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# SCIENTIFIC INFORMATION REPORT

## Physics and Mathematics

(27)

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# SCIENTIFIC INFORMATION REPORT

## Physics and Mathematics (27)

This is a serialized report consisting of unevaluated information prepared as abstracts, summaries, and translations from recent publications of the Sino-Soviet Bloc countries. It is issued in seven series. Of these, five, Biology and Medicine, Electronics and Engineering, Chemistry and Metallurgy, Physics and Mathematics, and Organization and Administration of Soviet Science, are issued monthly. The sixth series, Chinese Science, is issued twice monthly; and the seventh series, Outer Mongolia, is issued sporadically. Individual items are unclassified unless otherwise indicated.

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# I. PHYSICS

## Atomic and Nuclear Physics

### 1. $\pi^- + p \rightarrow \pi^+ + \pi^- + n$ Reaction and $\pi\pi$ Interaction

"$\pi^- + p \rightarrow \pi^+ + \pi^- + n$ Reaction at an Energy of 240 Mev and $\pi\pi$ Interaction," by Yu. A. Batusov et al., Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2015-2018

The mass spectrum of a $\pi^+\pi^-$ system is investigated in the 280-350 Mev energy range. The spectrum is shifted with respect to phase volume toward large mass values, but no peculiarities of a resonance nature have been observed. Some arguments are presented to prove that the cause of the spectrum shift is $\pi\pi$ interaction in the final state. Possible causes for the appearance of the anomaly in $\pi$ meson formation in the $p + d \rightarrow He^3 + \pi + \pi$ reaction are given.

### 2. Elastic Scattering of Protons

"Elastic Scattering of Protons by $Si^{30}$ Nuclei," by A. K. Val'ter, A. I. Popov, and V. Ye. Storizhko, Physicotechnical Institute, Academy of Sciences Ukrainian SSR, Kharkov State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2038-2041

The differential cross section for elastic scattering of protons by $Si^{30}$ nuclei is measured for proton energies between 1,000 and 3,650 Kev and at angles of 90, 125, and 141° in the center of mass system. In the energy range investigated, 52 resonances which are related to the excited states of the $p^{31}$ nucleus are investigated. The most pronounced resonances are analyzed in the single-level approximation of the dispersion theory.

### 3. $\alpha$ Decay of $Ac^{225}$

"$\alpha$ Decay of $Ac^{225}$," by B. S. Dzhelepov, R. B. Ivanov, and L. N. Moskvin; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2077-2079

The $\alpha$ spectrum of $Ac^{225}$ is investigated by means of a magnetic $\alpha$ spectrometer. The energies and intensities of previously known $\alpha$ transitions are in good agreement with the data presented in this paper. At least two new levels with energies of 388 and 544 Kev are detected and tentatively assigned to the $Fr^{221}$ nucleus.

4. Initial and Final States in Nuclear Reactions

"Interaction in the Initial and Final States in Direct Nuclear Reactions," by V. A. Kaminskiy and Yu. V. Orlov, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2146-2149

Interaction in the final state in direct nuclear reactions is rigorously taken into account within the framework of the dispersion method. An exact solution of the singular integral equation encountered in this problem is derived. Numerical calculations based on the exact solution reduce to the evaluation of a single quadrature. A comparison of the exact solution with the first interation is used for explaining qualitatively the success of the distorted wave method in describing direct processes.

5. Production of Slow $\pi$ Mesons

"Production of Slow $\pi$ Mesons in Pion-Nucleon and Nucleon-Nucleon Collisions," by S. M. Bilen'kiy and R. M. Ryndin, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2204-2207

It is shown that in the extreme case of production of "slow" $\pi$-mesons in $\pi N$ and $NN$ collisions, invariance with respect to time reversal leads to a number of consequences for the quantities observed which are independent of the dynamics. Thus, for example, polarization of recoil nucleons during the production of "slow" $\pi^0$ mesons in $\pi N$ collisions is found to be zero.

