FISHER, I. Z.

530.162 : 536.7

8521. Stability of the homogeneous phase. II. Determination of the limit of stability. I. Z. FISHER. *Zh. eksper. teor. Fiz.*, **28**, No. 4, 437–46 (1955) In Russian.

A criterion for the stability of a homogeneous phase is developed from the general theory of Pt I [Abstr. 5901 (1955)]. Fundamental properties of systems in the neighbourhood of the limiting points of stability are analysed. Two examples of the application of this criterion (for two systems having the limiting points of different types) are discussed. F. LACHMAN

Fisher, I. Z.

530.162 : 536.7

6523. Stability of the homogeneous phase. III. Theory of the crystallization curve. I. Z. FISHER. *Zh. eksper. teor. Fiz.*, 28, No. 4, 447–51 (1955) In Russian.

The empirical rule of Simon [Simon, Ruhemann and Edwards, *Z. phys. Chem. B* 6, 331 (1930)] $p_{fus}(T) = -A + BT^m$ for determining the pressure along the line of fusion of simple substances is developed from the theory of the limit of stability (see preceding abstract). The comparison between experiment and theory shows that the model accepted can be used in the first approximation to describe the properties of the fusion curve of real liquids. F. LACHMAN

Belorussian State U.

FISHER, I. Z.

USSR/Atomic and Molecular Physics - Statistical Physics, Thermodynamics, D-3

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34346

Author: Fisher, I. Z.

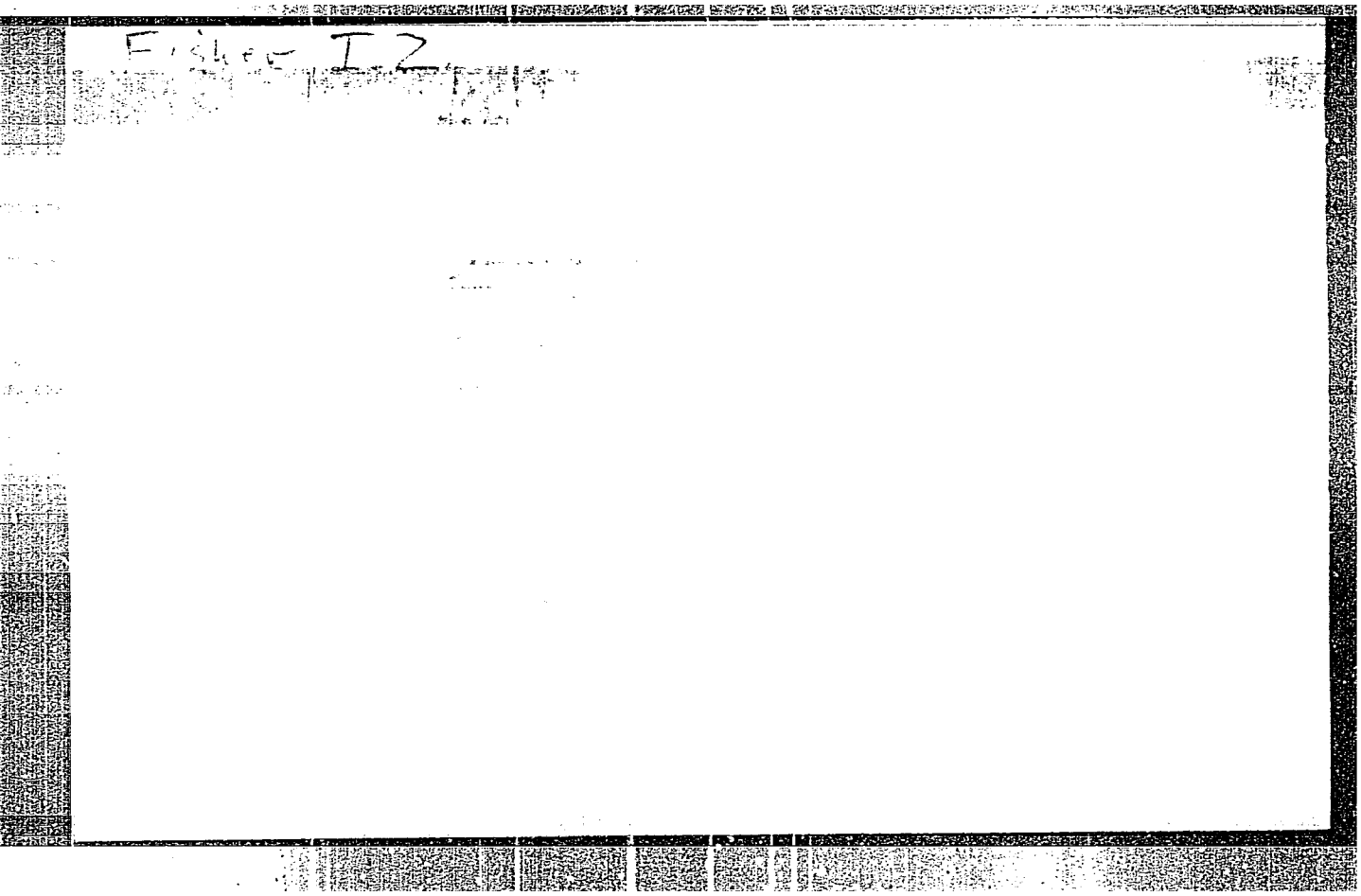
Institution: None

Title: On the Ratio Between the Stability Criteria of S. V. Tablikov's Homogeneous Phase and Ours

Original Periodical: Zh. eksperim. i teor. fiziki, 1955, 29, No 6, 884

Abstract: It is indicated that the crystallization criterion given in an article by the author (Referat Zhur - Fizika, 1955, 21504) agrees with the criterion previously obtained by S. V. Tablikov (Zh. eksperim. i tekhn. fiziki, 1947, 17, 386). The author admits that his statement concerning the inconsistency of S. V. Tablikov's criterion of liquid stability was in error.

1 of 1



APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000413310007-2"

FISHER, I.Z

CARD 1 / 2 PA - 1866

SUBJECT USSR / PHYSICS H
AUTHOR KARPMAN, V.I., FISER, I.Z.
TITLE On the Annihilation of Positrons in Metals.
PERIODICAL Dokl. Akad. Nauk, 111, fasc. 6, 1212-1214 (1956)
Issued: 2 / 1957

The present work shows that the correct computation of the life of a positron annihilated immediately on free electrons leads to a fully satisfactory agreement with experimental data. However, the production of a positron in a metal is very improbable. The presence of numerous free electrons must cause strong screening of the COULOMB field of any positive charge introduced into the metal. For a positron that lives in the metal for $\sim 10^{-10}$ sec, screening may be considered to be equilibrium-like. In a metal the production of a positron such as it exists in the vacuum is impossible. Besides, the bound states of an electron in a COULOMB field, that is so strongly screened, are probably entirely impossible. Therefore the annihilation of the positron without production of a positronium probably takes place immediately on one of the free electrons. The possibilities for the annihilation of the positron on the electrons of atomic rests can be neglected. As the slow electrons play the most important part on the occasion of the annihilation, interaction between the electron and the positron must by all means be taken into account and this interaction can approximatively be considered to be purely COULOMB-like. By taking this interaction into account we obtain the following annihilation cross section:
$\sigma = (2\pi^2 r_0^2 c^2 \alpha / v^2) \left[1 - \exp(-(2\pi\alpha c/v))\right]^{-1}$; $\alpha = 1/127$. However, the exponent in

this formula is infinitely small even if v is equal to velocity of the electron on the FERMI surface. Therefore it holds that $\sigma = 2\alpha(\pi r_0 c/v)^2 = 2\alpha^3(\pi\hbar/mv)^2$. Here m denotes the true mass of the electron. The probability of the annihilation of the positron within the time limit on electrons which, in infinite, have velocities of from $\vec{v}$ to $\vec{v} + d\vec{v}$, amounts to $dw = (\sigma\vec{v}).2(\zeta\mu/2\pi\hbar)^3 d^3\vec{v}$, where $\zeta\mu$ denotes the effective mass of the electron. In the case of the spherical FERMI surface, and if $\zeta\mu$ depends only slightly on velocity, $w = (\alpha^3\mu^3/\hbar m^2)v_0^2$ is obtained for the total probability. Here v_0 denotes the velocity of the electron on the FERMI surface. If, for the concentration of the free electrons $N = \nu.10^{22}$ is put, one obtains for the life of the positron in the metal $\tau = 5{,}0(m/\zeta\mu)^{5/3}\nu^{-2/3}.10^{-10}$ sec. With $\zeta\mu \sim m$ and $\nu \sim 5$ we obtain $\tau \sim (1\text{-}2).10^{-10}$ sec, which agrees with experimental data. For the numerical illustration of this result data for N and $\zeta\mu$ found by GINSBURG are given.

INSTITUTION: Pedagogic Institute, Minsk
White Russian State University "V.I.LENIN"

46-2-22/23

AUTHOR: Fisher, I.Z.

