S/058/61/000/012/064/083
A058/A101

AUTHORS: Rodichev, A.M., Ignatchenko, V.A., Salanskiy, N.M.

TITLE: Evaluating the Barkhausen Jump

PERIODICAL: Referativnyy zhurnal. Fizika, no. 12, 1961, 385, abstract 12E700 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 113 - 121)

TEXT: The Barkhausen jump is regarded as a variable magnetic dipole with magnetic moment m=m(t). The emf induced by the dipole field in single-layer and multilayer measuring coils is determined. It is assumed that field H is parallel or antiparallel to domain magnetization. It is shown that incident to evaluation of the Barkhausen jump, length l of the measuring coil has a great effect on measurement results; for the error not to exceed 10%, the condition $l \gg 40D$ must be observed (D being the mean diameter of the measuring coil). Maximum accuracy can be achieved if l exceeds specimen length by 2D. It is noted that experimental setups for measuring the Barkhausen jump that do not contain special integrating elements or that have a measuring coil for a pickup can only be graduated in

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Evaluating the Barkhausen Jump

S/058/61/000/012/064/083
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terms of dm/dt. On the basis of an experiment simulating the Barkhausen jump, it was found that the formulae of the present work can be utilized for specimens with $d \leqslant 0.6$ mm (d is specimen diameter).

L. Vinokurova

[Abstracter's note: Complete translation]

Card 2/2

S/058/61/000/012/066/083
A058/A101

AUTHORS: Ignatchenko, V.A., Rodichev, A.M.

TITLE: Concerning the distribution in magnitude of Barkhausen jumps

PERIODICAL: Referativnyy zhurnal. Fizika, no. 12, 1961, 385, abstract 12E702 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 123 - 127)

TEXT: The distribution in magnitude of the Barkhausen jumps is associated with how ordered in structure the specimen is. It is pointed out that experimental setups having only one measuring coil for a pickup can only measure one component of the rate of change dm^o/dt of the magnetic moment incident to jumps, for instance in the case of field H parallel to the Z-axis of the coil dm_z^o/dt. If, however, the texture degree W is known, then the V_o distribution (V_o being the volume remagnetized as a result of Barkhausen jumps) can be determined on the basis of the measured distribution of m^o_z. A calculation method is provided. In the case of a single crystal (the V_o distribution being known) the degree of ordering of domain structure (W) is determined from the measured m^o_z distribution. Calcula-

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Concerning the distribution ... S/058/61/000/012/066/083
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tion results were qualitatively borne out by experimental verification on Fe-Si single crystals and polycrystals.

L. Vinokurova

[Abstracter's note: Complete translation]

Card 2/2

S/126/60/009/03/022/033
E032/E414

AUTHORS: Ignatchenko, V.A. and Vansovskiy, S.V.

TITLE: On the Form of the Formula for the Magnetoelastic Energy of a Ferromagnetic 21

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 3, pp 456-457 (USSR)

ABSTRACT: In the derivation of their formula for the density of magnetoelastic energy, Becker and Doring (Ref 1) introduced a small inaccuracy. This was repeated in subsequent versions of this derivation (Ref 2,3). Let us reproduce some of the steps in the derivation of this formula. The part of anisotropy energy which depends on the powers of forced deformations may be written in the form given by Eq (1). In this formula the dependence of f_σ on pure volume changes is neglected (when $u_{11} = u_{22} = u_{33}$, $u_{ik} = 0$, $i \neq k$, then $f_\sigma = 0$). Here u_{ik} are the components of the elastic deformation tensor, α_i are the direction cosines of the vector I_s, c_2 and c_3 are the elastic moduli and f_u is written in the form given by Eq (2). It is well-known (cf for example Ref 2 or 4) that for a free cubic crystal, the

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On the Form of the Formula for the Magnetoelastic Energy of a Ferromagnetic

components of the deformation tensor are related to the components of the stress tensor by the relation given in Eq (3). A substitution of Eq (3) into Eq (1) leads to the expression given by Eq (4). In previous derivations, the term

$$\frac{1}{3}\sum_i \sigma_{ii}$$

was neglected since it is independent of α_i. However, this approximation robs the formula of any clear physical meaning. It is therefore suggested that the full Eq (4) should be used for f_σ. Let us consider expressions for f_σ in certain special cases. If the crystal is subjected to uniform extension (compression) in the direction $\gamma_1, \gamma_2, \gamma_3$, then $\sigma_{ik} = \sigma\gamma_i\gamma_k$ and f_σ is given by Eq (5). If the spontaneous magnetization is directed along the "easy" direction (along [100] for iron and along [111] for nickel) then f_σ is given by the

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On the Form of the Formula for the Magnetoelastic Energy of a Ferromagnetic

expressions in Eq (6) respectively, where φ is the angle between the direction of extension and the magnetization. Finally, in the isotropic magnetostriction approximation $(\lambda_{100} = \lambda_{111} = \lambda)$ and for an arbitrary orientation of I_s relative to the crystallographic axis, F_σ is given by Eq (7). There are 4 references, 2 of which are Soviet, 1 German and 1 English.

This is a complete translation.

ASSOCIATIONS: Institut fiziki Sibirskogo otdeleniya AN SSSR (Institute of Physics of the Siberian Branch AS USSR)
Institut fiziki metallov AN SSSR (Institute of Physics of Metals AS USSR)

SUBMITTED: February 3, 1960

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S/126/60/009/05/019/025
E032/E314

AUTHORS: Polivanov, K.M., Rodichev, A.M. and Ignatchenko, V.A.

TITLE: The Effect of the Parameters of Ferromagnetics on the Measurements of the Barkhausen Effect

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 5, pp 778 - 789 (USSR)

ABSTRACT: The Barkhausen effect is usually studied by measuring the emf induced in a coil surrounding the ferromagnetic specimen. The emf pulses induced in this coil by discontinuous changes in the magnetization are the only source of information about this phenomenon. The time interval between successive pulses can be made quite large by a suitable choice of the linear dimensions of the specimen and the rate of change in the magnetic field H. Under such conditions each emf pulse corresponds to a single discontinuity. The present paper is concerned with the determination of the relationship between the pulse parameters and the volume of the region in the ferromagnetic within which the discontinuous change in the magnetization takes place, the increase in the magnetization, the change in the magnetic moment, the duration and the rate

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S/126/60/009/05/019/025
E032/E314

The Effect of the Parameters of Ferromagnetics on the Measurements of the Barkhausen Effect

of the process, etc. It is shown that the only physical characteristic which can be found directly from the observed induced emf is the change in the dipole moment m_o which is proportional to the time integral of the induced emf. It follows that it is desirable to include an electronic integrator in the usual apparatus employed to measure the Barkhausen effect. A formula is obtained (Eq 21) which expresses the emf induced in the measuring coil as a function of the change in the magnetic dipole moment of a region in a ferromagnetic cylinder at an arbitrary distance from its axis. The formula is similar to that obtained by Tebble et al (Ref 3) but its derivation is more rigorous. The theoretical calculations are compared with published experimental results. There are 12 figures and 11 references, 8 of which are Soviet, 1 German and 2 English.

ASSOCIATION: Institut fiziki AN SSSR (Institute of Physics of the Ac.Sc., USSR)

SUBMITTED: December 15, 1959

Card 2/2

S/126/60/009/06/015/025
E073/E335

AUTHORS: Rodichev, A.M. and Ignatchenko, V.A.

TITLE: Dynamics of the Barkhausen Jump

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 903 - 908 (USSR)

ABSTRACT: The authors investigated the character of the movement of the domain boundary during a Barkhausen jump. The Barkhausen jump is attributed to the following mechanism: in the case of a slow increase of the magnetic field H the boundary between domains displaces in such a way that at each instant of time the conditions of the sum of all magnetic energies having a minimum are fulfilled. If the boundary hits a barrier, it may impede its movement. In this paper a solution is obtained of the equation of motion which has been written taking into consideration the basic forces acting on the boundary and formulae are derived which establish the dependence of the duration and speed of the process on various characteristics of the ferromagnetic. In another paper (Ref 8), the authors report on the measurement of the distribution of Barkhausen jumps as a function of pulse durations in

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nickel specimens for pulses of durations between 2 and 30 µs. The analysis of the results of this experiment published in earlier work (Ref 2) leads to the conclusion that the real durations of the jumps did not exceed 1 µs. Evaluation by means of Eq (14) of this paper for an equal specimen yields time values which are not contradictory to these conclusions.
There are 3 figures and 8 references, 3 of which are English, 2 French, 1 German and 2 Soviet.

ASSOCIATION: Institut fiziki AN SSSR (Institute of Physics of the Ac.Sc. USSR)

SUBMITTED: December 15, 1959

Card 2/2 √B

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

86898

24.7900 (1035,1055,1160)

S/056/60/039/005/015/051
B029/B079

AUTHORS: Kirenskiy, L. V., Ignatchenko, V. A., Rodichev, A. M.

TITLE: The Behavior of a Domain Structure Under the Influence of Elastic Tensions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1263-1268

TEXT: Using a thermodynamic method devised by L. D. Landau and Ye. M. Lifshits the authors studied an iron-type crystallite whose surface coincided with the (001) plane. They assume the existence of partially overlapping domains whose width can assume values between 0 and D (D denotes the width of the principal domains). In this paper, the free energy of such a structure is calculated. The coordinates are assumed to coincide with the tetragonal axes of the crystallite, and the dimensions of the crystallite along the coordinates are denoted by x_0, y_0, z_0. Using the method of Ch. Kittel (Ref. 2) for the calculation of the energy of the magnet poles, one obtains

$$\gamma_{M} = \frac{4\omega^2 D}{\pi^3}\left[1,05 + \sum_{m=1}^{\infty} \frac{\cos(2m-1)\pi k}{(2m-1)^3}\right], \quad (1.1)$$

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where ω denotes the surface density of the magnet poles. Moreover, $k = d/D$. $f(k)$, that is, the expansion appearing in the brackets of (1,1) was calculated by means of the tables compiled by K. A. Kitover (Ref. 11). For estimatés, $f(k) = 5.28k^3 - 6.84k^2 + 2.1$ for $k \leqslant 0.5$, and $f(k) = 5.28k^3 - 9k^2 + 2.16k - 1.56$ for $k \geqslant 0.5$. If the face of the crystallite does not coincide exactly with [001], the energy of the magnet poles is $F_M^{\mathbf{x}} = 1.7\, I_s^2 \sin^2\theta.\ 2D/(1 + \mu^{\mathbf{x}})y_o = aD/y_o$, where $\mu^{\mathbf{x}} = 1 + 2\pi I_s/K$. θ denotes the angle between the crystallite face and the direction [001], and K denotes the constant of magnetic anisotropy. In the principal domains and also in the closing domains there is an equilibrium state with a complicated distribution of the stress tensor. The authors assume that a deformation exists only in the direction of the x-axis, and they calculate the density of energy in the closing domains. In this case, the total free energy of the structure amounts to $F = F_m + F_m^{\mathbf{x}} + F_{m.s} + F_g + F\sigma$. Here, $F_m = (8\omega^2/\pi^2 z_o)Df(k)$ denotes the energy of the magnet poles; f_g is the total

