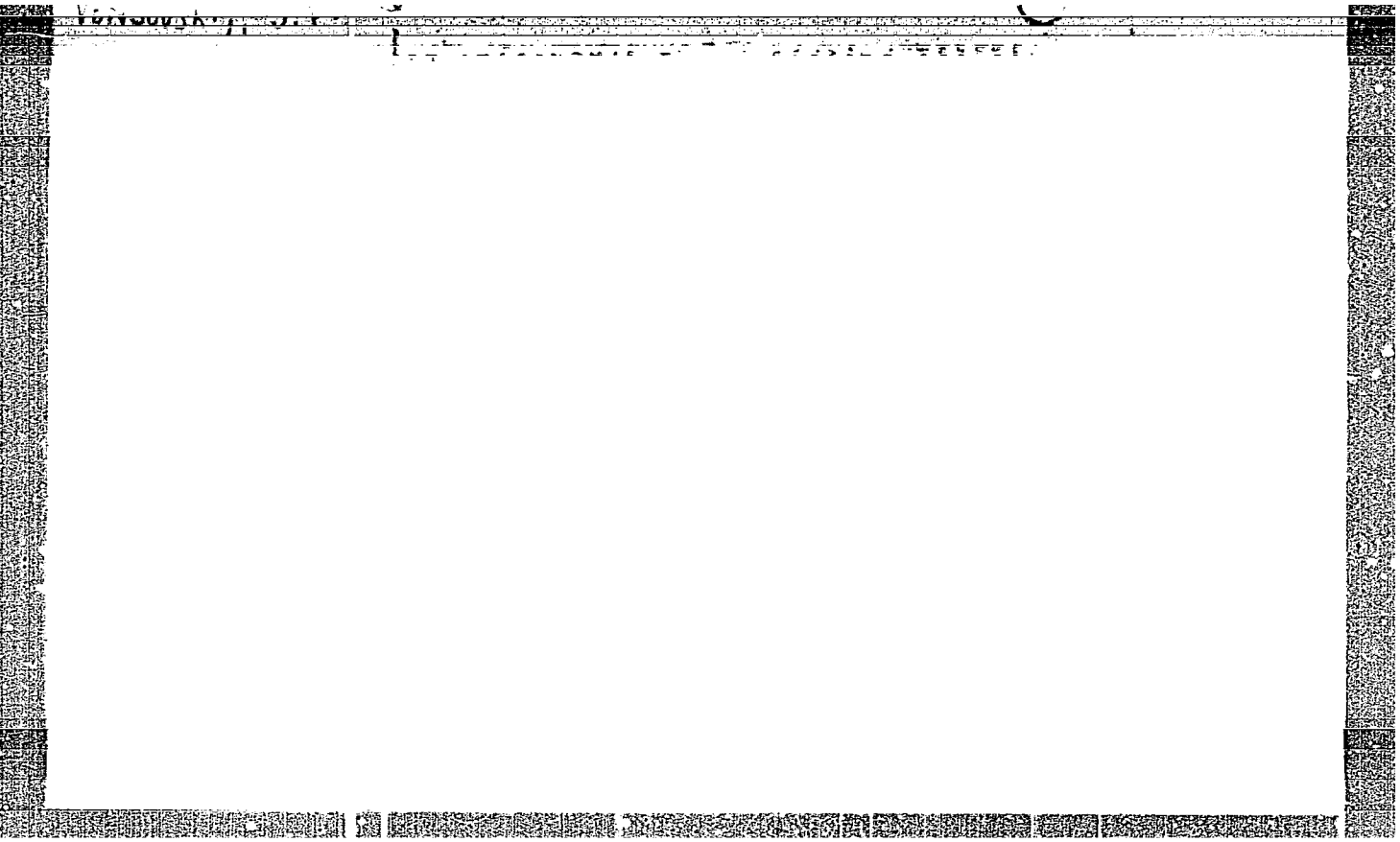
Surface photoelectric effect in ferromagnetics. S. V. Vonsovskiĭ and A. V. Sokolov. *Doklady Akad. Nauk S.S.S.R.* 76, 197–200 (1951).—The anomalous photoelec. current-temp. curve observed experimentally by Cardwell (*C.A.* 43, 6817*b*) for ferromagnetic Ni (a discontinuity in the curve) and the increase of the work function with temp. are explained theoretically, on the basis of a model proposed by Vonsovskiĭ (*C.A.* 41, 5375*f*), in which external *s*- and internal *d*-electrons mutually interact. It is found that the photoemission current I depends on the temp. and on the frequency of the incident light ν, which is near the limiting frequency of the photoeffect ν_0, and the work function $\chi(\nu)$ is a function of the spontaneous magnetization. The formulas worked out for I and $\chi(\nu)$ are confirmed qualitatively by Cardwell's data. The ferromagnetic "anomaly" of the work function is detd.; it should be tested experimentally. The photocurrent of a ferromagnetic is shown to depend on its spontaneous magnetization; near the ferromagnetic transition temp. this dependence is quadratic.

Ellen H. Dunlap



APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001860810010-6"

VONSOVSKIY, S.V.
PHASE I TREASURE ISIAND BIBLIOGRAPHICAL REPORT AID 194-I

BOOK Call No. QC753.V63

Author: VONSOVSKIY, S.V.
Full Title: CONTEMPORARY SCIENCE OF MAGNETISM. (CONTEMPORARY PHYSICAL PROBLEMS).
Transliterated Title: Sovremennoye ucheniye o magnetizme. (Sovremennyye problemy fiziki).

Publishing Data
Originating Agency: None
Publishing House: State Publishing House of Technical Theoretical Literature.
Date: 1952 No. pp.: 440 No. of copies: 4,000
Editorial Staff
Editor: None Tech. Ed.: None
Editor-in-Chief: None Appraiser: None

Text Data
Coverage: This textbook describes contemporary physical concepts of magnetic phenomena (atomic and nuclear magnetism, diamagnetic and paramagnetic substances, general theory of ferromagnetism, magnetization curves, magnetic materials and their behavior in variable fields). Analytical data are given in simple qualitative form on the basis of Soviet and foreign experimental data obtained up to 1951, with a few references from 1952.

1/2

26307

Sovremennoye ucheniye o magnetizme. (Sovremennyye problemy fiziki). AID 194-I

The book may be of general interest because it is a collection and review of the most recent concepts and data secured from 303 Soviet and 266 foreign sources.

Purpose: A book for scientific research workers and engineers, and for students of physical and chemical sciences.

Facilities: A.G. Stoletov did work on ferromagnetism, P.N. Lebedev on the magnetism of the earth, V.K. Arkad'yev on electrodynamics of ferromagnetic media and Akulov, Vedenskiy, Kapitsa, Frinkel and many other scientists are working on magnetic phenomena.

No. of Russian and Slavic References: 303 of total 569 (1892-1951)

Available: Library of Congress

VONSOVSKIY, S. V. and SHUR, Ya. S.

"Ferromagnetism", Glavpoligrafizdat, Main Polygraphic Publishing House, 816 pp, 1952

VONSOVSKIY, S. V. PA 241T84

USSR/Physics - Ferromagnetism Jul/Aug 52

"Problems of the Quantum Theory of Ferromagnetism," S. V. Vonsovskiy, Ural Affil, Acad Sci USSR

"Iz Ak Nauk, Ser Fiz" Vol 16, No 4, pp 387-397

Classical physics cannot explain stability of atomic systems effecting magnetic properties of bodies. It may be accomplished by quantum theory of ferromagnetism, although it cannot be considered as completed, even within framework of non-relativistic quantum mechanics.

241T84

VONSOVSKIY, S. V., KONDLEV, L. YA., RODIONOV, K. P.

Electromagnetism

Toward the theory of galvanomagnetic phenomena in ferromagnetic materials. Izv. AN SSSR. Ser. fiz. 16 No. 5, 1952.

9. Monthly List of Russian Accessions, Library of Congress, June 1953. Unclassified.

VONSOVSKIY, S. V.

Magnetism

Conference on magnetism Usp. fiz. nauk 46 no. 3, 1952

9. Monthly List of Russian Accessions, Library of Congress, August 1952 ~~1953~~ Uncl.

USSR/Physics - Electron Conductors Nov 52

"Problems of the Modern Quantum Theory of Electron Conductors," S. V. Vonsovskiy

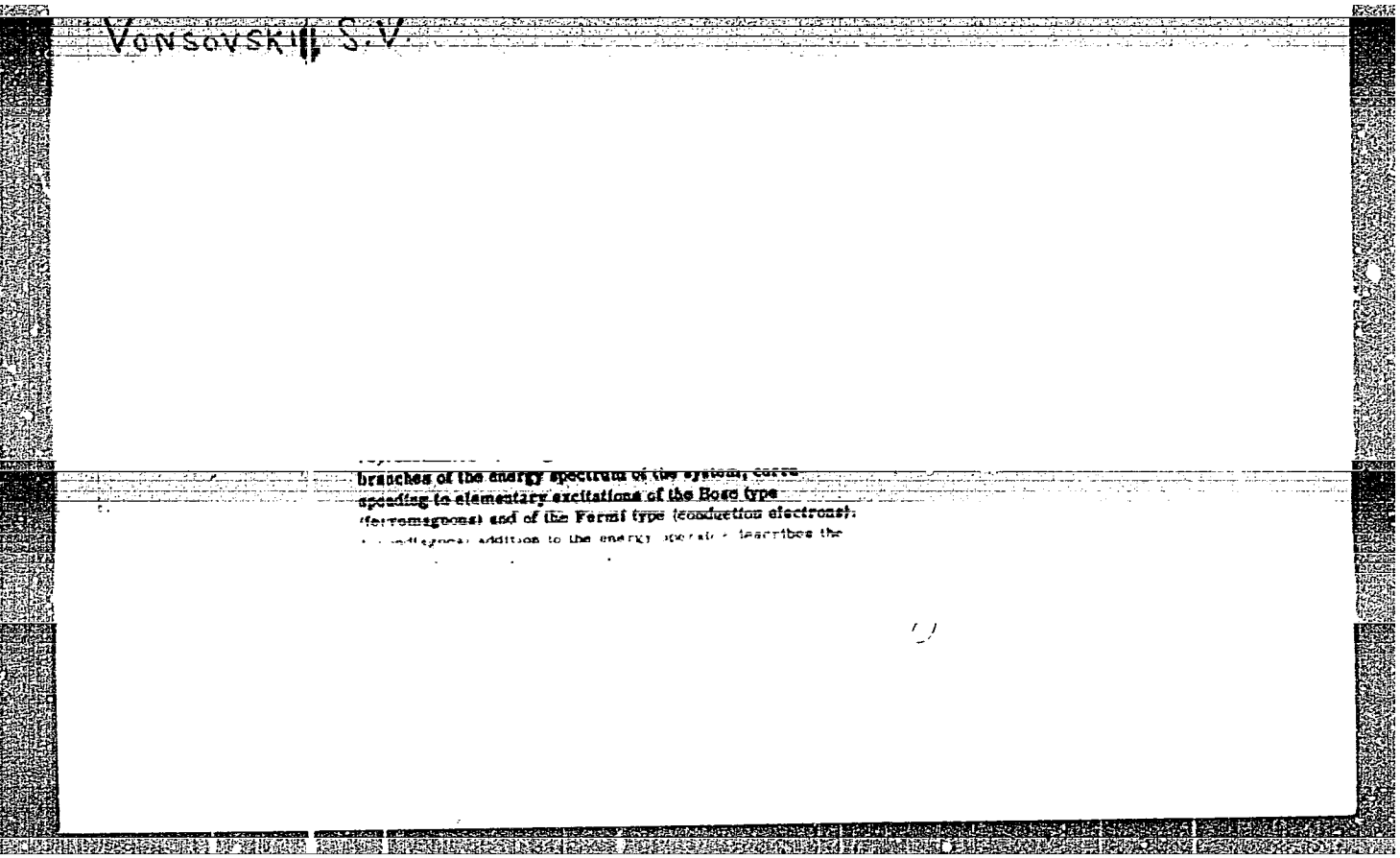
"Uspekhi Fiz Nauk" Vol 48, No 3, pp 289-388

A critical survey of modern quantum-mechanic theory of crystalline electron conductors. Multi-electron treatment of the problem by N. N. Bogolyubov, S. V. Tyablikov, S. I. Pekar, S. V. Vonsovskiy and others is described, as well as idealistic distortions by Slater, Van Fleck, Mott, Stoner and others. 62 references appended.

