aid of the usual relation

$$\sigma = \frac{\sigma_0}{1 + i\omega\tau} \qquad (2)$$

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where $\tau$ is the electron mean free path, $\omega$ is the frequency and $\sigma_o$ is the static conductivity. For an arbitrary time dependence, $i\omega$ must be replaced by the operator $d/dt$. It follows that the resistance $R$ in Eq.(1) must be replaced by

$$R = R_o + \tau R_o \frac{d}{dt} \tag{3}$$

where $R_o = b/\pi a^2 \sigma_o = bm/\pi a^2 n e_o^2 \tau$,

$b$ is the length of the wire, $a$ its radius, $n$ the number of electrons per unit volume and $e_o$, $m$ the charge and mass of the electron. Thus, if the quantity $R$ in Eq.(1) represents the static resistance then the coefficient of self inductance $L$ must be replaced by:

$$L_{eff} = L + L_{el} \qquad (L_{el} = c^2 \tau R_o = 4bc^2/a^2\omega_o^2) \tag{4}$$

where the first term represents the ordinary self induction which depends on the magnetic energy of the current, while the



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the second term in Eq.(4) is temperature dependent. All these formulae are derived from the assumption that the electron mean free path is much smaller than the diameter of the wire 2a. When this is not the case it can be shown that

$$L_{el} \simeq 3b \frac{c^2}{\omega_o^2 a^2} \ln \frac{\ell}{2a} \qquad (\ell/2a \gg 1) \tag{7}$$

and

$$R = b\rho/\pi a^2; \qquad \rho = mv_o/2ne_o^2 a \qquad (\ell/2a \gg 1). \tag{8}$$

These expressions are based on the formula for the electron mean free path given by R.B. Dingle (Ref.2; Proc. Roy. Soc., v.201, 545 (1950)). Analysis of Eqs. (7) and (8) shows that while the static electrical conductivity of a thin wire depends on all the electrons on the Fermi surface, the effective self-induction is due to only those particles which lie in the immediate neighbourhood of points on the Fermi surface at which the electron velocity is parallel to the axis of the wire. This means that $L_{el}$ is



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S/048/61/025/011/007/031
B108/B138

AUTHORS: Kaganov, M. I., and Tsukernik, V. I.

TITLE: Off-resonance absorption of a variable magnetic field by ferromagnetic dielectrics at low temperatures

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 11, 1961, 1346-1351

TEXT: The authors studied the absorption of an h.f. magnetic field whose plane of circular polarization is perpendicular to the equilibrium magnetic moment of the ferromagnetic. They consider absorption without resonance, which can only occur by the interaction of spin waves with one another and with phonons. The calculations are made for temperatures considerably below the Curie point $\Theta_c$. The absorption coefficient $\Gamma$ of the magnetic field is given as $\Gamma = \frac{8\pi\hbar\omega}{h_0^2 V} \sum \{W_{if} - W_{fi}\}$, where $W_{if}$ is the probability of direct, and $W_{fi}$ of inverse, transition. The absorption

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coefficient due to spin-spin interaction is evaluated for two limiting cases: (1) High temperatures $T \gg \varepsilon_0$ (but still $T \ll \theta_c$):

$$\Gamma_{ss} \approx \begin{cases} A_1 \omega \left(\frac{w}{\theta_c}\right)^2 \frac{\mu M_0}{\theta_c} \cdot \frac{\hbar\omega T^2}{\varepsilon_0^3}, & \hbar\omega \ll \varepsilon_0, \\ A_2 g M_0 \left(\frac{w}{\theta_c}\right)^2 \frac{T^2}{\hbar\omega\theta_c}, & \varepsilon_0 \ll \hbar\omega \ll T, \\ \frac{4}{15}\sqrt{\frac{\pi}{2}}\,\zeta(3/2)\, g M_0 \left(\frac{w}{\theta_c}\right)^2 \frac{T^{1/2}}{(\hbar\omega)^{1/2}\theta_c}, & \hbar\omega \gg T, \end{cases} \quad (17)$$

where $w = \frac{\mu^2}{a^3}$ is the dipole-dipole interaction energy; $A_1 \sim A_2 \sim 10^3$.

(2) Low temperatures ($T \ll \varepsilon_0$):



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Off-resonance absorption of a...

$$\Gamma_{ss} \approx \begin{cases} B_1 \omega \left(\frac{w}{\theta_c}\right)^2 \frac{\mu M_0}{\theta_c} \frac{\hbar\omega T^{1/2}}{\varepsilon_0^{3/2}} e^{-\frac{3\varepsilon_0}{T}}, & \hbar\omega \ll \varepsilon_0, \\ \frac{4}{15}\sqrt{\frac{\pi}{2}}\, \omega \left(\frac{w}{\theta_c}\right)^2 \frac{\mu M_0}{\theta_c} \left(\frac{T}{\hbar\omega}\right)^{3/2} e^{-\frac{3\varepsilon_0}{T}}, & \hbar\omega \gg \varepsilon_0, \end{cases} \quad (18)$$

where

$$B_1 = \frac{15\pi^{1/2}}{8\sqrt{2}}\left\{121 + \frac{1}{15}\left[\left(\frac{2\beta}{\pi} - \frac{2}{3}\right)^2 + \frac{121}{45}\right]\right\} + \frac{4}{15}\sqrt{\frac{\pi}{2}} \approx 10^4$$

$\varepsilon_0 = \mu H_0 + \beta\mu M_0$ where $H_0$ denotes the permanent magnetic field along the axis of easiest magnetization, $M_0$ the equilibrium magnetic moment, $\beta$ the anisotropy constant, a the lattice constant, $\mu = g\hbar$, $g$ the gyromagnetic ratio. The results for spin-lattice interaction show that these contributions to the overall absorption coefficient are considerably smaller than the contribution due to spin-spin interaction. The considerations have been made for perfect ferromagnetics without

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24.2200 1164 1068 1121

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S/048/61/025/011/008/031
B108/B138

AUTHORS: Kaganov, M. I., and Tsukernik, V. M.

TITLE: An absorption mechanism for a longitudinal magnetic field by a ferromagnetic dielectric

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 11, 1961, 1352-1353

TEXT: The ferro-dielectric absorption of the energy of a variable magnetic field polarized along the axis of easiest magnetization was studied in detail in a previous paper (Ref. 1: Zh. eksperim. i teor. fiz., 37, 823 (1959)). The absorption of the field at $\omega\tau_{ss} \ll 1$, where $\tau_{ss}$ is relaxation time, was calculated with the aid of the kinetic equations for the distribution function of the spin waves. The calculations were made for temperatures T considerably below Curie point $\Theta_c$. At high frequencies, absorption is chiefly determined by the disintegration of a photon into two spin waves with opposite momenta. This process was also considered in the above paper. It was pointed out, however, that a photon will only

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calculation of the appropriate absorption coefficients $\Gamma_a$ and $\Gamma_b$ is similar to that given in detail in Ref. 3 (Kaganov M. I., Tsukernik V. M., present number of this periodical, p. 1346). In this article, only the final results for the total absorption coefficient $\Gamma = \Gamma_a + \Gamma_b$ are given, with precision up to a numerical factor of the order of unity. At high temperatures ($\varepsilon_0 \ll T \lesssim \theta_c$)

$$\Gamma \sim \begin{cases} gM_0 \dfrac{w^2}{\varepsilon_0 \theta_c} \left(\dfrac{T}{\theta_c}\right)^2, & \dfrac{\hbar}{\tau_{ee}} \ll \hbar\omega \lesssim \varepsilon_0, \\ gM_0 \dfrac{w^2}{\hbar\omega \theta_c} \left(\dfrac{T}{\theta_c}\right)^2, & \varepsilon_0 \ll \hbar\omega \lesssim T, \\ gM_0 \dfrac{w^2}{\theta_c^{4/3} (\hbar\omega)^{1/3}} \left(\dfrac{T}{\theta_c}\right)^{4/3}, & T \ll \hbar\omega \lesssim \theta_c. \end{cases}$$

At low temperatures ($T \ll \varepsilon_0$)



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An absorption mechanism for a... 30064 S/048/61/025/011/008/031
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$$\Gamma \sim \begin{cases} gM_0 \dfrac{w^2}{\theta_c^2} \left(\dfrac{\varepsilon_0}{\theta_c}\right)^{1/2} \left(\dfrac{T}{\theta_c}\right)^{1/2} e^{-\frac{2\varepsilon_0}{T}}, & \dfrac{\hbar}{\tau_{ss}} \ll \hbar\omega \ll \varepsilon_0, \\ gM_0 \dfrac{w^2}{\theta_c^{3/2} (\hbar\omega)^{1/2}} \left(\dfrac{T}{\theta_c}\right)^{1/2} e^{-\frac{\varepsilon_0}{T}}, & \hbar\omega \gg \varepsilon_0. \end{cases}$$

Comparison of the results obtained with the absorption coefficient due to the disintegration of one photon into two spin waves (Ref. 1) shows that the processes considered in this paper are only effective at $\hbar\omega < 2\varepsilon_0$. [Abstracter's note: Complete translation.] This paper was read at the Conference on ferromagnetism and antiferromagnetism in Leningrad, May 5-11, 1961. There are 3 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk USSR (Physicotechnical Institute of the Academy of Sciences UkrSSR)