TITLE: On the molecular theory of sound velocity in liquids. (K molekulyarnoy teorii skorosti zvuka v zhidkostyakh)

PERIODICAL: "Akusticheskiy Zhurnal" (Journal of Acoustics), 1957, Vol.3, No.2, pp. 205-207 (U.S.S.R.)

ABSTRACT: The author presents the mathematical analysis of determination of the sound velocity from the molecular characteristics of the liquid for one particular case, which he thinks may be of interest. He considers a one-dimensional model of the liquid. p, T, 1 are the dimensional pressure, the absolute temperature and the mean inter-molecular distance, respectively. $\varphi(x)$ is the field of forces acting between two adjacent particles. Then, as shown in (1) the problem of statistical thermodynamics can be solved exactly and the expression for the sound velocity derived as eq.(4). Even for a one-dimensional space this expression is very complex. For a real three-dimensional case, the expression for the velocity of sound becomes much more complex, but is reduced to very simple ones for the limiting cases: $T \to 0$ or $T \to \infty$. For $T \to \infty$ the equation (following (1)) (8) is derived, which corresponds to results obtained by many authors for a 3-dimensional model. Unfortunately, as may be seen, the

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On the molecular theory of sound velocity in liquids. (Cont.)

eq. (8) can be applied only to a crystal at zero absolute temperature and cannot be applied to a liquid. There are 2 references, 1 of which is Slavic.

ASSOCIATION: The Byelo-Russian State University. (Belorusskiy Gosudartsvennyy Universitet)

SUBMITTED: January 18, 1957.

AVAILABLE: Library of Congress

46-2-23/23

AUTHOR: Fisher, I.Z.

TITLE: On sound propagation in the critical point. (O rasprostranenii zvuka v kriticheskoy tochke)

PERIODICAL: "Akusticheskiy Zhurnal" (Journal of Acoustics), 1957, Vol.3, No.2, p.208 (U.S.S.R.)

ABSTRACT: The author seeks the practical explanation of the behaviour of ultra-sound near and at the critical point which is not as yet fully explained as far as the velocity and absorption are concerned.

He considers the critical point K and the critical adiabate AKB on the $p - \rho$ plane (Fig.1). The curve C'KD' will define the absolutely unstable region, the curve CKD is the equilibrium liquid-gas line. Assuming plane compression waves, propagating in the state corresponding to point K, the state of the substance will vary along a section of the adiabate KA. If the wave approaches from the A direction, the derivative

$\frac{\partial p}{\partial \rho}$ is finite and no singularity occurs. If a depression wave propagates, it would do so into the region below the two curves, which formally, because of the construction method of

Card 1/3

On sound propagation in the critical point. (Cont.)

the adiabatic curve, does not correspond to any real state of the substance. The system within the depression wave will undergo transitions from the gaseous to liquid phase along lines KC and KD and the behaviour of the decompression wave will depend on its amplitude. For very small amplitudes, the state of the system will change along the tangent at point K and $\frac{\partial p}{\partial \rho}$ and velocity will be zero. The depression wave cannot propagate at the critical point and when a harmonic wave is generated into the system the critical point acts as an "acoustical diode".

For very small but finite amplitudes, the depression wave propagation would be possible but its velocity would be very small and nearly equal to that of the pressure wave, so that harmonic wave will propagate along very short complex paths, exhibiting, from the start, discontinuities. In the critical point the sound wave has the character of a shock-wave for any amplitude. The period of discontinuities is very small, of the order of a few periods and the effect of absorption is noticeable and is due to the irreversibility of processes in shock-waves (2). The above is thought to explain the fact of the

On sound propagation in the critical point. (Cont.)

anomalous by large absorption of ultra-sound in the critical point, as found experimentally by many workers (3). The above explanation applies not only to the critical point itself but also to any point displaced with respect to it, provided the p - ϱ plane contains such a point.

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1 graph of CKD and of C'KD' curves is given.
There are 4 Slavic references.

ASSOCIATION: Byelo-Russian State University.
(Belorusskiy Gosudarstvennyy Universitet)

SUBMITTED: January 18, 1957.
AVAILABLE: Library of Congress

AUTHOR FISHER, I.Z., PA - 2788

TITLE Screening of Coulomb Field by Free Charges in Metals and Semiconductors. (Effekty ekranirovaniya kulonovskogo polya svobodnymi zaryadami v metallakh i poluprovodniakakh - Russian)

PERIODICAL Zhurnal Tekhn. Fiz.,1957, Vol 27, Nr 4, pp 638-650, (U.S.S.R.)
Received 5/1957 Reviewed 7/1957

ABSTRACT The first chapter deals with screening constant. In the present paper the Coulomb potential, used in Zhurnal Tekhn. Fiz. Vol 27, Nr 6, pp ?, 1957, and the corresponding condition imposed on the relation between the screening constants and the number of free charges of the type a in volume unit n_a and the chemical potential μ_a of the charges are employed. In the second chapter the bound states of the electron (hole) are investigated. With reference to an earlier paper by the same author it was found that assuming the composition-energy $\varepsilon_{N1}(\varkappa)$ and the relations for $\varkappa$(parameter) developed here, to be known , the problem of the dependence of the energy of the bound states on the density of the sreening charges n and on the parameters T,D (dieelectric transmissivity of the crystal) μ(effective mass of the system of the two bodies under consideration) and m* (effective mass of the screening charge) can be fully solved. In the third chapter it is shown that the fluctuations of the potential are either small and adiabatic or great and non-adiabatic. In the formed case this leads to the occurrence of statically determined energy-level-widths, in the latter case self-excited steady levels are impossible and the bound states are unstable. The application of this general theory evolved here

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PA - 2788

Sceening of Coulomb Field by Free Charges in Metals and Semiconductors.

explains why in metals local states of the donor-type of admixtures cannot exist, and the second conclusion drawn from this theory relates to the annihilation of positrons in metals. This theory also applies to semiconductors, with the difference that here the number of screening free charges is a function of temperature. If this theory is applied to excitations in non-concuctors and semiconductors, it appears that the levels of the excitons are considerably shifted in relation to the increase of the number of free charges and to changes of temperature, which effect is augmented by a statistical widening of the levels of relatively equal intensity. (With 4 ill. and 9 citations from Slav publications).

ASSOCIATION Byelorussian State University, Minsk,(Belorusskiy Gosuniversitet, Minsk)
PRESENTED BY
SUBMITTED 23.5.1956.
AVAILABLE Library of Congress.
Card 2/2

FISHER, I.Z.

AUTHOR: FISHER,I.Z., KRYLOVICH,V.I. 57-6-21/36

TITLE: Hydrogen-Like System with a Partially Screened COULOMB Potential. (Vodorodopodobnaya sistema s chastichno zaekranirovannym kulonovskim potentsialom, Russian)

PERIODICAL: Zhurnal Tekhn.Fiz. 1957, Vol 27, Nr 6, pp 1289-1293 (U.S.S.R.)

ABSTRACT: When applying the method of an effective mass on the occasion of the motion of the electrons or holes in the crystal, often the problem of the motion of the electron or the hole in the COULOMB field of a certain different charge arises.
In these cases hydrogen-like systems are concerned with the only difference that here the motion does not take place in an empty space but in a crystal lattice.
Though many works concerning this theme are known, this problem has nowhere been solved quantitatively and systematically.
Here the basic equation by SCHROEDINGER for the entire problem of the motion of the electron (or the hole) in a partly screened COULOMB field is solved.
The application of the theory to concrete processes in

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57-6-21/36

Hydrogen-Like Systems with a Partially Screened COULOMB Potential.

metals and semiconductors is given separately. (With 2 Illustrations and 2 Slavic References).

ASSOCIATION: Belorussian State University, Minsk. (Belorusskiy gosuniversitet, Minsk

PRESENTED BY:

SUBMITTED: 23.5.1956
AVAILABLE: Library of Congress

Card 2/2

Journal of Physical Chemistry

Vol XXXI, No. [illegible]

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FISHER, I.Z.

PROKHORENKO, V.K.; FISHER, I.Z.

Fluctuation of the coordination number in simple liquids.
Zhur.fiz.khim. 31 no.9:2145-2146 S '57. (MIRA 11:1)

1.Belorusskiy gosudarstvennyy universitet, Minsk.
(Liquids)

FISHER, I. Z.

AUTHOR: FISHER, I.Z. 56-7-39/66
TITLE: On the Polar Model of Metals. (K polyarnoy modeli metalla, Russian)
PERIODICAL: Zhurnal Eksperim. i Teoret.Fiziki, 1957, Vol 33, Nr 7, pp 262-263 (U.S.S.R.)

ABSTRACT: In the polar model, according to VONSOVSKIY a new characteristic of metals is introduced: the degree of its polarity s. s is the ratio between the average number of the "holes" and the entire number of valence electrons. An attempt is made to evaluate s by setting up a cross connection with the fluctuations of electron density in metal. (With 3 Slavic References).