242T99

VONSOVSKIY, S.V.; GUSEV, A.A., redaktor; TUMARKINA, N.A., tekhnicheskiy redaktor.

[Modern theories on magnetism] Sovremennoe uchenie o magnetizme. Moskva, Gos. izd-vo tekhn.-teoret. lit-ry, 1953. 440 p.(MLRA 7:8)
(Magnetism)

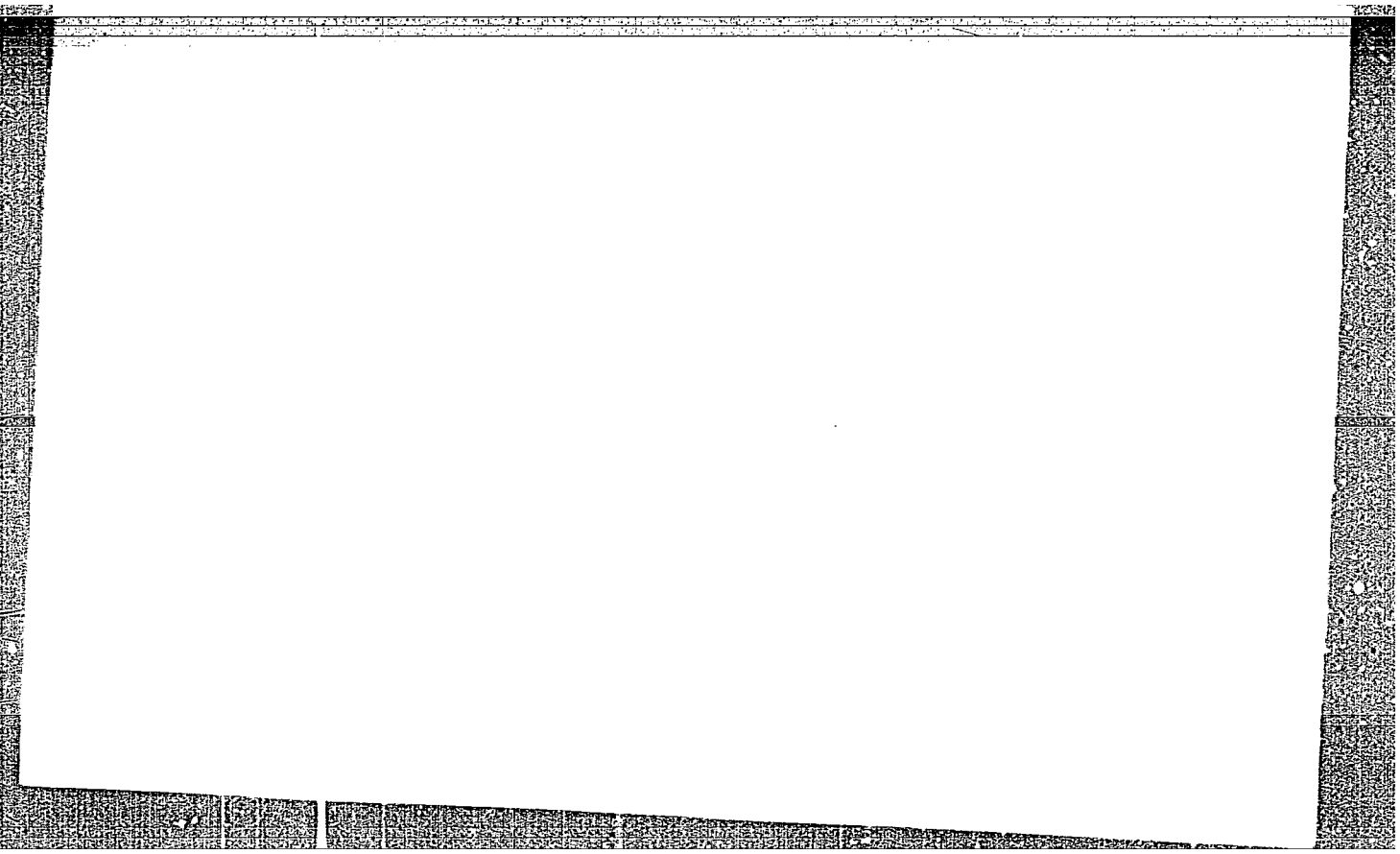


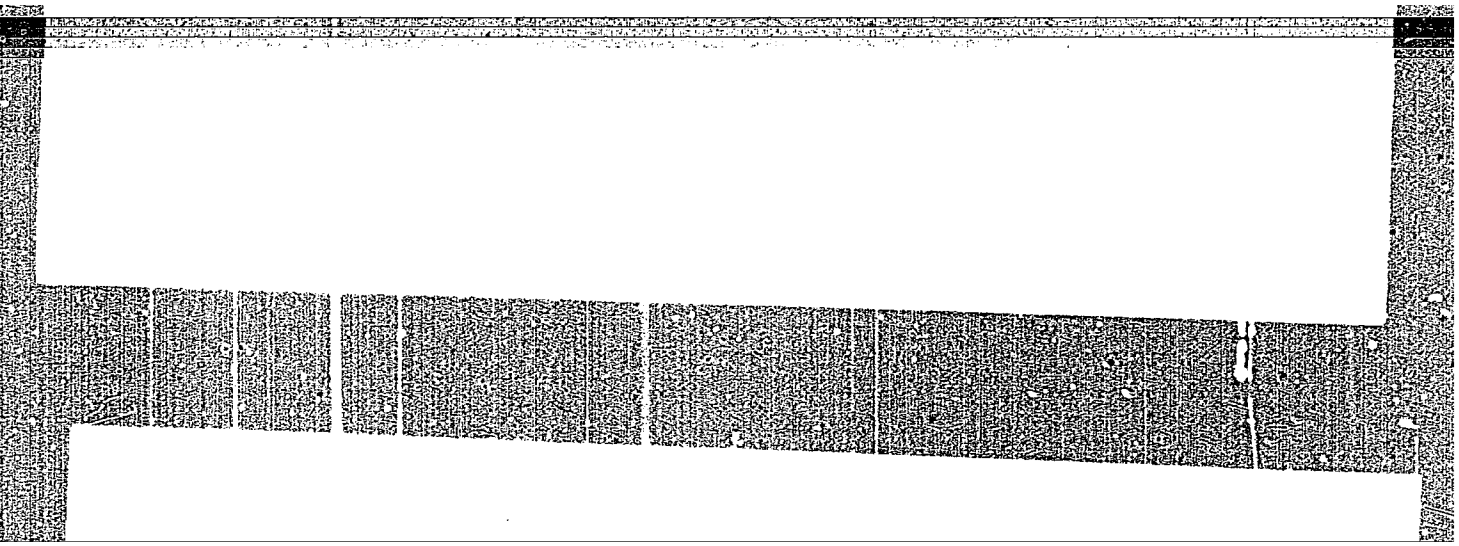
538.114

7179. Atomic magnetic moments of ferromagnetics. 62

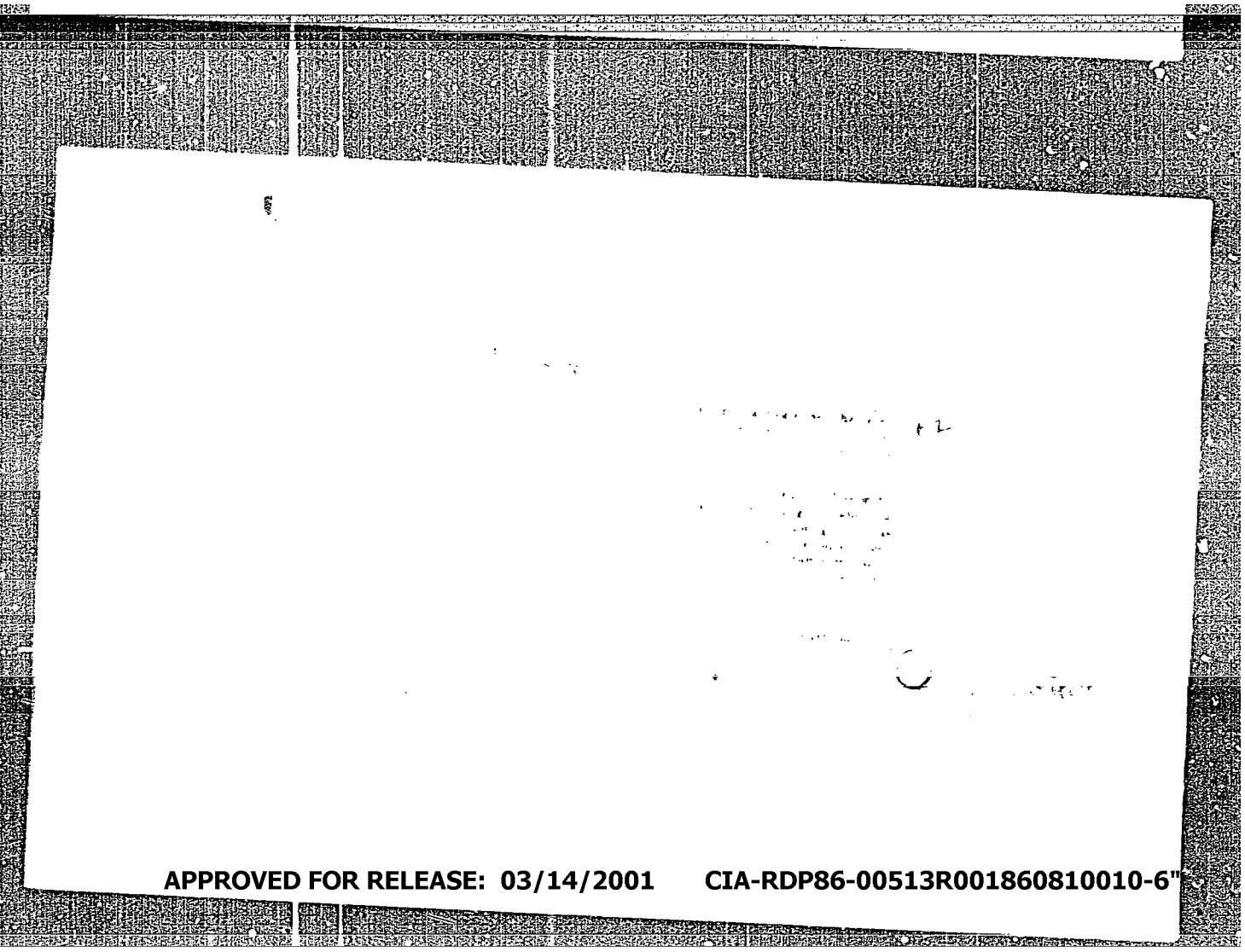
S. V. [illegible] and K. B. [illegible]

[illegible] Calculation of the energy [illegible] account of [illegible] alloy [illegible] overlapping bands.





APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001860810010-6"



VONSOVSKIY, S.V., redaktor; SHUBINA, L.A. [translator]; TELESHIN, N.L., redaktor; MIKIFOROVA, A.N., tekhnicheskiy redaktor.

[Elasticity and anelasticity of metals; collection of articles. Uprugost' i neuprugost' metallov; sbornik. Perevod L.A.Shubinoi. Moskva, Izd-vo inostrannoi lit-ry, 1954. 396 p. [Microfilm]
(Elasticity) (Metals) (MLRA 7:11)

VONSOVSKIY, S. V.