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B104/B102

24.7900 (1055, 1144, 1163)

AUTHORS: Kaganov, M. I., and Yü Lu

TITLE: Effect of magnetic moment boundary conditions upon spin-wave resonance in metals

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 11, 1961, 1375 - 1378

TEXT: Basing on the macroscopic theory of spin-wave resonance developed by W. S. Ament and G. T. Rado (Phys. Rev., 97, 1558 (1955)) the surface impedance was calculated with the boundary condition $\partial m/\partial n + \alpha m = 0$. $\alpha$ is a parameter which describes the surface properties. Supposing that m, h, and e be proportional to $\exp(i\omega t - ky)$, the approximative dispersion equation

$$K^6 - K^4 - (\eta - \Omega^2 + i\Omega L) K^2 - 2ix^2 = 0, \qquad (2)$$

where:

$$\eta = \frac{H_z}{4\pi M_s}; \quad \Omega = \frac{\omega}{4\pi M_s \gamma}; \quad L = \frac{\lambda}{M_s \gamma}; \quad x^2 = \frac{A}{2\pi M_s^2 b^2};$$

$$K = kx\delta; \quad \delta = c/\sqrt{2\pi\sigma\omega};$$

is obtained

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Effect of magnetic moment ...

of A determined from the spin-wave resonance is ambiguous. This method has thus to be combined with others, e. g. resonance of standing spin waves, or temperature dependence of the intensity of magnetization. There are 1 figure and 7 references: 3 Soviet and 4 non-Soviet. The four references to English-language publications read as follows: Rado G. T., Wertman J. R., Phys. Rev., 94, 1386 (1960); Phys. Chem. Solids, 11, 315 (1959); Ament W. S., Rado G. T., Phys. Rev., 97, 1558 (1955); Kittel C., Phys. Rev., 110, 1295 (1958)

ASSOCIATION: Khar'kovskiy gos. universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy). Fiziko-tekhnicheskiy institut Akademii nauk USSR (Physicotechnical Institute of the Academy of Sciences UkrSSR)

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$$\left.\begin{aligned} u\frac{\partial f_e}{\partial x}+\frac{e}{m_e}\frac{dV}{dx}\frac{\partial f_e}{\partial u}&=0,\\ u\frac{\partial f_i}{\partial x}-\frac{e}{m_i}\frac{dV}{dx}\frac{\partial f_i}{\partial u}&=0,\\ \frac{d^2V}{dx^2}&=4\pi e(n_e-n_i),\end{aligned}\right\} \quad (2)$$

describes the steady distribution of the potential V. It consists of the kinetic equations for the electron and ion distribution functions and of Poisson's equation. In establishing the boundary conditions for the distribution functions the authors show that the electron current from the anode is negligible. Thus, the boundary conditions have the form

$$f_e(0,\ u>0)=\frac{m_e}{ekT_1}f_e^{(1)}\exp\left(-\frac{m_eu^2}{2kT_1}\right), \quad (4)$$

$$f_e(L,\ u<0)=0, \quad (5)$$

$$f_i(0,\ u>0)=\frac{m_i}{ekT_1}f_i^{(1)}\exp\left(-\frac{m_iu^2}{2kT_1}\right). \quad (6)$$

The ions inciding upon the anode leave it as neutral atoms; thus, $f_i(L,\ u<0)=0$. For a potential V monotonically dependent on the coordinates, the solutions



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Kinetic theory of a...

$$f_e(x, u) = \frac{m_e I_e^{(1)}}{kT_1} \exp\left[\frac{1}{kT_1}\left(-\frac{m_e u^2}{2} + eV\right)\right] \sigma\left[u - \left(\frac{2eV}{m_e}\right)^{1/2}\right], \quad (10)$$

$$f_i(x,u) = \frac{m_i I_i^{(1)}}{kT_1} \exp\left[\frac{1}{kT_1}\left(-\frac{m_i u^2}{2} - eV\right)\right] \sigma\left[u + \left(\frac{2e(V_0 - V)}{m_i}\right)^{1/2}\right], \quad (11)$$

where $\sigma(z) = \begin{cases} 1, & z \geqslant 0, \\ 0, & z < 0. \end{cases}$

are obtained from (2). These solutions are used to plot the characteristic for the thermocouple without employing Poisson's solution. The characteristic of the converter is given by $U = \varphi_1 - \varphi_2 + \frac{kT_1}{e} \ln \frac{I_e^{(1)} - I}{I_i^{(2)}}$ (14). An analogous equation is found for a monotonic negative potential. It is noted that in both cases $dU/dl < 0$, which requires an additional study of stability. For the determination of those modes of operation for which a monotonic potential exists, Poisson's equation is solved. With the aid of (10) and (11), Poisson's equation is obtained in the form

$$2\frac{d^2\eta}{d\xi^2} = \Phi^-(\eta) - ae^{-\eta_0}\Phi^+(\eta_0 - \eta). \quad (15)$$

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where

$$\left.\begin{aligned} &\eta = \frac{eV}{kT_1}; \quad \eta_a = \frac{eV_a}{kT_1}; \quad \xi = \frac{x}{r}; \\ &\Phi^{\pm}(\eta) = e^{\eta}(1 \pm \operatorname{erf}(\eta^{1/2})); \ \operatorname{erf} x = 2\pi^{-1/2}\int_0^x e^{-t^2}\,dt, \end{aligned}\right\} \quad (16)$$

$$r = \left(\frac{k^2T_1^3}{32\pi^3 m_e e^2 I_0^{(1)2}}\right)^{1/2}; \ \alpha = \frac{I_1^{(1)}}{I_0^{(1)}}\sqrt{\frac{m_i}{m_e}}. \quad (17)$$

This leads to the integral

$$\xi = \int_0^{\eta}\left[\eta_0'^2 + \varphi(\eta, \eta_a, \alpha)\right]^{-1/2} d\eta, \quad (20)$$

which describes the potential explicitly. It is seen that $\xi$ grows substantially as $\eta$ approaches $\eta_k$; therefore, the potential varies only slowly throughout the space between the electrodes. The integration constant $\eta_0'^2$ is calculated from

$$\eta_0'^2 = \frac{1}{\alpha} 2\varkappa\eta_a \exp(-\Lambda\sqrt{\varkappa}), \quad (24)$$

where

$$\varkappa = \frac{1}{2}\varphi''_{\eta\eta}(\eta_a, \eta_a, \alpha),$$



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and $\eta_k$ is determined from

$$y_*(\eta_{k*}) \equiv \frac{1}{a} e^{2\eta_{k*}} (1 - erf\, \eta_{k*}^{1/2}) = 1 + erf \sqrt{\eta_{k*} - \eta_{k*}} \equiv y(\eta_{k*} - \eta_{k*}), \quad (25)$$

with the aid of a graphical solution. The results obtained here can be easily generalized to the case of a negative potential. A. I. Ansel'm, B. Ya. Moyzhes, and G. Ye. Pikus are mentioned. There are 7 figures and 12 references: 5 Soviet-bloc and 6 non-Soviet-bloc. The two references to English-language publications read as follows: Lewis et al, J.Appl. Phys., 30, 1438, 1959; Houston, J.Appl.Phys., 30, 481, 1959.

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would result in a change of the dispersion character. Starting from the Landau-Lifshits equations for the motion of the sublattice moments, the h-f susceptibility tensor of an antiferromagnetic body is computed for various values of the constant magnetic field strength, that is, for various equilibrium configurations of the moments. The results permit to draw conclusions from h-f measurements as to the equilibrium structures and the transitions between them. The uniaxial antiferromagnetic body is assumed to have two sublattices and to be positioned in a homogeneous, constant and in a weak and variable (frequency $\omega$) magnetic field. The motion of the moments due to field action is described by

$$\partial M_s/\partial t = g\,[M_s H_e^{(s)}] - (\gamma/M^s)\,[\dot{M}_s\,[M_s H_e]], \qquad (1),$$

where $\vec{M}_s$ is the magnetization vector of the s-th sublattice, M the sublattice magnetization which is assumed to be constant, g the gyromagnetic ratio, $\gamma$ the relaxation constant, $\vec{H}_e^{(s)}$ the effective field acting upon the s-th sublattice: $\vec{H}_e^{(s)} = -\partial\mathcal{H}/\partial\vec{M}_s$, where $\mathcal{H}$ stands for the energy density of the antiferromagnetic body:



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$$\mathcal{H} = \alpha M_1 M_2 - \tfrac{1}{2}\lambda\,[(M_1 n)^2 + (M_2 n)^2] + \eta\,(M_1 n)(M_2 n) - H\,(M_1 + M_2). \quad (3).$$