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energy (γ is the surface density of the boundary energy); $F_{ms} = c_2\lambda^2_{100}Dk^3/2z_0$ is the magnetostriction energy; and

$$F_e = -\frac{3}{2}\lambda_{100}\sigma\left(\cos^2\varphi - \frac{1}{3}\right) + \frac{3}{4}\lambda_{100}\sigma\cos 2\varphi\,\frac{Dk^2}{z_0},$$

where φ denotes the angle between the stress direction and the z-axis. The second part of the present paper deals with the behavior of a structure under the influence of stress. For any value of σ, the equilibrium state of the structure is defined by the conditions $\partial F(D,k)/\partial D = 0$, $\partial F(D,k)/\partial k = 0$ wherefrom the equations

$$D = \left[\frac{\gamma z_0}{az_0/y_0 + 8\omega^2\pi^{-2}f(k) + c_2\lambda^2_{100}k^2/2 + {}^3/_4\lambda_{100}\sigma k^2\cos 2\varphi}\right]^{1/2},$$

$$(16\omega^2/3\pi^2)f'(k) + \lambda^2_{100}c_2k^2 + \lambda_{100}k\sigma\cos 2\varphi = 0.$$

follow. If there is no stress in the crystallite, one of three structures, a,b, or c, will appear, depending upon the value of ω. If structure a is assumed to be stable, and if a uniform expanding stress is applied at an angle greater than $\pi/4$ relative to the z-axis, closing (b) appear at a certain value of σ. They increase until the total closing (c) is reached. In this case, D may either increase or decrease. Then, part of the closing

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domains increases, while the other part decreases. If σ increases, the closing domains decrease until structure h is formed. The accompanying figure shows the consecutive stages of change in the domain structure under expansion. Ya. S. Shur and V. A. Zaykova (Ref. 7) observed also a transition from f to g. The calculations described in the present paper agree well with the known experiments and demonstrate the possible existence of structure e. There are 7 figures and 11 references: 9 Soviet and 2 US.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics of the Siberian Branch of the Academy of Sciences USSR)

SUBMITTED: March 24, 1960

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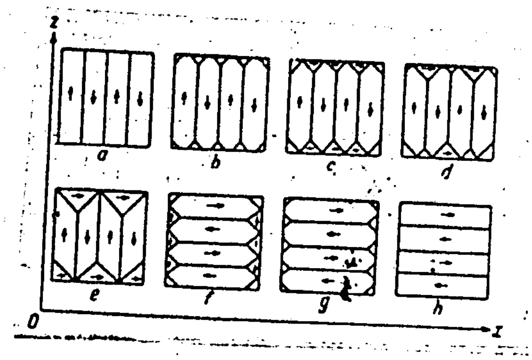

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APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

25805
S/048/61/025/005/019/024
B117/B201

24,7900

AUTHORS: Kirenskiy, L. V., Ignatchenko, V. A., and Baklanov, O. G.

TITLE: Ferromagnetic resonance in thin films

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 5, 1961, 640-642

TEXT: The present investigation was the subject of a lecture delivered at a symposium on thin ferromagnetic films (Krasnoyarsk, July 4 to 7, 1960). The phenomenon of ferromagnetic resonance was used for measuring the saturation magnetization and the anisotropy constant of thin ferromagnetic films. A block diagram of the system used for the purpose is shown in Fig. 1. The superhigh frequency vibrations generated by a 43И (43I) standard generator are modulated by the rectangular pulses from generator Г. The chain consisting of a tee junction H_o, a detector D_o, an amplifier, and an oscilloscope serves for supervising the generator operation. The main part of the superhigh frequency power incides upon aperture S which connects the resonant chamber to the waveguide circuit. A cylindrical

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Ferromagnetic resonance in thin films S/048/61/025/005/019/024 B117/B201

chamber with TE_{11} mode is utilized. The disk-shaped specimens are placed at the rear chamber wall. The reflected wave reaching the detector D_2 via junction H_2 is measured. To augment the sensitivity of the system, the ground level of the signal from the detector D_2 is compensated by the opposite phase of the signal from detector D_1. The difference of these signals is transmitted to the amplifier, and, subsequently, to the detector which had been synchronized by the pulses coming from the generator Г. The amplified and rectified signal is recorded by galvanometer A. Oscilloscope O_2 controls the work of the phase detector and of the compensator. The resonant chamber is placed into a constant magnetic field which is oriented in parallel to the film plane and in perpendicular to the magnetic component of the superhigh frequency field. The electromagnet is fed by a stabilized УИП-1 (UIP-1) source. The thin films were prepared by cathode sputtering in vacuum ($\sim 10^{-5}$ mm Hg). Disk-shaped cover glasses 18 mm in diameter served as backings. The backing temperature during sputtering was about 300°C. To create an artificial anisotropy a constant field of $\sim$100 oe is applied in the film plane during sputtering. Several permalloy films (80 % Ni, 17 % Fe, 3 % Mo) and a cobalt film were

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examined. The permalloy composition was not controlled after sputtering. The film thickness was determined with the aid of a УМ-2 (UM-2) monochromator by the method described by I. N. Shklyareyskiy (Ref. 4: Optika i spektroskopiya, 5, № 5, 617 (1958)). Sputtering took place at high temperatures. Since the coefficients of thermal expansion of metal and backing during cooling are unequal, radially symmetrical elastic stresses arise in the film. The active demagnetizing fields corresponding to them were calculated by J. R. MacDonald (Ref. 5: Proc. Phys. Soc., 64, 968 (1951)) and J. H. E. Griffiths (Ref. 1: Physica, 17, 253 (1951)). General formulas for the effective fields of crystallographic anisotropy were obtained by MacDonald (Ref. 5) for single crystals, in particular for hexagonal ones:

$$H_1^{\text{ан}} = \frac{2}{I_s}[(K_1' + [2K_2')(\gamma_{31}^2 - \gamma_{21}^2) + 2K_2''(3\gamma_{21}^2 - \gamma_{31}^2)\gamma_{21}^2], \qquad (4)$$

$$H_2^{\text{ан}} = \frac{2}{I_s}[(K_1' + 2K_2')(\gamma_{31}^2 - \gamma_{11}^2) + 2K_2'(3\gamma_{11}^2 - \gamma_{31}^2)\gamma_{21}^2].$$

Formally, the anisotropy of thin films of non-crystallographic origin can be expressed by formulas of this type (4), where K_1' and K'_2 are the

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Ferromagnetic resonance in thin films

effective anisotropy constants. The results obtained from the measurement of the saturation magnetization of a thin permalloy film have shown a qualitative agreement of the saturation magnetization as a function of thickness with data given in Ref. 3 (Tannenwald P. E., Seavey M. N., J. phys. et radium, 20, 323 (1959)) for an 80 % Ni, 20 % Fe film. The sharp magnetization drop was, however, observed with thicknesses larger than those of Ref. 3 by one order of magnitude. Possibly, this is to be explained by the varying chemical composition. Even more likely, however, an insufficient homogeneity of the films employed is responsible for this phenomenon. No anisotropy was established on permalloy films, i.e., it cannot exceed 10^3 erg cm^{-3}. On the cobalt film (d = 3200 Å) the resonant field was found to be distinctly dependent upon the rotational angle of the film. The anisotropy constant K_1' can be easily calculated from formula (4) if assuming $K_2' = 0$. In this case, $H^a = (2K_1'/I_s) = 175$ oe. When assuming that $J_s = 1.42 \cdot 10^3$, it follows that $K_1' = 1.24 \cdot 10^5$ erg cm^{-3}.

T. A. Stepanova is thanked for her assistance. There are 3 figures and 5 references: 1 Soviet-bloc and 4 non-Soviet-bloc.

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Ferromagnetic resonance in thin films

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics of the Siberian Department, Academy of Sciences USSR)

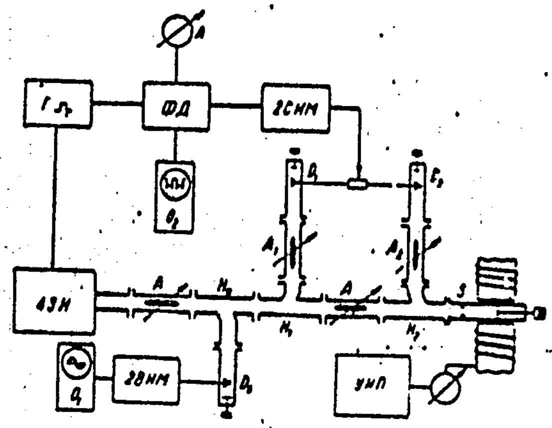

Fig. 1

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24.2200(1121, 1147, 1068)

31599
S/048/61/025/012/003/022
B125/B112

AUTHORS: Ignatchenko, V. A., Degtyarev, I. F., Zakharov, Yu. V.

TITLE: Behavior of domain structure in the magnetization process

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 12, 1961, 1439-1444

TEXT: The domain structure of small monocrystal plates, cut in parallel to the (011) plane, is very simple. Sometimes irregular inversely magnetized wedges can be observed in domains of antiparallel magnetization. The domain structure of such monocrystals was studied theoretically.

$$\gamma_M = -\frac{1}{4\pi^2}\int_0^{2\pi} d\xi \int_0^{2\pi} d\eta \int_{-z_0/2}^{0} H_z(\xi,\eta,z)\omega(\xi,\eta)dz$$

is the energy density of the demagnetizing poles per unit area. The surface density $\omega(x,y)$ of the magnetic poles which are formed on the planes $z = 0$ and $z = -z_0$ is periodic with the periods $2\pi L_x$ and $2\pi L_y$ with respect to the x and y axes. In the case most significant in practice ($\omega(x,y)$

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periodic with respect to x and along y except for the interval $(-y_0/2, y_0/2)$ everywhere equal to zero)

$$\gamma_m = \frac{4\pi^2}{y_0}\int_{-\infty}^{+\infty}\frac{\bar{\omega}_0(v)\,\bar{\omega}_0(-v)}{|v|}(1-e^{-|v|z_0})\,dv + \frac{4\pi^2}{y_0}\sum_{-\infty}^{+\infty}{}'\int_{-\infty}^{+\infty}\frac{\bar{\omega}_m(v)\,\bar{\omega}_{-m}(-v)}{Q_m(v)}(1-e^{-Q_m z_0})\,dv, \qquad (1.8)$$

holds with $Q_m^2(v) = v^2 + (m/L_x)^2$.