"Multielectron Approach in the Quantum Theory of Crystals (Criticism of the Single Electron Theory of Solid Bodies)"
Tr. In-ta Fiziki AN UkrSSR, No 5, 1954, 3-27

Criticizes the single electron approach in the quantum mechanics theory of crystals, lays the foundations for a general multielectron theory of the solid state, and analyzes the multielectron models necessary for studying concrete properties of crystalline bodies. (RZhKhim, No 2, 1955)

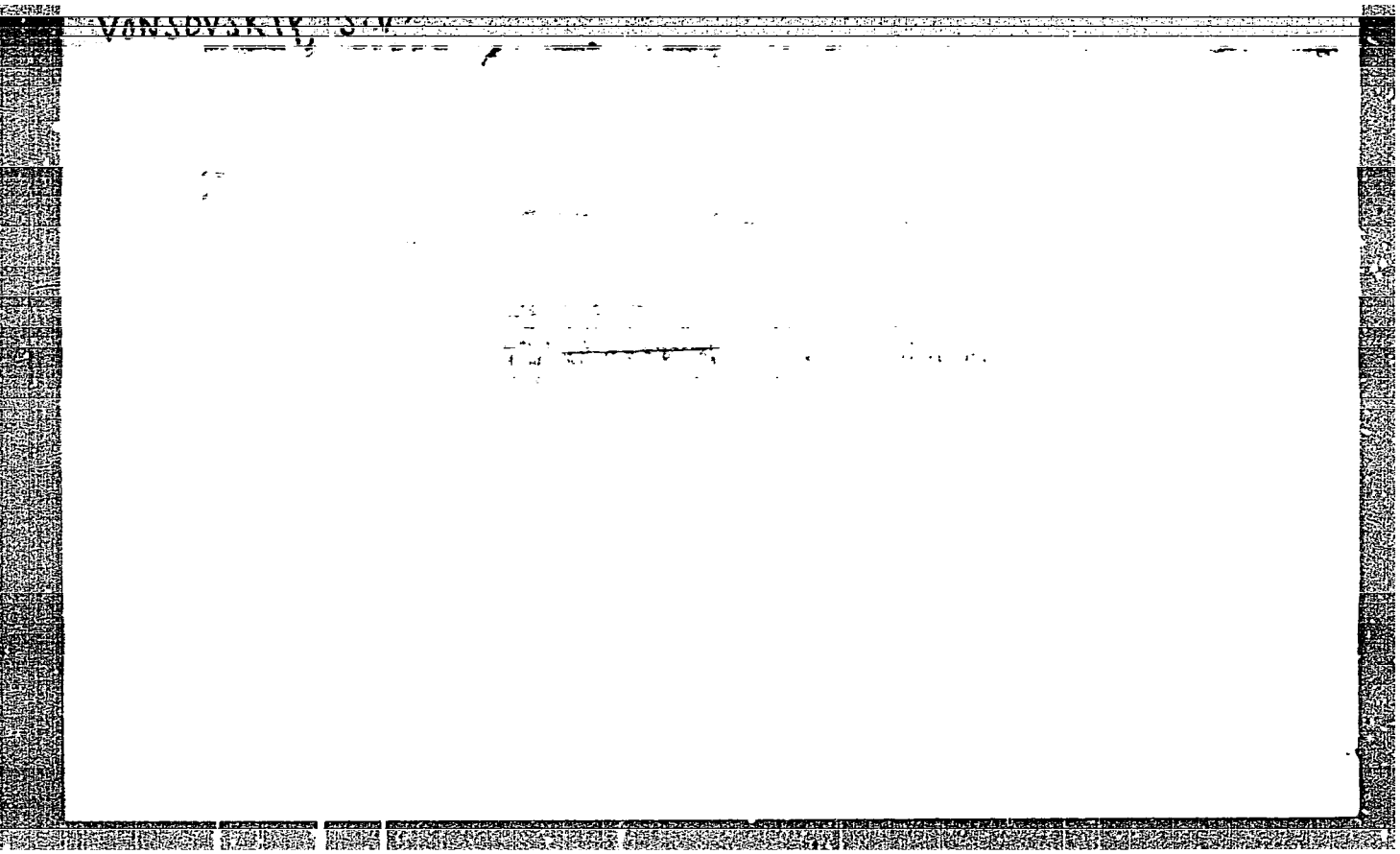
SO: Sum-No 787, 12 Jan 56

VONSOVSKIY, S. V. and Rodionov, K. P.

"Theory of Variation of Electric Resistance of Ferromagnetics I"
Tr. in-ta Fiziki Metallov Uralsk Fil, AN SSSR, No 15, 1954, 3-9

The dependence of the variation of electric resistance of a ferromagnetic on the square of the spontaneous magnetization is clarified by means of a model of interacting external and internal electrons, as described previously (ZhETF 16, 981, 1946) and taking into account the magnetic spin-spin interaction of conducting electrons with ferromagnetic electons. Theoretical and experimental results are in good agreement. (RZhFiz, No 9, 1955)

SO: Sum-No737 12 Jan 56



USSR/Physics - Ferromagnetism

Card 1/1 Pub. 43 - 2/15

Authors : Vonsovskiy, S. V.

Title : [illegible] ferromagnetism [illegible] theory.

Periodical : Izv. AN SSSR. Ser. fiz. 18/3, 312-318, May-Jun 1954

Abstract : The numerous specific properties of ferrites ($MeO.Fe_2O_3$, where Me is the [illegible] are [illegible]. These properties distinguish ferrites [illegible] the ferromagnetism of ferrites [illegible] existing difficulties of the quantum-mechanical theory of ferromagnetism of metals and alloys, are listed. Seventeen references : 6 USSR, 4 USA, 1 French and 1 German (1933-1953). Graphs.

Institution: : Academy of Sciences USSR, Ural Branch, Institute of Physics of Metals

Submitted: : May 3, 1954

USSR/Physics - Ferromagnetism

Card 1/1 Pub. 43 - 3/15

Authors : Tomashkiy, S. V., and Seidov, Yu. M.

Title : Problem of quantum-mechanical theory regarding the ferromagnetism of [illegible]. Part I. Quantum mechanical theory of ferromagnetic ferrites

Periodical : Izv. AN SSSR. Ser. fiz. 18/3, 319-327, May-Jun 1954

Abstract : A quantum mechanical treatise is presented on the ferromagnetic phenomena of [illegible] at regions of low temperatures. The [illegible] of ferromagnetic ferrites is described. The [illegible] neutral oxygen ions form a face-centered cubical lattice [illegible] and trivalent metal [illegible]. The theoretical [illegible] properties of ferrites [illegible] ferrites [illegible] in the field [illegible].

Institution : [illegible], Institute of Physics of Metals

Submitted : June 3, 1954

USSR/Physics - Ferromagnetism

Card 1/1 Pub. 43 - 4.1-

Authors : Berdyshev, A. A., and ...

Title : ... regarding the ferromagnetism of ...

Periodical : Izv. AN SSSR. Ser. fiz. 18/3, 328-338, May-Jun 1954

Abstract : It is explained that the formulation of a multi-electron theory for transition metals requires the existence of two electron groups, one of which ... the electro-conductivity phenomena and the other - the magnet...

Institution : ...

Submitted : May 3, 1954

USSR/Physics - Paramagnetic relaxation

Card : 1/1

Authors : Vonsovskiy, S. V., Mebm. Corres. of Ac. of Sc. USSR.; and Salikhov, S. G.

Title : Paramagnetic relaxation in metals

Periodical : Dokl. AN SSSR, 96, Ed. 4, 717 - 719, June 1954

Abstract : Various metals were tested at room temperature, to determine the paramagnetic energy absorption of a high frequency field. In a greater number of the tested metals an intensive relaxation type absorption, which [illegible] all investigated metals, judging by the nature of their paramagnetic relaxation, can be divided into three groups. Data pertaining to [illegible]

Institution : ...

Submitted : March 10, 1954

VONSOVSKIY, S.V.

Conference on Low Temperature Magnetism. Papers read at the conference on Low Temperature Magnetism held at Kharkov, July 1-3, 1954. Izv.AN SSSR.Ser.Fiz.19 no.4:387-394 Jl-Ag '55. (MLRA 9:1)

(Low temperature research) (Magnetism)

Vonsovskiy, S.V.

USSR/Solid State Physics - Solid State Theory. Geometric Crystallography, E-2

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34560

Author: Vonsovskiy, S. V.

Institution: Institute of Metal Physics, Ural Branch, Academy of Sciences USSR

Title: Certain Problems in Quantum Mechanics Theory of Crystals at Low Temperatures

Original Periodical: Izv. AN SSSR, ser. fiz., 1955, 19, No 4, 447-461

Abstract: An analysis is given of the present-day status of quantum mechanics theory of crystals in the low temperature region, and also a survey of the work performed by the author and his students on this problem. Solution methods are examined, as well as approximations used in the study of the problem of the behavior of a condensed system. The conditions under which the complex motion of the interacting elementary particles can be represented as the motion of an ideal gas of elementary excitations (quasiparticles) is indicated. Discussion of the method of establishing the type of statistics for the elementary excitations and of the connection between the statistics and the type of statistics of the initial microsystem. The calculation of the energy spectrum of the system of internal and external electrons of ferromagnetic-transition metals on the basis of the so-called s-d model is explained; the

USSR/Solid State Physics - Solid State Theory. Geometric Crystallography, E-2

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34560

Author: Vonsovskiy, S. V.

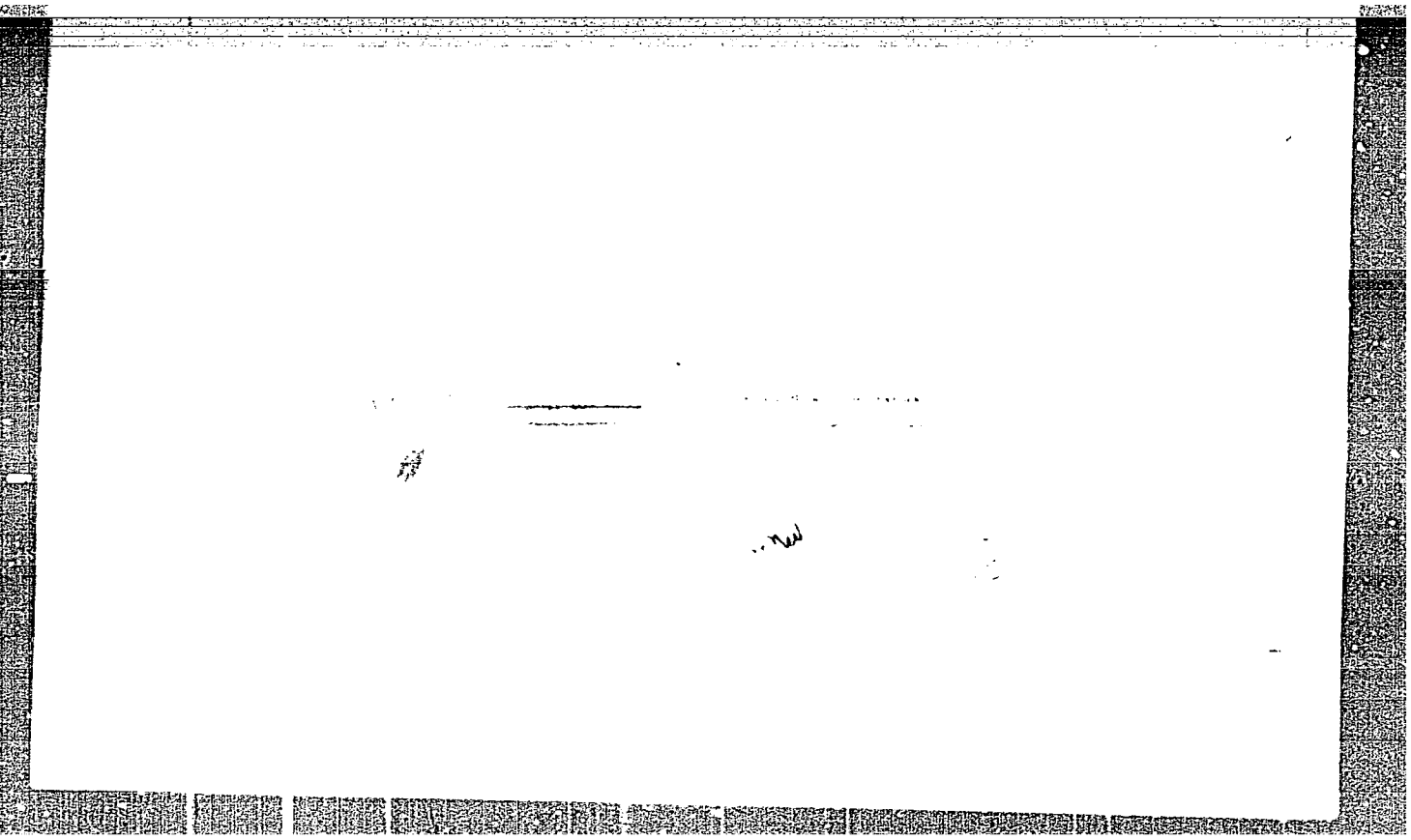
Institution: Institute of Metal Physics, Ural Branch, Academy of Sciences USSR

Title: Certain Problems in Quantum Mechanics Theory of Crystals at Low Temperatures

Original Periodical: Izv. AN SSSR, ser. fiz., 1955, 19, No 4, 447-461

Abstract: probabilities of the quantum transitions in this system are given. The absence of a universal temperature dependence of the electric resistance of the type $\rho \sim T^5$ is attributed to the fact that in certain crystals the carriers of the electric current may be elementary excitations, obeying the Bose statistics. An exposition is made of a polar model of semimetals and semiconductors, in which the current carriers are doublets holes (obeying the Bose statistics) and excitons. Results of calculation of the electric and magnetic properties of crystals, based on the s-d and polar model, are given.