Here, $\alpha$ is the constant of exchange interaction ($\alpha > 0$), $\lambda$ and $\eta$ represent the anisotropy constants which are assumed to be positive; $n$ is the unit vector in the direction of the axis of the antiferromagnetic body. Using the notation stated hereinafter: $H_1 = \sqrt{(\lambda + \eta)(2\alpha - \lambda + \eta)}\,M$, $H_2 = \sqrt{(\lambda + \eta)(2\alpha + \lambda + \eta)}\,M$, $H = H_3 = (2\alpha - \lambda + \eta)M$, and $H_4 = [\lambda(2\alpha - \lambda + \eta)^2/(2\alpha + \lambda + \eta)]^{1/2}\,M$ ($H_4 < H_1$; $H_2 - H_4$ is the width of the hysteresis loop of the antiferromagnetic body), the following cases are subjected to investigation: 1) $H < H_1$. $m_\pm$ is equal to $\chi_\pm h_\pm$, where $h_\pm = h_x \pm i h_y$, $m_\pm = m_x \pm i m_y$, $\vec{h}$ stands for the h-f magnetic field, and $\vec{m}$ for the variable part of the entire magnetic moment. With

$$\Omega^2 = (g^2 M^2 + \gamma^2)(\lambda + \eta)(2\alpha + \lambda + \eta) - \gamma^2 H^2/M^2. \quad (5)$$

$$\Omega_1^2 = 2\,(g^2 M^2 + \gamma^2)(\lambda + \eta).$$



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the following is obtained:

$$\chi_{\pm} = \frac{\Omega_1^2 - 2i\omega\gamma}{\Omega^2 - (\omega \mp gH)^2 - 2i\omega\gamma(\alpha + \lambda + \eta)}, \quad \chi_{zz} = 0. \qquad (6).$$

The width of the antiferromagnetic resonance lines is thus given by $2\gamma(\alpha + \lambda + \eta)$. With H = 0 one has $\chi_+ = \chi_- = \chi_{xx} = \chi_{yy}$. 2) $H_1 < H < H_3$; Here, $\chi_{zz} \neq 0$, and the following is obtained:

$$\chi_{zz}(\omega) = \chi_{zz}(0)\frac{\nu^2 + i\nu\omega}{\nu^2 + \omega^2}; \qquad (7)$$

$$\chi_{zz}(0) = 2/(2\alpha - \lambda + \eta), \qquad (8)$$

$$\nu = (2\alpha - \lambda + \eta)\gamma \sin^2\theta = \gamma(1 - H^2/H_3^2)H_s/M.$$

From this, the following is obtained for the behavior of the relaxation time $\tau = 1/\nu$ in the vicinity of the point of second-kind phase transition (with $H \approx H_3$):

$$\tau = \frac{1}{\gamma}\frac{2H_3}{H_3^2 - H^2}.$$ If T is fixed, and $H = H_3$ the following is valid:



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where

$$\omega_0^2 = (g^2M^2 + \gamma^2)(4\alpha^2\cos^2\theta - 2(\lambda + \eta)\alpha\sin^2\theta), \qquad (10)$$

$$\omega_1^2 = 4\alpha(g^2M^2 + \gamma^2), \qquad \gamma' = \gamma\left[1 + \cos^2\theta + \frac{1}{2\alpha}(\lambda + \eta)\sin^2\theta\right].$$

3) $H > H_3$, $(\vec{H} \parallel \vec{n})$. Here, the tensor of h-f susceptibility coincides with that of the susceptibility of the uniaxial antiferromagnetic body:

$$\chi_{xx}(\omega) = \chi_{yy}(\omega) = \chi_\perp(0)\frac{\omega_\Phi^2 - i\omega\gamma_\Phi}{\omega_\Phi^2 - \omega^2 - 2i\omega\gamma_\Phi},$$

$$\chi_{xy}(\omega) = -\chi_{yx}(\omega) = \frac{2igM\omega}{\omega_\Phi^2 - \omega^2 - 2i\omega\gamma_\Phi}, \qquad (11),$$

$$\chi_{xz} = \chi_{yz} = \chi_{zz} = 0,$$

$$\chi_\perp(0) = 2M/(H + (\lambda - \eta)M),$$

$$\omega_\Phi^2 = g^2[H + (\lambda - \eta)M]^2(1 + \gamma^2/g^2M^2), \qquad (12).$$

$$\gamma_\Phi = \gamma(H/M + \lambda - \eta).$$



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28934
S/056/61/041/004/019/019
B111/B112

9,2165 (1001, 133/, 1482)

AUTHORS: Aleksandrov, B. N., Kaganov, M. I.

TITLE: Resistivity of thin monocrystalline wires

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 4, 1961, 1333-1336

TEXT: Measuring the resistivity is of interest for the determination of the free path. The standard method worked out by R. B. Dingle (Ref. 2: Proc. Roy. Soc., A201, 545, 1950) is, however, only applicable to an isotropic quadratic dispersion law of electrons. B. N. Aleksandrov used wires made from tin previously subjected to zone purification (99.99986 %) to measure the dependence of specific resistivity on the diameter. Results are shown in a figure. It is shown that $\delta = R_{4.2}/R_{293}$ ($R_{4.2}$ resistivity at 4.2°K, $R_{293}$ at 293°K) is a linear function of the reciprocal diameter d. If the axis of the wire is parallel to the principal axis of the crystal, the slope of the straight line will be smaller than in perpendicular position. The theoretical treatment can be only concluded if

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28934
S/056/61/041/004/019/019
B111/B112

Resistivity of thin monocrystalline wires

the path $\lambda \gg d$. If the wire axis is perpendicular to the symmetry plane of the crystal, the following holds for the electrical conductivity $\sigma(d)$, without particular assumptions:

$$\sigma(d) \approx \frac{8de^2}{3\pi(2\pi\hbar)^3} I, \quad I = \oint \frac{(\vec{N}\vec{b})^2}{\sqrt{1-(\vec{N}\vec{b})^2}} dS,$$

where $\vec{b}$ is the unit vector in the direction of wire axis, $\vec{N}$ the unit vector, perpendicular to the Fermi surface, dS the element of area. Computing the integral necessitates assumptions on a dispersion law. An anisotropic and an isotropic law are dealt with. In the latter case, the authors obtain $I_{\parallel} = 2.2 \cdot 10^{-37}$ CGSE and $I_{\perp} = 1.1 \cdot 10^{-37}$ CGSE, respectively, for the two crystallographic directions. The difference in slope of the straight line $\delta = f(d)$ is due to different forms of the Fermi surfaces for tin. It is of interest to establish this difference experimentally in the directions [100] and [111] for various metals such as Pb, Cu, Au, Ag, and possibly Al. According to computations performed, every tin atom, for instance, should possess 1.2 conductivity electrons. This value has been derived under extremely idealized assumptions.

Card 2/3 Physico-Tech Inst AS UkrSSR

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$$\varepsilon_{jk}(\omega, q) = \delta_{jk} + 4\pi B_{js}\Delta_{sk},$$

$$B_{jk}^{-1} = -\omega^2\delta_{jk} + \beta_{jk} + i\gamma_{jkl}q_l - \alpha_{jklm}q_l q_m. \qquad (2)$$

the dispersion $\omega(\vec{q})$ of the light waves can be calculated:

$$q^2(q, \hat{\varepsilon}q) - \frac{\omega^2}{c^2}[(\mathrm{Sp}\,\hat{\varepsilon})(q, \hat{\varepsilon}q) - (q, \hat{\varepsilon}^2 q)] + \frac{\omega^4}{c^4}|\det\hat{\varepsilon}| = 0. \qquad (4).$$

If $\hat{\varepsilon}_{ik}$ is an analytic function of the wave vector then $\omega(\vec{q})$ is an analytic function of $\vec{q}$. If retardation is neglected ($c \to \infty$) then (4) changes into

$$(s, \hat{\varepsilon}(\omega, q)s) = 0, \quad s = \frac{q}{|q|}, \qquad (5).$$

As in anisotropic crystals, the exciton energy is not an analytic function of the wave vector $\vec{q}$. At small $|\vec{q}|$ the dispersion $\omega(\vec{q})$ for waves which



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are not purely transverse is obtained from the equations (2) and (5). As an example polarization perpendicular to the optical axis is considered: in this case $n^2 = \frac{q^2c^2}{\omega^2}$. The crystal symmetry unambiguously determines the amounts of the tensor components, thus making it possible to determine the structure of the exciton bands in crystals of whatever symmetry. The ambiguity of the limits of the exciton energy is eliminated by taking account of retardation.

SUBMITTED: August 10, 1961 (initially)
March 5, 1962 (after revision)



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43128
S/181/62/004/011/029/049
B125/B186

26.2351

AUTHORS: Bass, F. G., Kaganov, M. I., and Yakovenko, V. M.

TITLE: Cherenkov radiation and supplementary waves in a dielectric

PERIODICAL: Fizika tverdogo tela, v. 4, no. 11, 1962, 3260-3265

TEXT: The spectral density of the radiation emitted by a particle, moving perpendicularly to the interface dielectric - vacuum (z = 0), is investigated and calculated. Special attention is paid to the generation of supplementary transverse waves of exciton origin. In addition to excitation of exciton waves, their transformation into electromagnetic waves at the interface are considered. The system is described by the Maxwell equations.

$$\operatorname{rot}\mathbf{H}=\frac{4\pi}{c}e\mathbf{v}\delta(z-vt)\delta(x)\delta(y)+\frac{1}{c}\frac{\partial\mathbf{E}}{\partial t}+\frac{4\pi}{c}\frac{\partial\mathbf{P}}{\partial t}, \qquad (1)$$

$$\operatorname{rot}\mathbf{E}=-\frac{1}{c}\frac{\partial\mathbf{H}}{\partial t}$$

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velocities of the particle this spectrum is narrowed, and it disappears completely if the velocity approaches the value $c/n_0$. At further deceleration a narrow line, associated with the exciton wave, is observed on the entry side. It is shown that the group velocity corresponding to the exciton wave is negative. In isotropic optically active media, (2) is to be replaced by

$$\mathbf{P} + g\varepsilon \frac{c}{\omega} \operatorname{rot} \mathbf{P} := \frac{\varepsilon - 1}{4\pi} \mathbf{E}; \quad g = \frac{f\omega}{c(\omega_0^2 - \omega^2)\varepsilon}. \qquad (15)$$

after Fourier transformation with respect to time. $\omega$ is the radiation frequency. At $\varepsilon \gg 1$ the dispersion equation has generally three roots. Hence the Cherenkov radiation propagates on the surface of three cones. Fig. 2 shows the frequency dependence of the refractive indices for 2 media, considering all constants of both media as equivalent and assuming that two types of waves propagate in the optically active media: $n_1^2 = \varepsilon$, $n_2^2 = 1/\varepsilon^2 g^2$. Since spatial dispersion occurs in frequency ranges far from



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37259
S/057/62/032/005/006/022
B125/B102

24.6714

AUTHORS: Bar'yakhtar, V. G., and Kaganov, M. I.