ASSOCIATION: Belorussian State University. (Belorusskiy gosudarstvennyy universitet)
PRESENTED BY:
SUBMITTED: 27.11.1956
AVAILABLE: Library of Congress
Card 1/1

Fisher, I. Z.

20-3-12/52

AUTHOR: Fisher, I. Z.

TITLE: On the Mobility of Electrons and Holes in a Liquid Semiconductor (O podvizhnosti elektronov i dyrok v zhidkom poluprovodnike)

PERIODICAL: Doklady AN SSSR, 1957, Vol. 117, Nr 3, pp. 399 - 402 (USSR)

ABSTRACT: The author here investigates the problem of an "excess electron" or a hole in an atomic semiconductor from the point of view of strong coupling. Here the diffusion of electrons and holes in a liquid semiconductor is investigated. In this case there exists no free length of path. When determining the diffusion coefficient D the author assumes that a distribution of the type $dW(\vec{R};t) \sim \sim(4\pi Dt)^{-3/2} e^{-R^2/4Dt} dV$ can be determined also in a certain auxiliary problem of the vagrant behavior (Bluzhdaniye) of a classical particle within the given totality of points $\vec{R}_k$ with given a priori transition probability $\vec{R}_k - \vec{R}_j$. The transition process can also be developed in certain various details, as e.g. into a process that leads exactly to the value D. This value of D is identical with the diffusion coefficient in the quantum-mechanical problem of the behavior of an electron or hole in a real liquid semiconductor. This process is here described as an equivalent probability process. The probability process can be considered with suf-

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20-3-12/52

On the Mobility of Electrons and Holes in a Liquid Semiconductor

ficient accuracy as a Markov process in real liquids. In a real liquid the probabilities of the successive quantum transitions $\psi_i - \psi_k$ are practically independent of each other, which means the Markov- or quasi-Markov character of the aforementioned equivalent probability process. The expressions for the diffusion coefficient corresponding to this case, for the coefficient of mobility, for the total number of transitions per time unit, as well as for the mobility of an electron or hole are given here. In order to obtain the actual values of mobility and of the diffusion coefficient, the heat motion of the atoms of the liquid and the probability of their reciprocal positions must be taken into account. The respective formulae are given. There are 5 Slavic. references.

ASSOCIATION: Belorussian State University imeni V. I. Lenin (Belorusskiy gosudarstvennyy universitet im. V. I. Lenina)

PRESENTED: June 12, 1957, by M. A. Leontovich, Academician

SUBMITTED: June 10, 1957

AVAILABLE: Library of Congress

Card 2/2

FISHER, I. Z.

"Molecular Theory of Sound XX Velocity."

paper presented at the 4th All-Union Conf. on Acoustics, Moscow, 26 May - 4 Jun 58.

FISHER, I.Z., Doc Phys-Math Sci --(diss) "Studies on the theory of liquids." Minsk, 1958. 27 pp (Belorussian State Univ im V.I.Lenin), 200 copies (KL,49-58,119)

AUTHORS: Prokhorenko, V.K., and Fisher, I.Z. 46-4-2-18/20

TITLE: On the Molecular Theory of Sound Velocity in Liquids
(K molekulyarnoy teorii skorosti zvuka v zhidkostyakh)

PERIODICAL: Akusticheskiy Zhurnal, 1958, Vol IV, Nr 2, pp. 204-205 (USSR)

ABSTRACT: In an earlier note (Ref 1) I.Z. Fisher dealt with an exact calculation of velocity of sound in a unidimensional model of a liquid expressed in terms of molecular characteristics of this liquid. The present note deals with a 3-dimensional liquid consisting of hard non-interacting spheres, with an arbitrary value of density (Refs 2, 3). Such a model represents really a strongly compressed gas, rather than a liquid. Nevertheless, it is one of the few problems which can be solved exactly and completely. The authors find that the velocity of sound in the liquid considered increases with increase of density. At the highest possible values of the relative density v_0/v, where v_0 = volume of one sphere (molecule) and v = mean volume per single sphere, the sound velocity is about 5 times the value of velocity in an ideal gas. There are 1 figure and 5 references, 4 of which are Soviet and 1 American.

Card 1/1

ASSOCIATION: Belorusskiy gosudarstvennyy universitet, Minsk (Belorussian State University, Minsk)

SUBMITTED: January 31, 1958

1. Sound—Velocity—Theory 2. Liquids—Applications

FISHER, I. Z.

AUTHORS: Kuz'mich, V. I., Fisher, I. Z. 76-1-14/32

TITLE: Limits of the Thermodynamic Stability of Multicomponent Systems (Granitsy termodinamicheskoy ustoychivosti mnogokomponentnykh sistem).

PERIODICAL: Zhurnal Fizicheskoy Khimii, 1958, Vol. 32, Nr 1, pp. 93-98 (USSR)

ABSTRACT: The problem solved here can be shortly formulated as follows. A homogenous multicomponent system is given. Within wide ranges the temperature, pressure and composition of the system are changed. Can this system stay homogenous with all possible values of these parameters? If not, what are then the limits for the stability of their homogenous state? - Therefore this problem is connected with the problem of the solubility of liquids and gases. The authors try to find the solution only on the basis of the law of intermolecular forces as well as of the general laws of physics. No formal dynamic investigation methods and no model theories of the liquid state are used. The authors start from the basic equation of the theory of N. N. Bogolyubov (ref. 3). The analysis of the course of the radial functions of the distributions in a homogenous multi-component system with long distances between the particles

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is exposed. The total result is expressed by the equation (22). In the terms of the course of radial functions at the distribution of system particles in long distances the range of thermodynamic stability is determined for the system states. The limits of this range determine the limits of absolute thermodynamic stability of a homogenous multicomponent system (with regard to evaporation, freezing, splitting etc). An analytical criterion for the stability limit of the system in the terms of intermolecular forces as well as of the radial functions of distribution are given. The final result is expressed by the equations (30). By their means the position of the surface at the stability limit of the system in the space: density-temperature-composition (or pressure-temperature-composition) may be determined. The important case of a two-component system was dealt with more exactly.
There are 4 references, all of which are Slavic. Byelorussian State University, Minsk (Byelorusskiy gosudarstvennyy Universited, Minsk)

SUBMITTED: October 8, 1956
AVAILABLE: Library of Congress

76-32-2-10/38

AUTHORS: Kuz'mich, V. I., Fisher, I. Z.

TITLE: On the Theory of the Separation of a Gaseous Mixture Subjected to High Pressures (K teorii rassloyeniya gazovoy smesi pri vysokikh davleniyakh)

PERIODICAL: Zhurnal Fizicheskoy Khimii, 1958, Vol. 32, Nr 2, pp. 291-297 (USSR)

ABSTRACT: The general theory on the limit of stability in multi-component systems, which was developed in Reference 1, is a two-component system of solid balls. The difficulties connected with the ignorance of the analytical form of radial functions of the particle distribution in real systems forced the authors to solve this problem somehow schematically. A two-component system with particles in form of solid balls and of the diameters D_{11}, D_{22} and the "common diameter" D_{12} (which is not equal to $(D_{11} + D_{22})/2$) is investigated. The forces of attraction of the particles are neglected. Such a schematic arrangement can serve as a certain approximation

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On the Theory of the Separation of a Gaseous Mixture Subjected to High Pressures

for gaseous systems subjected to high pressure where the essential part is played by the repulsive forces between the compressed molecules, while th. forces of attraction play a secondary part. Thus a logical statistical interpretation of the separation phenomena in binary gaseous systems at high and superhigh pressures (Reference 2) is obtained with a model of solid balls. But even with such a simplification of the problem its solution showed complications. For reasons of briefness only one special case of two types of particles of the same diameter, i. e. $D_{11} = D_{22} = D$, is investigated, where $D_{12} = \Delta \neq D$. Thus a certain "regular" solution is investigated. The denominations and the basic equations of Reference 1 are used. The curve of the limit of stability in the space of density composition is determined. The equation (30) is deduced. It is the equation of the stability limit for this investigated system - with small δ values (δ being a δ-function) - in the diagram of the composition of density. With given δ the position of the limit does not depend on the temperature which is a specific characteristic feature of the system of solid balls. The numeri-

On the Theory of the Separation of a Gaseous Mixture Subjected to High Pressures

cal solution of the equation in its diagram gives separation curves of the system. These curves qualitatively agree with the results known on gaseous mixture separations with high pressures (Reference 2). This qualitative coincidence is also given in relation to the temperature dependence of the position of the separation curve. There are 2 figures, and 6 references, 5 of which are Soviet.