6. Three Pion Interaction

"Data on Three Pion Interaction," by Ya. Ya. Shalamov and A. F. Grashin, Institute of Theoretical and Experimental Physics, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 65-67

The $\pi^- + n \rightarrow \pi^- + \pi^- + \pi^0 + p$ reaction for an initial $\pi^-$meson momentum of 2.8 Bev/c is studied with the aid of a 17-liter bubble chamber filled with a freon mixture. Indications are obtained that three pion resonances for an isospin I = 2 many exist for masses $M_\pi \approx 0.45$, 0.63, 0.87, and 1.05 Bev.

7. Nuclei Excitation

"Excitation of Nuclei by Slow Charged Particles," by V. A. Dzhrbashyan, Physics Institute, Academy of Sciences Armenian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 157-159

The cross section for excitation of nuclei by slow charged particles is obtained by taking into account Coulomb, as well as nuclear, forces which appeared in the resonances. It is shown that in a number of cases the interference term in the total excitation cross section is small. The results agree with the experimental data.

8. Resonances in Scattering of Electrons

"Resonances in Scattering of Electrons on Hydrogen Atoms," by R. Ya. Damburg and R. K. Peterkop, Institute of Physics, Academy of Sciences Latvian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 244-246

The behavior of the cross section for elastic scattering of electrons on hydrogen atoms near the threshold of the 2s excitation level is investigated. The calculations are carried out by taking into account the strong bond between the 1s and 2s levels for the incident s and p waves. Narrow resonances in the cross sections have been found below the threshold for the s wave in the singlet state and the p wave in the triplet state.

9. Resonance Phenomena in the Motion of a Particle

"Resonance Phenomena in the Motion of a Particle in a Plane Electromagnetic Wave," by A. A. Kolomenskiy and A. N. Lebedev; Moscow; Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 261-269

The motion of a particle in the field of a plane electromagnetic wave in the presence of an external magnetic field is considered. It is shown that under certain conditions resonance effects occur which involve a growth of the particle energy. Increase of the energy does not violate the resonance condition.

10. $\pi^-$ Meson Capture

"Mechanism of $\pi^-$ Meson Capture by Light Nuclei," by I. S. Shapiro and V. M. Kolybasov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 270-271

Capture of stopped $\pi^-$ mesons by light nuclei with the production of protons, deuterons, and tritons is examined on the basis of the dispersion theory of direct nuclear reactions. It is shown that the predominant mechanism is the capture of $\pi^-$ mesons by alpha particle groups.

11. Electron Form Factor

"Problem of Determining the Electron Form Factor," by A. A. Bogush and I. S. Satsunkevich, Institute of Physics, Academy of Sciences Belorussian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 303-305

Differential cross sections for the scattering of high energy electrons having a distribution charge and magnetic moment are computed by taking into account the initial and final longitudinal polarizations. A simple scheme is indicated for determining the electron form factors in this case and also for the case when only the initial (final) polarizations are fixed.

12. Collective States of Nuclei

"Excitation of Collective States of Nuclei in the Scattering of Charged Particles," by S. I. Drozdov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 335-340

Inelastic scattering of fast charged particles (protons) by translucent nuclei with excitation of the first collective levels is examined in the diffraction approximation. Comparison of the results of the calculation with the experimental data makes it possible to estimate the radius and nonsphericity parameter of the nucleus, as well as the parameter of the imaginary part of the optical potential.

13. Symmetric Properties of Elementary Particles

"Axiometric Theory for the Properties of Symmetry of Elementary Particles," by Yu. V. Novozhilov; Leningrad, Vestnik Leningradskogo Universiteta, No 16, Seriya Fiziki i Khimii, Issue 3, 1962, pp 5-19

The notion of "transformation properties" of fields is introduced to describe properties of fields. This notion contains some information on quantum field axioms (quantum postulates, positive definiteness of energy, uniqueness of the vacuum state, gauge invariance). It is proposed to consider transformation properties as fundamental ones from which symmetry properties of elementary particles can be extracted.

It is shown that isospin symmetry is a consequence of basic axioms. Some additional statements about symmetries are made also.