$$\gamma_m = \frac{8\pi^2}{x_0 y_0}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\frac{\bar{\omega}(u,v)\,\bar{\omega}(-n,-v)}{R(u,v)}(1-e^{-R(u,v)z_0})\,du\,dv, \qquad (1.9)$$

$R^2 = u^2 + v^2$ н

$$\bar{\omega}(u,v) = \frac{1}{4\pi^2}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\omega(x,y)\,e^{-i(ux+vy)}\,dx\,dy.$$

holds for a crystal with finite x_0, y_0, z_0. With $z_0/L_x \gg 1$

$$\gamma_m = 2\pi\omega^2(1-q)^2 z_0 + \frac{8\omega^2}{\pi^2} D f(q),$$

$$f(q) = \sum_{m=1}^{\infty} \frac{1-\cos m\pi q}{m^2}, \qquad (2.1)$$

$$2D = d_1 + d_2, \quad q = d_1/D.$$

follows when applying the formula

$$\gamma_m = 2\pi\omega_0^2 z_0 + 2\pi L_x \sum_{-\infty}^{+\infty}{}' \frac{\omega_m \omega_{-m}}{|m|}(1 - e^{-p_{mn} z_0}),$$

$$\omega_m = \frac{1}{2\pi}\int_0^{2\pi} \omega(\xi)\, e^{-im\xi} d\xi. \qquad (1.7),$$

periodic only with respect to x and independent of y, to the domain structure shown in Fig. 1. The free energy of the crystal per unit volume, $F(D,q) = 2\pi\omega^2 \cdot (1-q)^2 + (8\omega^2/\pi^2 z_0)\, Df(q) + (\gamma/D) - \omega H(1-q)$, consists of the energy of the demagnetizing fields, of the limiting energy and of the energy of the external magnetic field (direct along the z-axis). The equilibrium domain structure can be described for any value of the external field H by

$$D = \frac{\pi}{\omega}\left[\frac{z_0\gamma}{8f(q)}\right]^{1/2}, \quad (2.3)$$

$$-4\pi\omega(1-q) + f'(q)\left[\frac{8\gamma}{\pi^2 z_0 f(q)}\right]^{1/2} + H = 0. \quad (2.4).$$

Magnetization is caused not only by diminishing the width of the unsuitably magnetized domains but also by their divergence.

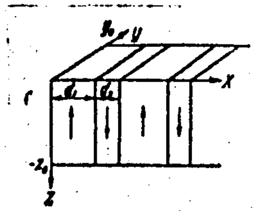
$$F(D,q) = K\left(\frac{y_0}{z_0}\right)2\pi\omega^2(1-q)^2 + \frac{8\omega^2}{\pi^2 z_0}D\Psi(D/y_0, q) + \frac{\gamma}{D} - \omega H(1-q), \quad (2.8)$$

$$\Psi(D/y_0, q) = \frac{4}{D}\sum_{m=1}^{\infty}\frac{1-\cos m\pi q}{m^3}G.$$

holds for a crystal of finite thickness. If $y_0 \approx 10^{-2}$, the following holds: $\chi_0 \approx [4\pi K(y_0/z_0)]^{-1}$ which agrees approximately with experimental data. The domain structure of such crystals as are finite in all three dimensions must be computed electronically. K. A. Kitover (Priklad. matem. i mekhan., 12, 233, 1948) is mentioned. There are 3 figures and 4 references: 2 Soviet and 2 non-Soviet. The two references to English-language publications read as follows: C. Kittel, Rev. Mod. Phys. 21, 541, 1949; J. Goodenough, Phys. Rev. 102, 356 (1956).

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics of the Siberian Franch of the Academy of Sciences USSR)

Fig. 1. Schematical drawing of domain structure.



APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

IGNATCHENKO, V.A.

Spontaneous magnetization of this ferromagnetic films. Zhur. eksp. i teor. fiz. 40 no.4:1228-1229 Ap '61. (MIRA 14:7)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.
(Magnetic materials)

39755
S/126/62/014/001/011/018
E194/E435

24.2200

AUTHORS: Ignatchenko, V.A., Chistyakov, N.S., Tarasenko, V.I.

TITLE: Power absorption at super-high frequency during remagnetization of a thin ferromagnetic film

PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.1, 1962, 125-126

TEXT: Power absorption was observed when a thin ferromagnetic film located in a weak super-high-frequency (3.2 cm) field produced by a klystron generator is remagnetized by a low frequency sinusoidal field excited by a coil supplied from an audio frequency generator. The tests were made on permalloy discs 1000 Å thick, 16 mm diameter, prepared by evaporation in vacuo. Increase of the remagnetizing field applied along the axis of easy magnetization of the film did not affect the absorption peak except to reduce its base width. This indicated that high-frequency power is absorbed only during remagnetization of the film; the absorption intensity increased at the beginning of

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E194/E435

Power absorption at ...

remagnetization, reached a maximum and then tailed off to its initial value when remagnetization was completed. When the angle between the direction of remagnetization and the axis of easy magnetization coincided, strong absorption was observed; it was less near the direction of difficult magnetization. The absorption did not depend on frequency. The shape of hysteresis loop as function of the angle between the axis of easy magnetization and the direction of the remagnetizing field showed that remagnetization of the film occurred over a field range of 25 to 30 Oe. The observed phenomena are attributed to the formation of and changes in the domain structure during the remagnetization process. There are 2 figures.

ASSOCIATION: Institut fiziki SO AN SSSR (Institute of Physics SO AS USSR)

SUBMITTED: November 17, 1961 (initially)
February 10, 1962 (after revision)

Card 2/2

39482
S/056/62/043/002/016/053
B102/B104

24.2200

AUTHORS: Ignatchenko, V. A., Zakharov, Yu. V.

TITLE: Domain structure of thin ferromagnetic films

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 2(8), 1962, 459-461

TEXT: The equilibrium domain structure of a uniaxial ferromagnetic plate of thickness y_0 with its axis of easiest magnetization lying in the plane of the sample is calculated. The volume density of the energy of the demagnetizing fields is given by

$$F_M = \frac{32 y_0 J_s^2}{\pi^4 z_0} \sum_{m\,\text{неч}} \frac{1}{m^3} \left\{ \frac{\pi^2}{2} \operatorname{Arsh} \frac{2\delta}{45m} + 18{,}09\,[1 + (45\,m/2\delta)^2]^{-1/2} + 4{,}75\,[1 + (45\,m/24\delta)^2]^{-1/2} + 0{,}61\,[1 + (45\,m/46\delta)^2]^{-1/2} + 0{,}18\,[1 + (45\,m/68\delta)^2]^{-1/2} + (\delta^2/m^2)\,[\sqrt{1 + (m/2\delta)^2} - 1] \right\}, \quad \delta = D/y_0. \qquad (2),$$

where J_s is the surface density of magnetic poles, D is the domain diameter,

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APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

and z_0 is the plate dimension along the direction of easiest magnetization. Perpendicular to z_0 the plate is infinitely long. The equilibrium width of a domain: $R(\delta) = \gamma z_0/J_s^2 y_0^2$ is derived from the free energy minimum condition. Here, γ is the surface density of the end-point energy. For $\delta \ll 1$ (massive material) $D = (\pi/4)\left[\gamma z_0/1.052 J_s^2\right]^{1/2}$; this relation agrees with the Kittel formula with an error of 1.2%. If $\delta \gg 1$, $D = 0.493\ \gamma z_0/J_s^2 y_0 - 24.8\ y_0$. These relations hold for a sufficient number of domains in the sample so that the surface density of magnetic poles is a periodic function. There is 1 figure.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics of the Siberian Department of the Academy of Sciences USSR)

SUBMITTED: October 28, 1961

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

ACCESSION NR: AP4023408 S/0048/64/028/003/0568/0571

AUTHOR: Ignatchenko, V.A.; Zakharov, Yu.V.

TITLE: On taking into account the finite geometrical dimensions of the ferromagnet in the theory of domain structure /Report, Symposium on Ferromagnetism and Ferroelectricity held in Leningrad 30 May to 5 June 1963/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.3, 1964, 568-571

TOPIC TAGS: domain size, finite crystal domain size, thin film domain size, domain size theory

ABSTRACT: The size of the domains in a finite rectangular parallelepiped having the simple domain structure illustrated in Fig.1 of the Enclosure is discussed theoretically. The surface energy density in a domain wall is assumed to be independent of the size of the crystal. The problem thus reduces to that of calculating the energy of the system in its own demagnetizing field. After a brief discussion of formulas for the demagnetization energy previously published for the case in which the crystal is finite only in the z direction (see figure) (C.Kittel,Rev.Mod.Phys.21,541, 1949; J.Goodonough,Phys,Rev.102,356,1956), and for the case in which the crystal is

ACCESSION NR: AP4023408

finite in the y and z directions (V.A.Ignatchenko, I.F.Degtyarev and Yu.V.Zakharov, Izv.AN SSSR,Ser.fiz.25,1439,1961), the authors present an analogous formula that they have derived for the case in which the crystal is finite in all three directions. The demagnetization energy was evaluated numerically for the case of a square thin film in the x-z plane and the condition was derived that a uniformly magnetized film be stable against domain formation. This condition is

$$y_0 < k\frac{\gamma}{M_s^2},$$

where y_0 is the thickness of the film, M_s is the saturation magnetization, γ is the surface energy density of the domain walls, and the dimensionless quantity k is a function of the side $x_0 = z_0$ of the square film. When x_0 is 0.1, 0.2 or 1.0 cm, the value of k is 4.03, 1.67 or 0.177, respectively. Thus, a 1 cm^2 film of a material having a saturation magnetization of 600 gauss and a domain wall energy density of 1 erg/cm^2 will be stable against domain formation provided it is less than about 50 Å thick. Orig.art.has: 10 formulas and 2 figures.

Card 2/4

ACCESSION NR: AP4023408

ASSOCIATION: Institut fiziki Siberskogo otdeleniya Akademii nauk SSSR (Institute of Physics, Siberian Division, Academy of Sciences, SSSR)

SUBMITTED: 00 DATE ACQ: 10Apr64 ENCL: 01

SUB CODE: PH NR REF SOV: 004 OTHER: 005

Card 3/4

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

ACCESSION NR: AP5000337

IGNATCHENKO, V.A.; ZAKHAROV, Yu.V.

Structure of the domain boundary in a ferromagnet of finite thickness. Zhur. eksp. i teor. fiz. 49 no.2:599-608 Ag '65. (MIRA 18:9)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

L 5342-66 EWT(1) IJP(c)

ACCESSION NR: AP5021123 UR/0056/65/049/002/0599/0608

AUTHOR: Ignatchenko, V. A.; Zakharov, Yu. V.