2 of 2



APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001860810010-6"

[redacted], S. V., (Sverdlovsk)

"Quantum-Mechanical Treatment of the Problem of Ferromagnetism of Transition Metals," a paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 56.

SHUBINA, L.A. [translator]; VONSOVSKIY, S.V., redaktor; TELESNIN, N.L., redaktor; GERASIMOVA, Ye.S., tekhnicheskiy redaktor

[Antiferromagnetism; a collection of articles. Translations] Antiferomagnetizm; sbornik statei. Perevod L.A.Shubinoi. Pod red. S.V.Vonsovskogo. Moskva, Izd-vo inostrannoi lit-ry, 1956. 487 p.
(Ferromagnetism) (MIRA 10:3)

Vonsovskiy, S.V.

Category : USSR/Solid State Physics - General Problems E-1

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3651

Author : Vonsovskiy, S.V.
Title : Research in the Physics of Metals (In the Ural' Branch of the Academy of Sciences USSR).

Orig Pub : Vestn. AN SSSR, 1956, V. 16 No 7, 16-23

Abstract : No abstract

Card : 1/1

VONSOVSKIJ, S.V.

SUBJECT USSR / PHYSICS
AUTHOR VONSOVSKIJ,S.V.
TITLE Congress on the Physics of Magnetic Phenomena.
PERIODICAL Usp.fis.nauk, 60,fasc.4, 709-722 (1956)
Issued: 1 / 1957

CARD 1 / 2 PA - 1800

This congress was organized from May 23rd to May 31st 1956 at Moscow by the department for physical sciences of the Academy of Science in the USSR, the commission for magnetism of the Academy of Science in the USSR at the Ural branch, and by Moscow University. This was the Third Great Soviet Congress on Magnetism since the end of the war (1946 and 1951 at SVERDLOVSK). The congress was attended by 700 scientists and engineers (among them about 30 from foreign countries), and 80 lectures and reports were read out. The congress dealt with the following problems: a) Magnetism of slightly magnetic substances and magnetism at low temperatures. b) Paramagnetic and ferromagnetic resonance. c) The physics of the ferromagnetic and antiferromagnetic state. d) The Physics of the technical magnetization curve and of magnetic substances. Individual lectures dealt among others with the following topics: The magnetic properties of nonferromagnetic metals at low temperatures, experimental investigations within the HAAS and VAN ALFVÉN (?) domain, galvanomagnetic properties of bismuth, theory of cyclotron resonance in metals, energy spectrum of electrons in metals, and HAAS-VAN ALFVÉN effect, determination of the single components of the magnetic susceptibility of a semiconductor, linear and quadratic ZEEMAN effect and diamagnetism of exiton in cuprous oxide, cyclotron- and plasma resonance in solids, paramagnetic re-

laxation, non-resonancelike paramagnetic resonance phenomena, new magneto-optic phenomena in microwaves, permeability of ferromagnetica for centimeter waves, artificial magnetic dielectrica of magnetic powders, quantum theory of ferromagnetism and antiferromagnetism, approximation methods of second quantization in the quantum theory of magnetism, spin waves, spontaneous magnetization of thin layers, relaxation- and kinetic processes in ferrodielectrica at low temperatures, spectrum of elementary excitations, supraconductivity in ferromagnetica, thermodynamics of ferromagnetic and antiferromagnetic phenomena, temperature dependence of the most important properties of these substances, temperature dependence of the magnetic properties of nickel and nickel alloys, nonmagnetic properties of ferromagnetica, theory of elastic ferromagnetica, structure of the domains of spontaneous magnetization, new experiments with powder figures, phenomena of magnetooptic polarization in ferromagnetic crystals, influence of phase transformations as well as of the crystallographic and magnetic texture upon the magnetic properties of ferromagnetic substances, magnetic hysteresis, magnetic viscosity of ferromagnetica, magnetic measurements, etc.

INSTITUTION:

VONSOVSKIY, S. V.

B-5

USSR/ Physical Chemistry - Crystals

Abs Jour : Referat Zhur - Khimiya, No 4, 1957, 11050

Author : Vonsovskiy S.V., Seyidov Yu.M.
Inst : Academy of Sciences USSR, Inst. Physics of Metals, Ural Affil, AS USSR
Title : On Indirect Exchange Interaction

Orig Pub : Dokl. AN SSSR, 1956, 107, No 1, 37-40

Abstract : Indirect exchange interaction in ionic crystals was calculated within the scope of a polyelectronic polar model. An ionic lattice of Mno type is considered, a portion of the lattice points of which is occupied by magnetic and the other portion by non-magnetic ions. It is assumed that in the basic state each magnetic ion has one s-electron in the incomplete shell and each non-magnetic ion has two p-electrons of opposite spin. Indirect exchange interaction occurs as a result of the transfer of electrons between magnetic and non-magnetic points of the lattice. As a result of expansion of polyelectronic hamiltonian to a series in powers of minor integral of inorthogonality of atomic wave functions, it is shown that integral of indirect exchange interaction differs from zero only at fourth approximation and not at the third as was assumed heretofore.

Card 1/1

VONSOVSKIY, S. V.

USSR/Magnetism - Ferromagnetism, F-4

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34905

Author: Vonsovskiy, S. V., Seyidov, Yu. M.

Institution: Institute of Physics, Ural Branch, Academy of Sciences, Sverdlovsk

Title: Concerning the Indirect Exchange Interaction

Original Periodical: Dokl. AN SSSR, 1956, 107, No 1, 37-40

Abstract: The indirect exchange interaction in condensed media is examined using the method of the Bogolyubov-Tyablikov perturbation theory. The small parameter chosen is the overlap of the wave functions of the electrons of the magnetized and nonmagnetized ions (nonorthogonality integrals). It is shown that the indirect exchange interaction appears in the fourth application of the theory of perturbation. The shortcomings of the Kramers theory of the indirect exchange interaction (Kramers, A. H., Physica, 1933, 1, 182) and of Anderson's theory (Anderson, P. W., Physical Review, 1950, 79, 350) are considered where the indirect exchange interaction is obtained only for the molecules of the Mn-O-Mn

Card 1/2

USSR/Magnetism - Ferromagnetism, F-4

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34905

Abstract: type assuming the electron wave functions to be orthogonal. For a particular case, the authors obtained an expression for the Kramers-Anderson indirect exchange from the general expression for the indirect exchange.

Card 2/2

AUTHORS: Vonsovskiy, S.V., Cherepanov, V.I. and Galishev, V.S.

TITLE: On the theory of exciton absorption of light. (K teorii eksitonnogo pogloshcheniya sveta). 126-2-3/30

PERIODICAL: "Fizika Metallov i Metallovedeniye" (Physics of Metals and Metallurgy), Vol.IV, No.2, 1957, pp.205-211 (U.S.S.R.)

ABSTRACT: The theory of Frenkel as generalised by Galishev and Vonsovskiy (1) is applied to the investigation of the mechanism of the absorption of light in crystals. The probability is calculated of a quantum transition of a system of electrons from a ground state to an excited state under the action of light. It is shown that the optical properties of such a system at absolute zero of temperature are not fully analogous to the properties of a system of isolated atoms. In the cases where exchange effects and pair processes of excitation can be neglected, the present theory reduces to Frenkel's theory. In accordance with refs. 1 and 6, a crystal lattice with "frozen" positive ions is considered in which non-uniformities in electron density are absent, and each crystal node has a valency electron over the closed shells. It is assumed that each such electron can be either in a ground state or in an excited state. Spin characteristics

Card 1/3

On the theory of exciton absorption of light. (Cont.) 126-2-3/30

of electrons are not considered and the excited states under consideration are taken to be non-degenerate. The probability of transition of the system from a normal to an excited state is shown to be given by

$$P_\nu(t) = \left|\frac{2\pi W_o}{h}\right|^2 . t \cdot \delta(\nu_1 - \nu)$$

where $P_\nu(t)$ is the probability of absorption of a quantum $h\nu$ in time t, $\nu_1 = (E_1 - E_o)/h$ is the transition of frequency, and W_o is given by (cf. Frenkel: Wave Mechanics, Pt.II) :-

$$W_o = \frac{\sqrt{N}\, ei}{\mu c} (\vec{A}_o \cdot \vec{I}_{o,1}) \cdot a(0)$$

Card 2/3 The spectral coefficient of absorption of light is shown to be given by (cf. Seitz, E, Ref.2):

$$\eta(\nu) = \frac{4\pi\sigma(\nu)}{c} = \frac{2\pi e^2 n}{\mu^2 ch\nu} (\vec{n}_o \vec{I}_{o1}) a(0)^2 \cdot \delta(\nu_1 - \nu).$$

There are 8 references, 6 of which are Slavic.

VONSOVSKIY, S. V.

126-3-2/34

AUTHORS: Svirskiy, M. S. and Vonsovskiy, S. V.

TITLE: On the possibility of spontaneous ionisation in the system of interacting electrons of a crystal. (O vozmozhnoy samoproizvol'noy ionizatsii v sisteme vzaimodeystvuyushchikh elektronov kristalla).

PERIODICAL: "Fizika Metallov i Metallovedeniye" (Physics of Metals and Metallurgy), 1957, Vol.4, No.3, pp. 392-399 (U.S.S.R.)

ABSTRACT: Fundamentally two approximations are available for solving the multi-electron problem of the crystal. One is based on the generalised Geitler-London-Geisenberg model, the other is based on the model of collectivised electrons. It is usually assumed that the first model can be successfully utilised in investigating various properties of the electron system of crystals of dielectrics and semi-conductors, whilst the second can be successfully applied for crystals of metals and alloys. Shubin and Vonsovskiy (1) showed that it is possible to utilise the first mentioned model for metallic crystals; thereby, the quasi-classical approximation was utilised which enabled accurate determination of the relation of the mutual distribution of the minima of the energy levels of the electron system on the number of ionised nodes 2s. It is shown that only those naive classical conceptions

Card 1/4

On the possibility of spontaneous ionisation in the system of interacting electrons of a crystal. (Cont.)

which do not take into consideration the influence of the distribution of ionised nodes along the crystal and of the quantum "energies" could lead to the incorrect interpretation of ionised states being unfavourable from the energy point of view. Mott (3) states that for low values of s the energy of the system increases only with increasing degree of ionisation owing to increase of the classical ionisation energy; only for very large values of s, when screening starts to play a certain part, does Mott consider ionisation states as being favourable from the energy point of view. These qualitative conclusions of Mott are not supported by calculations. On the basis of results obtained in the above mentioned earlier paper and one of the authors (1), it is possible to plot easily the curves of the dependence of the energy of the electron system of the crystal on its degree of ionisation s/N. The authors of this paper investigated this dependence for various ratios of the absolute values of the integrals A, I and L and the results are represented diagrammatically in the graph, Fig.1. They consider that, contrary to the view of Mott, states of spontaneous ionisation are fully possible for low values of s, as is

On the possibility of spontaneous ionisation in the system of interacting electrons of a crystal. (Cont.)

shown by more systematic consideration of the quantum effects. The problem of determination of the lowest energy state of a system of interacting electrons within the framework of the polar model was also considered in the work of Bogolyubov,N.N. and Tyablikov, S.V. (4,5); they give a quantitative justification of the ideas of Mott that the existence of a weakly ionised state is, from the energy point of view, unfavourable. Detailed analysis of this problem, given in this paper, shows that this conclusion is unjustified. It is concluded that the distribution of the energy levels of the homeopolar and the ionised states in a crystal have a direct and complicated dependence on the ratio of the absolute values of the atom energies of various types in the crystal, due to the quasi-classical as well as the specific quantum part of the electrostatic interactions of electrons in the crystal. Therefore, partial as well as full spontaneous ionisation of the electron states may occur and it can be stated that the generalised Geitler-London-Geisenberg model can be applied for explaining phenomena relating to the metallic conductivity.

Card 3/4 There are one graph and 6 references, four of which are Slavic.

126-3-2/34

On the possibility of spontaneous ionisation in the system of interacting electrons of a crystal. (Cont.)

SUBMITTED: December 26, 1956.

ASSOCIATION: Institute of Metal Physics Ural Branch of the Ac.Sc. U.S.S.R. (Institut Fiziki Metallov Ural'skogo Filiala AN SSSR) Chelyabinsk Pedagogic Institute. (Chelyabinskiy Pedagogicheskiy Institut).