14. Energy Levels of $Gd^{152}$

"Comparison of the Energy Levels of $Gd^{152}$ With the Nonaxial Nuclei Theory," by A. T. Strigachev; Moscow, Vestnik Moskovskogo Universiteta, Seriya 3, Fizika, Astronomiya, No 6, 1962, pp 20-23

The initial excited levels, those above the ground state, for the nucleous $Gd^{152}$ are compared with the deductions of the nonaxial nuclei theory.

Graphs and charts of the results are given.

15. Methods of Removal Cross Section

"Application of Methods of Removal Cross Section in Computation of Shielding Not Containing Hydrogen," by D. L. Broder et al.; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 5, No 12, Dec 62, pp 65-70

The author presents experimental data which prove the possibility of generalizing the methods of removal cross section and applying them to heavier moderating media. The values of removal cross sections are calculated for various materials.

16. Theory of the Majority

"Application of the Method of the Majority for Inelastic Processes of the Type $N + b \to N + b' + b''$," by M. A. Mestyirishvili, Institute of Cybernetics, Academy of Sciences Georgian SSR; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 29, No 6, Dec 62, pp 665-672

In essence, the theory of the majority is as follows: since the amplitude of the process is represented as the sum of the diagrams, then it is obvious that the region for the analysis of the amplitude is given as the intersection of the region for the analysis of individual diagrams, that is:

$$\Delta \subset \bigcap_s \Delta s, \ (s = 1, \ldots, n), \qquad (1)$$

where $\Delta$ is the region for the analysis of the amplitude and $\Delta_s$ is the region for the analysis of the diagram.

Let us assume that $\Delta_s \subset \Delta_{s'}$ (2)
In the case, it is said that diagram s is contained in diagram s'. By determining relation (2) for some diagrams, it is possible to show that $\Delta$ is the intersection of a certain number of simpler (primitive) diagrams.

As an illustration, the problem of the summation of Feynman diagrams in the process N + b → N + b' + b' ' (N is a nucleon; b, b', b' ' are mesons or photons) is examined. The majority is constrcted with theorems 1, 2 and the generalized theorem of Simanzik, as well as several lemmas given in an appendix.

17. Double Compton Effect

"Theory of Double Compton Effect on an Electron," by N. F. Nelipa, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 148, No 2, Jan 63, pp 311-313

The goal of this article is to find a general expression for the differential cross section of the double Compton effect in a first non-vanishing approximation of perturbation theory (on the order of magnitude of $\sim \frac{1}{137}$ of the cross section for the single Compton effect).

18. Beta-Spectrograph

"Focusing of Broad Electron Beam in Beta-Spectrograph," by M. Balodis et al., Institute of Physics, Academy of Sciences Latvian SSR; Riga, Izvestiya Akademii Nauk Latviyskoy SSR, No 11 (184), 1962, pp 41-44

The shape of magnetic screens and the distribution of focal lines with respect to electron beams are calculated. The experimental data obtained with source $Cs^{137}$ of diameter 22 mm are in good agreement with experimental data. An increase in the transmission of the beta-spectrograph is obtained with a magnetic screen.

19. Reactor Kinetics

"Kinetics of Reactor With Linear Reactivity," by I. G. Morozov, Ye. I. Inyutin, and G. I. Sidorov; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 6, No 1, Jan 63, pp 73-78

The behavior of a nuclear reactor when the reactivity is a linear function of time is described. Comparison of the theory with experimental data is made for a reactor with an extraneous neutron source and without it. The problem of safety during reactor runaway interval is also considered.

Calculations were done by an electronic analog computer.

20. Dynamics of a Reactor With Feedback

"Study of the Feedback Reactor Dynamics by an Electric Simulation Method," by I. I. Sidorova; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 10, Oct 62, pp 53-57

The dynamics of a reactor which has a negative feedback with a delay is studied. The condition of natural oscillation is obtained, and the effect of the delay, magnitude of the feedback, and lifetime of instantaneous neutrons on it is determined.