TITLE: Structure of domain boundary in a ferromagnet of finite thickness

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 2, 1965, 599-608

TOPIC TAGS: ferromagnetic material, magnetic domain boundary, uniaxial crystal, ferromagnetic film

ABSTRACT: The structure of the domain boundary of a uniaxial ferromagnetic crystal of finite thickness 2d is determined by perturbation theory. Unlike all earlier studies of the subject, account is taken of the surface anisotropy β' and real boundary conditions on the crystal surface are employed. A uniform boundary and a boundary which is longitudinally periodic are considered. It is shown that when β' ≠ 0 there exists a range of thicknesses in which a Neel boundary can exist. When β' exceeds a critical value, a Bloch boundary becomes energetically more favorable at any thickness. General equations are derived for the period and shape of the periodic boundary and are investigated in two limiting cases of large and small anisotropy. Depending on the magnitude of the surface anisotropy, the Bloch

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0901 1128

L 5342-66

ACCESSION NR: AP5021123

boundary may become either narrower or become broadened toward the crystal surface. Orig. art. has: 5 figures and 28 formulas.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Physics Institute, Siberian Department, Academy of Sciences, SSSR) 44,55

SUBMITTED: 20Feb65 ENCL: 00 SUB CODE: SS, EM

NR REF SOV: 008 OTHER: 014

Card 2/2

L 8312-66 EWT(1)/EWT(m)/T/EWP(b)/EWP(t) IJP(c) GG/JD

ACC NR: AP5024700 SOURCE CODE: UR/0056/65/049/003/0787/0796

AUTHOR: Ignatchenko, V. A.; Kuz'min, Ye. V.

ORG: Institute of Physics, Siberian Department, Academy of Sciences SSSR (Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR)

TITLE: Magnetic and acoustic excitation of coupled magnetoelastic oscillations in a thin magnetic film

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 3, 1965, 787-796

TOPIC TAGS: excited state, magnetic thin film, excitation spectrum, electric energy conversion

ABSTRACT: The purpose of the investigation was to calculate the amplitudes and effective relaxation parameters line widths) of magnetoelastic oscillation in a thin magnetic film, both in the case of magnetic and in the case of acoustic excitation. A linearized system of equations is written out for a magnetically uniaxial ferrodielectric which is isotropic with respect to its elastic and magnetoelastic properties and has the form of a thin film supporting uniform oscillations in the plane of the film. A general solution is obtained, from which equations are derived for the amplitudes of the spin waves in the case of magnetic excitation and for the amplitudes of the acoustic waves produced by acoustic excitation (complex amplitudes of the elastic components of magnetoelastic oscillations). This is followed by a study of

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L 2312-66

ACC NR: AP5024700

the magnetic components of magnetoelastic oscillations under acoustic excitation and the elastic components of magnetoelastic oscillations under magnetic excitation. The relaxation characteristics of the magnetoelastic oscillations are also considered. For both magnetic and acoustic excitation, it is shown that a discrete spectrum of resonance peaks and coupled magnetoelastic oscillations, determined by exchange of magnetoelastic interactions, should be observed in a thin magnetic film. In the case of acoustic excitation, in contrast to excitation by a uniform microwave magnetic field, even modes are also excited, thus doubling the number of resonance peaks. The distributions of the peaks are discussed, together with the optimal conditions for the most effective use of a thin magnetic film as an element for mutual conversion of microwave oscillations of different types. Orig. art. has: 4 figures and 39 formulas.

SUB CODE: 20/ SUBM DATE: 11Feb65/ ORIG REF: 004/ OTH REF: 002

jw

Card 2/2

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

L 15381-66 EWT(1)/EWP(e)/EWT(m)/T/EWP(t)/EWP(b) IJP(c) JD/GG

ACC NR: AP6004456 SOURCE CODE: UR/0048/66/030/001/0012/0016

60

B

AUTHOR: Ignatchenko, V.A.; Kuz'min, Ye.V.; Gorenko, L.M.

ORG: Institute of Physics of the Siberian Section of the Academy of Sciences, SSSR (Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR)

21,44,55

TITLE: Influence of damping on the magneto-elastic vibration spectrum of a thin magnetic film /Transactions of the Second All-Union Symposium on the Physics of Thin Ferromagnetic Films held at Irkutsk 10 July to 15 July, 1964/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.30, no. 1, 1966, 12-16

TOPIC TAGS: ferromagnetic film, magnetic thin film, magnetodielectrics, magnetostriction, spin wave, resonance line, relaxation process,

ABSTRACT: Two of the authors have previously calculated the discrete spectrum of the characteristic vibrations of a thin magnetic film 21,44,55 due to exchange and magnetoelastic interactions (V.A. Ignatchenko and Ye.V. Kuz'min, Zh. eksperim. i teor. fiz., 47, 1814 (1964)). In the present paper the widths and amplitudes of the corresponding lines are calculated. Terms are adduced to describe the relaxation of the spin and phonon systems, and linearized equations are written for the magnetization and the elastic displacement under the influence of a high frequency external field in a thin uniaxial ferromagnetic dielectric film which is isotropic with regard to its elastic and magnetostrictive properties. It is stated that this equation can be derived by the method

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ACC NR: AP6004456

employed in the earlier paper. The dispersion equation for plane waves propagating perpendicular to the plane of the film is written. For right-hand polarized waves this equation describes slightly modified elastic waves; these solutions are not further discussed. For left-hand polarized waves the dispersion equation describes magnetoelastic vibrations. The roots of the dispersion equation corresponding to magnetoelastic vibrations are discussed at some length. The spectrum is made discrete by imposing the boundary conditions that the elastic stresses vanish and the spins are pinned at the boundary, and expressions are derived for the widths and amplitudes of the resonance lines. Orig. art. has: 29 formulas and 2 figures.

SUB CODE: 20 SUBM DATE: 00 ORIG. REF: 002 OTH REF: 000

Card 2/2

L 15506-66 EWT(d)/EWT(l)/EWT(m)/EWP(e)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b) IJP(c)
ACC NR: AP6004468 JD/GG SOURCE CODE: UR/0048/66/030/001/0059/0063

AUTHOR: Chistyakov, N.S.; Ignatchenko, V.A.

ORG: Institute of Physics, Siberian Section of the Academy of Sciences, SSSR (Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR)

TITLE: Microwave frequency susceptibility of thin ferromagnetic films in weak magnetic fields /Transactions of the Second All-Union Symposium on the Physics of Thin Ferromagnetic Films held at Irkutsk 10 July to 15 July, 1964/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.30, no. 1, 1966, 59-63

TOPIC TAGS: ferromagnetic film, magnetic thin film, superhigh frequency, magnetization, magnetic susceptibility, magnetic domain boundary

ABSTRACT: A technique is described by which, with the use of microwaves, one can distinguish between different switching mechanisms in thin ferromagnetic films. In the authors' equipment 3.2 cm microwaves were fed to a T bridge carrying a resonant cavity in one arm and a detector in the other. The resonator consisted of a section of rectangular waveguide and was excited in the H_{102} mode. The end wall of the resonator had an 8 mm diameter opening over which the film under investigation was mounted. When the film was magnetized parallel to the magnetic field of the resonator it had no influence on the resonator characteristics; when, however, the magnetization of the film was perpendicular to the resonator field, the magnetization would oscillate about

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ACC NR: AP6004468

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

its equilibrium direction at the microwave frequency and would thus influence the resonant frequency and the Q of the cavity and alter the reflected wave. This change in the reflected wave was detected and displayed on an oscilloscope. Switching coils were excited with an audio oscillator, which was also coupled to the horizontal sweep of the oscilloscope. When switching occurs entirely by 180° domain wall motion, the magnetization is always parallel to the resonator field and no signal is produced. When magnetization rotation takes place, however, the magnetization is perpendicular to the resonator field at one stage of the process and a signal is observed on the oscilloscope screen. It is also possible to detect and distinguish between uniform magnetization rotation and switching in which the magnetization rotates in one direction in part of the film and in the opposite direction in other parts of the film. Experiments with a number of iron and Permalloy films confirmed the expected behavior, and oscillograms are presented that illustrate the signals produced by different switching mechanisms. Orig. art. has: 2 formulas and 4 figures.

SUB CODE: 20 SUBM DATE: 00 ORIG. REF: 006 OTH REF: 000

Card 2/2

IGNATCHENKO, V.A.; KUDENKO, Yu.A.

Theory of nuclear magnetic resonance and ferromagnetic resonance in thin magnetic films. Izv. AN SSSR. Ser.fiz. 30 no.1:77-79 Ja '66. (MIRA 19:1)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

ACC NR: AP7005378

AUTHOR: Ignatchenko, V. A.; Kudenko, Yu. A.

SOURCE CODE: UR/0181/66/008/012/3677/3679

ORG: Institute of Physics, SO AN SSSR, Krasnoyarsk (Institut fiziki SO AN SSSR)

TITLE: Inversion of nuclear magnetization upon motion of a domain boundary

SOURCE: Fizika tverdogo tela, v. 8, no. 12, 1966, 3677-3679

TOPIC TAGS: nuclear magnetic moment, magnetic domain boundary, ferromagnetic material, ferrodielectric, nuclear magnetic resonance

ABSTRACT: This is a continuation of earlier work (Izv. AN SSSR ser. fiz. v. 30, 933, 1966) where the possibility was analyzed of producing an inversion state of nuclear magnetization by pulsed reversal of magnetization of thin magnetic films, when the electronic magnetization is reversed by rotation. The present article analyzes the possibility of producing inversion of nuclear magnetization by reversing the magnetization of a ferromagnet via motion of the domain boundaries. This situation is realized more frequently than magnetization reversal by rotation of the electronic magnetization. The change in the effective magnetic field at a given nucleus in the ferromagnet and its mobility coefficient are calculated, and it is shown that an inverted state of the nuclear magnetic system can be obtained when the magnetization of a ferromagnet (either a thin film or bulky ferrodielectric) is reversed by displacement of the domain boundaries. The conditions for the immunity of the inverted state to decay into nuclear spin waves are the same as in the earlier investigation.

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ACC NR: AP7005378

The repetition frequency of the magnetization-reversal pulses should also be the same as in the earlier case. A similar result is obtained by periodic variation of the domain boundary. The nuclear magnetic resonance signal from the domain boundaries, which interferes in this case with the signal due to the magnetization inversion, can be eliminated by a suitable choice of the relative direction of the radio-frequency field. Orig. art. has: 8 formulas.

SUB CODE: 20/ SUBM DATE: 28Jun66/ ORIG REF: 001/ OTH REF: 002

Card 2/2

L 24788-66 EWT(1)/EWT(m)/T/EWP(t) IJP(c) JD/GG

ACC NR: AP6014256 SOURCE CODE: UR/0109/66/011/005/0950/0951

AUTHOR: Chistyakov, N. S.; Ignatchenko, V. A.; Bayukov, O. A.; Rusova, S. G.