AVAILABLE: Library of Congress

Card 4/4

AUTHORS: Vonsovskiy, S. V. and Kushnirenko, A. N. 126-5-3-3/31

TITLE: Excited States in an Atomic Semiconductor in a Multi-electron Model (Vozbuzhdennyye sostoyaniya atomnogo poluprovodnika v mnogoelektronnoy modeli)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol V, Nr 3, pp 395-401 (USSR)

ABSTRACT: Configuration space concepts are applied to an inherent semiconductor, in which each lattice site is assumed occupied by two (non-degenerate) s-state electrons with antiparallel spin projections. The first excited p state (assumed non-degenerate) is included. The two possible species of excitation in such crystal are Frenkel excitons (singlet or triplet states), and electron-hole conduction. The work extends earlier studies on a one-electron model, and on a two-electron model neglecting conduction. The problem is initially formulated in Slater determinant form (Eq.(1.1)) for Frenkel excitons and analysis (neglecting magnetic interactions) for the wave-functions and energy is then standard. It is then shown that the Frenkel excitons can carry no current. The electron-hole type of excitation is then considered more briefly, starting from the excited-state eigenfunction,

Card 1/2

126-5-3-3/31

Excited States in an Atomic Semiconductor in a Multi-electron Model

Eq.(2.1). It is demonstrated also that there is no essential physical difference between Frenkel and Mott excitons, which can only be done from a multi-electron model.
There are 11 references, 10 Soviet, 1 English.

ASSOCIATION: Institute of Metal Physics, Ural Branch of the Ac.Sc., U.S.S.R. (Institut Fiziki Metallov Ural'skogo Filiala AN SSSR)

SUBMITTED: April 8, 1957.

[illegible]: 1. Semiconductors--Excitation 2. Semiconductors--Electron transitions

Card 2/2

VONSOVSKIY, S.V.

137-58-5-10391

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 5, p 215 (USSR)

AUTHOR: Vonsovskiy, S. V.

TITLE: Problems of Solid-state Physics as Treated in the Work of the Institute for the Physics of Metals of the Urals Branch of the USSR Academy of Sciences (Problemy fiziki tverdogo tela v rabotakh Instituta fiziki metallov Ural'skogo filiala AN SSSR)

PERIODICAL: Izv. vost. fil. AN SSSR, 1957, Nr 8, pp 130-142

ABSTRACT: A communication is presented on the major directions taken by the work of the Institute. Theoretical studies are in the direction of determining interelectronic interactions in solids. Investigation is under way of the mechanism of the forces of cohesion in various types of solids. Studies are under way in the theory of the technical magnetization curve and in the physics of ferromagnetic materials. The electrical and optical properties of metals are investigated. The problem of the relationship between phase composition and mechanical properties in metals and alloys is being elaborated. Bibliography: 28 references.

A. R.

1. Physics--Theory 2. Metals--Properties

Card 1/1

VONSOVSKIY, S.V.

48-6-14/23

SUBJECT: USSR/Physics of Magnetic Phenomena

AUTHOR: Vonsovskiy, S.V.

TITLE: Quantum-Mechanical Treatment of Ferromagnetism in Metals of Transition Groups (Kvantovomekhanicheskaya traktovka ferromagnetizma metallov perekhodnykh grupp).

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizhicheskaya, 1957, Vol 21, #6, pp 854-861 (USSR)

ABSTRACT: At present, there are two multi-electron approximations in the ferromagnetism theory:

1. A generalized model of Heitler-London-Heisenberg, and
2. A model of collectivized electrons, which makes use of the Bloch collectivized one-electron functions.

For the case of crystals of the transition group elements and their compounds, it turned out to be expedient to use a "mixed" presentation, in which valence electrons are described by Bloch functions and internal electrons by atomic localized functions.

Anomalies in many properties of ferromagnetic metals, such as fractional atomic magnetic moments (5, 10), optical (11), mag-

Card 1/3

TITLE: Quantum-Mechanical Treatment of Ferromagnetism in Metals of Transition Groups (Kvantovomekhanicheskaya traktovka ferromagnetizma metallov perekhodnykh grupp).

neto-optical (12) and other anomalies, were explained by the author and other physicists in Sverdlovsk by making use of this latter model, which was named the "СДОМ" (s-d exchange model).

A further improvement of this model can be achieved by its generalization which consists in the combination of a generalized polar model of semiconductors (28) and a s-d exchange model.

The main result of applying this model consists in the derivation of the following law: For the Fermi branch of the energetic spectrum ("holes" in the s-shell and p-electrons) the electroconductivity δ depends on the magnetization of a ferromagnetic material as follows:

$$\delta \sim e^{-\frac{\gamma}{\varkappa T}} \left[e^{\frac{\gamma}{\varkappa T}\mu} + e^{-\frac{\gamma}{\varkappa T}\mu} \right]$$

where α and γ - are some constants having dimensionality of energy and which are connected to the width of the energetic "gap" between the s- and p-conductivity bands,

Card 2/3

48-6-14/23

TITLE: Quantum-Mechanical Treatment of Ferromagnetism in Metals of Transition Groups (Kvantovomekhanicheskaya traktovka ferromagnetizma metallov perekhodnykh grupp).

$\varkappa$ - is the Boltzman constant, and
T - is the temperature.

The bibliography lists 33 references, 25 of which are Russian.

ASSOCIATION: Institute for Physics of Metals in the Ural Branch of the USSR Academy of Sciences.

PRESENTED BY:

SUBMITTED: No date indicated

AVAILABLE: At the Library of Congress.

Card 3/3

32-10-21/32

AUTHORS: Vonsovskiy, S.V., Corresponding Member of the Academy of Sciences USSR, Mikheyev, M.N., Candidate of Technical Sciences

TITLE: Analysis of Magnetic Structure (Magnitnyy strukturnyy analiz)

PERIODICAL: Zavodskaya Laboratoriya, 1957, Vol 23, Nr 10, pp 1221-1226 (USSR)

ABSTRACT: The chapter of the paper: Development of the methods of analysis of magnetic structure begins by mentioning a series of Soviet, as well as American, German, and French scientists who contributed to the development of the method referred to in the title. Among them are: Arkad'yev, Frenkel, Dorfman, Akulov, Kondorskiy, Landau Lifshits and Yanus (USSR), further Bozopt and Bitter (USA), Dering (Germany) and Neel (France). The elaborate studies of Soviet scientists in the field of magnetic control of the materials are declared to be of greatest importance, and that in the sense of their practical application in industrial enterprises. The most important studies in this field are mentioned here, most of them with the application of a coercimeter in the control methods and finally a special method which is called here "magnetic metallography" with which the investigation of the structure of the phases is judged according to the picture of the deposit of the magnetic powder on the ground sections of the metals. (according to Yeremin, N. I.). In the following chapter: Ratio bet-

Card 1/2

Analysis of Magnetic Structure

ween magnetic properties and structural state of substance, the characteristic property of interaction of the electrons and positive ions of the crystalline lattice of the substance is taken as a basis for the investigation of this ratio. With this, it is also explained that the changes in the chemical and phase-structure of the substance and various states of their structure in their magnetic characteristic become effective and that they determine the belonging of the substance to one of the magnetic groups. (Diamagnetica, para-,or ferromagnetica). Taking account of the variations of saturation, or of the Curie point, with respect to the changes in chemical composition, the degree of order of the atoms in the alloy and disturbances in higher bonds, it therefore results a possibility of elaborating a measuring method for these variations in atomic structure of the substance. The same can be stated with respect to the structural dependence of magnetic parameters which are in proportion to the technical magnetization curve (original and maximum susceptibility, coercive force, final magnetization, etc.). Corresponding measuring instruments are built on these principles. There are 59 references, 58 of which are Slavic.

AVAILABLE: Library of Congress
Card 2/2 1. Magnetic properties-Analysis

PA-2846

AUTHOR VONSOVSKIY S.V., corresponding member of the Academy of Science of the USSR.

TITLE On the connection of dynamic and static rules in the case of atomic phenomena. (O svyasi dinami nurcheskich i statisticheskich tsakonomernostej v atomnych javlenijakh. Russian)

PERIODICAL Vestnik akademii nauk S.S.S.R. 1957, Vol 27, Nr 4, pp 31 - 45 (U.S.S.R.)

Received: 5 /1957 Reviewed: 6 /1957

ABSTRACT In physical science dynamic rules are the expression of immediate and causal dependence. The basic idea is that if for any physical-mechanical system the coordinates and determining momenta are known, the also the "trend" of the system is known according to the equation of motion. A number of conditions must, of course be satisfied. Great success has been achieved in practice by classical macroscopic mechanics. This led to the conviction of the absolute exactitude of the principles of mechanical determinism. The first blow was dealt to this "absolutization" in connection with the theoretical generalizations in the field of the investigation of the form of heat (of the motion of matter). These problems became particularly acute in connection with the reciprocal relations of dynamic and static rules governing phenomena in nature (in connection with the progress made by nuclear physics:

CARD 1/2

On the connection of dynamic and static rules in the case of atomic phenomena.

quantum mechanics). The adherents of Laplace's determinism always hoped that in the end all difficulties would be overcome, and that the (strictly dynamic) thermodynamics would be the goal attained eventually. However, these hopes remained unfulfilled. Atomic dynamics turned out to be static. The struggle concerning quantum mechanics naturally gave rise to opposing philosophical conceptions. HEISENBERG, one of the greatest physicists of our time, is inclined to favor the "Copenhagen interpretation", which may safely be described as "idealistic". This is opposed by A.D. ALEXANDROW'S interpretation, which inclines more towards the philosophy of dialectic materialism.

ASSOCIATION: not given.
PRESENTED BY: -
SUBMITTED: -
AVAILABLE: Library of Congress.

CARD 2/2

VONSOVSKIY, S. V. (Sverdlovsk)

"Aspects of Soveit Researches in Magnetism."
"Thermodynamics of Anti- and Ferromagnetics near the Neel or Curie Temperatures."
"Parasitic Ferromagnetism in Antiferromagnetics." (Dzyaloshinskiy)
"General Theory." (Turov, Tyablikov, Irkhin, Akhiezer)

report presented at Colloquim on Magnetism, Grenoble, France, 2-5 Jul 58.

Eval: B - 3,111,755 3 Sep 58.

VONSOVSKIY, S. V. (Prof.)

"Work of Soviet Physicists in the Area of Magnetism during the Last Few Years,"

report presented at the Colloquium on Magnetism, Grenoble, France, 2-6 Jul 58.

Director, Magnetics Inst, Sverdlovsk.

VONSOVSKIY, S. V. (Dr.)

"Phenomenological Treatment in the Quantum Theory of Ferro- and Antiferro-magnetism," with TUROV, Ye. A.

paper presented at the Fourth Annual Conference on Magnetism and Magnetic Materials Philadelphia, Pa., 17-20 Nov. 1958.

Division of Theoretical Physics of the Institute of Metal Physics, USSR Acad. Sciences, Sverdlovsk.

Vonsovskiy, S.V.

PHASE I BOOK EXPLOITATION SOV/3847
SOV/26-M-20

Akademiya nauk SSSR. Ural'skiy filial. Institut fiziki metallov

Trudy, vyp. 20 (Transactions of the Institute of the Physics of Metals, Ural Branch, Academy of Sciences USSR, No. 20) Sverdlovsk, 1958. 402 p. Errata slip inserted. 1,000 copies printed.

Resp. Eds.: S.V. Vonsovskiy, Corresponding Member, Academy of Sciences USSR, and V.I. Arkharov, Doctor of Technical Sciences.

PURPOSE: This book is intended for scientists working in the field of physical metallurgy.

COVERAGE: This is a collection of 28 articles written by members of the Institute of the Physics of Metals, Ural Branch of the Academy of Sciences USSR, on problems investigated at the Institute. Studies at the Institute have concentrated on two basic problems: 1) developing a theory of metals and alloys and finding ways to improve the

Card ~~1/6~~

properties of engineering materials; and 2) developing new physical methods for investigating and controlling the quality of materials and metal articles. In connection with these basic problems the articles in the collection treat the following subjects: problems of the multielectron quantum-mechanical theory of solids; the laws of distribution and diffusion of admixtures in various metallic alloys (internal adsorption theory); strength and plasticity of polycrystalline materials in relation to interatomic binding forces, distortions in the crystal lattice; structural theory of diffusion reaction, i.e. diffusion due to chemical reactions in solid phases; theory of the magnetic structure of ferromagnetic substances; theory of the heat treatment of steel; and the physical theory of magnetic measurements (magnetic flaw detection and structural analysis). The first article gives a description of the work being done by the Institute and a list of departments and laboratories along with their chief personnel. Several persons are cited for their work at the Institute. References accompany each article.