ASSOCIATION: Belorusskiy gosudarstvenny universitet, Minsk
(Belorussian State University, Minsk)

SUBMITTED: October 8, 1956

1. Gases--Separation 2. Gases--Pressure 3. Gases--Model test results

24(7)

AUTHOR: Fisher, I. Z. SOV/48-22-11-11/33

TITLE: Conditions for the Existence and the Spectroscopic Manifestation of Excitons in a Semiconductor (Usloviya sushchestvovaniya i spektroskopicheskogo proyavleniya eksitona v poluprovodnike)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya Fizicheskaya, 1958, Vol 22, Nr 11, pp 1329-1351 (USSR)

ABSTRACT: The existence of excitons and their considerable role played in the processes taking place in non-conducting crystals is evident. Just as evident is, from physical point of view, the fact that no exciton excitation is possible in conducting media (as, for example, in metals). As, however, between those two extreme cases the wide field of semiconductors is found there rises the problem whether excitons are capable of existing and persisting in semiconductors, according to their conductivity. In this paper the author proceeds from a hydrogen-type model of a non-polarizing exciton, taking into account the crystal lattice field by the effective mass method. In this case the exciton levels in the insulator, if referenced to the dissociation limit, are

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Conditions for the Existence and the Spectroscopic Manifestation of Excitons in a Semiconductor

$$E_N = -\frac{m^* e^4}{2D^2\hbar^2} \cdot \frac{1}{N^2} \qquad (N = 1, 2, 3, \ldots.) \qquad (1)$$

m^* denoting the reduced effective mass of the electron and of the hole, respectively, D the dielectric constant in the region of optical frequencies. The stable existence of the exciton is limited to thermal oscillations of the crystal lattice, which may cause its thermal dissociation. If the temperature T is given, only levels, for which $|E_N| > kT$ will be stable. In semiconductors the existence and the stability of the exciton levels is not only restricted by the oscillations of the crystal lattice, but also by the background of free charges, which guarantee the conductivity of the semiconductor. The analysis carried out in this paper shows that the existence of excitons is equally restricted by high temperatures and by a good conductivity of the crystal. The exciton is capable of existing in its ground state in a relatively wide range of the n- and T values, n denoting the free charge density. Hence the phenomena of passive electric light absorption, of energy exchange and migration, in which

Conditions for the Existence and the Spectroscopic Manifestation of Excitons in a Semiconductor

alone the existence of the exciton is of decisive influence, can be found under normal conditions in almost all semiconductors, only semiconductors with a good conductivity are an exception to this rule. Very small values of T and n are required in order to obtain an exciton absorption spectrum which is complete at least to some extent. Under dark conditions in an n = n(T) type semiconductor the value of n is automatically reduced with a temperature drop. This is favorable for establishing conditions which make possible an existence of excited levels of the exciton. There are 2 figures and 6 references, 4 of which are Soviet.

ASSOCIATION: Belorusskiy gos. Universitet (Belorussian State University)

Card 3/3

AUTHOR: Fisher, I. Z. SOV/76-32-7-44/45

TITLE: On the Structural Diffusion of Liquids (O "strukturnoy diffuzii" zhidkostey)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol 32, Nr 7, pp. 1692 - 1693 (USSR)

ABSTRACT: The concept of the structural diffusion was introduced to molecular physics by Prins (Refs 1,2). According to him the radial function of the distribution $g(r)$ of any mono-atomic liquid may be obtained from an anlogous function of corresponding crystal by an extension of the points according to the diffusion law. In the present paper the author points out that this theory loses its validity by a certain fact. After the corresponding explanations using the equation of Fokker-Planck he finally states that the diffusion law by Prins may not be used already for the first points $g(r)$, and that the others cannot be observed; hence the theory of the structural diffusion is ruled out, as are all calculations made on its basis. The author adds that also for the possibility of the separation of the points from the plane background $g(r) = 1$ the above mentioned theory cannot be used as the microstructure and the thermodynamics of the liquids

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On the Structural Diffusion of Liquids SOV/76-32-7-44/45

are determined just in the near range g(r) where the theory is not applicable. There are 9 references, 7 of which are Soviet.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet, Minsk (Minsk, Belo-Russian State University)

SUBMITTED: January 23, 1958

1. Liquids--Diffusion 2. Diffusion--Theory 3. Liquids--Microstructure 4. Liquids--Thermodynamic properties

Card 2/2

AUTHORS: Ryabushko, A. P., Fisher, I. Z. SOV/56-34-5-19/61

TITLE: On the Motion of Rotating Masses in the General Theory of Relativity (O dvizhenii vrashchayushchikhsya mass v obshchey teorii otnositel'nosti)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 5, pp. 1189-1194 (USSR)

ABSTRACT: In an earlier paper A. P. Ryabushko (Ref 1) (using Einstein's gravitation equations) derived equations for the translation and rotation of spherically symmetric equations. This paper investigates the solutions of these equations. Because of the well-known difficulties of the general problem of celestial mechanics they are confined to the investigation of the two-body problem. These two bodies are regarded as equally important, they may have masses of the same order of magnitude and both of them may have a proper rotation. The authors at first investigate the rotation of the bodies in an approximation that is by one degree higher than the Newton approximation. In this case integrable equations are obtained. The absolute values of the vectors of the eigenmomenta remain constant.

Card 1/3

On the Motion of Rotating Masses in the General Theory of Relativity

The moment $\tilde{\sigma}_2$ of one body carries out a pure precession. A formula for the precession period is given. The consideration of the bilinear members of the above mentioned equations would lead to a weak disturbation of this pure precession. The next section of this paper investigates the influence of the proper rotation of bodies on the orbital momentum. If the bodies have a proper rotation, the orbital momentum obtains secular deviations from its Newton (Hyuton) value. This secular perturbation of the orbital momentum lies within the plane of the Newton (Hyuton) orbit. This perturbation, therefore, may be reduced to a secular rotation of the orbital moment vector and also to a secular deviation of the orbit from its Newton (Hyuton) position. A formula is given for the angle of this deviation. Then the special case $m_b \ll m_a$ (m_a and m_b denote the masses of the two bodies) is investigated. In the last two sections the periheliun rotation and the motion of the Newton (Hyuton) center of gravity are calculated. There are 9 references, 6 of which are Soviet.

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56-34-5-19/61

On the Motion of Rotating Masses in the General Theory of Relativity

ASSOCIATION: Belorusskiy gosudarstvennyy universitet
(Belorussian State University)

SUBMITTED: November 29, 1957

1. Relativity theory 2. Bodies of resolution--Motion
3. Mathematics--Applications

Card 3/3

FISHER, I.Z.

Molecular correlation function at the critical point.
Uch. zap. BGU no.41:87-92 '58. (MIRA 12:3)
(Critical point)

SOV/81-59-15-52492

Translation from: Referativnyy zhurnal. Khimiya, 1959, Nr 15, p 29 (USSR)

AUTHORS: Fisher, I.Z., Ayzenshtat, V.S.

TITLE: On the Distribution of Atoms of an Admixture in a Crystal

PERIODICAL: Uch. zap. Belorussk. un-t, 1958, Nr 41, pp 181-188

ABSTRACT: The problem of the distribution of atoms of admixtures in crystals is solved mathematically by a generalization of the analogous problem of stellar statistics for the case of the discrete change of coordinates. It has been shown that with the exception of solutions of unusually low concentrations an appreciable part of couples of near-located admixture atoms is found which strongly interact with each other. Due to the chaotic state of the distribution of admixture atoms, approximately half of them has adjacent neighbors which are located 2 times nearer as in equal distribution. The attraction of the atoms of the admixture contributes to the increase of the non-homogeneity of the distribution of admixtures.

Yu. Leonov

Card 1/1

5(4)

AUTHORS: Fisher, I. Z., Prokhorenko, V. K. SOV/20-123-1-35/56

TITLE: On the Structure of Water (O strukture vody)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 123, Nr 1, pp 131-132 (USSR)

ABSTRACT: The most reliable and direct data concerning the structure of liquids can be obtained by the investigation of the scattering of X-rays by liquids. For this purpose the radial distribution function g(r) of the atoms is calculated from the angular dependence of scattering intensity. According to the authors' opinion, the fluctuations of the coordination numbers are not less characteristic of the structure of the liquid than the coordination numbers themselves. They are suited as a direct measure of the deviation of the local structure of a given liquid on the structure of the corresponding crystal.
A particularly interesting problem is that of the structure of water. By means of the equations derived in one of their earlier papers (Ref 1) the authors calculated the first 2 coordination numbers of oxygen atoms in water and also the correlation between the fluctuations of these two coordination numbers.