TITLE: Homogeneous and inhomogeneous resonance in plasma

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 5, 1962, 554-558

TEXT: The equations $(\partial/\partial x_i)\varepsilon_{ik}(\omega)E_k = 0$, curl $\vec{E} = 0$, which are valid inside, and curl $\vec{E} = 0$, div $\vec{E} = 0$ which are valid outside a plasma-filled volume, have to be solved in order to determine the natural frequencies $\omega_1$, $\omega_2$, and $\omega_3$ of longitudinal plasma oscillations in a bounded volume. This problem is solvable only for a plasma contained in an ellipsoid. Some of the solutions correspond to a uniform field within the ellipsoid, and their natural frequencies are determined from $|\delta_{ik} + 4\pi n_{il}\chi_{lk}(\omega)| = 0$, where $n_{ik}$ is the tensor of the demagnetizing factors. If the field is parallel to one of the ellipsoid axes, the homogeneous resonance frequencies are given by

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$$\left.\begin{aligned}\omega_{1,2}^2 &= \frac{\omega_H^2 + (n_1 + n_2)\Omega^2}{2} \pm \sqrt{\frac{1}{4}\left(\omega_H^2 + (n_1 + n_2)\Omega^2\right)^2 - n_1 n_1 \Omega^4} \\ \omega_3^2 &= n_3 \Omega^2.\end{aligned}\right\} \qquad (11).$$

This leads to the following special cases: For an ellipsoid of revolution ($n_1 = n_2 \neq n_3$) or a sphere, one finds

$$\omega_{1,2}^2 = \frac{1}{2}\left[\omega_H^2 + 2n_1\Omega^2 \pm \omega_H \sqrt{\omega_H^2 + 4n_1\Omega^2}\right], \quad \omega_3 = \sqrt{1 - 2n_1}\,\Omega. \qquad (12) \text{ and}$$

Сфера ($n_1 = n_2 = n_3 = 1/3$)

$$\left.\begin{aligned}\omega_{1,2}^2 &= \frac{1}{2}\left[\omega_H^2 + \frac{2}{3}\Omega^2 \pm \omega_H \sqrt{\omega_H^2 + \frac{4}{3}\Omega^2}\right], \\ \omega_3 &= \frac{1}{\sqrt{3}}\Omega.\end{aligned}\right\} \qquad (13),$$

respectively; for a cylinder with the axis parallel to the magnetic field,



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on the substitution of -z for z: cotan v = $(v/u)\varepsilon_3(\omega_{1,2})$ and tan v = $-(v/u)\varepsilon_3(\omega_{1,2})$, respectively. These equations provide a simple graphic solution if v is real. The natural frequencies of an ellipsoid are "very similar" to those of a plate. The present calculation of natural frequencies is suited to every case where the characteristic frequencies of the dielectric constant $\varepsilon_{ik}$ satisfy the condition $c/\omega \gg L$ (L = dimensions of the system). A plasma cylinder with the axis perpendicular to the magnetic field has natural frequencies given by (23) with cotan v = $\frac{v}{u}\varepsilon_3(\omega_{1,2})$ for the symmetrical solutions, and tan v = $-\frac{v}{u}\varepsilon_3(\omega_{1,2})$ for the antisymmetrical ones. In the case of a magnetic field parallel to the cylinder axis one finds

$$\omega_{1,2}^2 = \frac{\omega_H^2 + \Omega^2}{2} \pm \frac{1}{2}\sqrt{(\omega_H^2 + \Omega^2)^2 - 4\frac{u^2}{u^2+v^2}\omega_H^2\Omega^2}, \qquad (28) \text{ with}$$

$$\frac{\varepsilon_1(\omega)\, v J_n'(v) - \varepsilon_2(\omega)\, n J_n(v)}{J_n(v)} = u\frac{K_n'(u)}{K_n(u)}, \qquad (29),$$

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where $J_n(x)$ and $K_n(x)$ are Bessel and MacDonald functions, respectively.

A. I. Akhiyezer is thanked for a discussion. The English-language reference is: L. Walker. Phys. Rev., 105, 309, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR Khar'kov
(Physicotechnical Institute AS UkrSSR, Khar'kov)

SUBMITTED: November 1, 1960 (initially)
July 21, 1961 (after revision)



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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

43458

S/053/62/078/003/002/005
B163/B104

AUTHORS: Lifshits, I. M., Kaganov, M. I.

TITLE: Some problems of the electron theory of metals. II. Statistical mechanics and thermodynamics of electrons in metals

PERIODICAL: Uspekhi fizicheskikh nauk, v. 78, no. 3, 1962, 411-461

TEXT: A review on the thermodynamical equilibrium qualities of metals at low temperatures is given, paying special attention to those effects that are sensitive to the dispersion law of the conduction electrons. The treatment is mainly based on the "gas model" in which the conduction electrons may be considered as an ideal gas of charged quasi-particles. The shape of Fermi surface in conducting crystals is discussed, especially degenerate cases where the energy surfaces have singular points or where the surfaces of equal energy belonging to neighboring zones intersect. The density of states within the energy zones, which forms the base for a thermodynamic treatment of the conduction electrons, is discussed, again with special consideration of degenerate cases. Such special cases are

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APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, M.I.; PESCHANSKIY, V.G.

Theory of sound absorption in solids. Fiz. tver. tela 5 no.11: 3215-3223 N '63. (MIRA 16:12)

1. Fiziko-tekhnicheskiy institut nizkikh temperatur, Khar'kov.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

LIFSIT, I.M.; KAGANOV, M.I.

Some problems of the metal electronic theory. Pt. 2. Anulele mat 17 no.4:113-170 O-D '63.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, M.I.; CHUPIS, I.Ye.

Threshold absorption of sound in a uniaxial antiferromagnetic. Zhur. eksp. i teor. fiz. 45 no.5:1581-1584 N '63. (MIRA 17:1)

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L 10192-63 EWT(1)/BDS/EEC(b)-2--AFFTC/ASD--IJP(C)

ACCESSION NR: AP3000070 S/0056/63/044/005/1695/1702

AUTHOR: Kaganov, M. I.; Chupis, I. Ye.

TITLE: Threshold absorption of magnetic energy in a uniaxial antiferromagnet

SOURCE: Zhurnal eksper. i teoret. fiziki, v. 44, no. 5, 1963, 1695-1702

TOPIC TAGS: antiferromagnets, magnetic energy absorption, threshold absorption

ABSTRACT: The absorption coefficient of an alternating magnetic field polarized along the preferred axis of a uniaxial antiferromagnet is calculated. It is shown that for frequencies close to threshold (the threshold frequency is equal to 2gH sub 0, where g is the gyromagnetic ration and H sub 0 is the external magnetic field) the absorption coefficient is proportional to the square root of the difference between the frequency and the threshold frequency, and that the absorption coefficient attenuates exponentially with rising frequency. The lower the temperature, the finer the "absorption line." The behavior at relatively high temperatures (much above the activation energy) is investigated. The Hamiltionian of the ferromagnet is diagonalized in the appendix, under some very

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ACCESSION NR: AP3000070

general assumptions. "In conclusion, we take the opportunity to thank A. S. Borovik-Romanov, I. M. Lifshits, and V. M. Tsukernik for useful discussions." Orig. art. has: 45 formulas and 1 figure.

ASSOCIATION: none

SUBMITTED: 25Dec62 DATE ACQ: 12Jun63 ENCL: 00

SUB CODE: PH NR REF SOV: 001 OTHER: 000

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APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

BASS, F.G.; BLANK, A.Ya.; KAGANOV, M.I.

Galvanomagnetic phenomena in a variable electromagnetic field. Zhur. eksp. i teor. fiz. 45 no.4:1081-1086 O '63. (MIRA 16:11)

1. Institut radiofiziki i elektroniki AN UkrSSR i Fiziko-tekhnicheskiy institut AN UkrSSR.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, M.I.; LIFSHITS, I.M.