TABLE OF CONTENTS:

SOV/3847

Transactions of the Institute (Cont.)

Card 3/6

VONSOVSKIY, S.V

24(7) p.3 PHASE I BOOK EXPLOITATION SOV/1338

Frenkel', Yakov Il'ich, Corresponding Member, USSR Academy of Sciences

Sobraniye izbrannykh trudov. t. 2: Nauchnyye stat'i (Colletcion of Selected Works. Vol. 2:Scientific Articles) Moscow, Izd-vo AN SSSR, 1958. 600 p. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Redaktsionno-izdatel'skiy sovet.

Resp. Ed.: Semenov, N.N., Academician: Ed. of Publishing House: Kontorova, T.A.; Tech. Ed.: Smirnova, A.V.; Editorial Board for the Works of Ya. I. Frenkel'; Semenov, N.N. (Chairman) Academician, Sokolov, A.A. (Deputy Chairman) Doctor of Physical and Mathematical Sciences. Bogolyubov, N.N., Academician, Tamm, I.Ye., Academician, Ansel'm, A.I., Doctor of Physical and Mathematical Sciences, Blokhintsev, D.I., Doctor of Physical and Mathematical Sciences, and Kontorova, T.A., Candidate of Physical and Mathematical Sciences.

Card 1/8

Collection of Selected Works. (Cont.)

PURPOSE: This book is intended for persons interested in the scientific contributions of Ya. I. Frenkel'.

COVERAGE: This, the second volume of the collected works of Ya. I. Frenkel', is a compilation of his scientific articles and books. The volume is divided into four sections. The first consists of his contributions to semiconductors, and dielectrics and the electron theory of metals. The second section covers his works on molecular physics and deals with the kinetic theory of solids and liquids, the mechanical properties of solids, and the physical properties of high-molecular compounds. The third section covers his works on the theory of electrons and atomic nuclei, and the last section presents his contributions to geophysics. No personalities are mentioned. The volume includes a list of Ya. I. Frenkel''s published works amounting to 251 articles and 41 books.

Card 2/8

Collection of Selected Works (Cont.) SOV/1338

TABLE OF CONTENTS:

Card 3/10

VONSOVSKIY, S.V.; LEONTOVICH, M.A.; TAMM, I.Ye.

Semen Petrovich Shubin; on the on the occasion of this fiftieth birthday and 20th anniversary of his death. Usp. fiz. nauk 6 no.4:733-737 Ag '58. (MIRA 11:10)

(Shubin, Semen Petrovich 1908-1938)

VONSOVSKIY, S. V.

56-1-15/56

AUTHORS: Vonsovskiy, S. V., Cherepanov, V. I.

TITLE: Extension of the Bogolyubov-Tyablikov Perturbational Method to the Non-Steady Case (Obobshcheniye metoda teorii vozmushcheniy Bogolyubova-Tyablikova na nestatsionarnyy sluchay)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 1, pp. 97 - 105 (USSR)

ABSTRACT: In the present work the method by Bogolyubov-Tyablikov is extended to the non-steady case of the alternating electromagnetic field of a light wave propagated in a crystal. The authors first investigated a simple atomic cubic crystal with an s-electron in the s-state in each node of the lattice. The thermal oscillations of the ions of the lattice are neglected. On this occasion the Hamiltonian of the system of the electrons of the crystal in an electromagnetic field in the representation of the second quantization are given and discussed. In the following chapter the definition and the properties of the operator of the projection on the L-space are discuss-

Card 1/2

Extension of the Bogolyubov-Tyablikov Perturbational Method to the Non--Steady Case

ed. Then, the perturbational method by Bogolyubov-Tyablikov is extended to the non-steady case. The computations given here hold for such light frequencies which disagree with the fundamental frequencies of the system. The consideration of damping makes possible the investigation of the general case with any frequency of the incident light which will be demonstrated more precisely in a later paper. In the case of the approximation investigated here the spectrum of absorption of light through the system of electrons of the crystal is a discrete spectrum. This means from the physical point of view that the "pairs" and "holes" occurring due to the action of light remain in the bound states and the absorption of light by the crystal is not photo-electrically active. The last chapter treates the determination of the "deformed" current operator. There are 5 references, all of which are Slavic.

ASSOCIATION: Ural State University, Sverdlovsk (Ural'skiy gosudarstvennyy universitet Sverdlovsk)

SUBMITTED: June 26, 1957

AUTHORS: Volkenshteyn, N. V., Fedorov, G. V., Vonsovskiy, S. V. SOV/56-35-1-11/59

TITLE: The Hall Effect of Pure Nickel Within the Range of Helium Temperatures (Effekt Kholla chistogo nikelya v oblasti geliyevykh temperatur)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 1, pp 85 - 88 (USSR)

ABSTRACT: The present paper deals with the investigation of the temperature dependence of R_1 and R_o in the temperature range of between room temperature and 4,2°K; according to reference 1 the following holds for the Hall field: $e = R_o H_2 + R_1 J$ (J = magnetization, R_o ordinary Hall constant), and $R = A\rho^2$ (Ref 6) (A= constant, ρ specific electric resistance). The first data concerning the temperature dependence of Ni within the range of from room temperature to Curie (Kyuri) point were supplied by Kikoin (Ref 2); Jan and Gijsman (Yan, Giysman)(Ref 3) investigated R_o and R_1 for Ni and Fe, and found an unsharp minimum in the ranges of 30-50° (Ni) and 50-70° (Fe). R_1 decreased from T =300°K → T=14°K to a twentieth part of its value.

Card 1/5

The Hall Effect of Pure Nickel Within the Range of Helium Temperatures SOV/56-35-1-11/59

The authors of this paper investigated the Hall effect in pure Ni(99,99%). Size of sample: 9.4.0,3 mm, H = 5000 Oe, B in the sample: 22 000 G; sensitivity of the potentiometer 2.10^{-8}V; measurements were carried out at room temperature, 0°C, as well as in baths of liquid N, liquid H, and liquid He; specific resistances: $\rho_{20,4^\circ}/\rho_{293^\circ} = 12,36.10^{-3}$ and $\rho_{4,2^\circ}/\rho_{293^\circ} = 10,28.10^{-3}$.
The measuring results are given in figures 1-4 in form of diagrams. R_1 decreases sharply with reduced temperature and has a minimum at 20 - 30°K; $R_1(T=300^\circ K) \sim 100.10^{-12}$V.cm/A.G, $R_1(T=14^\circ K) \sim 5.10^{-12}$V.cm/A.G. R_0 decreases from 300° to 4,2°K to about 1/3(0,6 → 0,2.10^{-12}V.cm/A.G) and has no minimum. In conclusion the authors (Refs 10-16) discuss the theory of the Hall effect and the possibility of calculating R_1 according to Patrakhin (Ref 15) within the framework of the (s-d) exchange model of ferromagnetism(Vonsovskiy,Ref 16). There are 4 figures and 17 references, 10 of which are Soviet.

Card 2/2

Inst. Physics of Metals Ural Affil AS USSR

SOV/56-35-6-19/44

24(5)

AUTHORS: Vonsovskiy, S. V., Svirskiy, M. S.

TITLE: On the Problem of the Statistics of Spin- and Polar Excitations in Crystals (K voprosu o statistike spinovykh i polyarnykh vozbuzhdeniy v kristalle)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 6, pp 1447-1456 (USSR)

ABSTRACT: It was proved by some papers (Refs 1-3) that the spin waves (ferromagnons) occur not as bosons but as fermions. Also for the polar elementary excitations (of "twins" and "holes") in electron systems of crystals this question was discussed (Ref 4). In this connection the question is of interest as to the statistical classification of ferromagnons and polar excitation. The present paper deals with some faults committed in dealing with the spin- and polar excitations in crystals (which may lead to the occurrence of fictitious states (Refs 2, 5, 6)), and it is shown that if these faults are eliminated, the spin waves may be assigned to the bosons; for polar excitation the question is investigated as to when it is caused by bosons. Further, the question is discussed as to how this method of second quantization is to be formulated

Card 1/2

On the Problem of the Statistics of Spin- and Polar Excitations in Crystals

if one has a finite number of particles that can be described by symmetric wave functions (bosons). It is shown that quasi-particles (separable in the system of interacting crystal electrons) obey Fermi statistics in such cases in which "single electron transitions" correspond to the solution, and that they obey Bose (Boze) statistics if "two electron transitions" play the part of a solving agent in the dynamics of the system. (Correspondingly: half-integral spin → Fermi statistics, integral spin → Bose statistics). The results obtained by this paper verify the opinion expressed by I. M. Lifshits (Ref 4) concerning the statistics of "twins" and "holes" at the Kiyev Conference on Semiconductors (1956). There are 17 references, 7 of which are Soviet.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR
(Institute for Metal Physics of the Academy of Sciences, USSR)

SUBMITTED: June 17, 1958

AUTHORS: Vonsovskiy, S. V., Leontovich, M. A., SOV/53-65-4-12/13
Tamm, I. Ye.

TITLE: Semen Petrovich Shubin (On the Occasion of the Fiftieth Anniversary of His Birth and of the Twentieth Anniversary of His Death)(Semen Petrovich Shubin(K pyatidesyatiletiyu so dnya rozhdeniya i dvadtsatiletiyu so dnya smerti))

PERIODICAL: Uspekhi fizicheskikh nauk, 1958, Vol 65, Nr 4, pp. 733 - 737 (USSR)

ABSTRACT: As introduction a short curriculum vitae of the scientist, who was born on July 31, 1908 in Liepaja(Latvia), is given. Subsequently his work is discussed in detail.
a)Publications on the classical theory of oscillation:"Some Problems in the Perturbation Theory of Linear Oscillation Systems" was the title of his first publication (Ref 1); a theoretical investigation of the oscillations of thin diaphragms fastened at a finite number of points followed one year later. b) Publications on the theory of solids: "On the Theory of the Photoeffect in Metals", "On the Transmission Band in Silver", "Concerning the Theory of Liquid Metals", "On the Possible Anomalies of Resistance at Low Temperatures",

Card 1/2

Semen Petrovich Shubin (On the Occasion of the Fiftieth Anniversary of His Birth and of the Twentieth Anniversary of His Death) SOV/53-65-4-12/13

"On the Theory of Exchange Interaction", "Problems of the Quasiclassical Treatment of Ferromagnetism" and others. c) Publications on physical statistics: A summary of statistical formulae is mentioned. d)Publications on quantum electrodynamics and theory of the quantized fields: "Classical Analog to the Dirac Theory of Emission", "On the New Dirac Theory of the Electromagnetic Field" and others. Finally a list of scientific papers published by Shubin is given (18 papers, written partly in German, English, and French). There are 1 figure and 26 references, 21 of which are Soviet.

Card 2/2

AUTHORS: Vonsovskiy, S. V., Corresponding Member SOV/20-120-2-12/63
Academy of Sciences, USSR, Svirskiy, M. S.

TITLE: On the Theory of the Superconductivity of Metals (K teorii sverkhprovodimosti metallov)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 2, pp. 269-272 (USSR)

ABSTRACT: Some authors (Refs 1,3) were very successful in explaining the microscopic nature of this phenomenon. However, these authors investigated the properties of weakly interacting gases of Fermi particles (electrons) and Bose particles (phonons) outside the binding with the structure of the metal. It is therefore interesting to use the multielectronic model of the metal (Ref 4) in the investigations of this problem. The authors investigate a system of interacting external electrons of a crystal. The corresponding Hamiltonian is given explicitly, after which then it is transformed. In this expression for the Hamiltonian H one may separate the disturbation due to the interaction with the phonons. The investigation of the separated expression for H makes it possible to affirm the existence of the superconductivity in the investigated system. A formula

Card 1/3

for the critical temperature is given. A criterion for the superconductivity is the prevailing of the interaction with the phonons over the shielded interaction. According to the considerations of this paper, it may be assumed that $L < 0$ and great values of $Z_{effective}$ are favourable for the existence of the superconductivity. L is a term figuring in the expression of H. In order to verify this conclusion the authors computed T_{eff} according to Slater's (Sleter) method and found the following result: For every superconductor with the exception of Nb ($Z_{effective} = 2.8$) the inequation $Z_{eff} \geqslant 3$ holds good. The maximal value of Z_{eff} of all the superconductors was found for Bi ($Z_{effective} = 6.3$). The upper limits of $Z_{effective}$ in any period are determined by the superconductors. Within the indicated limits the following metals are non-superconductive: Fe, Co, Ni, Cu, Rh, Pd, Ag, W, Ir, Pt, and Au. The above mentioned and also other facts lead to the following conclusion: The investigation of $Z_{effective}$ and of the methods to increase $Z_{effective}$ is a simple and useful way leading to the explanation of the available experimental data and to the

On the Theory of the Superconductivity of Metals SOV/2o-12o-2-12/63

search of new superconductive elements and compounds. There are 1 figure and 1o references, 7 of which are Soviet.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala Akademii nauk SSSR(Institute of Metal Physics, Ural Branch, AS USSR)

SUBMITTED: March 3, 1958

1. Metals—Conductivity 2. Superconductivity--Theory

Card 3/3

SOV/20-122-2-11/42

24(3)
AUTHORS: Vonsovskiy, S. V., Corresponding Member, Academy of Sciences, USSR, Svirskiy, M. S.