21. 15-Mev Linear Accelerator

"15-Mev Linear Accelerator," by T. N. Filimonova and A. M. Shmygov; Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 32, No 12, Dec 62, pp 1438-1445

An electron linear accelerator with energy of 15 Mev and current pulse of 50 ma is described. The duration of the electron current pulse is 0.7 microsecond, and it can be decreased to 0.05 microsecond. The pulse train rate is 1,000 pulses per second. The width of the energy spectrum is 10%. The over-all high frequency power consumption is 3.5 megawatts. The efficiency of the accelerator is 25%. Two intersynchronized magnetron generatiors are the source of the high-frequency power.

## Plasma Physics

### 22. Weak Plasma in a Magnetic Field

"Weakly Turbulent Plasma in a Magnetic Field," by B. B. Kadomtsev and V. I. Petviashvili; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6 (12), Dec 62, pp 2234-2244

Equations describing the behavior of a weakly turbulent plasma in a magnetic field are derived by taking into account the interaction between waves. In such a plasma, the interaction between various oscillations is sufficiently small and can be taken into account by expanding, by powers, the square of the oscillation amplitude. The problem of "anomalous" diffusion of a plasma in a magnetic field in the presence of oscillations is discussed.

### 23. Low-Frequency Waves in a Magnetcactive Plasma

"Radiation of Low-Frequency Waves by Ions and Electrons in a Magnetoactive Plasma," by V. I. Pakhomov and K. N. Stepanov, Physicotechnical Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2153-2165

The radiation of ion-cyclotron and magnetohydrodynamic waves by ions and electrons of a high-temperature plasma in a magnetic field is examined. The emission and absorption capabilities of the plasma and the equilibrium intensity of the radiation are determined.

### 24. Rotational Magnetomechnical Effect in a Plasma

"Some Data of the Rotational MagnetomechanicalEffect in a Low-Pressure Plasma," by E. I. Urazakov, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 44, No 1, Jan 63, pp 41-44

The rotational magnetomechanical effect in a low-pressure plasma is studied quantitatively. The dependence of the angular momentum in the plasma on the magnetic field strength, pressure, and nature of the gas and the magnitude of the current flowing through the plasma are determined. The rotational magnetomechanical effect was also detected in the plasma of an inert gas produced by a high-frequency field.

25. High-Temperature Plasma

"Stationary States of High-Temperature Plasma. The Plasma Column in a Longitudinal Magnetic Field," Ye. F. Tkalich and V. S. Tkalich; Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 32, No 12, Dec 62, pp 1418-1427

Stationary states of high-temperature plasma are studied in a kinetic approximation. The distribution (along the radius) of the density, the azimuthal flow, and other macroscopic physical quantities are investigated in a plasma column with a longitudinal magnetic field.

26. Cylindrical Plasma Jet in a Magnetic Field

"Stability of a Cylindrical Plasma Jet in a Magnetic Field," L. S. Solov'yev; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 5, Dec 62, pp 1071-1074

The author obtained in a previous article (ZhTF, Vol 31, 1961, p 4) a system of magnetohydrodynamic equations for the stationary spiral flow of an ideally conducting incompressible liquid in a magnetic field. In this article, only the linear equations and the boundary conditions for waves in a plasma jet are derived.

27. Turbulence in Relativistic Plasma

"Statistical Theory of Homogeneous Isotropic Turbulence in a Relativistic Plasma," by Yu. L. Klimontovich, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 5, Dec 62, pp 1063-1066

For the property of the microscopic state of relatavistic plasma, it is possible to use the density function in the phase space

$$N_\alpha (q,p,t) = \sum_{1 \le i \le N_\alpha} \delta (q - q_i (t)) \; \delta (p - p_i (t))$$

and the strengths of the microscopic fields $E^{(M)}$, $H^{(M)}$; here $N_\alpha$ is the total number of particle of type $\alpha$. The equations for the functions $N_\alpha$, $E^{(M)}$, $H^{(M)}$ are given. Examining the functions $N_\alpha$, $E^{(M)}$, $H^{(M)}$ as random, we are limited here by the approximation when the statistical properties are determined by the definition of the first and second moments of these random functions.