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For these calculations the experimentally obtained radial distribution functions for water at low temperatures (Ref 2) were used. The results obtained by calculations for the first coordination number are given in a table. The second table shows the results obtained by similar calculations for the weak peak of $4\pi r^2 g(r)$ existing at low temperatures in the domain $r \sim 3.6$ Å, which originates from the dislocated atoms which penetrated into the cavities of water structure. According to the results shown by these two tables, the fluctuations of the two coordination numbers are about equal and, in addition, very large. The fluctuations of the orders in water probably have a fine structure. From the experimental curves $4\pi r^2 g(r)$ it is possible also to sort out a "normal" second coordination sphere in the domain approximately between $r = 3.9$ Å and $r = 5.7$ Å, which corresponds satisfactorily with the coordination of water molecules in ice. Water is also not more "quasicrystalline" than other simple liquids. This fully agrees with the comparatively low value of the coefficient of the internal viscosity of water. The results obtained correspond well with the ideas expressed by O. Ya. Samoylov with respect to the

influence exercised by temperature on the structure of water and concerning the considerable influence exercised by the motion of translation upon the structure and the physical as well as the physico-chemical properties of water. The fluctuations of the first coordination number are suited to be used as a direct measure of the intensity translation of the molecules of the liquid from the mean into new equilibria as a result of thermal motion. The part played by the molecules shifted by translation is very considerable in the case of water. The authors thank O. Ya. Samoylov for his useful discussion of the results obtained. There are 2 tables and 5 references, 4 of which are Soviet.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet im. V. I. Lenina (Belorussian State University imeni V. I. Lenin)

PRESENTED: June 26, 1958, by I. I. Chernyayev, Academician

SUBMITTED: June 23, 1958

Fisher, I. Z.

24(8) PHASE I BOOK EXPLOITATION SOV/2809

Akademiya nauk SSSR. Otdeleniye khimicheskikh nauk

Termodinamika i stroyeniye rastvorov; trudy soveshchaniya... (Thermodynamics and Structure of Solutions; Transactions of the Conference Held January 27-30, 1958) Moscow, Izd-vo AN SSSR, 1959. 295 p. 3,000 copies printed.

Ed.: M. I. Shakhparonov, Doctor of Chemical Sciences; Ed. of Publishing House: N. G. Yegorov; Tech. Ed.: T. V. Polyakova.

PURPOSE: This book is intended for physicists, chemists, and chemical engineers.

COVERAGE: This collection of papers was originally presented at the Conference on Thermodynamics and Structure of Solutions sponsored by the Section of Chemical Sciences of the Academy of Sciences, USSR, and the Department of Chemistry of Moscow State University, and held in Moscow on January 27-30, 1958. Officers of the conference are listed in the Foreword. A list of other reports also read at the conference, but not included in this book, are given. Among the problems treated in this work are: electrolytic solutions, ultrasonic measurement, dielectric and thermodynamic properties of various mixtures, spectroscopic analysis, etc. References accompany individual articles.

FISHER, I.Z.
P.2

PHASE I BOOK EXPLOITATION SOV/3544

Akademiya nauk SSSR. Otdeleniye fiziko-matematicheskikh nauk

Fizika tverdogo tela; sbornik statey, II (Solid State Physics; Collection of Articles, II) Moscow, Izd-vo AN SSSR, 1959. 328 p. 3,500 copies printed.

Ed.: A.F.Ioffe, Academician; Ed. of Publishing House: V. N. Filipovich; Tech. Ed.: R.A. Zamarayeva.

PURPOSE: This collection of articles is intended for physicists investigating the structures and properties of solids.

COVERAGE: This volume II of a two-volume collection of articles dealing with problems of solid state physics, was prepared by the Department of Physics and Mathematics, Academy of Sciences, USSR. The authors report on the physical properties of semiconductors such as germanium, cadmium sulfide, cadmium selenide, gallium arsenide, silicon, and various metal alloys. The electrical conductivity of these substances is studied. The effects of irradiation and acoustic phonons on semiconductors are also investigated. Several articles are

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devoted to the theory of electrical breakdown. X-ray studies were made on polycrystalline substances, and one study of the gold-barium system was carried out. No personalities are mentioned. References accompany each article.

TABLE OF CONTENTS:

Solid State Physics

SOV/3544

Gordonov, A.Yu. Transients in a Transistor With a Common Emitter 319

AVAILABLE: Library of Congress

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TM/gmp
6/1/60

FISHER, I.Z.

Conductivity of impurities in liquid and amorphous semiconductors. Fiz. tver. tela 1 no.2:192-194 F. '59. (MIRA 12:5)

1. Belorusskiy gosudarstvennyy universitet im. V.I. Lenina.
(Semiconductors) (Electric conductivity)

FISHER, I.Z.; PROKHORENKO, V.K.

Law of distribution of coordination numbers in simple liquids.
Dokl.AN BSSR 3 no.2:41-43 F '59. (MIRA 12:5)

1. Predstavleno akademikom AN BSSR M.A. Yel'yashevichem.
(Coordination number)

FISHER, I.Z.

Temperature dependence of the sound velocity in dense gases.
Akust.zhur. 5 no.4:459-463 '59. (MIRA 14:6)

1. Belorusskiy gosudarstvennyy universitet, Minsk.
(Sound--Speed) (Gases)

5(4) SOV/76-33-8-30/39

AUTHORS: Prokhorenko, V. K., Fisher, I. Z.

TITLE: The Microstructure of Simple Liquids

PERIODICAL: Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 8, pp 1852-1858 (USSR)

ABSTRACT: Some new knowledge on the microstructure of liquids can be obtained by investigations of the fluctuation of coordination numbers (FCN) (Ref 1). An interpretation of the (FCN) theory is given, and concrete calculation results are listed for some real liquids. In reference 1, the general expression (1) of the fluctuation of the particle number in a definite range G was derived which refers to a certain particle of the liquid in the point q". The calculation method to be used for the first and second coordination numbers (CN) is given, as well as the method of calculating the correlation of these two values. The two values are indicated for liquid argon (Table 1), xenon (Table 2), mercury (Table 3), and some other elements (various metals)(Table 4), and it is stated that the fluctuation of the first (CN) is, on average, at least 20%, and of the second (CN), in the order of magnitude of 50%. Thus, the fluctuation of particles becomes discernible already in the first coordination sphere of the liquids. As

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the liquids are heated, their loosening and the undeterminability of the first (FCN) rise so that the concept of (CN) in liquids has to be considered with great care, and no analogy with the (CN) of crystals may be assumed. The value mentioned above shows that the undeterminability of the second (CN) is even greater, and can in many cases not be defined at all. The correlation of the fluctuation numbers in both coordination spheres is at all times negative and relatively high. It is stated that a quasicrystalline structure is not to be found in simple liquids, contrary to the general assumption, but that the effects of a regulated order are due to the density. The observations made are, however, in agreement with the statements made by Hildebrand on the liquid structure (Ref 14). There are 4 tables and 14 references, 5 of which are Soviet.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet Minsk
(Belorussian State University, Minsk)

SUBMITTED: February 14, 1958

21(1)

AUTHORS: Prokhorenko, V. K., Fisher, I. Z. SOV/56-36-4-54/70

TITLE: The Fluctuations of Atomic Structure in Liquid Helium (Fluktuatsii atomnoy struktury v zhidkom gelii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 4, pp 1311-1312 (USSR)

ABSTRACT: In connection with the results obtained from reference 1 (investigation of the atomic structure of liquid helium by the method of the scattering of slow neutrons - it is shown that the atomic structure in the range 2-5° K is hardly sensitive at all to temperature variations and does not vary during passage through λ-point) as well as with those of one of the authors' earlier papers (Ref 2) the present "Letter to the Editor" investigates the fluctuation of the average structure by using equation (1) derived in reference 2. Equation (1) runs as follows:

$$(\delta z)^2 = \overline{(\Delta z)^2} = \overline{z} + \frac{8\pi^2}{v^2}\int_0^{r_1}\int_0^{r_1} g(r)g(\rho)\left\{\int_{r-\rho}^{r+\rho}(g(t)-1)t\,dt\right\} r\,dr\rho d\rho$$

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$(\delta z)^2$ denotes the square of the fluctuations of the coordinate number, the mean value of which obeys the expression $\overline{z} = \frac{4\pi}{v}\int_0^{r_1} g(r)r^2\,dr$; $g(r)$ denotes the radial distribution function, v the average space of a particle, r_1 the abscissa of the first minimum of $g(r)$. For the calculation of $\delta(z)$ the experimentally determined function $g(r)$ of $\delta(z)$ (Ref 1) is used. For r_1 = 4.6 Å 8.4 results for $\overline{z}$ (which agrees well with the values obtained in reference 1 by means of another method), and for δz 1.47 is obtained. For the root-mean-square fluctuation of z about 18 % is found, a value that appears to be somewhat low. The distribution curve W(z) has a somewhat Gaussian shape (cf. figure p 1312). There are 1 figure and 2 references, 1 of which is Soviet.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet (Belorussian State University)

SUBMITTED: December 18, 1958

24(0), 16(2) SOV/53-69-3-1/6

AUTHOR: Fisher, I. Z.