TITLE: Concerning the Problem of the Absence of Superconductivity in Ferromagnetics (K voprosu ob otsutstvii sverkhprovodimosti v ferromagnetikakh)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 122, Nr 2, pp 204-207 (USSR)

ABSTRACT: It is interesting to investigate this problem from the point of view of the new microtheory of superconductivity (Refs 2, 3, 4) where the peculiarities of the energy spectrum of the external (s) electrons have to be taken into account. These peculiarities may be considered, for instance, in the (s-d) exchange model of the ferromagnetic metals. (S. V. Vonsovskiy, Ref 5). At T = 0, in the normal state of the ferromagnetics, there are 3 regions in the $\vec{k}$ space. ($\vec{k}$ denotes the wave vector). In region I there are equal quantities of spins of the 2 possible orientations. In region II there are only s-electrons of the left spin orientation, and in region III there are only holes. The following conclusions may be drawn from the

Card 1/2

Concerning the Problem of the Absence of Superconductivity in Ferromagnetics

calculations discussed in this paper: From the point of view of the new microtheory, the absence of the superconductivity in the ferromagnetics is an internal property of the system of its electrons. This property is caused by the relatively strong (s-d) exchange interaction. The superconductivity, therefore, can be observed only in those ferromagnetic metals which have a very weak (s-d) exchange interaction. There are 13 references, 8 of which are Soviet.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala Akademii nauk SSSR (Institute of the Physics of Metals of the Ural Branch, AS USSR)

SUBMITTED: June 12, 1958

SHUBINA, L.A., [translator]; VONSOVSKIY, S.V., red.; MAKHNSON, I.G., red.; GRIBOVA, M.P., tekhn.red.

[Magnetic structure of ferromagnetic materials] Magnitnaia struktura ferromagnetikov; sbornik statei. Pod red. S.V. Vonsovskogo. Moskva, Izd-vo inostr.lit-ry, 1959. 514 p. (MIRA 14:1)

(Ferromagnetism)

24(8)

AUTHORS: Vonsovskiy, S. V., Svirskiy, M. S. SOV/56-36-4-43/70

TITLE: On the Problem of the Superfluidity of Bose Polar Excitations (K voprosu o sverkhtekuchesti sistemy bozevskikh polyarnykh vozbuzhdeniy)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 4, pp 1259-1266 (USSR)

ABSTRACT: A number of papers is first discussed which deal with the microtheory of superconductivity, and the assumptions concerning the nature of the statistics of the elementary current carriers are discussed. Whereas in some cases Fermi statistics is used, the majority of authors work with Bose or Bose-Einstein statistics. In the present paper the authors investigate a system of charged Bose polar excitations by means of the method employed by Bogolyubov for analyzing the superfluidity of a weakly non-perfect Bose-Einstein gas. The possibilities for a superconductive state in metals was investigated for the case in which the elementary current excitations of the electron system are quasibosons. The problem is solved within the framework

Card 1/2

On the Problem of the Superfluidity of Bose Polar Excitations

SOV/56-36-4-43/70

of the "polar" many-electron crystal model. Criteria are obtained for the possible existence of a supraconductive state in the system of charged bosons: low temperature, small thickness of the quasiparticles, practically no "single-electron" transitions, and negative sign of the exchange integral. The phonon-induced interaction between the current Bose particles is of an attractive character and impedes the occurrence of the superconductivity of the latter. The dependence of the critical temperature of a superconductor with Bose current carriers on the isotopic mass of the crystal ions differs from that of a metal with a Fermi electron spectrum. This difference can be used in order experimentally to divide the superconductors in to such of Fermi- and such of the Bose type. There are 14 references, 10 of which are Soviet.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute for Metal Physics of the Academy of Sciences, USSR)

SUBMITTED: October 27, 1958

Card 2/2

84814

S/181/60/002/008/049/052/XX
B006/B070

24.4500
AUTHORS: Vonsovskiy, S. V., Giterman, M. Sh.

TITLE: Many-electron Theory of Ion Crystals

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 8, pp. 1793-1805

TEXT: Ion crystals are characterized by strong inhomogeneities of the electron density at neighboring lattice points. The binding forces have, therefore, essentially an electrostatic character. The interaction of electrons with one another and with lattice vibrations must be taken into account in the theory of ion crystals. Such studies were made earlier by S. I. Pekar (Ref. 1). In the present paper, the authors describe the investigation of ion crystals (phenomenological and model treatment) within the framework of a many-electron theory by means of the method of elementary excitations. The approximation used here is valid only for weakly excited states of the many-electron system. A consistent handling of the problem by quantum mechanics is possible only under this limitation. When the excitation is weak and an energy gap exists, it is possible to separate the energy spectrum in good approximation into individual branches

Card 1/3

representing different aspects of the collective motion of the many-electron system. The theoretical studies are made on the basis of the Hamiltonian of the ion crystal in second quantization representation:

$$H=\sum_{\alpha\alpha'} L(\alpha\alpha') a_\alpha^+ a_{\alpha'} + \sum_{\alpha_1\alpha_2\alpha_1'\alpha_2'} F(\alpha_1\alpha_2\alpha_1'\alpha_2') a_{\alpha_1}^+ a_{\alpha_2}^+ a_{\alpha_1'} a_{\alpha_2'} + \sum_{\alpha\alpha'\varkappa} \left[K(\alpha\alpha'\varkappa) a_\alpha^+ a_{\alpha'} \xi_\varkappa + \text{c.c.}\right]$$

$$+\sum_{\varkappa} \hbar\omega_\varkappa \xi_\varkappa^+ \xi_\varkappa.$$

Here, a_α^+ and a_α are Fermi's annihilation and production operators of the electrons in the state α; $\xi_\varkappa^+$ and $\xi_\varkappa$ are Bose's production and annihilation operators of the phonons with momentum $\varkappa$ and energy $\hbar\omega_\varkappa$. The functions L, F, and K may be determined either phenomenologically, or in the microscopic model representation as given in (2). H can be represented by: $H = E_0 + H^{\text{Fermi}} + H^{\text{Bose}} + H^{\text{Fermi-Bose}}$. The Hamiltonian H^{Fermi} for an alkali-halide crystal is represented by (4), and the Fermi branch of elementary excitations are studied for the following special cases: 1) a very simplified model neglecting the electron-phonon interaction and the electron degeneracy; 2) neglecting the electron-phonon interaction but taking account of the degeneracy; 3) weak electron-phonon interaction; 4)

Many-electron Theory of Ion Crystals

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strong electron-phonon interaction in adiabatic approximation; 5) impurity conductivity; 6) ion crystal whose one component is a transition metal. In the last section of the paper, the Bose branch of elementary excitations is briefly discussed. There are 24 references: 22 Soviet, 1 US, and 1 British.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im. Gor'kogo (Ural State University imeni Gor'kiy)

SUBMITTED: December 24, 1959

Card 3/3

IGNATCHENKO, V.A.; VONSOVSKIY, S.V.

Type of formula for magnetoelastic energy in ferromagnetic materials. Fiz.met.i metalloved. 9 no.3:456-457 Mr '60. (MIRA 13:6)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR i Institut fiziki metallov AN SSSR.
(Ferromagnetism)

VONSOVSKIY, S.V.; IZYUMOV, Yu.A.

Statistical properties of the electron system of ferromagnetic transition metals. Fiz. met. i metalloved. 10 no.3:321-334 S '60.
(MIRA 13:10)

1. Institut fiziki metallov AN SSSR.
(Transition metals) (Electrons)

83188
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B006/B056

24.2140

AUTHORS: Vonsovskiy, S. V., Svirskiy, M. S.

TITLE: The Superconductivity of a Ferromagnetic With Weak Exchange Interaction

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 2(8), pp. 384-392

IX

TEXT: Already in an earlier paper (Ref. 1) the authors have shown that a shift of the Fermi sphere of s-conduction electrons with opposite spin projections depends on their coupling with d- or f-electrons of the inner spin-unsaturated shells, i.e., it is due to (s-d) exchange interaction and prevents the occurrence of superconductivity in ferromagnetics such as Fe, Co, and Ni. Ferromagnetics with sufficiently weak (s-d) exchange interaction can become superconductive; as a condition it was found that $\mu J \ll \hbar\omega$, where μ is the excess of d- or f-electrons with predominating spin orientation, i.e., the relative magnetization of these electrons at the lattice points, J - the energy parameter of (s-d) exchange, and ω - the mean phonon frequency. The influence exerted by the Fermi sphere

The Superconductivity of a Ferromagnetic With Weak Exchange Interaction

shift upon the characteristic of the superconductive state is investigated more extensively and more accurately. The Hamiltonian describing the system of conduction electrons is written down, and the definitions of the individual quantities are discussed; the ground state and the free energy of the ferromagnetic superconductor is investigated, after which an expression is derived for the critical temperature (transition into the superconductive state). Likewise, the problem of specific heat and that of the critical magnetic field of a ferromagnetic superconductor are theoretically studied. Finally, the results obtained are discussed, and possibilities of their experimental verification are considered. Superconductivity of ferromagnetics has hitherto been found only in the $(Ce,Gd)Ru_2$ system, but it might also be possible in other systems as, e.g., $(Ce,Pr)Ru_2$. It follows from theory that the characteristic of the superconductive state of a ferromagnetic deviates from the ordinary one, which is due to the (s-d) exchange coupling. An experimental investigation of these deviations would be of interest not only for the superconductivity but also for a re-examination of the (s-d) exchange model of ferromagnetic metals. The parameter of (s-d) exchange coupling could be determined from determinations

Card 2/3

83188

The Superconductivity of a Ferromagnetic With Weak Exchange Interaction

S/056/60/039/002/025/044
B006/B056

of the jumps of specific heats at T_0; from a measurement of α_1 as a function of $H_c^2(T)$ according to formula (43) of the present paper, etc. The shift of the Fermi surface indicates superconductivity only if the (s-d) exchange coupling is weak. N. N. Bogolyubov is mentioned. There are 10 references: 4 Soviet, 5 US, and 1 Japanese.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Physics of Metals of the Academy of Sciences, USSR).
Chelyabinskiy gosudarstvennyy pedagogicheskiy institut (Chelyabinsk Pedagogical State Institute)

SUBMITTED: March 3, 1960

Card 3/3

S/020/60/132/04/17/064
B014/B007

AUTHORS: Vonsovskiy, S. V., Corresponding Member of the AS USSR, Berdyshev, A. A., Izyumov, Yu. A., Karpenko, B. V., Polyak, Yu. Ya.

TITLE: Exchange Interaction of Inner and Outer Electrons in Transition Metals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 4, pp. 797-800

TEXT: In the electron spectrum of metallic crystals which are composed of elements of the transition group and of the rare-earth group, special properties are observed compared to the crystals of other metals. This is brought into connection with the d- and f-shells of the electron sheath. The electron density of the transition metals is divided into three regions. The first is near the nucleus, the second consists of the valence electrons, and the third intermediate region consists of the electrons of the non-closed shells. For this system the Hamiltonian (1) is written down. The present paper describes the influence exerted by the non-diagonal terms in (1) upon the development of the exchange coupling, i.e., on the

Card 1/2

Exchange Interaction of Inner and Outer Electrons in Transition Metals

S/020/60/132/04/17/064
B014/B007

spectrum of the d- and s-electrons. For this purpose the authors use the statistical Green function developed by N. N. Bogolyubov and S. V. Tyablikov (Ref. 7). The development of the distribution functions of the Bose- and Fermi particles is dealt with in detail, and formulas (11) and (12) are obtained. As turned out in the course of a further investigation, the exchange interaction between the outer and inner electrons leads to an exchange coupling between the inner electrons. As may be seen from formulas (18) and (19), this interaction has the character of a ferromagnetic coupling. If a direct d-d exchange of the inner electrons is lacking, this leads to ferromagnetism. Indirect interaction by conduction electrons leads only to the renormalization of the exchange integral and does not change the energy spectrum of the spin waves. Ye. A. Turov, Pu Fu-cho, T. Shiklosh, and D. N. Zubarev are mentioned. There are 9 references, 6 of which are Soviet.