Non-threshold internal photoeffect in metals with intersecting bands. Zhur. eksp. i teor. fiz. 45 no.4:948-954 O '63. (MIRA 16:11)

1. Fiziko-tekhnicheskiy institut AN UkrSSR.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

ACCESSION NR: AP4036409 S/0030/64/000/004/0160/0163

AUTHORS: Lifshits, I. M. (Corresponding member); Kaganov, M. I. (Doctor of physico-mathematical sciences)

TITLE: The development of the solid state theory

SOURCE: AN SSSR. Vestnik, no. 4, 1964, 160-163

TOPIC TAGS: solid state theory, detector effect, transistor effect, semiconductor, quantum property, metal energy spectrum, high alloy semiconductor, superconductivity, dielectric state

ABSTRACT: This is a review of the All-Union Conference on the Solid State Theory, held in Moscow from December 2 to 12, 1963. More than 800 Soviet and 50 foreign scientists participated. The reports covered all basic developments in the solid state theory, including forecasts, discoveries and studies of such properties as the detector and transistor effects in semiconductors, coherent amplification, and frequency generation. The paper presented by the authors of this article was a summary of the methods used and the results obtained in the study of the electron energy spectrum of metals. E. A. Kaner and V. G. Skobov reported on the



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ACCESSION NR: AP4036409

importance of "all-encompassing" conventions.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 20May64 ENCL: 00

SUB CODE: GP NO REF SOV: 000 OTHER: 000

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APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

[illegible] Fikus, V. B.

[illegible] by an impurity center

[illegible] 1964 [illegible]

[illegible] scattering, impurity center, momentum transfer, dispersion relation, electron collision

[illegible] whereby the momentum transfer to an impurity [illegible] is governed by the concrete scat[illegible] for several limiting cases. [illegible] with arbitrary dispersion law [illegible]

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electron to the [illegible]

formulas.

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L 16342-65 EWT(1)/EPA(s)-2/EEC(t)/EEC(b)-2 Pt-10/Pl-4 IJP(c)/
RAEM(c)/ESD(t)/ESD(gs)/SSD/AFWL/ASD(a)-5/AS(mp)-2/AFMD(c)/AFETR/RAEM(a)
GG

ACCESSION NR AP5000654 S/0181/64/006/012/3577/3584

AUTHOR Buss F G Gredeskul, S A , Kaganov, M I

[illegible] charged particles and a piezodielectric

[illegible] 64 3577 3584

[illegible] charged particle [illegible]

[illegible]

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

ACCESSION NR: AP5000[illegible]

SUB CODE: SS, NP

NR REF SOV: 006

ENCL: 00

OTHER: 003

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

ACCESSION NR: AP4030655 S/0048/64/028/004/0741/0747

AUTHOR: Kaganov, M.I.; Chupis, I.Ye.

TITLE: Threshold and relaxation effects in uniaxial antiferromagnets /Report, Symposium on Ferromagnetism and Ferroelectricity held in Leningrad 30 May-5 June 1963/

SOURCE: AN SSSR. Izv. Ser.fiz., v.28, no.4, 1964, 741-747

TOPIC TAGS: antiferromagnetism, spin wave, antiferromagnet spin wave, spin wave interaction

ABSTRACT: The propagation and interaction os spin waves in antiferromagnetic materials are discussed. The notation is taken from an earlier review (V.I.Akhiyezer, V. G.Bar'yakhtar and M.I.Kaganov, Uspekhi fiz.nauk,71,533,1960) in which presumably the necessary derivations can also be found. In the present paper formulas are for the most part simply quoted, and in some cases their physical consequences are briefly discussed. The energy of the spin wave is a two-valued function of the wave vector (i.e., there are two types of spin waves), and for each branch it depends on the direction of propagation. This anisotropy is due to the relativistic interactions, the exchange interaction being regarded as isotropic. A future discussion of anisotropic

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ACCESSION NR: AP4030655

exchange interaction in antiferromagnets is promised. The following interaction processes are possible: decay of a spin wave into two spin waves; scattering of a spin wave by another spin wave; creation or absorption of a phonon by a single spin wave; and annihilation of two spin waves with the production of a phonon. These processes are discussed and their probabilities are given. Decay of spin waves involves a threshold effect that should be observable by inelastic scattering of slow neutrons. The threshold depends on the strength of the applied magnetic field. In contrast to the behavior of spin waves in ferromagnets, here the probability for creating or absorbing phonons is greater than that for a spin wave to decay into two. The scattering of two spin waves is even more probable, however, and for many purposes the spin waves and the phonons can be treated as "quasi-independent". An almost resonant absorption of energy from an oscillating magnetic field is possible, with the transformation of a spin wave from one type to the other. Similar absorption of acoustic energy can also occur. Those processes are discussed in less detail than the others. "In conclusion, we desire to express our gratitude to V.M.Tsukernik for very useful discussions." Orig.art.has: 15 formulas and 5 figures.

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APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, M. I.; CHUPIS, I. Ye.

Threshold and relaxation phenomena in uniaxial antiferromagnetics.
Izv. AN SSSR. Ser. fiz. 28 no. 4:741-747 Ap '64. (MIRA 17:5)

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, M.I.; LIFSHITS, I.M.; FIKS, V.B.

Electron scattering by impurity centers. Fiz. tver. tela 6 no.9: 2723-2728 S '64. (MIRA 17:11)

1. Institut poluprovodnikov AN SSSR, Leningrad.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

BASS, F.G.; GREDESKUL, S.A.; KAGANOV, M.I.

Interaction between charged particles and a piezodielectric.
Fiz. tver. tela 6 no.12:3577-3584 D '64 (MIRA 18:2)

1. Institut radiofiziki i elektroniki AN UkrSSR, Khar'kovskiy gosudarstvennyy universitet, i Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAZANEV, M.I.; KADIGROBOV, A.M.

Characteristics of the energy spectrum in magnetics. Fiz. met. i metalloved. 18 no.6:821-825 D '64.

(MIRA 18:3)

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T. 58879-65

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 4414-66 EWT(1)/EPA(s)-2/EEC(k)-2/T IJP(c) GG

ACCESSION NR: AP5025391 UR/0181/65/007/010/3090/3098

AUTHOR: Bass, F. G.; Gredeskul, S. A.; Kaganov, M. I.

TITLE: Theoretical basis for the use of a beam of charged particles to amplify sound in piezoelectric crystals

SOURCE: Fizika tverdogo tela, v. 7, no. 10, 1965, 3090-3098

TOPIC TAGS: piezoelectric crystal, ultrasonic amplification, dispersion equation

ABSTRACT: The authors study Cerenkov sound radiation from a uniformly charged filament moving in a slot in a piezoelectric crystal. The mechanism of ultrasonic amplification by the crystal is explained and formulas are derived for the coefficient of ultrasonic amplification by an unfocused plasma beam moving in a slot in a piezoelectric crystal and in a flat waveguide filled with a piezoelectric medium. Elimination of the requirement for a focused beam simplifies the experimental conditions and brings about some interesting effects. Crystals in the $T_d$ class are examined on the assumption that they are isotropic with respect to elastic properties. The formulas derived may be used for calculating radiation from a cluster of charged particles if the dimensions of the cluster are considerably less than a wavelength. The

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L 4414-66

ACCESSION NR: AP5025391

dispersion equation for a beam of charged particles moving in a slot in a piezoelectric crystal depends on the dielectric constant of the crystal due to the fact that the dielectric plasma wave is a surface wave. The energy of the wave is concentrated close to the plasma-crystal interface, and therefore the dispersion equation will always depend on the crystal characteristics. The amplified sound wave is propagated in a direction opposite to the motion of the beam. Orig. art. has: 5 figures, 37 formulas. [14]

ASSOCIATION: Institut radiofiziki i elektroniki AN UkrSSR, Khar'kov (Institute of Radio Engineering and Electronics, AN UkrSSR); Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University); Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov (Physicotechnical Institute, AN UkrSSR)

SUBMITTED: 26Mar65 ENCL: 00 SUB CODE: SS, GP

NO REF SOV: 002 OTHER: 001 ATD PRESS: 4126

Card 2/2

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

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[illegible] the surface of the metal disrupts its local mechanical equilibrium in a layer of the order of the length of the mean free path of the electrons. This diffuse scattering also generates uncompensated electromechanical forces. Because of this fact, a sound wave is generated by an alternating current in a metal film. The wave is propagated in a direction perpendicular to the surface of the film and has the same frequency as the alternating current which is responsible for it. The authors discuss this effect for metal films of various thicknesses supported by dielectrics with various properties. The reverse effect of current generation by a sound wave in a metal film is also discussed briefly. Orig. art. has: 3 figures, 39 formulas.

ASSOCIATION: none

Card 2/3

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 63980-65

ACCESSION NR: AP5011748

SUBMITTED: 22Jul64 ENCL: 00 SUB CODE: MM, GP

NO REF SOV: 005 OTHER: 001

KC

Card 3/3

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 12084-66 EWT(1)/EWT(m)/EWA(d)/EWP(t)/EWP(t)/EWP(b) IJP(c) JD/WW

ACC NR: AP5024702 SOURCE CODE: UR/0056/65/049/003/0807/0819

AUTHORS: Blank, A. Ya.; Kaganov, M. I.