TITLE: Application of the Monte Carlo Method in Statistical Physics

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 69, Nr 3, pp 349-369 (USSR)

ABSTRACT: In the introduction the author discusses the difficulties arising in solving a system of N integro-differential equations for N unknown functions in the case of $N \longrightarrow \infty$, and the Monte Carlo method developed and used by J. Mayer (Ref 7), its variants and the possibilities for its application. A short survey is given of the problems dealt with in the survey given by the present article. Chapter 2 gives a detailed description of the fundamental ideas of this method. It is demonstrated on the basis of the multiple integral $[r_N]$

$$\overline{F} = Q_N^{-1} \int\int_{(V)} \cdots \int F(\vec{r}_1, \ldots \vec{r}_N) \exp\left\{-U_N(\vec{r}_1, \ldots \vec{r}_N)/kT\right\} d\vec{r}_1 \ldots d\vec{r}_N$$

on the basis of the theory of Markov's chains in the 3N-dimensional configuration space. Chapter 3 deals with the practical application of the method and the evaluation of the theory for computers. Chapter 4 gives results obtained for calculations for systems with Legendre-Johns potential. A real molecule system is

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investigated, in the case of which the potential of intermolecular forces in Legendre-Johns form is set up. Numerous papers are referred to and results obtained are given. In references 9 and 11 systems consisting of 32 and 108 molecules are thus investigated; the author mentions some characteristic formulas from these papers as well as a number of diagrams. Apart from some details concerning argon (Refs 14,17) practically all data in this chapter are taken from papers by Wood et al. Chapter 5 gives a representation of calculated results concerning systems of solid spheres. The representation was taken from papers by Rosenbluth, as well as by Wood et al. A diagram (Fig 5, Wood) gives a representation of the equations of state obtained by various methods. In chapter 6 the dynamical calculation of systems of solid spheres is dealt with; extracts from papers by Alder and Wainwright (Refs 19,20) are given. Figures 7 and 8 show diagrams of projections of particle motions; it is pointed out that the representation agrees with that introduced by Ya. I. Frenkel' with respect to the thermal motion of molecules in a liquid. The material of the present paper originates entirely from western publications. There are 8 figures and 20 references.

5(4)

AUTHORS: Prokhorenko, V. K., Samoylov, O. Ya. SOV/20-125-2-33/64
Fisher, I. Z.

TITLE: Asymmetry in the Distribution of the Coordination Number of Molecules in Water (Ob asimmetrii raspredeleniya koordinatsionnogo chisla molekul v vode)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 2, pp 356-358 (USSR)

ABSTRACT: The investigation of the coordination numbers of liquid particles leads to the problem of determining the distribution function of the probabilities w(z) of the coordination numbers z(z = 0,1,2,..) in concrete liquids. If this distribution is a Gaussian one or if it is sufficiently similar to a Gauss distribution, it is necessary, for the construction of w(z), to know only $\overline{z}$ and $\overline{(\Delta z)^2}$. However, w(z) is probably in reality not so symmetric as Gauss distribution, and this fact may be of essential importance in order to be able to understand the microstructure of the liquid. Possibly, it is

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necessary that, in the case of liquids with sufficiently close molecular structure, the fluctuations of the coordination number towards a decrease of this number and in the case of a less close molecular structure those towards an increase of this number predominate. Special interest is caused by the extremely fine structure of the water. At present the fact has been established with sufficient certainty that in water, in the sense of the short range order, the structure of the ice remains essentially conserved. Reference is made to several earlier papers dealing with this problem. The authors then carry out a quantitative determination of the asymmetry of the fluctuations of the coordination numbers. The quantities $\overline{z}$ and $\overline{(\Delta z)^2}$ are assumed as being known. Next, the sign and the approximate amount of asymmetry of the distribution $w(z)$ is determined by the sign and by $\overline{(\Delta z)^3}$. For the accurate computation of $\overline{(\Delta z)^3}$ it is necessary to know the fourth correlative function $F_4(q,q', q'', q''')$ of the liquid particles, whereas from the radiographic data only the binary function

$F_2(q,q')$ can be determined. The authors therefore refrain from carrying out an exact computation, and instead of determining $\overline{(\Delta z)^3}$, they determine $\overline{(\Delta N)^3}$, - the average cubic deviation of the number of particles from their average value in a certain arbitrarily located liquid volume, which is as great as the volume occupied by the selected liquid particle and its first coordination sphere. By such a modification the problem will hardly be essentially distorted. In this case the rule $\overline{(\Delta N)^3} < 0$ must apply. For the evaluation of the value and sign of $\overline{(\Delta N)^3}$ it is necessary by approximation to use the known semi-thermodynamical theory of fluctuations which is based upon the Boltzmann principle. However, when expanding the thermodynamic potential in a series with respect to the powers of the deviation Δv, it is necessary, besides the quadratic terms $(\Delta v)^2$, to take also the higher terms into account. The distribution of the volume fluctuations or the number of particles is then no longer Gaussian. There follows a rigorous

On the Asymmetry of the Distribution of the Coordination Number of Molecules in Water

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statistical evaluation of $\overline{(\Delta N)^3}$. The corresponding operations supply negative two-figure values of $\overline{(\Delta N)^3}$ for two tightly packed liquids, viz. argon and mercury, near melting temperature. This also corresponds to the results of the above-mentioned semi-thermodynamical theory. For water, $\overline{(\Delta N)^3} > 0$ is found in all cases; $\overline{(\Delta N)^3}$ decreases with increasing temperature. There are 1 table and 11 references, 7 of which are Soviet.

ASSOCIATION: Institut obshchey i neorganicheskoy khimii im. N. S. Kurnakova Akademii nauk SSSR (Institute of General and Inorganic Chemistry imeni N. S. Kurnakov of the Academy of Sciences, USSR)
Belorusskiy gosudarstvennyy universitet im. V. I. Lenina (Belorussian State University imeni V. I. Lenin)

PRESENTED: December 10, 1958, by I. I. Chernyayev, Academician

SUBMITTED: December 2, 1958

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FISHER, I Z.

30

PHASE I BOOK EXPLOITATION SOV/5469

Soveshchaniye po kriticheskim yavleniyam i flyuktuatsiyam v rastvorakh. Moscow, 1960.

Kriticheskiye yavleniya i flyuktuatsii v rastvorakh; trudy soveshchaniya, yanvar' 1960 g. (Critical Phenomena and Fluctuations in Solutions; Transactions of the Conference, January 1960) Moscow, Izd-vo AN SSSR, 1960. 190 p. 2,500 copies printed.

Sponsoring Agencies: Akademiya nauk SSSR. Otdeleniye khimicheskikh nauk. Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova. Khimicheskiy fakul'tet.

Responsible Ed.: M. I. Shakhparonov, Doctor of Chemical Sciences, Professor; Ed. of Publishing House: E. S. Dragunov; Tech. Ed.: S. G. Tikhomirova.

PURPOSE: This collection of articles is intended for scientific personnel concerned with chemistry, physics, and heat power engineering.

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Critical Phenomena and Fluctuations SOV/5469

COVERAGE: The book contains 24 of the 26 reports read at the Conference on Critical Phenomena and Fluctuations in Solutions organized by the Chemical Division of Moscow State University, January 26-28, 1960. The reports contain results of investigations carried out in recent years by Soviet physicists, chemists, and heat power engineers. The Organizing Committee of the Conference was composed of Professor Kh. I. Amirkhanov, A. Z. Golik, I. R. Krichevskiy (Chairman), V. K. Semenchenko, A. V. Storonkin, I. Z. Fisher, and M. I. Shakhparonov (Deputy Chairman). References accompany individual articles.

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AVAILABLE: Library of Congress (QD545.S73)

JP/dfk/jw
10-28-61

S/170/60/003/005/017/017
B012/B056

AUTHOR: Fisher, I. Z.

TITLE: All-Union Conference on Critical Phenomena and Fluctuations in Solutions

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1960, Vol. 3, No. 5, pp. 145-146

TEXT: From January 26 to January 28, 1960 the All-Union Conference on Critical Phenomena and Fluctuations in Solutions was held at the khimicheskiy fakul'tet MGU im. M. V. Lomonosova (Department of Chemistry at the MGU imeni M. V. Lomonosov) in Moscow. The Conference was convened by the Otdeleniye khimicheskikh nauk AN SSSR (Department of Chemical Sciences of the AS USSR) and the Department of Chemistry at the MGU. It was attended by about 100 representatives of various scientific institutions and schools of higher learning of the USSR. In the name of the Department of Chemical Sciences of the AS USSR, Ya. I. Gerasimov, Corresponding Member of the AS USSR, welcomed the delegates. The opening address was held by Professor I. R. Krichevskiy, President of the Organization Committee.