28. Diffusion of Plasma-Charged Particles

"Diffusion of Plasma-Charged Particles in a Strong Magnetic Field Affecting Particle Collisions," by V. Ye. Golant, Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR; Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 33, No 1, Jan 63, pp 3-18

Diffusion of plasma-charged particles at right angles to a magnetic field is examined for various relations between the Larmor radii of the particles and the Debye radius. Expressions determining the particle diffusion fluxes are obtained.

29. Radiation of an Electron in a Magnetoactive Plasma

"Radiation of an Electron Moving Along a Spiral in a Magnetoactive Plasma. II," by V. I. Pakhomov and K. N. Stepanov, Physicotechnical Institute, Academy of Sciences Ukrainian SSR: Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 33, No 1, Jan 63, pp 43-50

Magnetic braking radiation of an electron is examined for the fundamental frequency in a large density plasma. Expressions are obtained for the intensity of the radiation of a separate electron and for the radiating and the absorbing power of a plasma for frequencies close to the electron gyrofrequency.

30. Magnetogasdynamics in Plasma Flow

"Some Problems of Magnetogasdynamics in Quasionedimensional Flow of a Plasma. II," by V. S. Yerofeyev and Yu. V. Sanochkin; Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 33, No 1, Jan 63, pp 73-79

In the magnetogasdynamic approximation, when $Re_m \gtrsim 1$, the problem of a onedimensional flow of a plasma in crossed electric and magnetic fields is solved. Regions are found for the existence of various flow systems, and conditions are investigated for the transition through sonic barriers. The quasi-onedimensional isothermal flow of a plasma in a channel of a fixed cross section is solved.

## Solid State Physics

31. Dielectric Permeability

"Theory of Dielectric Permeability," by V. N. Piskovoy, Institute of Semiconductors, Academy of Sciences Ukrainian SSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 3-12

The dependence of the tensor of dielectric permeability $\epsilon(\omega, k)$ on the frequency and on the wave vector is investigated. The index of refraction for light, taking into account the space dispersion, and the transition effected from the light excitions to the mechanical excitons are obtained for crystals having a cubic symmetry $O_h$.

32. Electron Scattering

"Electron Scattering From Thin Films," by N. G. Nakhodkin, A. A. Ostroukhov, and V. A. Romanovskiy, Kiev State University imeni T. G. Shevchenko; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 41-47

The passage of electrons through free films is examined on the basis of a model of continuous loss in an approximation of single elastic scattering at large angles. The thickness and energy curves calculated for the coefficient of transparency are compared with experimental data. The relation of the total to the extrapolated path is given. A new method is proposed to determine the total path of the electron.

33. Certain Properties of Germanium

"Investigation of the Structure and Some Electrical Properties of Germanium Dendrites," by V. N. Vasilevskaya, Ye. G. Miselyuk, and N. N. Formunatova, Institute of Semiconductors, Academy of Sciences Ukrainian SSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 52-60

The formations, structures, and some electrical properties of germanium dendrites, pure and doped with Sb, Au, and Ga, are investigated. It is shown that the crystallographic orientation of the main surfaces of the dendrite is determined by the number of twin surfaces: for an even number of twin surfaces, the main surfaces are different; and for an odd number, they are identical. The values $\rho$ and $\tau$ along the length of the dendrites are practically constant. On the "perfect" side $\rho$ almost does not differ from the value of the initial germanium, but $\tau$ is always less. The distribution of $\rho$ along the cross section of dendrites is characterized by the presence of a minimum for the existing twin region arising more sharply toward the "perfect" side and increasing insignificantly toward the "imperfect" side of the dendrite. The course observed for the distribution $N_D$ along the cross section correlates directly with the distribution $\rho$ and $\tau$ on the "perfect" and "imperfect" sides of the dendrite.

34. Inelastic Scattering of Neutrons

"Investigation of Inelastic Scattering of Neutrons on Ti-Zr Alloy," by N. A. Chernoplekov et al., Institute of Atomic Energy imeni I. V. Kurchatov; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 112-117

Investigation of inelastic scattering of cold neutrons on a sample of disordered Ti-Zr alloy with a component corresponding to zero value of the mean amplitude for coherent scattering of neutrons is investigated on a neutron spectrometer. A general theory connecting the cross section of single noncoherent phonon scattering to the frequency spectrum for arbitrary crystals is given.