ORG: Institute of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR (Institut radiofiziki i elektroniki Akademii nauk Ukrainskoy SSR)

TITLE: Contribution to the theory of spatial dispersion in ferromagnetic metals in a strong magnetic field

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 3, 1965, 807-819

TOPIC TAGS: ferromagnetic resonance, magnetic permeability, surface property, electromagnetic wave reflection, skin effect, exciton, absorption edge

ABSTRACT: The authors calculate the surface impedance of a metal at frequencies close to the frequency of ferromagnetic resonance, when the spatial dispersion of the magnetic permeability must be taken into account. The problem is solved by analyzing the reflection of an electromagnetic wave from a metallic ferromagnetic half-space situated in a magnetic field parallel to the surface of the metal. The alternating field propagates normally to the surface. Dissipation is not

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L 12084-66

ACC NR: AP5024702

taken into account. Exact formulas are derived for the spatial dispersion in the weak magnetic field under the conditions of normal skin effect. The reflection of an electromagnetic wave from a ferromagnetic dielectric is also considered and the expression obtained for the impedance is applied to a ferromagnetic metal under conditions of propagation of helicon waves. This is followed by an analysis of the behavior of a ferromagnetic metal under anomalous skin effect conditions, with a study made of the distribution of the electromagnetic field inside the metal. It is shown that in this case the resonant field constitutes a standing wave. The distribution of a field in a dielectric near the edge of exciton absorption, which is similar to that in a ferromagnetic metal under anomalous skin effect condition, is discussed in an appendix. Orig. art. has: 6 figures and 43 formulas.

SUB CODE: 20/ SUBM DATE: 03Mar65/ NR REF SOV: 010/ OTH REF: 006

Card 2/2

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 12181-66 EWT(1)/EWT(m)/EWP(w)/T/EWP(t)/EWP(b)/EWA(m)-2 IJP(c) JD/AT

ACC NR: AP5024716 SOURCE CODE: UR/0056/65/049/003/0941/0943

AUTHORS: Gurzhi, R. N.; Kaganov, M. I.

ORG: Physicotechnical Institute, Academy of Sciences, Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

TITLE: Effect of interelectron collisions on the optical properties of metals

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 3, 1965, 941-943

TOPIC TAGS: electron collision, electromagnetic wave absorption, internal photoeffect, electric conductivity, metal property, optic property

ABSTRACT: For the purpose of analyzing the role of interelectron interactions at optical frequencies, the authors calculate the electromagnetic energy absorption coefficient due to this interaction by using the model of ideal Fermi gas with an arbitrary dispersion law. No account is taken of the interaction between the electrons. The absorption coefficient is calculated from the tensor of the specific electric conductivity and it is shown that although an increase in frequency

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 12181-66

ACC NR: AP5024716

gives rise to singularities in the frequency dependence of the absorption at certain points, these singularities are quite weak and the quadratic dependence of the absorption coefficient on the frequency can be discerned with assurance for most metals. The results indicate that the intraband transitions can make an appreciable contribution to the absorption at high frequencies and that the deviations from the quadratic dependence are not due solely to the internal photoeffect. Orig. art. has: 4 formulas

SUB CODE: 20/ SUBM DATE: 19Apr65/ NR REF SOV: 007/ OTH REF: 003

Card 2/2

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 10264-66 EWT(m)/T/EWP(t)/EWP(b)/EWA(c) JD

ACC NR: AP5028689 SOURCE CODE: UR/0053/65/087/003/0389/0460

AUTHOR: Lifshits, I. M.; Kaganov, M. I.

44,55 44,55

ORG: none

TITLE: Certain problems in the electronic theory of metals 44,55

SOURCE: Uspekhi fizicheskikh nauk, v. 87, no. 3 1965, 389-460

TOPIC TAGS: metal, free electron, Boltzmann equation, Ohms law, electric conductivity, thermal conductivity, galvanomagnetic effect, thermoelectric effect, skin effect, metal property

ABSTRACT: The present paper is the third part of an extensive analysis of certain problems in the electronic theory of metals (the first two installments appeared in Uspekhi fizicheskikh nauk, v. 69, no. 3, 1959, p. 419 and v. 78, no. 3, p. 411). The latest article deals with the kinetic properties of metals primarily at low temperatures. The main emphasis is placed on the properties and effects affected by the dispersion of the conduction electrons, which are analyzed by means of Boltzmann's equation. Since the review is devoted to static and quasi-static properties, the gas approximation is used (the Fermi-liquid interaction does not affect the final formulas). The paper consists of 10 sections dealing with the various aspects of electrical conductivity, thermal conductivity and thermoelectric effects; galvanomagnetic effects, normal and anomalous skin effects, and ultrasound absorption. The bibliography consists of 128 cited sources, about 30% of which are Russian. Orig. art. has: 283 formulas and 30 figures. [CS]

Card 1/2 UDC: 530.145+537.311.33

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 10264-66

ACC NR: AP5028689

SUB CODE: 11,20/ SUBM DATE: none/ ORIG REF: 011/ OTH REF: 035/ ATD PRESS: 4161

Card 2/2

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 24394-66 EWT(1)/T IJP(c)
ACC NR: AP6010984 SOURCE CODE: JR/0056/66/050/003/0630/0641

AUTHORS: Kaganov, M. I.; Semenenko, A. I.

ORG: Physicotechnical Institute of Low Temperatures AN UkrSSR, Khar'kov (Fiziko-tekhnicheskiy institut nizkikh temperatur AN UkrSSR)

B

TITLE: Singularities of the phonon absorption coefficient and the geometry of the Fermi surfaces

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 3, 1966, 630-641

TOPIC TAGS: phonon interaction, absorption coefficient, phonon spectrum, dispersion equation, electron interaction, spin wave

ABSTRACT: The authors consider the singularities which are produced in the phonon spectrum and in the phonon damping coefficient in metals by phonon-electron interaction. The singularity consists in the abrupt vanishing of the absorption coefficient when the phonon momentum is equal to twice the Fermi electron momentum. To analyze these singularities, the authors establish a connection between these singularities and the properties of the Fermi surface at absolute

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ACC NR: AP6010984

zero. The connection established is between the singularities and the local properties of the Fermi surface. It is shown that the difference in the singularities is determined not so much by the difference between the local properties on the Fermi surface, as by the difference in the character of the tangency of this surface to its displaced analog. The connection between the singularities of the absorption coefficient and the singularities in the spectrum is established with the aid of dispersion relations similar to the Kramers-Kroenig relations. Allowance for a finite temperature smear out the singularities somewhat. The extent of the singularity is limited somewhat by the renormalization of the spectrum-phonon interaction when the electron-electron interactions are taken into account. In the case of metals possessing a magnetic structure, the singularities should be observed not only in the phonon spectrum but also in the spin-wave spectrum. Orig. art. has: 6 figures and 37 formulas.

SUB CODE: 20/ SUBM DATE: 28Jul65/ ORIG REF: 005/ OTH REF: 004

Card 2/2 ULR

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

L 04697-67 EWT(1)/EWP(k) IJP(c) WG/RIW/GG/JI/JAT(GW)

ACC NR: AP6029742 SOURCE CODE: UR/0053/66/089/004/0719/0723

AUTHOR: Kaganov, M. I.; Kochelayev, B. I.; Peschanskiy, V. G.

ORG: none

TITLE: Twelfth All-Union Conference on Low-Temperature Physics

SOURCE: Uspekhi fizicheskikh nauk, v. 89, no. 4, 1966, 719-723

TOPIC TAGS: physics conference, low temperature physics, Mossbauer effect, electron spectrum, EPR spectrum

ABSTRACT: The Twelfth All-Union Conference on Low-Temperature Physics, held 25—29 June 1965 in Kazan', dealt with investigations (using resonance methods) of condensed systems at low temperatures. More than 100 reports were presented at the conference, which was attended by approximately 300 Soviet scientists. The introductory address was given by P. L. Kapitsa.

The work of the conference was divided into four sections. Section 1 was concerned with electron spectra in non-conducting crystals; Section 2, with dynamic phenomena in non-conducting crystals; Section 3, with the

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ACC NR: AP6029742

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of the EPR spectra of various types of exchange pairs they determined the value of the exchange integral.

Dynamic Phenomena in Non-Conducting Crystals

The process of equilibrium establishment in spin-systems was discussed in detail. V. A. Atsarkin found that a two-staged process of spin-lattice relaxation takes place. In such a process, the excessive heat of the spin-system is transferred to thermal lattice oscillations by means of the rapid relaxation of the "exchange pairs." S. A. Peskovatskiy investigated the spin-lattice relaxation of chromium ions in ruby in the absence of an external magnetic field and concluded that in a wide range of chromium concentrations the "exchange pairs" do not contribute substantially to the relaxation of individual ions.

Other reports dealt with evaluations of the lifetime and temperature dependence of thermal phonons and spin-lattice relaxation.

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6

P. A. Bezuglov, V. D. Fil', and O. A. Shevchenko reported on observing nonlinear effects in the absorption of ultrasound (at frequencies of 115, 160, and 210 Mcps) in superconducting indium.

I. Ye. Dzyaloshinskiy discussed the theory of magnetic structures in antiferromagnetic metals. The appearance of such structures, he found, is linked with the exchange interaction of conduction electrons with spins of magnetic ions.

Other reports discussed the Fermi surface of some metals and its investigation by means of cyclotron resonance and magnetoacoustic methods.