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ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Metal Physics of the Academy of Sciences, USSR). Ural'skiy gosudarstvennyy universitet im. A. M. Gor'kogo (Ural State University imeni A. M. Gor'kiy)

Card 2/2

VONSOVSKIY, S.V.

USSR (cont.)

ALIKHANOV, R. A., Institute for Physical Problems imeni S. I. Vavilov, Academy of Sciences USSR, Moscow - "Neutronographic study of $MiCO_3$" (Section J-2)

BELOV, N. V., Associate Director, Institute of Crystallography, Academy of Sciences USSR, Moscow - "Magnetic (ferromagnetic) space group symmetry" (C-6)

BELOV, N. V., NERONOVA, N. N., Both Institute of Crystallography, Academy of Sciences USSR, Moscow, DONNAY, J. D. H., Johns Hopkins University, Baltimore, Md., and DONNAY, G. H., Geophysical Laboratory, Carnegie Institution, Washington, D. C. - "Tables of magnetic space groups, II. Special positions" (C-6)

BOROVIK-ROMANOV, A. S., Institute for Physical Problems imeni S. I. Vavilov, Academy of Sciences USSR - "Antiferromagnetic resonance in ... of transition elements" [sic] (M-16)

BOROVIK-ROMANOV, A. S., ALEKSANYAN, G. G., RUDASHEVSKIY, O. Ye. - "Piezomagnetic effect in antiferromagnets" (M-18)

KONDORSKIY, Ye. I., Head, Magnetism Laboratory, Moscow State University - (1) "The electrical and galvanomagnetic properties of thin films at very low temperatures" (M-5); (2) "On the connection between the spontaneous magnetization of current carriers and the Nernst-effect in ferromagnetic metals" (M-4); "The exchange interaction and magneto-effects in ferrites..." (M-15)

LOBACHEV, B., and VAYNSHTEYN, B., Institute of Crystallography, Moscow - "Electron diffraction study of thiourea CO $(NH_2)_2$"

LYASHENKO, B. G., Central Scientific Research Institute of Metallurgy, Moscow - "The problem of the influence of spontaneous magnetization on crystal structure and phase state of alloys" (M-8)

LYASHENKO, B. G., LIVSHITS, D. F., FUZEY, I.M., ABOV, Yu.G. Central Scientific Research Institute of Metallurgy, Moscow - "Neutron diffraction investigation of order-disorder in the alloys 'Ferrum-nickel and ferrum-cobalt'" (J-1)

OZEROV, R. P., KOGAN, V. S., ZHDANOV, G. S., Scientific Research Physico-Chemical Institute imeni L. Ya. Karpov, Moscow - "Neutron diffraction study of the structure of solid hydrogen and deuterium" (C-8)

PINSKER, Z. G., Institute of Crystallography, Academy of Sciences USSR, Moscow - "Results and progresses of electron diffraction analysis" (C-11)

FUZEY, I. M., Scientific Research Institute of Metallurgy, Moscow - "Magnetic anistropy in monocrystals of Ni-Fe-Co alloys" (M-9)

SHUR, Yakov S., Scientific Research Institute of Metallurgy, Moscow - "Some problems of the physics of high coercive materials" (M-17)

SMOLENSKIY, G. A., Institute of Semiconductors, Leningrad - "Some investigations of non-metallic ferro and antiferromagnetics" (M-13)

VAYNSHTEYN, B. K., Institute of Crystallography, Academy of Sciences USSR - "Development of electron diffraction method" (C-11)

YAMZIN, I. I., BELOV, N. V., NOZIK, Y. Z., Institute of Crystallography, Moscow - "Atomic and magnetic structures of magnese ferrite" (J-2)

VONSOVSKIY, S. V., Institute of the Physics of Metals, Academy of Sciences USSR, Sverdlovsk. A member of the IUPAP Commission on Magnetism. See paragraph 1 of Comment for a complete listing of members of the Commission. "Some investigations of Soviet physics on the theory of ferromagnetism for the last years" (Invited paper. Section M-11)

paper to be submitted for the IUPAP Intl. Conference on Magnetism and Crystallography, Kyoto, Japan, 25-30 Sep 1961

65

VONSOVSKIY, S.V., red.; GUSEV, A.A., red.; AKHLAMOV, S.N., tekhn. red.

[Ferromagnetic resonance; the phenomenon of resonance absorption of a high-frequency electromagnetic field in ferromagnetic substances] Ferromagnitnyi rezonans; iavlenie rezonansnogo pogloshcheniia vysokochastotnogo elektromagnitnogo polia v ferromagnitnykh veshchestvakh. Moskva, Gos. izd-vo fiziko-matem.lit-ry, 1961. 343 p. (MIRA 15:2)

1. Chlen-korrespondent Akademii nauk SSSR (for Vonsovskiy).
(Ferromagnetic resonance)

VONSOVSKIY, S.V.; SVIRSKIY, M.S.

Spin of phonons. Fiz.tver.tela 3 no.7:2160-2165 Jl '61.
(MIRA 14:8)

1. Institut fiziki metallov AN SSSR, Sverdlovsk i Chelyabinskiy pedagogicheskiy institut.
(Quantum electrodynamics)

VONSOVSKIY, S.V.; KOBELEV, L. Ya.

Quantum theory of the ferromagnetism of collective electrons. Fiz. met. i metalloved. 11 no.6:820-824 Je '61. (MIRA 14:6)

1. Institut fiziki metallov AN SSSR i Ural'skiy gosudarstvennyy universitet imeni A.M. Gor'kogo.
(Electrons)
(Ferromagnetism)

VONSOVSKIY, S.V.; SVIRSKIY, M.S.; VOLKENSHTEYN, N.V.

Direct determination of shear of Fermi surfaces on polarized conduction electrons in ferromagnetic materials. Fiz. met. i metalloved. 12 no.2:285-287 Ag '61. (MIRA 14:9)

1. Institut fiziki metallov AN SSSR.
(Fermi surfaces) (Ferromagnetism)

VONSOVSKIY, S.V.; KOBELEV, L.Ya.

Magnetic interaction energy between two systems of interacting electrons. Fiz. met. i metalloved. 12 no.6:814-825 D '61. (MIRA 16:11)

1. Institut fiziki metallov AN SSSR i Ural'skiy gosudarstvennyy universitet imeni A.M. Gor'kogo.

S/126/61/012/006/003/023
E032/E514

AUTHORS: Vonsovskiy, S.V. and Kobelev, L.Ya.

TITLE: On the energy of magnetic interaction between two systems of interacting electrons

PERIODICAL: Fizika metallov i metallovedeniye, v.12, no.6, 1961, 814-825

TEXT: In the s-d-model of transition metals put forward by the first of the present authors (Ref.1: ZhETF, 1946, 16, 981) it is assumed that the magnetic properties of a crystal containing atoms of transition elements are almost entirely determined by the sub-system of "internal" electrons (d- and f-electrons), which are looked upon as a set of localized spin particles. The outer particles (s- and p-electrons) contribute mainly to the electrical conductivity and for them it is the Fermi energy which is the significant quantity. In the present paper the authors discuss the interaction of two sets of electrons with the hope that this might throw some light on the theoretical foundations of the s-d-model. The paper starts with the formulation of the general equations for a system of Fermi quasi-

Card 1/3

particles in a crystal consisting of two sub-systems. The single-particle excitations of these sub-systems are described by means of the operator Spinor functions

$$\psi^{x\sigma}(x) \left(\begin{matrix} \psi_1^{x\sigma} \\ \psi_2^{x\sigma} \end{matrix} \right) \text{ and } \psi^{\sigma}(x) \left(\begin{matrix} \psi_1^{\sigma} \\ \psi_2^{\sigma} \end{matrix} \right)$$

which represent the creation and annihilation of elementary excitations (e.g. conduction electrons, holes etc.). Use is made of the single-particle Green functions as originally described by J. Schwinger (Ref.3: Proc. Nat. Acad. Sci., 1951, 37, 452). The derived set of equations for the single-particle temperature Green function is then used to determine the spectrum of elementary excitations and the magnetization of the system. The analysis is then stabilized to the case of ferromagnetic systems and terms responsible for the magnetic anisotropy of the

system and the contribution due to the mean electrostatic energy are neglected. The energy spectrum is then examined in detail and it is shown how the magnetization-dependent terms vary when one or both of the sub-systems may be looked upon as collective or localized. There are 12 references: 6 Soviet-bloc and 6 non-Soviet-bloc. The English-language references read as follows: Ref.5: Schwinger I. Phil.Mag., 1953, 44, 1171; Ref.9: Stoner E. Proc.Roy.Soc., 1938, A165, 372, Ref.10; Kasuia T. Progr.Theor. Phys., 1956, 16, 45; Ref.12: Marschall W. Phys. Rev., 1960, 118, 1519.

ASSOCIATIONS: Institut fiziki metallov AN SSSR (Institute of Physics of Metals AS USSR) and
Ural'skiy gosuniversitet im. A. M. Gor'kogo
(Ural State University imeni A. M. Gor'kiy)

SUBMITTED: July 20, 1961

VONSOVSKIY, S.V.

Some problems in the modern theory of ferromagnetism and antiferromagnetism. Izv. AN SSSR. Ser. fiz. 25 no.11:1314-1315 N '61. (MIRA 14:11)

1. Institut fiziki metallov AN SSSR.
(Ferromagnetism)

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AUTHORS: Vonsovskiy, S. V., Svirskiy, M. S.

TITLE: Interaction of conduction electrons induced by spin waves in a ferromagnetic substance

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 6, 1961, 1676 - 1681

TEXT: The interaction between conduction electrons and electrons participating in magnetic ordering of atoms leads to two effects: 1, displacement of Fermi spheres for conduction electrons with different spin projections, and 2, additional interaction of conduction electrons induced by spin waves. Since various methods had already been applied to this problem in the past, the authors of the present paper applied Bogolyubov's method (N. N. Bogolyubov, V. V. Tolmachev, D. V. Shirkov, Novyy metod v teorii sverkhprovodimosti, Izd. AN SSSR, 1958). The Hamiltonian of the conduction electrons interacting with spin waves of the ferromagnetic material is

Card 1/5

Interaction of conduction electrons...

$$H = U_0 + \sum_k \varepsilon_{k\uparrow} c^+_{k\uparrow} c_{k\uparrow} + \sum_k \varepsilon_{-(k+\chi)\downarrow} c^+_{-(k+\chi)\downarrow} c_{-(k+\chi)\downarrow} +$$
$$+ \sum_q \omega_q b^+_q b_q - \frac{1}{VN} \sum_{k,k'} J c^+_{-(k+\chi)\downarrow} c_{k'\uparrow} b^+_{k'+k+\chi} + \text{K. c.},$$

where $\varepsilon_{k\uparrow} = E_k + \frac{1}{2}\mu_0 J - E_F$, $\varepsilon_{k\downarrow} = E_k - \frac{1}{2}\mu_0 J - E_F$ (Ref. 7: S. V. Vonsovskiy, Ye. A. Turov, ZhETF, 24, 419, 1953). $|K + \chi| \leq k_{F\downarrow}$ with $|K| \geq k_{F\uparrow}$, where $k_{F\uparrow}$, $k_{F\downarrow}$ denote radii of Fermi spheres for electrons with right-hand and left-hand projection in the k-space. Since the total momentum of the interacting pairs in the case concerned is non-vanishing, Bogolyubov's canonical transformation cannot be applied. It is, in fact, necessary to pass over to new Fermi operators α_{K0} and α_{K1}. $\alpha_{k0} = u_{k\uparrow} c_{k\uparrow} - v_{k\uparrow} c^+_{-(k+\chi)\downarrow}$, $\alpha_{k1} = u_{k1} c_{-(k+\chi)\downarrow} + v_{k\uparrow} c^+_{k\uparrow}$ (5) is valid, where $u^2_{k\uparrow} + v^2_{k\uparrow} = 1$, $u_{k\uparrow} = u_{-k\uparrow}$, $v_{k\uparrow} = -v_{-k\uparrow}$ (4). The possibility of coupled pair formation is examined. Here, $u_{k\uparrow} v_{k\uparrow}$ must be non-vanishing. The Hamiltonian (1) may be written

Card 2/5