ORG: none

TITLE: Certain UHF properties of multilayer films

SOURCE: Radiotekhnika i elektronika, v. 11, no. 5, 1966, 950-951

TOPIC TAGS: magnetic thin film

ABSTRACT: Transmission and reflection factors of single-layer and multilayer magnetic films were measured in a waveguide system operating at λ = 3 cm. Individual films were made by sputtering 17Fe80Ni3Mo alloy on a glass substrate heated to 200C in a vacuum of 10^{-5} mm Hg and in a magnetic field of ∿ 100 oe. Multilayer films were made by insulating each film layer by a layer of SiO 1000 Å thick. Experimental data (see Fig. 1) shows that the transmission factors for multilayer films (point 1—10 layers, 1000 Å each; point 2—40 layers, 500 Å each) substantially exceeds the same factor for a single layer 10^4 Å film (solid line). By breaking the film into layers, but keeping the same total thickness, skin depth is increased. This fact was substantiated by switching the films in a cavity resonator and

 UDC: 539.216.22:621.318.

ACC NR: AP6014256

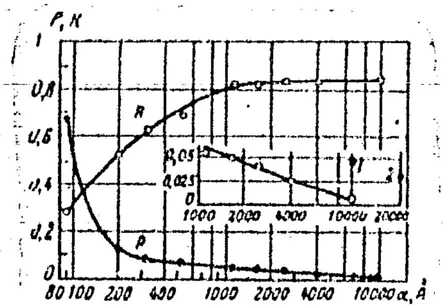

Fig. 1. Transmission (P) and reflection (R) factors as functions of film thickness d.

noting the resonator frequency shift. The shift for multilayer films is greater than that for equivalent single-layer film and shift linearity is preserved up to total film thickness of 3 x 10^4 Å (30 layers 1000 Å each). Orig. art. has: 2 figures. [BD]

SUB CODE: 09/ SUBM DATE: 17Apr65/ ORIG REF: 005/ ATD PRESS: 4250

Card 2/2

L 07109-67 EWT(l)/EWT(m)/EWP(t)/ETI IJP(c) JD/GG

ACC NR: AP6029101 SOURCE CODE: UR/0048/66/030/006/0933/0935

AUTHOR: Ignatchenko, V.A.; Kudenko, Yu.A.

ORG: Institute of Physics, Siberian Section, Academy of Sciences, SSSR (Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR)

TITLE: Some peculiarities of nuclear magnetic resonance in ferromagnets /Report, All-Union Conference on the Physics of Ferro- and Antiferromagnetism held 2-7 July 1965 in Sverdlovsk/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 30, no. 6, 1966, 933-935

TOPIC TAGS: ferromagnetic film, nuclear magnetic resonance, nuclear spin, spin system, spin wave, maser

ABSTRACT: The authors discuss the population inversion produced in the nuclear spin system of a ferromagnet by sudden magnetization reversal. Experimental results obtained by W. Dietrich and W. Proebster (Elektronische Rundschau, 14, 2 (1960)) with thin permalloy films show that the magnetization of a thin ferromagnetic film can be reversed in a time comparable with the ferromagnetic resonance period, and that a considerable population inversion can accordingly be achieved in the nuclear spin system. The decay of this population inversion into inhomogeneous electron-nuclear oscillations (electron-nuclear spin waves) is discussed with the aid of the Landau-Lifshits and Bloch equations of motion. It is shown that the population inversion can decay

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L 07109-67

ACC NR:

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R0005 33(

only into spin waves with frequency close to that at which the electronic and nuclear branches of the solution of the spin-wave dispersion equation intersect, and that that intersection occurs outside the physical region when the magnetic field is sufficiently strong (above about 10 Oe). It is concluded that by sudden switching with a sufficiently strong field one can achieve a population inversion in the nuclear spin system of a thin ferromagnetic film that will persist for a time long enough to permit maser action at the nuclear magnetic resonance frequency to be experimentally demonstrated. The authors thank A.K. Popov for valuable discussions. Orig. art. has: 7 formulas.

SUB CODE: 20 SUBM DATE: 00 ORIG. REF: 005 OTH REF: 001

Card 2/2

ACC NR: AP6029104

2

anisotropy and another parameter of the model with the aid of a computer, and the results are presented graphically. The critical period increases with increasing surface anisotropy. The authors thank D.M.Frumin and E.K.Zykova for performing the computations. Orig. art. has: 3 formulas and 1 figure.

SUB CODE: 20 SUBM DATE: 00 ORIG. REF: 003

Card 2/2

ABAKUMOVSKIY, D.D., inzh.; VIKHMAN, Yu.L., inzh.; VODOVOZOV,A.I.,inzh.; ZORIN,R.P.,inzh.; IGNATCHENKO,Ye.A.,inzh.; LITINSKIY,M.E.,inzh.; SAZONOV,A.I.,inzh.; PRITULA,V.A., inzh.,; POMAZKOV,S.A.,inzh.; FRUKHTSHEYN,L.I.,inzh.; SAPOZHNIKOV,N.M.,inzh.; MASYUK, A.I., inzh.; YANKELEV,L.F.,inzh.; BASHILOV,M.M.,otv. red.; LATINSKIY,M.E., red.; POLOSINA, A.S., tekhn. red.

[Handbook for buidlers and assemblers of the petroleum industry] Spravochnik stroitelia-montazhnika neftianoi promyshlennosti. Moskva, Gostoptekhizdat, 1946. 250 p. (MIRA 15:4)

1. Russia(1923- U.S.S.R.) Narodnyy komissariat neftyanoy promyshlennosti. Glavnoye upravleniye. 2. Narodnyy komissariat neftyanoy promyshlennosti SSSR (for all except Bashilov, Latinskiy, Polosina). (Petroleum industry)

IGNATCHENKO, Ye. A., inzhener.

Introducing results of scientific work into industry (results of joint work of the Ministry of the Oil Industry of the U.S.S.R. and the Academy of Sciences of the Ukrainian S.S.R.). Vest.AN SSSR 23 no.5:28-33 My '53. (MLRA 6:7)
(Technology)

IGNATCHENKO, Ye. A.

AID P - 1141

Subject : USSR/Engineering

Card 1/2 Pub. 78 - 19/25

Authors : Ignatchenko, Ye. A. and Fal'kevich, A. S.

Title : Further improvement of construction methods for oil storage metal tanks

Periodical : Neft. khoz., v. 32, #11, 71-79, N 1954

Abstract : The author outlines various improvements introduced in the construction of metal storage tanks. The improvements include: (1) prefabricated tanks in sheet-rolls, (2) special welding methods with ammonia and phenolphthalein, (3) automatic seam welding, (4) the use of various improved arrangements for hoisting and supporting of the wall sheets and (5) design, bending and assembling of double curvature leaves of "Horton-spheroidal" tanks (drop-shaped). Five drawings and 2 tables.

Neft. khoz., v. 32, #11, 71-79, N 1954 AID P - 1141

Card 2/2 Pub. 78 - 19/25

Institutions: All-Union Scientific Research Institute for Petroleum Industry (VNII-Stroyneft), Central Scientific Research Institute on Technology of Machine Building (TsNIITMASH)

Submitted : No date

IGNATCHENKO, Ye.A.

Industrial method and progressive technology in the installation of connecting pipelines. Stroi.pred.neft.prom. 1 no.1:8-11 Mr '56. (Petroleum--Pipelines) (MLRA 9:9)

IGNATCHENKO, Ye.A., inzhener.

Interesting experiments. Stroi. pred.neft.prom. 2 no.1:27-29 Ja '57. (MIRA 10:3)

(Pipe fittings) (Pipe)

IGNATCHENKO, Ye.A., inzh. (Moskva)

Shorten the construction time of petroleum refineries. Stroi. pred. neft. prom. 2 no.12:1-4 D '57. (MIRA 11:3)
(Petroleum refineries)

...RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00...33(

Ignatchenko, Ye.

IGNATCHENKO, Ye.A., inzh.

Advanced installation methods used in enterprises of the petroleum industry. Nov. tekh. i pered. op. v stroi., no.11:13-18 N '57. (MIRA 10:12)
(Petroleum industry)

SOV/137-58-8-17169

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 8, p 138 (USSR)

AUTHOR: Ignatchenko, Ye.A.

TITLE: Advanced Methods for Welding of Gas and Oil Lines (Progressivnyye metody svarki gazo-neftetruboprovodov)

PERIODICAL: Novaya tekhn. i peredov. opyt v str-ve, 1958, Nr 1, pp 10-13

ABSTRACT: A description of a mobile welding unit equipped with an annular transformer employed for butt-welding (W) of main pipe lines and industrial pipe lines. The procedures employed during W of pipes are described. At a diameter of 325-529 mm, the process of flash W and compression of pipes requires 90-110 seconds, and the entire operation of centering and W of the first junction consumes 5-7 minutes. Measures introduced in order to further the development of oil- and gas-line construction are listed. A process is described whereby steel pipe lines are welded automatically in an atmosphere of CO_2. It is pointed out that, unlike the method of submerged-arc W, this process makes it possible to observe the motion of the electrode and permits W of stationary butt-type junctions without the employment of backing rings, as well as W of small-diameter pipes

Card 1/2

SOV/137-58-8-17169

Advanced Methods for Welding of Gas and Oil Lines

(from 1" to 6"), etc. At a diameter of 6" the productivity amounts to 125-130 top-grade welded junctions per run. Measures for wide-range utilization of the method of automatic W of pipes in a CO_2 atmosphere are listed.

B.K.

1. Pipes—Welding
2. Welding—Equipment

Card 2/2

IGNATCHENKO, Ye. A., HAYEVSKIY, G. V., POPOVSKIY, [illegible] (Section VIII)

"Industrial Methods of Building Oil Tanks in the Soviet Union."

Report submitted for the Fifth World Petroleum Congress, 30 May - 5 June 1959. New York.

IGNATCHENKO, Ye.A.

Methods for reducing the time expended in constructing petroleum refineries and petroleum chemical plants. Nov. tekh. mont. i spets. rab. v stroi. 21 no.2:1-7 F '59. (MIRA 12:1)

1. Glavneftemontazh Ministerstva stroitel'stva RSFSR.
(Petroleum refineries)

KHARAS, Z.B., inzh.; IGNATCHENKO, Ye.A., inzh.

Optimum load capacity of tower hoists in assembling vertical apparatus for petroleum refineries. Prom. stroi. 37 no.7:57-60 Jl '59. (MIRA 12:10)

(Petroleum refineries--Equipment and supplies)
(Hoisting machinery)

IGNATCHENKO, Ye.A., inzh.

"Electric arc welding" by D.G.Magnitskii. Reviewed by E.A. Ignatchenko. Mont.i spets.rab.v stroi. 22 no.3:32 Mr '60. (MIRA 13:6)

(Electric welding)
(Magnitskii, D.G.)

IGNATCHENKO, Ye.A., inzh.