On the basis of the results obtained, the properties of the phonon spectrum are discussed for a two-component disordered system.

35. Damping of Conductivity in Semiconductors

"Damping of Nonequilibrium Conductivity in a Semiconductor With Two Types of Recombination Centers," by K. I. Svistunova, Institute of Radio Engineering and Electronics, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 118-123

In certain approximations, the damping of nonequilibrium conductivity in a semiconductor with two types of recombination centers is calculated. The results of the calculation are used to explain some features of the damping of photoconductivity in silicon containing some indium.

36. Final Temperatures

"Generalization of the Spin Wave Method for Final Temperatures," by S. V. Tyablikov and Ye. N. Yakovlev, Mathematics Institute imeni V. A. Steklov, Institute of Physcis of High Pressures, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 137-141

The energy spectrum of spin waves and the magnetization of ferromagnetics for final temperatures are determined by the excitation theory for lagging and leading Green functions.

37. Paramagnetic Resonance

"Role of Electric Fields in Paramagnetic Resonance," by A. B. Roytsin, Institute of Semiconductors, Academy of Sciences Ukrainian SSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 151-157

The effect constant and variable electric fields on paramagnetic resonance of impurity atoms (ions) for the iron group (in a crystal) with an orbital expressed basic term is examined. Specific calculations are given for the atom $Cr^{o}$ and the ion $Mn^{+}$ ($3d^{6}$ configuration) imbedded in a diamond type lattice.

38. Optics and Excitons

"Crystal Optics and Theory of Excitons," by V. N. Piskovoy, Institute of Semiconductors, Academy of Sciences Ukrainian SSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 158-169

A relation is established between exciton theory and crystal optics in which a space dispersion arises. The dependence of the effective mass and the threshold energy ($|k| \to 0$) of the mechanical exciton on the direction of the propagation of light in a crystal is obtained. Indexes of refraction are determined, and the dependence of the frequency of maximum absorption on external fields is investigated.

39. Germanium Photoconductivity

"Negative Photoconductivity of Germanium in a Magnetic Field," by E. A. Zavadskiy, Yu. T. Kovrizhnykh and I. G. Fakidov, Institute of the physics of Metals, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 194-200

Results are given of an investigation on the photoconductivity of germanium in a magnetic field. It is shown that in strong magnetic fields the photoconductivity is nagative. The results of measurements in a wide range of magnetic fields and exposures agree qualitatively with theoretical calculations.

40. Drift Effect in Doped Germanium

"Drift Dispersion of the Photoelectric Effect in Doped Germanium," by Ya. A. Oksman, M. N. Kiseleva, and B. M. Martinson, State Optical Institute imeni S. I. Vavilov; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 220-223

The effect of electric fields on the value of the increase in the active conductivity of a photodielectric condenser, between whose plates are placed single crystal plates of doped germanium, is investigated. It is shown that during excitation by short-wave radiation (1.8 to 2.5 mk), the field, in exceeding a specific value, damps the photoconductivity. The frequency dependence of the effect, as well as its absence during the excitation of photoconductivity by long-wave radiation, gives reason to assume that it was due to the drift of minority carriers.

41. Electron Temperature Fluctuations

"Electron Temperature Fluctuations and Corresponding Noise," by Sh. M. Kogan, Institute of Radio Engineering and Electronics, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 224-228

Since the exchange of energies between electrons and lattices is a random process, the electron temperature fluctuates close to its own mean value. This leads to a rise in the current noise. The special density of this noise may reach that of Johnson noise only in comparatively strong fields.

42. Spin Lattice Relaxation

"Nuclear Spin Lattice Relaxation in Ferro- and Antiferromagnetics," by L. L. Buishvili; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 229-232

The spin lattice relaxation of nuclei in ferro- and antiferromagnetics with the simultaneous participation of the phonon and magnon is examined.