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All-Union Conference on Critical Phenomena and Fluctuations in Solutions

S/170/60/003/005/017/017
B012/B056

27 lectures were delivered. I. R. Krichevskiy, N. Ye. Khazanova, and L. S. Lesnenskaya (Moscow) gave new and important data concerning the approach to zero of the diffusion coefficient of liquid and gaseous systems with two components in approaching the critical point. Ye. T. Shimanskaya, Yu. I. Shimanskiy, and A. Z. Golik (Kiyev) spoke about the results of an investigation of the density of a pure substance in the neighborhood of the critical point by means of the optical method. V. F. Nozdrev (Moscow) spoke about investigations of the thermodynamical properties of liquids within wide temperature and pressure ranges, including the critical point, by employing ultrasonic methods. I. Z. Fisher (Moscow) reported on the results of a theoretical investigation of the critical point by using correlation functions. N. V. Mokhov and Ya. M. Labkovskiy (Dnepropetrovsk) spoke about investigations of X-ray scattering at small angles in ether and benzene. M. F. Vuks and L. I. Lisnyanskiy (Leningrad) spoke about an investigation of the broadening of scattering lines in various liquid solutions. Kh. I. Amirkhanov (Makhachkala) gave data concerning the thermal capacity and thermal conduction in water, ethyl alcohol, normal heptane, and carbonic acid within wide temperature and pressure ranges, including the critical point. G. P. Roshchina (Kiyev)

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spoke about the results of an experimental investigation of light scatter in binary and ternary solutions at different temperatures. V. P. Skripov and Yu. D. Kolpakov (Sverdlovsk) described the results of very accurate measurements of light scatter in carbonic acid on two subcritical and six transcritical isothermal lines within a narrow temperature range near the critical point. B. A. Smirnov (Moscow) spoke about visual and microphotographic observations of the behavior of pure liquids and the CH_3OH-C_6H_{14} solution during their passage through the critical point and/or the critical point of demixing. L. P. Zatsepina (Moscow) described the results of an investigation of the intensity and the degree of depolarization of scattered light in four binary solutions within wide temperature and concentration ranges, and endeavored to interpret the molecular structure of these solutions. I. R. Krichevskiy and Yu. V. Tsekhanskaya (Moscow) reported on an investigation of the kinetics of the reaction in the dissolution of a solid in a binary solution and of the extraction of the dissolved substance from the drops during their motion in a liquid medium within the critical range. The results obtained are in good agreement with calculations made by V. G. Levich. I. R. Krichevskiy, N. Ye. Khazanov,

All-Union Conference on Critical Phenomena and Fluctuations in Solutions

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L. R. Linshits, and M. V. Kal'sina (Moscow) spoke about the results obtained by investigating the molecular diffusion in ternary solutions within the critical range of demixing. L. A. Rott (Minsk) spoke about a theoretical investigation of the molecular diffusion in binary systems near the critical point of demixing. V. P. Skripov (Sverdlovsk) spoke about the molecular nature of transcritical states. R. M. Kasimov and Ya. Yu. Akhadov (Moscow) gave the results obtained by an investigation of the dielectric constant and the electrical conductivity of acetone-benzene and acetone-water solutions in the centimeter frequency range near the critical point. M. I. Shakhparonov (Moscow) spoke about the entire problem of fluctuations in solutions. I. R. Krichevskiy, N. Ye. Khazanova, and L. R. Linshits (Moscow) gave data concerning total and partial vapor pressures in ternary systems near the critical point of demixing. D. K. Beridze (Moscow) reported on new results obtained when investigating the intensity and the degree of depolarization of scattered monochromatic light in binary solutions near the critical point of demixing. Ya. V. Yegupov (Nal'chik) gave his opinion concerning the nature of the transcritical state of substances. L. V. Lanshina (Moscow) spoke about the results she obtained by investigating the fine structure in Rayleigh light scatter in binary

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solutions and spoke about the interrelation between the fluctuations in these solutions and the propagation velocity of ultrasonic waves. N. N. Lomova and M. I. Shakhparonov (Moscow) reported on the results obtained by investigating the dielectric constants and the refractive indices of a large group of binary solutions with a critical range of demixing. Ye. T. Shimanskaya and A. Z. Golik (Kiyev) gave a report on accurate measurements of the density of binary solutions, carried out by the optical method, and spoke about the influence exerted by the gravitational field upon the density gradient. N. V. Mokhov and I. V. Kirsh (Dnepropetrovsk) spoke about X-ray studies of concentration fluctuations in liquid binary systems near the critical dissolution temperature. I. Z. Fisher and V. K. Prokhorenko (Minsk) spoke about an investigation of the fluctuations of coordination numbers in pure liquids. K. V. Arkhangel'skiy and V. K. Semenchenko (Voronezh) described results obtained when investigating the dielectric constants and dielectric losses in binary systems and liquid crystals.

FISHER, I.Z.

Periodic boundary conditions in statistical physics. Dokl.AN BSSR 4 no.4:148-151 Ap '60. (MIRA 13:10)

1. Belorusskiy gosudarstvennyy universitet im. V.I.Lenina. Predstavleno akademikom AN BSSR A.M. Yel'yashevichem.
(Statistical analysis)

S/180/60/000/006/013/030
E201/E391

AUTHOR: Fisher, I.Z. (Minsk)

TITLE: The Relationship Between the Structure of Monatomic Liquids and the Crystal Structure

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No. 6, pp. 76 - 80

TEXT: The author considers a relationship between the structure of monatomic one-component liquids ("simple liquids", such as liquefied inert gases or molten metals) and the structure of these liquids after solidification. Stress is laid on thermal motion of atoms in such liquids. It is found that, at sufficiently low temperatures, the following three structures may exist in the same liquid: an almost completely disordered instantaneous structure, short-lived "quasi-crystalline" structure within small groups of atoms, and mean radial short-range ordered structure. The author discusses also a relationship between the structure of simple liquids and their physical properties, such as mechanical and elastic

S/180/60/000/006/013/030
E201/E391

The Relationship Between the Structure of Monatomic Liquids and the Crystal Structure

properties, motion of free electrons, viscosity, thermal conductivity, diffusion, etc.
There are 10 references: 8 Soviet and 2 non-Soviet.

SUBMITTED: August 26, 1960

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S/020/60/133/01/22/070
B014/B011

AUTHORS: Fisher, I. Z., Kopeliovich, B. L.

TITLE: On the Refinement of the Superposition Approximation in the Theory of Liquids

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 1, pp. 81-83

TEXT: The authors offer a new variant of the correction of a superposition approximation, in which the correction factor of the functions depends on the coordinates of the three particles considered. The authors obtained the system of equations (10) and (11) for the determination of these functions. Here, the conditions for the normalization and attenuation of the correlation are satisfied for all of the superposing functions. The solutions of the system (10) and (11) are written down in the form of two series, (12) and (13), and the separation of these series is described next. Equations (10) and (11) are investigated for gases and liquids. There are 7 references: 2 Soviet and 5 American.

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On the Refinement of the Superposition Approximation in the Theory of Liquids

S/020/60/133/01/22/070
B014/B011

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR
(Branch for the Physics of Solids and Semiconductors of the Academy of Sciences, BSSR)

PRESENTED: February 11, 1960, by N. N. Bogolyubov, Academician

SUBMITTED: February 11, 1960

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PHASE I BOOK EXPLOITATION SOV/5845

Fisher, Iosif Zalmanovich

Statisticheskaya teoriya zhidkostey (Statistical Theory of Liquids) Moscow, Fizmatgiz, 1961. 280 p. (Series: Sovremennyye problemy fiziki) 10,000 copies printed.

Ed.: K. P. Gurov; Tech. Ed.: Ye. A. Yermakova.

PURPOSE: This book is intended for scientific workers and students and graduate students interested in the theory of liquids and dense gases.

COVERAGE: The book deals with the fundamentals of the statistical theory of liquids, based on the study of correlation functions of a group of molecules. The mathematical expression of the method of correlation functions and its application to the study of properties of liquids is discussed. The reader is assumed to be familiar with the fundamentals of statistical physics. The author thanks the editor of the book, K. P. Gurov. References follow each chapter.

Card [redacted]

24.2500(1109,1160,1538)

32198
S/201/61/000/003/001/006
D299/D303

AUTHOR: Ivanov, Ye. A. and Fisher, I. Z.