Using the method of sheet-steel rolling in constructing tanks and gasholders. Mont. i spets.rab.v stroi. 22 no.11:3-7 N'60. (MIRA 13:10)

1. Glavneftemontazh.
(Gasholders) (Tanks) (Sheet steel)

DUMITRESCU, M.; DEGERATU, V.; IGNATENCO, Gh.

Utilization of low-grade pyrites with about 30% sulfur in sulfuric acid manufacture. Rev chimie Min petr 13 no.10:597-600 O '62.

IGNATENKO, A. [Ihnatenko, A.], inzh. (Dnepropetrovsk)

Applied television. Nauka i zhyttia 11 no.3:36-37 Mr '62. (MIRA 15:8)

(Television adaptations)

ANTOSHCHENKO, Ye.M.; IGNATENKO, A.D.; OBODAN, V.Ya.; REVA, V.K.

Television methods for automatic con rol of geometrical parameters of controlled systems. Avtom. i prib. no. 1:73-78 Ja-Mr '64. (MIRA 17:5)

GRODZINSKIY, Dmitriy Mikhaylovich; VLASYUK, P.A., akademik, otv. red.; IGNATENKO, A.I., red.; POTOTSKAYA, L.A., tekhn. red.

[Methods of using radioactive isotopes in biology]Metodika primeneniia radioaktivnykh izotopov v biologii. Kiev, Izd-vo Ukr. akad. sel'khoz.nauk, 1962. 170 p. (MIRA 15:11)
(Tracers (Biology))

ZINOV'YEVA, Khristina Gavrilovna; VLASYUK, P.A., akademik, red.; IGNATENKO, A.I., red.; KVITKA, S.P., tekhn. red.

[Azotobacter and farm plants]Azotobakter i sel'skokhoziaistvennye rastenila. Kiev, Gos.izd-vo sel'khoz.lit-ry, USSR, 1962. 178 p. (MIRA 16:3)

(Azotobacter) (Field crops)

IGNATENKO, A.I.

Republican interplant school. Bum. i der. prom. no.1:51-52 Ja-Mr '65. (MIRA 18:10)

14-57-6-11715 KRT

Translation from: Referativnyy zhurnal, Geografiya, 1957, Nr 6, p 13 (USSR)

EDITOR: Ignatenko, A. N.

MAP: Moscow District, to the Scale of 1:600 000. For Tourists (Podmoskov'ye. M. 1:600 000. Turistskaya karta)

PERIODICAL: GUGK MVD SSSR, 1956

ABSTRACT: Bibliographic entry

Card 1/1

IGNATENKO, A.P.

Rare case of barotrauma of the respiratory tract. Sud-med. ekspert. 6 no.4:42 O-D'63 (MIRA 16:12)

1. Byuro sudebnomeditsinskoy ekspertizy Krasnoyarskogo kraya (zav. Ye.D.Kindayeva).

ROZOVA, Yekaterina Sergeyevna; VOLEVAKHA, M.M., kand. geogr. nauk, red.; IGNATENKO, A.Y. [Ihnatenko, A.I.], red.; POKIDKO, A.I. [Pokyd'ko, A.I.], red.; KVITKA, S.P., tekhn. red.

[Rainless periods in the Ukraine] Bezdoshchovi periody na Ukraini. Kyiv, Vyd-vo UASHN, 1961. 69 p. (MIRA 16:5)
(Ukraine--Droughts)

IGNATENKO, A YE

USSR/ Physics - Nuclear cross section

Card 1/1 Pub. 22 - 12/46

Authors : Ignatenko, A. Ye; Mukhin, A. I.; Ozerov, E. B.; and Pontekorvo, B. M.

Title : Total cross-sections of the interaction between the negative π -mesons and hydrogen in the energy range from 140 up to 400 Mev

Periodical : Dok. AN SSSR 103/1, 45-47, Jul 1, 1955

Abstract : Experimental studies of the total cross-sections of the interactions between negative π -mesons and protons (hydrogen) are described. The experiments were conducted at the Institute of Nuclear Problems of the Acad. of Sc., USSR. Measurements of the cross-sections were carried out in the energy areas from 140-400 Mev. The measurements were conducted by the method of differences (CH_2-C). Five references: 2 USSR and 3 USA (1952-1954). Diagrams; table.

Institution : Acad. of Sc., USSR, Institute of Nuclear Problems

Presented by: Academician L. A. Artsymovich, May 17, 1955

. . . . A Ye.

USSR/ Physics - Nuclear physics

Card 1/1 Pub. 22 - 9/45

Authors : Ignatenko, A. Ye.; Mukhin, A. I.; Ozerov, Ye. B.; and Pontekorvo, B. M.

Title : Full cross-sections of the interaction between negative π-mesons and deuterium in the energy region between 140 and 400 Mev.

Periodical : Dok. AN SSSR 103/2, 209-212, Jul 11, 1955

Abstract : Experiments intended to obtain more precise data on the full cross-section of negative π-mesons and deteurium reactions (π^-,d) are described. The experiments were conducted in the range of energy between 140 and 400 Mev. Ten references: 1 French, 3 USSR, and 6 USA (1952-1955). Tables; graphs.

Institution : The Acad. of Sc., USSR, Institute of Nuclear Physics

Presented by : Academician L. A. Artsimovich, May 17, 1955

IGNATENKO A E

539 172

531 THE INTERACTION OF NEGATIVE π-MESONS WITH NUCLEI OF BERYLLIUM, CARBON AND OXYGEN IN THE ENERGY RANGE FROM 140 TO 400 MeV. A.E.Ignatenko, A.I.Mukhin, E.B.Ozerov and B.M.Pontekorvo (Pontecorvo). Dokl. Akad. Nauk SSSR, Vol. 103, No. 3, 395-7 (1955). In Russian.

Gives the results of an investigation of the energy dependence of total cross-sections for the interaction of π^--mesons with these three elements. Scintillation counters were used to measure the attenuation of a π^--meson beam, with the arrangement described in a previous paper (Abstr 6141/1953). The measured cross-sections were corrected for μ^--meson admixture, chance coincidences, miscounting, small-angle scattering and secondary particles, and the results are tabulated together with the corresponding errors. The total cross-section is found to have a flat maximum from 140 to 230 MeV, decreasing sharply on each side of this range.

J.B.Sykes

APPROVED FOR RELEASE; Thursday, July 27, 2000 CIA-RDP86-00513R000 ... 33(

IGNATENKO, A.E.

PA - 1751

CARD 1 / 2

SUBJECT	USSR / PHYSICS
AUTHOR	IGNATENKO,A.E., KRIVICKIJ,V.V., MUCHIN,A.I., PONTEKORVO,B., REUT,A.A., TARAKANOV,K.I.
TITLE	The Leading-Out of Bundles of Energy-Rich Particles through the Pole Shoes of the Electromagnet of a Phasotron.
PERIODICAL	Atomnaja Energija, 1, fasc.5, 5-8 (1956) Issued: 1 / 1957

The present paper describes the method for the production of collimated pion bundles which was developed in the summer of 1953. On this occasion the pole shoes of the electromagnet serve as the main protection against the direct radiation of the accelerator. Apart from the economic advantage offered, the application of pole shoes as protection against radiation permits a considerable increase of the operation surface for investigations. In the 6 m phasotron of the Institute for Nuclear Problems of the Academy of Science in the USSR the properties of mesons are investigated on bundles which are led out not only through and between the pole shoes, but also through a specially built "principal concrete protection" of the phasotron. However, this concrete protection is comparatively far away from the chamber of the accelerator, and therefore the meson bundles led through the pole shoes are more intense than the bundles led out through the principal concrete protection.

The leading out of monoenergetic pion bundles through the pole shoes of the phasotron magnet is discussed on the basis of a drawing. The mesons produced by the bombardment of the target (arranged in the accelerator chamber) with 680 MeV

APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00051833(

Total cross sections of interaction of positive π mesons with hydrogen. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontecorvo. *Zhur. Eksptl. i Teoret. Fiz.* 30, 7-11(1956).—The total cross sections of interaction of pos. π mesons with H were detd. by attenuation in liquid H. From the combined measurements of total cross sections of π^+ mesons with H and with D a contribution to the cross section by states with different isotopic spin were obtained in the 140-230-m.e.v. region. The length of the scatterer was 28 cm., corresponding to the surface d. of H 1.97 g./sq. cm. In addn. to the previously described sector (*C.A.* 50, 7614e) Cherenkov detector, poly(methyl methacrylate) and polyethylene filters were used to absorb protons. Total uncertainty in energy measurements (including the slowing down of mesons in H, errors in measuring energy, and initial and max. probability of heterogeneity in the meson beam) was ±6 m.e.v. For π^+ mesons with energy (m.e.v.) 140 ± 7, 144 ± 6, 164 ± 6, 174 ± 6, 184 ± 6, 194 ± 6, 209 ± 10, 219 ± 6, 229 ± 6 the following total cross sections (mb.) were obtained, resp.: 133 ± 8, 151 ± 4, 169 ± 5, 193 ± 6, 196 ± 6, 200 ± 6, 179 ± 6, 156 ± 7, 132 ± 7.

A. P. Kotlobay

CARD 1 / 2 PA - 1867

SUBJECT USSR / PHYSICS
AUTHOR IGNATENKO, A.E., MUCHIN, A.I., OZEROV, E.B., PONTEKORVO, B.
TITLE The Interaction between Pions and the Nuclei of Lead, Copper, Carbon and Beryllium.
PERIODICAL Žurn.eksp.i teor.fis, 31, fasc.4, 545-549 (1956)
Issued: 1 / 1957

The present work at first deals with the results obtained by measuring the cross sections σ_{ne} of the nonelastic collisions between negative pions and Be-, C-, Cu- and Pb-nuclei in the energy interval of from 140 to 400 MeV and then discusses them in connection with the corresponding total cross sections σ_t. The nonelastic cross sections were measured by measuring the attenuation of the meson bundle passing through a scatterer by the method of scintillation counters. Measuring results are shown in a table. The necessary corrections are discussed. A diagram illustrates the found energy dependence of the nonelastic cross sections and compares them with the nonelastic cross sections measured previously by means of scintillation counters at energies of less than 140 MeV. The energy dependence of the nonelastic and total cross sections of these nuclei in general reminds us of the energy dependence of the total cross sections of the scattering of pions by hydrogen and deuterium. At energies of from 100 to 250 MeV the cross sections depend only slightly on energy, but above 250 MeV cross sections diminish comparatively quickly. Also at energies below 100 MeV cross sections diminish comparatively quickly. σ_t and σ_{ne} attain their maximum within that energy domain

(~ 190 MeV), in which also the total cross sections of the scattering of pions by hydrogen and deuterium attain their maxima. For the purpose of determining data concerning the energy dependence of the range $\lambda = f(E)$ the here obtained data on σ_{ne} were analyzed (on the basis of the optical model). The here obtained ranges are shown in a diagram and correspond at all energies to the nonelastic cross sections of Be and C. The range may be computed also from the data on the cross sections of interaction between pions and free nucleons; a corresponding formula is given. The ranges determined by these two methods agree with one another at energies of more than 200 MeV. Therefore, pions probably enter into interaction with the individual nucleons of the nucleus. The computed and measured energy dependence of the total cross section are in good agreement. From the analysis of the here discussed results it follows that the optical model, if suitable parameters are used (which were computed from the mechanism of the one-nucleon interaction of mesons with nuclei) describes the energy dependence of the total and nonelastic cross sections for Be, C, Cu and Pb at from 140 to 400 MeV satisfactorily. From the values of σ_t and σ_{ne} it is possible to obtain data concerning nuclear dimensions.