At the final session session N. Ye. Alekseyevskiy summed up the work of the conference. It was resolved that an all-union conference on low-temperature physics and engineering be held in 1967 at Khar'kov.
[FSB: v. 2, no. 10]

SUB CODE: 20 / SUBM DATE: none

Card 5/5

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

ACC NR: AP/003212 SOURCE CODE: UR/0056/66/051/006/1703/1711

AUTHOR: Kaganov, M. I.; Yankelevich, R. P.

ORG: Physicotechnical Institute, Academy of Sciences, Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

TITLE: Contributions to the theory of antiferromagnetic resonance in metals

SOURCE: Zh eksper i teor fiz, v. 51, no. 6, 1966, 1703-1711

TOPIC TAGS: antiferromagnetism, ferromagnetic resonance, electric conductivity, plasma wave, spin wave

ABSTRACT: The authors explain the role played by plasma effects in antiferromagnetic resonance. The analysis is restricted to uniaxial antiferromagnets with positive anisotropy constant. The role of spatial dispersion in the variation of the surface impedance is first determined near the antiferromagnetic resonance frequencies. This is followed by consideration of the influence of the magnetic field on the electric conductivity, under the assumption that the resonance frequencies lie in the range where helicon waves exist. It is shown how the nature of the ground state is reflected in the properties of the electromagnetic waves, and that in the case of a comparatively weak magnetic field, undamped waves can be propagated in an antiferromagnetic metal. One of these is the supplementary wave due to spatial dispersion. The frequency dependence of the surface impedance exhibits singularities, which are explained. Couple spin-helicon waves are shown to propagate in an antiferromagnetic

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KAGANOV, M.R.

Efficiency suggestions and innovations submitted by physics teachers. Fiz.v shkole 16 no.1:51-54 Ja-Fe '56. (MLRA 9:3)

1. Nachal'nik byuro ratsionalizatsii i izobretatel'stva Ministerstva prosveshcheniya RSFSR.
(Physical instruments)

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, N. L.

PA 3/49T56

USSR/Electricity May 48
Power
Efficiency, Industrial

"Review of 'Economy of Electrical Power in Industry' Edited by V. I. Veyts;" Prof A. T. Golovan, N. L. Kaganov, R. Yu. Malaya, A. D. Svenchanskiy, A. A. Tayts, 3 pp

"Elektrichestvo" No 5

New 208-page book published in 1947 discusses economy of power in industry. Book, though it has a few errors, is valuable addition to wide field of technology and engineering.

[redacted] 3/49T56

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, N. L.

"Methods of Economizing Electric Power During Welding Operations," Collection of Data of the Scientific and Technical Session on Electric Power Economy (Sbornik materialov nauchno-tekhnicheskoy sessii po ekonomii elektroenergii), No II, MONITOE, 1949, 139 pp.

All-Union Scientific and Technical Society of Power Engineers Moscow Division, Industrial Electrical Engineering Section.

W - 15368, 6 Dec 50

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, N. L.

PA 197T33

USSR/Engineering - Welding

Apr 51

"Rational Methods of Welding Rods for Reinforced Concrete in Hydraulic Structures," Docent N. L. Kaganov, Cand Tech Sci, Moscow Higher Tech School imeni N. E. Bauman

"Avtogen Delo" No 4, pp 1-4

Divides all joints in concrete reinforcements, in respect to conditions for welding operations, into 4 groups and discusses the most efficient welding methods for each group. Describes in detail 2 automatic machines used for resistance butt welding.

197T33

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

AKHUN, A.I.; KAGANOV, N.L., kandidat tekhnicheskikh nauk, retsenzent; SERGEYEV, I.P., inzhener, retsenzent; GALAKTIONOV, A.T., kandidat tekhnicheskikh nauk, redaktor; ARZAMASTSEV, D.A., kandidat tekhnicheskikh nauk, redaktor; STEPANOV, V.G., kandidat tekhnicheskikh nauk, redaktor.

[Contact electric-welding machines] Kontaktnye elektrosvarochnye mashiny. Sverdlovsk, Gos. nauchno-tekhn. izd-vo mashinostroit.i sudostroit. lit-ry [Uralo-Sibirskoe otd-nie], 1953. 310 p. (MLRA 7:6)

1. Kafedra svarki MVTU imeni N.E.Baumana (for Kaganov, Sergeyev). 2. Uralmashzavod (for Stepanov).
(Electric welding)

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, Nota L'vovich, dotsent, kandidat tekhnicheskikh nauk; ROZANOV, V.F., inzhener, redaktor; STARICHKOV, V.P., inzhener redaktor; TOKER, A.M., tekhnicheskiy redaktor

[Electric butt welding of the framework for reinforced concrete] Kontaktnaia stykovaia elektrosvarka armatury zhelezobetona. Moskva, Gos. izd-vo lit-ry po stroitel'stvu i arkhitekture, 1955. 90 p. (MLRA 8:3)
(Electric welding)
(Reinforced concrete)

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

KAGANOV, N.L., kandidat tekhnicheskikh nauk.

Operational properties of Moscow Technical School condensers for welding thin and ultra-thin segments. [Trudy] MVTU no.37:227-239 '55. (Electric welding)(Condensers (Electricity)) (MLRA 9:6)

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9"

"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

28(1) SOV/159-58-3-22/31

AUTHOR: Kaganov, N.L.

TITLE: Ways of Mechanizing and Automating Resistance Welding Processes

PERIODICAL: Nauchnyye doklady vysshey shkoly, Mashinostroyeniye i priborostroyeniye, 1958, Nr 3, pp 158-162 (USSR)

ABSTRACT: This report was read at the inter-vuz scientific-technological conference at MVTU imeni Baumana in January 1958. The author explains six trends in developing mechanized and automated resistance welding processes. 1) For automating the resistance welding process, the contemporary resistance welding machines must be equipped with high-quality electronic, semi-conductor, capacitor and electromagnetic devices, controlling automatically the welding current intensity and its duration. Further, it is necessary to design equipment for controlling the welding current curve and for program controlled resistance welding processes. 2) The mechanization of resistance welding consists in the application of assembly jigs fixing the position

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Ways of Mechanizing and Automating Resistance Welding Processes

of the parts during the welding process. 3) Multi-position resistance welding machines must be designed, performing automatically a considerable amount (up to 300 and more) of welds during one work cycle. The author mentions in this connection the multi-spot welding machine K-21 which was developed by the Kafedra "Svarochnoye proizvodstvo" MVTU imeni Baumana (Chair "Welding Industry" of MVTU imeni Bauman). A great economical effect is also provided by multi-seam and multi-butt welding machines. 4) Resistance welding machines must be equipped with automatic feeders, mechanical operators and other mechanical devices performing the automatic feed, shift, rotation and removal of parts to be welded. The author mentions as an example of such a process the welding of fuel tanks at the Gor'kovskiy avtozavod (Gor'kiy Automobile Plant) and the welding of radiator housings at ZIL. 5) It is necessary to develop automatic welding equipment for application a conveyer line. In this case, one large assembly consisting of numerous smaller sub-assemblies

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

SOV/159-58-3-22/31

Ways of Mechanizing and Automating Resistance Welding Processes

is mounted and welded on a conveyer line. This method is of interest for the automobile industry, for welding driver's cabs of trucks, etc. An interesting example in this field is the assembly of the body of the "Volga" automobile, whereby the entire assembling and welding cycle lasts only 3.5 minutes. This method may also be used at other plants for the manufacture of RR cars, ships, diesel locomotives, harvesting machines and similar units. 6) All, or the majority of operations of a resistance welding process may be automated. For this purpose special machine units must be used, performing all technological operations automatically. The author mentions as example the welding tubes of steel band skeletons of steel-reinforced concrete columns. The latter are manufactured on an automatic assembly line at the Baumanskiy zavod stroydetaley (Bauman Plant of Structural Parts) which was developed by the "Krasnyy proletariy" plant. More than 20

Card 3/4

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operations are performed here automatically in the required sequence, beginning with the feeding of the wire rods from the bunker to the welding machines and ending with the removal of the finished skeleton.

ASSOCIATION: MVTU imeni Baumana

SUBMITTED: May 6, 1958

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

SOV/135-59-7-9/15

18(5), 25(1)

AUTHOR: Vaganov, N.I., Candidate of Technical Sciences

TITLE: New Impulse Resistance Welding Machines of the MVTU for Spot and Seam Welding of Thin Parts

PERIODICAL: Svarochnoye proizvodstvo, 1959, No 7, pp 31-34(USSR)

ABSTRACT: The author describes the experience made when developing a number of new impulse-resistance welding machines for spot and seam welding of thin parts, for example parts of vacuum tubes, at MVTU imeni Bauman. Fig.1 shows a photograph of the impulse-resistance welding machine K-22-1. Fig. 2 shows a photograph of the impulse-welding machine K-23. Fig. 3 is a circuit diagram of the dosing device K-29, while Fig 4 is a photograph of the aforementioned device. Fig. 5 shows seam welding machine K-30. Finally, Fig. 6 shows the impulse resistance-welding machine K-31. The latter is used for welding especially thin parts. The welding machine K-31 is in many parts identical with welding machine K-22-1. There are 6 photographs and 1 circuit

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SOV/113-59-7-3/15

New Impulse Resistance Welding Machines of the MVTU for Spot and Seam Welding of Thin Parts

diagram

ASSOCIATION: MVTU imeni Bauman

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NIKOLAYEV, G.A.; AKULOV, A.I.; BRATKOVA, O.N.; YEVSEYEV, G.B.; KAGANOV, N.L.; MORDVINTSEVA, A.V.; NAZAROV, S.T.; CHANGLI, I.I., red.; SOBOLEVA, G.N., red.izd-va; SMIRNOVA, G.V., tekhn.red.