TITLE: On current flow in a conducting half-space

PERIODICAL: Akademiya nauk Bielorusskoy SSR. Izvestiya. Seriya fiziko-tekhnicheskikh nauk. no. 3, 1961, 5-12

TEXT: The homogeneous isotropic conducting half-space P is considered (σ = const, μ = const, ε = const), in which the current i_o flows through a circular contact of radius r_o in a normal direction to the surface P. It is required to determine the singular part of the field at P. This problem is formulated as follows: Determine at P the exact solution of Maxwell's equations, subject to the following conditions: 1) E and H can have a polar singularity not higher than second-order along the periphery of the circular contact; 2) E and H vanish at infinity; 3) the solution should possess axial symmetry about the Oz-axis. For uniqueness of the solution, it is also required that if the frequency ω approaches zero, the

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sought-for field should pass continuously into the field of the corresponding stationary problem. The spheroidal coordinates ξ, η, φ are used; if the circular contact degenerates into a point contact, the spheroidal contacts pass into spherical contacts, whereby $r_0 \xi = R$, $\eta = \cos\theta$. For the stationary problem, one obtains from Maxwell's equations:

$$E_\xi = \frac{\text{const}}{\sqrt{(1+\xi^2)(\xi^2+\eta^2)}} \qquad (4)$$

and

$$H_\varphi = \frac{2i_0}{cr_0} \frac{\eta - 1}{\sqrt{(1+\xi^2)(1-\eta^2)}} \qquad (6)$$

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in case of a point contact:

$$E_{\xi} = \frac{i_0}{2\pi\sigma R^2} \tag{7}$$

$$H_{\varphi} = -\frac{2i_0}{cR} \operatorname{tg} \frac{\theta}{2} \tag{8}$$

With regard to the non-stationary problem, after computations, one obtains

$$H_{\varphi} = -\frac{2i_0 e^{ikr_0\xi}}{ckr_0^2} \frac{\operatorname{sh}[kr_0(1-\eta)]}{\sqrt{(1+\xi^2)(1-\eta^2)}} \tag{21}$$

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$$E_\xi = \frac{i_0 e^{ikr_0\xi}}{2\pi\sigma r_0^2} \frac{ch[kr_0(1-\eta)]}{\sqrt{(\xi^2+\eta^2)(1+\xi^2)}} \quad (22)$$

$$E_\eta = \frac{i_0 e^{ikr_0\xi + \frac{\pi}{2}i}}{2\pi\sigma r_0^2} \frac{sh[kr_0(1-\eta)]}{\sqrt{(\xi^2+\eta^2)(1-\eta^2)}} \quad (23)$$

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if the circular contacts degenerate into points, one obtains for the real parts of the complex components:

$$\mathrm{Re}H_\varphi = -\frac{2i_0}{cR} e^{-nR} \operatorname{tg}\frac{\theta}{2} \cos(nR - \omega t) \quad (31)$$

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$$ReE_R = \frac{i_0 e^{-nR}}{2\pi\sigma R^2} \cos(nR - \omega t) \tag{32}$$

$$ReE_\theta = -\frac{i_0 e^{-nR}}{\sqrt{2}\pi\sigma R} n \operatorname{tg}\frac{\theta}{2} \cos\left(nR - \omega t - \frac{\pi}{4}\right) \tag{33}$$

Hence at the points which are situated in the vicinity of P, the normal component of the vector E changes periodically with time. Therefore, the mean surface density of charges at the boundary of P, equals zero; the surface P itself can be compared to the plate of a periodically overcharged capacitor. As the current density is expressed by

$$j = |j| = \sigma|E| \tag{34}$$

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one obtains for the mean quantity of Joule heat

$$\bar{Q} = \frac{\overline{j^2}}{\sigma} \qquad (36)$$

From Eq. (34) it is evident that with increasing distance between contact and the points of P, the current density decreases rapidly. Already at the boundary of the "half-spheroid" surface $\xi = 1/nr_0$ (where $n = \frac{1}{c}\sqrt{2\pi\mu\omega\sigma}$), the current density j is smaller by a factor e as compared to its density at the input of P, for $\xi = 0$. Hence it can be assumed that the main part of the current is concentrated in the region of P, bounded by the "half-spheroid" $\xi = 1/nr_0$. It also follows that in the case of high-frequency currents the entire current is practically concentrated in a region, adjacent to the contact. With decreasing frequency, the region of current concentration spreads out. Comparing the quantities of heat produced by a high-frequency current per unit volume and unit time, in the two

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regions of Fig. 1 (the shaded and unshaded regions respectively), one obtains

$$\frac{\bar{Q}_0}{\bar{Q}_1} > nr_0 e^{nr_0} \qquad (42)$$

Hence the mean quantity of heat in the first region exceeds by a factor of more than $nr_0 e^{nr_0}$ the mean quantity of heat of the second region. In general, more heat is produced in the region of P, close to the edges of the contact in a thin layer, than in any other region of P. Formulas are given for j and Q in the case of a point contact, and for the stream lines. There are two figures.

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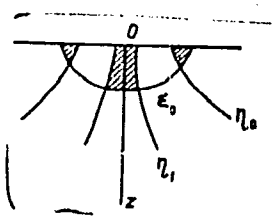

Fig. 1

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FISHER, I.Z.; ZAYTSEVA, A.M.; PROKHORENKO, V.K.

Statistical thermodynamics of point electrical charges. Zhur. fiz.khim. 35 no.8:1877-1878 Ag '61. (MIRA 14:8)

1. Belorusskiy gosudarstvennyy universitet.
(Dynamics of a particle)

KUZ'MICH, V.I.; PROKHORENKO, V.K.; SAMOYLOV, O.Ya.; FISHER, I.Z.

Temperature dependence of coördination numbers of particles in liquid solutions. Dokl. AN SSSR 141 no.2:400-401 N '61.
(MIRA 14:11)

1. Belorusskiy gosudarstvennyy universitet im. V.I.Lenina i Institut obshchey i neorganicheskoy khimii im. N.S.Kurnakova AN SSSR. Predstavleno akademikom I.I.Chernyayevym.
(Solution (Chemistry)) (Dynamics of a particle)

FISHER, I. Z.

STRUCTURE AND PHYSICAL PROPERTIES OF MATTER IN A LIQUID STATE reports read at the 4th Conference convened in KIYEV from 1 to 5 June 1959, published by the publishing House of KIYEV University, KIYEV, USSR, 1962

S/250/62/006/006/003/006
I046/I242

AUTHORS: Fisher, I.Z. and Barishevskiy, V.G.

TITLE: Radiation of a spark between metallic contacts

PERIODICAL: Akademiya nauk Belorusskoy SSR. Doklady, v.6,no.6, 1962, 360-362

TEXT: High-voltage sparks between planar metallic electrodes are made up of very thin streams of current that shift continuously at a characteristic frequency of 10^8 - 10^9 cps. Calculations with an idealized model, viz., a steady-current element of finite length oscillating harmonically at right angles to its length, show that the radiation is essentially restricted to the equatorial plane of the element where it propagates mainly in the direction of the mechanical oscillation. No exact solution can be obtained for the actual case allowing for diffraction at the electrodes and for the nonlinearity and anharmonicity of spark oscillation. An approximation that considers the spark-stream motion as a random process

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S/250/62/006/006/003/006
I046/I242

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shows that radiation, losing its line directivity, is still restricted to the equatorial plane. The radiative power output in the actual case is close to that of the idealized model.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet im. V.I. Lenina (Belorussian State University im. V.I. Lenin)

PRESENTED: by M.A. Yel'yashevich, Academician, AS BSSR

SUBMITTED: September 20, 1961

Card 2/2

FISHER, I.Z.; PROKHORENKO, V.K.

Direct estimation of the "settled life" of an atom in an elementary liquid. Zhur. fiz. khim. 36 no.3:588-591 Mr '62. (MIRA 17:8)

1. Belorusskiy universitet.

4494

S/033/62/039/005/007/011
E032/E514

3,1908

AUTHORS: Shirokov, M.F. and Fisher, I.Z.

TITLE: Isotropic space with discrete gravitational field sources (Towards a theory of the non-homogeneous isotropic universe)

PERIODICAL: Astronomicheskiy zhurnal, v.39, no.5, 1962, 899-910

TEXT: It is pointed out that all existing relativistic cosmological theories are exceptionally inconsistent. Thus, while on the one hand the average energy-momentum tensor is inserted into the right-hand side of the Einstein equations

$$R_i^k(g) - \frac{1}{2}\delta_i^k R(g) = \frac{8\pi k}{c^4} T_i^k \text{ (micro)}, \qquad (7)$$

the left-hand side of these equations is not subjected to this averaging process. The hybrid equations obtained as a result, in which only one half of the equations is averaged, are incorrect both from the microscopic and macroscopic points of view. In the present paper the author investigates the average behaviour of isotropic space in which gravitational field fluctuations due to

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local irregularities in the mass distribution are small. The case of large average densities of matter is not considered, although extrapolation to this region of the solution found for a weakly nonuniform micro-field does yield interesting predictions as regards the expected behaviour of the exact solution for an average metric at very high densities.. It appears that when the discrete mass distribution is considered, the average metric will not contain singularities. These conclusions are deduced from a new cosmological equation which is derived in the present paper and reads as follows:

$$R_i^k(G) - \frac{1}{2}\delta_i^k R(G) + C_i^k(G) = \frac{8\pi k}{c^4} T_i^k \text{ (macro)} \qquad (48)$$

Comparison with Eq.(7) shows that this equation includes the additional term $C_i^k(G)$, which depends on micro-field fluctuations. It is shown that although Hoyle has reported an equation which in its external appearance is very similar to Eq.(48) and includes the term $C_i^k(G)$, the term was introduced simply as a "correction", whereas in the present theory it is a consequence of the Einstein

equations and appears naturally as a result of the averaging process. This new equation is now solved for a flat space, for a space of positive curvature and a space of negative curvature. In distinction to the Friedman model, the extrapolated form of these solutions do not contain a singularity at which the density of matter becomes infinite for some initial instant of time.

ASSOCIATIONS: Moskovskiy gos. universitet
(Moscow State University) and
Belorusskiy gos. universitet
(Belorussian State University)

SUBMITTED: July 15, 1961