INSTITUTION: Institute for Nuclear Problems of the Academy of Science in the USSR

24(5) SOV/56-35-4-9/52

AUTHORS: Ignatenko, A. Ye., Yegorov, L. B., Khalupa, B., Chultem, D.

TITLE: Investigation of the Depolarization of Negative μ-Mesons in Liquid Hydrogen (Issledovaniye depolyarizatsii otritsatel'nykh μ-mezonov v zhidkom vodorode)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 4, pp 894-898 (USSR)

ABSTRACT: The investigation of the capture of polarized negative myons in hydrogen furnishes data concerning the form of weak myon-nucleon interaction (Refs 1-3). The myon absorption process on protons develops according to $\mu^- + p \rightarrow n + \nu$. Thus, investigation of the angular neutron distribution of this reaction according to the formula $\omega(\theta) = 1 + a\beta \cos\theta$ (β-asymmetry coefficient of neutron angular distribution, θ-angle between the direction of neutron emission and myon spin, a - the degree of polarization of myons in mesic hydrogen) should supply information concerning the form of interaction. The present paper, which deals with the experimental investigation of myon polarization in liquid hydrogen, was carried out on the synchrocyclotron Ob"yedinennyy

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Investigation of the Depolarization of Negative μ-Mesons in Liquid Hydrogen SOV/56-35-4-9/52

institut yadernykh issledovaniy (United Institute for Nuclear Research). After a short theoretical explanation of possible (μ^-H)-processes, the experimental arrangement is described and results are discussed. The angular distribution of the electrons (μ - e -decay) was measured by means of scintillation counters; within the error limits isotropy was determined. The degree of polarization of myons in mesic hydrogen, which was calculated according to the results obtained by measurements of angular distribution, is less than 2.5%. The complete μ^--meson depolarization is explained according to Ya. B. Zel'dovich and S. S. Gershteyn (Refs 7-9) by the fact that the myon should jump from one proton to another, simultaneously with transition to the hyperfine structure ground state. According to this mechanism also the mutual transformation of ortho- and para-hydrogen is possible. As, however, the μ^--mesons are subjected to total depolarization, it is impossible to draw conclusions on the basis of measurement of neutron angular distribution of the process $\mu^- + p \rightarrow n + \nu$, as to the form of interaction between a negative myon and nucleon. In conclusion the authors

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Investigation of the Depolarization of Negative μ-Mesons in Liquid Hydrogen SOV/56-35-4-9/52

thank Ya. B. Zel'dovich, Academician, and S. S. Gershteyn for their help and discussions, and they expressed their gratitude to V. B. Belyayev and B. N. Zakhar'yev for their discussions and their constant interest in this work. There are 1 figure and 15 references, 7 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute for Nuclear Research)

SUBMITTED: May 5, 1958 (initially) and July 14, 1958 (after revision)

24(5) SOV/56-35-5-10/56

AUTHORS: Ignatenko, A. Ye., Yegorov, L. B., Khalupa, B., Chultem, D.

TITLE: The Measurement of the Polarization of Negative μ-Mesons in Mesic Atoms of Carbon, Oxygen, Magnesium, Sulfur, Zinc, Cadmium, and Lead (Izmereniye polyarizatsii otritsatel'nykh μ-mezonov v mezoatomakh ugleroda, kisloroda, magniya, sery, tsinka, kadmiya i svintsa)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 5, pp 1131-1134 (USSR)

ABSTRACT: An investigation of the angular distributions of neutrons originating from the process $\mu^- + p \to n + \nu$ (capture of polarized muons in liquid hydrogen) would offer a possibility of obtaining information concerning the form of weak muon-nucleon interaction (Refs 1, 2). As was, however, shown by experiments (Ref 3), this is not possible because of the total depolarization of muons. A theoretical investigation (Ref 2) of the capture of polarized muons by light nuclei shows, however, that by measuring the angular distribution of neutrons with energies in the upper part of the spectrum it is possible to determine the nature of interaction. The formula for angular distribution is $W(\theta) = 1 + a\beta\gamma \cos\theta$. Herefrom it follows that

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investigation of neutron angular distribution should be preceded by measurement of muon polarization in the mesic atoms as well as by an investigation of neutron depolarization in nuclear matter (in the formula β denotes the asymmetry coefficient of angular distribution, the amount and sign of which depends on the form of interaction, Θ - the angle between the direction of neutron emission and the spin of the muon, a and γ - coefficients connected with polarization and depolarization respectively). Within the framework of this investigation program, the present paper describes muon polarization measurements carried out in various substances. Determination of polarization was carried out by measuring the anisotropy of the angular distribution of decay electrons by using the apparatus described by reference 3. Aluminum filters were used for the purpose of slowing-down pions and muons. The target had a size of 15.15 cm^2 and its thickness corresponded to 2-6 g/cm^2; the target was inclined towards the axis of the meson beam at an angle of 45°. The polyethylene filter between the counters corresponded to 4-8 g/cm^2. For C, O, Mg, SOV/56-35-5-10/56

The Measurement of the Polarization of Negative μ-Mesons in Mesic Atoms of Carbon, Oxygen, Magnesium, Sulfur, Zinc, Cadmium, and Lead

and S the asymmetry coefficient a was determined in the electron angular distribution $I(\Theta) = 1 + a \cos \Theta$ by investigating the dependence of the number of electrons on the voltage of the H-field in which the target was located. For Zn, Cd and Pb a was determined by determining the number of electrons at H_{max} and H_{min}, corresponding to the maximum and minimum of electron intensity on the precision curve

$$I(H) = \int_{t_1}^{t_2} e^{-t/\tau} \cdot \left[1 + a \cos(2\pi f t) + \Theta_0\right] dt.$$

Results of polarization determination:

C:	14 ± 4
O:	15 ± 4
Mg:	20 ± 5
S:	15 ± 4
Zn, Cd, Pb:	19 ± 7

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SOV/56-35-5-10/56

The Measurement of the Polarization of Negative μ-Mesons in Mesic Atoms of Carbon, Oxygen, Magnesium, Sulfur, Zinc, Cadmium, and Lead

These values give muon polarization in %. In substances in which nuclear spin is equal to zero, muon depolarization can be explained mainly by spin-orbit interaction during the formation of mesic atoms; partly it may also be explained by the effect produced by the magnetic field of the electron shell of the atom on the muon during its life on the K-orbit. There are 1 figure, 1 table, and 11 references, 4 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: May 31, 1958

16.8100,16.8300,24.6100, 24.6200,24.2100

76963
SOV/56-37-6-3/55

AUTHORS: Egorov, L. B., Ignatenko, A. E., Chultem, D.

TITLE: Effect of the Hyperfine Structure on the Polarization of μ^--Mesons in Mesic Atoms

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 6, pp 1517-1523 (USSR)

ABSTRACT: A study was made with the aid of scintillation counters of the angular distributions of the μ^--meson decay electrons from aluminum, phosphorus, and carbon mesic atoms. It was shown that because of the interaction of the hyperfine structure there was a decrease of the μ^--meson polarization. These results accord with the theoretical calculations provided that the depolarization exclusively on the K orbit of the mesic atom is taken into account. A comparison of the results of the measurements for phosphorus with the results previously obtained for liquid hydrogen (cf. A. E. Ignatenko, L. B. Egorov, B. Khalupa, D. Chultem, Zhur. eksp. i teoret.

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fiz., 35, 894, 1958) showed that the complete depolarization of μ^--mesons observed in hydrogen cannot be explained only by the interaction between the fine and hyperfine structures. The explanation would require the assumption of an additional mechanism (such as the "jumping" of a μ^--meson from one proton to another with concurrent transition of the hyperfine structure to the ground state). All experimental data on the depolarization of μ^--mesons in various substances can be explained theoretically, if it is assumed that in the mesic atoms of metals the electron shell does not affect the depolarization of μ^--mesons. The presence of a fine and hyperfine structure in mesic atoms was confirmed and this again indicated that the electromagnetic properties of mesons and electrons are similar. In experiments with phosphorus the observed reduction of precision frequency in the mesic nucleus spin by a factor of 2 as compared with the precision frequency of the free μ-meson spin indicates directly that the spin

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Effect of the Hyperfine Structure on the Polarization of μ^--Mesons in Mesic Atoms

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of a negative μ -meson is equal to 1/2. There is 1 graph; 1 table; and 11 references: 6 Soviet, 5 U.S. The 5 most recent U.S. references are: M. E. Rose, Depolarization precesses for negative mu-mesons, preprint Oak Ridge Nat. Lab., 1958; H. Uberall. Hyperfine splitting effects in the capture of polarized μ^--mesons, preprint Carnegie Inst. of Technol., 1959; J. Bernstein, T. D. Lee, C, N. Yang, H. Primakoff. Phys. Rev., 111, 313, 1958; R. Garwin, L. Lederman, M. Weinrich. Phys. Rev., 105, 1415, 1957; V. Telegdi. Proc. of 1958 Ann. Intern. conf. on high energy physics at CERN, p. 250.

ASSOCIATION: Joint Inst. Nuclear Research, USSR (Ob'edinenyy institut yadernykh issledovaniy, SSSR)

SUBMITTTED: June 7, 1959

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84976

S/056/60/038/005/054/057/XX
B006/B070

24.6900

AUTHOR: Ignatenko, A. Ye.

TITLE: The Problem of Transitions Between the Levels of Hyperfine Structure in μ-Mesic Atoms 19

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1515 - 1517

TEXT: The possibilities of verifying experimentally the existence of transitions between levels of hyperfine structure are discussed. The method suggested in Ref. 8, which depends on a study of the curvature K of the decay curve of μ^- mesons, is first considered. If such transitions were possible, K would be positive; an experiment on Al showed, however, that $K < 0$. One experiment, however, is not significant; all the more so because this method depends on the hypothesis of the universality of the A-V interaction which has not been proved for the process $\mu^- + p \rightarrow n + \nu$ by a direct experiment. An experiment is suggested here to decide about the existence of such transitions. The method is based on studying the polarization of mesons in a definite kind of mesic atoms. Suitable for this purpose are

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The Problem of Transitions Between the Levels of Hyperfine Structure in μ-Mesic Atoms

S/056/60/038/005/054/057/XX
B006/B070

V. B. Belyayev, and B. N. Zakhar'yev are thanked for discussions. There are 11 references: 5 Soviet and 6 US.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: November 13, 1959

Card 3/3

IGNATENKO, A.Ye.; KUPTSOV, A.B.; LI SUANG-MING; PETRASKU, M.G.; YEGOROV, L.B.; ZHURAVLEV, G.V.