[Welding] Svarka. Red.serii "Mashinostroenie v 1959 gg." I.I. Changli. Moskva, Gos.nauchno-tekhn.izd-vo mashinostroit.lit-ry, 1960. 106 p. (MIRA 13:7)

(Welding)

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"APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619920005-9

YERSHOV, L.K.; GORIN, F.I.; AKULOV, Ye.F., red.; KIRETEV, M.T., red.; NOVIKOV, V.K., red.; SAVEL'YEV, V.I., red.; CHUMAKOV, N.M., red.; KAGANOV, N.L., red.; LARIONOV, G.Ye., tekhn. red.

[Economical use of electricity in welding] Ekonomiia elektroenergii v svarochnom proizvodstve. Moskva, Gos.energ.izd-vo, 1961. 94 p. (MIRA 14:12)

(Electric welding)

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PHASE I BOOK EXPLOITATION SOV/5656

Nikolayev, Georgiy Aleksandrovich, Natan L'vovich Kaganov, Nikolay Aleksandrovich Ol'shanskiy, Aleksandra Vladimirovna Mordvintseva, and Dmitriy Mikhaylovich Shashin

Novaya svarochnaya tekhnika v priborostroitel'noy promyshlennosti (New Welding Processes in the Instrument Industry) Moscow, Gosizdat "Vysshaya shkola", 1961. 110 p. 10,000 copies printed.

Ed. of Publishing House: D. Ya. Koptevskiy; Tech. Ed.: R. K. Voronina.

PURPOSE: This book is intended for students in schools of higher education and tekhnikums; it may also be used by technical personnel in the instrument industry.

COVERAGE: The principal modern methods of joining metals and nonmetallic materials are discussed. The book is based on scientific research work performed by the authors, and on other investigations conducted in the USSR and abroad in recent years. Much of

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the material was obtained from experimental investigations conducted in the welding laboratory of the MVTU (Moskovskoye vysheye tekhnicheskoye uchilishche -- Moscow Higher Technical School) and at the Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute.) The introduction was written by Professor G. A. Nikolayev, Doctor of Technical Sciences; Section 3, 5, and 6 are by N. A. Ol'shanskiy; Section 2 is by D. M. Shashin; Section 4 is by N. L. Kaganov; and Section 7 is by A. V. Mordvintseva. No personalities are mentioned. References accompany some of the chapters. There are 37 references: 33 Soviet and 4 English.

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1.2300 (1573)

S/549/61/000/101/010/015
D256/D304

AUTHOR: Kaganov, N.L., Candidate of Technical Sciences, Docent

TITLE: Development of technology and equipment for condenser seam welding of bellows and heat exchangers

PERIODICAL: Vyssheye tekhnicheskoye uchilishche. Trudy. Svarka tsvetnykh splavov, redkikh metallov i plastmass, no. 101, 1961, 197 - 215

TEXT: The equipment was designed to provide maximum precision, self-regulation, and reliability in the resistance welding of thin-gage stainless steel (0.1 - 0.5 mm). The principles of the K-29 "controlled energy injector" are shown in Fig. 1. After warming, the cathodes of charging and discharging thyratrons CT and DT, and the charging transformer CTr are switched in, CT and ignition CIg conducted, and the battery of condensers BC becomes charged. Simultaneously current begins to flow through the parallel resistance bank. The current rises in the resistance circuit in proportion to

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the potential drop on $r_1$ through $r_6$, and a positive potential develops on the grid of DT. The time to reach this overcharge of condenser $C_2$, determining the pause between the current impulses, is given by the value of $r_6$. After, condenser discharge $NL_1$ is extinguished and the current through $r_5$ ceases. The grid potential of CT relative to its cathode becomes zero. CT and CIg become conducting again and the charging of the condensers recommences. This process of condenser bank charging and discharging to the desired voltage at the required frequency is repeated automatically until, through special devices on the charging or discharging thyratron grids, the cut-off voltage is not presented from the external source, or the anode voltage is not removed from the thyratron CT. The instant of start and finish of current impulses in welding every component is determined by the opening and closing of the circuit connecting the semi-conductor rectifier with thyratrons CT or DT. When a negative displacement is fed onto the grid of CT from the rectifier (supplied by an auxiliary transformer), the process of charging and discharging becomes discontinued. On breaking, the current between



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Development of technology and ...

+ 0.8 mm, and 0.8 + 2 mm. Another important factor is the design of the external secondary loop. It was found that the occurrence of variable contact resistances has an extremely unfavorable influence on the stability of current pulsing, since these resistances can constitute a large part of the total circuit resistance. The author explains how fusible alloys were used to overcome this. Design of electrode wheels is also important. For optimum strength and corrosion-resistant properties the outer layer of metal in the thinner component should remain unfused to a depth of 0.[illegible] - 0.5 of the thickness of this component. To ensure the optimum amount of penetration it is important that conduction of heat into the electrodes be sufficiently intensive. This was achieved by creating a special design of welding wheel with internal cooling just below the electrode working surface. The electrode pressure mechanism of seam-welders for welding thin-gauge components with constant setting should ensure a strictly identical pressure throughout the welding of a series of identical components. Experience showed that the greatest consistency of pressure is achieved by the use of spring--actuated drives and slides with minimum friction. Fig. 11 shows the complete electro-mechanical scheme of the K-30 welding machine.

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Supply of current to the rollers 1 from the condenser pack 2 and welding transformer 3 is accomplished through liquid contact [redacted] and current carrying shaft 5. Cooling water enters and leaves through collector 6. Electrode heads with horizontal axes of rotation can easily be [redacted] to those with vertical axes. Rods can easily be fitted instead of rollers, converting the seam welding machine into a spot welder. The machine is suitable for spot and seam welding components in a variety of forms and dimensions. Friction forces around the driven roller are reduced to a minimum by liquid contacts and ball-bearing journals of special design. By various modifications, longitudinal and spiral welds can be made. Apart from a number of automatic control and switching devices the complete welding machine consists of the K-29 condenser and electronic apparatus and the K-30 welding machine. The latter has the following characteristics: Continuous power - 12 kVA; maximum pressure - 200 k; welding speed with K-29 apparatus - 0.14-1.4 m/min; maximum distance between electrode working surfaces - 230 mm. There are 12 figures.

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S/145/62/000/009/003/005
D262/D308

AUTHOR: Kaganov, N.L., Docent

TITLE: Automation of electric point welding

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Mashinostroyeniye, no. 9, 1962, 140-144

TEXT: The article deals briefly with the following aspects of the automation of electric point welding: 1) Classification of automatic welding machines (semi-automatic, fully automatic, with various welding current sources, and their selection for various duties). 2) Automatic control of welding (feeding operation, positioning and fixing of welded components, and their removal after welding operation, synchronization and control of work of all elements of the machine, and control of process of joint formation: a) for fixed programming operation, and b) with automatic compensation. Recent research on applications of technical cybernetics to automation of the joint formation processes and the results of the indus-

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Automation of electric ... S/145/62/000/009/003/005
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trial tests for the longitudinal welding of tubes are also mentioned.

ASSOCIATION: MVTU im. N.E. Baumana (MVTU im. N.E. Bauman)

SUBMITTED: July 12, 1962

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PARAKHIN, V.A., kand. tekhn. nauk; FROLOV, V.V., dots., kand.tekhn. nauk; SHORSHOROV, M.Kh., dots., kand. tekhn. nauk; GOSPODAREVSKIY, V.I., inzh.; SUBBOTIN, Yu.V., inzh.; KURKIN, S.A., dots., kand. tekhn. nauk; VINOKUROV, V.A., dots.,kand. tekhn. nauk; KAGANOV, N.L., dots., kand. tekhn. nauk; SHASHIN, D.M., kand. tekhn. nauk; AKULOV, A.I., dots., kand. tekhn. nauk; NAZAROV, S.T., dots., kand. tekhn. nauk; YEVSEYEV, G.B., dots., kand. tekhn. nauk; NIKOLAYEV, G.A., prof., doktor tekhn. nauk, red.; TITOVA, V.A., red.; FUFAYEVA, G.I., red.; CHIZHEVSKIY, E.M., tekhn. red.

[Laboratory work on welding] Laboratornye raboty po svarke. Moskva, Rosvuzizdat, 1963. 274 p. (MIRA 16:8)

1. Nauchno-pedagogicheskiy kollektiv Kafedry svarochnogo proizvodstva Moskovskogo vysshego tekhnicheskogo uchilishcha (for all except Nikolayev, Titova, Fufayeva, Chizhevskiy).
2. Zaveduyushchiy kafedroy "Mashiny i avtomatizatsiya svarochnykh protsessov" Moskovskogo vysshego tekhnicheskogo uchilishcha (for Nikolayev).
(Welding—Study and teaching)

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K[illegible] [illegible] tekhnicheskoye CHEREDNICHENKO, N.G., inzh.

[illegible] the quality of spot joints of tungsten and nickel in [illegible] bulbs. Svar.proizv. no.12:11-13 D '65. (MIRA 18:12)

[illegible] Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.

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