Spin dependence of weak interaction in the process $\mu^- + p \rightarrow n + \nu$
Dubna, Izdatel'skii otdel Ob"edinennogo in-ta iadernykh issledovanii, 1961. 13 p. (MIRA 14:10)
(No subject heading)

YEGOROV, L.B.; ZHURAVLEV, G.V.; IGNATENKO, A.Ye.; LI SYUAN-MIN;
PETRASHKU, M.G.; CHULTEM, D.

Investigating the paramagnetism of μ-mesonic atoms. Zhur. eksp. i teor. fiz. 40 no.2:391-399 F '61. (MIRA 14:7)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Mesons)

YEGOROV, L.B.; ZHURAVLEV, G.V.; IGNATENKO, A.Ye.; KUPTSOV, A.V.;
LI SYUAN-MIN; PETRASHKU, M.G.

Investigating the spin dependence of weak interaction in the process $\mu^- + p \rightarrow n + \gamma$. Zhur.eksp.i teor.fiz. 41 no.3:684-691 S '61. (MIRA 14:10)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Nuclear reactions) (Protons) (Mesons)

41122
S/056/62/043/004/005/061
B102/B180

24 6400

AUTHORS: Yegorov, L. B., Ignatenko, A. Ye., Kuptsov, A. V., Petrashku, M. G.

TITLE: The anomaly problem in the μ^- meson decay in mesic atoms of transition metals of the iron group

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 4(10), 1962, 1149 - 1153

TEXT: Using scintillation counters with a 128-channel pulse-height analyzer, the ratio between the decay probability of μ^- mesons in mesic atoms and of free μ^- mesons was measured for mesic Fe, Zn, Ni and Cu to verify published experimental results and predictions. The Fe and Zn targets were in the form of sandwiches consisting of ten 15·15 cm^2 plates, separated by Al sheets 0.7 mm thick. The Ni and Cu targets were 15·15 cm^2 plates, 5g/cm^2 thick. From the time distributions of the μ^- decay electrons, $S = \sum t_i n_i / \sum n_i$ was determined, where n_i is the number of pulses in time t_i. For Fe+Al $S = 0.485 \pm 0.009$ μsec and for Zn+Al, $S = 0.463 + 0.008$ μsec. Then

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with $S(\mathrm{Fe}+\mathrm{Al}) = n_1 S(\mathrm{Fe}) + n_2 S(\mathrm{Al})$, and
$S(\mathrm{Zn}+\mathrm{Al}) = n_1' S(\mathrm{Zn}) + n_2' S(\mathrm{Al})$. (5)

$S(\mathrm{Fe}) = 0{,}201 \pm 0{,}004$, $S(\mathrm{Zn}) = 0{,}161 \pm 0{,}004$, $S(\mathrm{Al}) = 0{,}707 \pm 0{,}002$,

$$\xi = \frac{\Lambda_p(\mathrm{Fe})}{\Lambda_p(\mathrm{Zn})} = \frac{n_1}{n_1'}\frac{n_2'}{n_2}\frac{\Lambda(\mathrm{Fe})}{\Lambda(\mathrm{Zn})} k_1 k_2, \quad (6)$$

was calculated. ξ is the μ^- decay probability ratio, $k_{1,2}$ are correction factors.

$\xi = \Lambda_p(\mathrm{Fe}) / \Lambda_p(\mathrm{Zn}) = 0{,}94 \pm 0{,}05$.
$\xi = \Lambda_p(\mathrm{Ni}) / \Lambda_p(\mathrm{Cu}) = 0{,}98 \pm 0{,}05$.

was obtained: Within the error limits the ξ - values are equal - which indicates the absence of anomalies such as were observed e. g. in Phys. Rev. Lett. 1, 102, 1958; Phys. Rev. 113, 661, 1959; Phys. Rev. 117, 1580, 1960) and that the instrument effect mentioned by Huff (ANN. Physics, 16, 288, 1961) and Chilton (Phys. Rev. Lett. 7, 31, 1961) cannot be the cause of the anomalies observed by those writers. There are 4 figures.

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The anomaly problem ... S/056/62/043/004/005/061
B102/B180

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: April 23, 1962

Card 3/3

YEGOROV, L.B.; IGNATENKO, A.Ye.; KUPTSOV, A.V.; PETRASHKU, M.G.;
SARANTSEVA, V.R., tekhn. red.

[Search for anomalies in μ^--meson decay in paramagnetic metals]
Poiski anamalii pri raspade μ^--mezonov v paramagnitnykh metallakh.
Dubna, Ob"edinennyi in-t iadernykh issl., 1962. 5 p. (MIRA 15:6)
(Mesons--Decay) (Magnetic materials)

YEGOROV, L.B.; IGNATENKO, A.Ye.; KUPTSOV, A.V.; PETRASHKU, M.G.; SARANTSEVA, V.R., tekhn. red.

[Anomaly in μ^--meson decay in mesic atoms of transition metals of the iron group] K voprosu ob anomalii pri raspade μ^--mezonov v mezoatomakh perekhodnykh metallov gruppy zheleza. Dubna, Ob"edinennyi in-t iadernykh issledovanii, 1962. 9 p. (MIRA 15:6)

(Mesons—Decay) (Transition metals) (Iron group)

IGNATENKO, A.YE.

YEGOROV, L.B. IGNATENKO, A.E., KUPTSOV, A.V., PETRASHKU, M.

"Search for Anomalies in Mu-Meson Decay in Mesonic Atoms of the FE Group Transition Metals"

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Institute for Nuclear Research
Laboratoryoof Nuclear Problems

YEGOROV, L. B., IGNATENKO, A. Ye. and KUPTSOV, A. V.

Investigation of Mu Meson Capture by Protons from the States of Hyperfine Structure in Mesonic Atoms of Phosphorus.

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962.

Joint Inst. Nuclear Research, Lab of Nuclear Problems.

S/056/62/042/002/055/055
B108/B138

AUTHORS: Ignatenko, A. Ye., Petrashku, M. G., Chultem, D.

TITLE: Electron activation of mesic atoms

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 2, 1962, 646-647

TEXT: It is known that the formation and occupation of "holes" on the inner electron shells of atoms leads to multiple ionization, stripping of chemical bonds, and ejection of an atom in the form of a free ion. The study of the atomic charge distribution in radioactive transformations has shown that the atoms lose on the average about 7 electrons when one "hole" is filled up. De Borde (Proc. Phys. Soc., A67, 57, 1954) has shown that cascade transitions of muons in mesic atoms in general lead to an ionization of the inner atomic shells. For instance, the bromine mesic atom may emit about 5 electrons when muons from the shell with principal quantum number n = 14 go over to the ground level. Consequently, the mean charge of ions in the case of mesic atoms can be considerable. The so called electron activation of mesic atoms may lead, for instance, to the transi-

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three or four electrons. In red phosphorus (dielectric) where $t_0 \gg \tau$, R is already smaller than $1/\tau$ when one "hole" is formed. It was shown experimentally by L. B. Yegorov et al. (ZhETF, 40, 391, 1961) that the shell has no effect on the polarization of muons in diamagnetic substances. Therefore, it has also no effect in black phosphorus. Experiments with red phosphorus showed a maximum asymmetry of the electrons from $\mu - e$ - decay at the frequency of the mesic nucleus spin precession, which is half as high as the precession frequency of the spin of the free muon. This indicates that in red phosphorus also the electron shell has no effect on the polarization of the muons. [Abstracter's note: Complete translation.] There are 7 references: 3 Soviet and 4 non-Soviet. The four references to English-language publications read as follows: Beta- and Gamma-Ray Spectroscopy, Ed. by K. Siegbahn, North-Holland Publishing Company, Amsterdam, 1955, pp. 591-594; R. Winston, V. L. Telegdi. Phys. Rev. Lett., 7, 104, 1961; H. L. Donley. Phys. Rev., 50, 1012, 1936; De Borde. Proc. Phys. Soc., A67, 57, 1954.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: November 14, 1961

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AUTHORS: Yegorov, L. B., Ignatenko, A. Ye., Kuptsov, A. V., Petrashku, M. G.

TITLE: Search for μ^- decay anomalies in paramagnetic metals

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 3(9), 1962, 873-876

TEXT: The observation of nontrivial effects in μ^- decays caused in mesic atoms by unpaired electrons would be of great use for investigating the magnetic properties of atoms and of hydrides of transition metals. The authors measured the relative μ^- decay probabilities at different numbers of unpaired electrons in mesic atoms of the systems Pd-H and Ti-H. Under identical experimental conditions the following yield ratios were obtained:

$$Y(TiH_{1.8})/Y(Ti) = 1.00 \pm 0.02,$$
$$Y(PdH_{1.0})/Y(PdH_{0.6}) = 1.02 \pm 0.02,$$
$$Y(PdH_{0.6})/Y(Pd) = 0.99 \pm 0.02,$$
$$Y(PdH_{0.6})/Y(PdH_{0.2}) = 1.01 \pm 0.02.$$

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The equality of the results strengthens the supposition that no effects caused by unpaired electrons are responsible for the increase of the μ^- decay probability in mesic atoms of transition metals of the iron group (Phys. Rev. 113, 661, 1959; 119, 365, 1960). It indicates also a shift of the X-ray frequency emitted in the 2p-1s transitions of the mesic atoms of these metals (C. Scott et al. Chicago, Preprint EFJNS-61-59). There is 1 figure.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

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Figure. Block diagram of apparatus.
Legend: 1-5 Scintillation counters, 6 - target, 7 - magnetizing coil, 8 - copper filter, 9 - aluminum filter, 10 - anticoincidence circuit, 11 - coincidence circuit, 12, 13 - amplifiers, 14, 15 - shaper, 16 - delay line (0.1 μsec), 17 - delay (≥ 1.1 μsec) 18 - trigger, 19, 20 - transmission, 21, 22 - discriminators, 23, 24, 25 - counting devices.

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YEGOROV, L.B.; IGNATENKO, A.Ye.; KUPTSOV, A.V.; PETRASHKU, M.G.

Anomaly in μ^--meson decay in mesic atoms of transition metals of the iron group. Zhur. eksp. i teor. fiz. 43 no.4:1149-1153 O '62. (MIRA 15:11)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Mesons—Decay) (Transition metals)
(Iron group)