43. Trapping Level Parameters

"Kinetic Method of Determining Trapping Level Parameters," by Ye. A. Sal'kov, Institute of Semiconductors, Academy of Sciences Ukrainian SSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 240-245

A method is proposed to determine the parameters of fast trapping levels based on the investigation of the relaxation curve for additional conductivity after exposing the sample to short ($t_{pulse} \sim 2 \times 10^{-7}$ sec) pulses of light for a constant bias lightning. The concentration, the penetration depth, the capture cross section for trapping levels, and the effective concentration of levels in the zone of conductivity are determined for CdS single crystals.

44. Dependence of Electron Mass on Its Concentration

"Dependence of the Effective Electron Mass on the Concentration in InSb, InAs, and GaAs," by G. I. Guseva and I. M. Tsidil'kovskiy, Institute of the Physics of Metals, Academy of Sciences; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 263-268

The dependence of the effective mass of electrons on their concentration is calculated for InSb, InAs, and GaAs.

45. Elastic-Plastic Waves

"Investigation of Elastic-Plastic Waves in Iron and Steel During Explosive Loading," by A. G. Ivanov, S. A. Novikov, and V. A. Sinitsyn; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 269-278

Possible cases of elastic-plastic waves are analyzed depending on the adiabatic shape of the shock compression of the material. A method is described for the continuous recording of the velocity of movement of the free surface of the sample. Results are given for the investigation of the parameters of elastic-plastic waves in iron and steel samples at the time of the surface explosion by a charge of explosives.

46. Distribution and Movement in CdS Crystals

"Potential Distribution and Minority Carrier Movement in CdS Single Crystals," by St. Kynev, R. Pirinchiyeva, and Kr. Marinova, Institute of Physics, Bulgarian Academy of Science; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 291-300

Distribution of the electrical potential in CdS single crystals is investigated. It is shown that in the potential distribution along the length of the crystal under certain conditions, there is always a steep slope next to the anode. After adding intermediate metallic bands between the two main electrodes, the band potential, by comparison with the surrounding parts of the crystal, takes on unusually high values. These phenomena greatly depends on the gases absorbed in the crystal.

The facts given, as well as specially formulated experiments with the action of infrared light, show that the movement of a positive space charge, determined by holes which are created optically or injected from the anode, plays the principal role in the phenomena investigated.

The phenomena of the charge of the intermediate band may be used to investigate the state of minority carriers in CdS and, possibly, to determine the values characterizing these carriers.

47. Sound Absorption in Semiconductors

"Theory of Sound Absorption in Semiconductors," by Ya. M. Chikvashvili, Physicotechnical Institute, Academy of Sciences Georgian SSR; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 363-364

Recently there has been much attention devoted to the optical properties of semiconductors in the infrared region where the optical parameters are determined mainly by electron conductivity (in n-type semiconductors). By measuring the absorption coefficient for infrared light, it was possible to obtain valuable information on the electron effective mass, as well as on the nature of the electron-phonon interaction. It follows that the measurement of the coefficient of sound absorption can give information on those same microscopic parameters. Therefore, the coefficient of ultrasonic absorption is more directly connected with the electron-phonon interaction than the coefficient of absorption for infrared light.

Attention should also be paid to the fact that the velocity of thermal electrons in semiconductors is less than the speed of light in that same medium; therefore, Cerenkov radiation or absorption is forbidden, and the absorption of infrared quantum may arise only with the assistance of the thermal phonon (or the foreign impurity). Consequently, this process can occur only in the second approximation of the perturbation theory. Moreover, the speed of the thermal electron is usually greater than the speed of sound. So electrons may radiate or absorb phonons.

Therefore, sound absorption is described with a first approximation of perturbation theory. It is to be noted that the applicability of perturbation theory is limited by the condition $\omega\tau \gg 1$.

Starting from a Hamiltonian matrix element for the electron-phonon interaction, a coefficient for sound absorption is obtained.

48.. Excitron Drag Effect

"Exciton Drag Effect by Charged Quasi Particles," by S. L. Korolyuk, Chernovtsy State University; Leningrad, Fizika Tverdogo Tela, Vol 5, No 1, Jan 63, pp 352-353

An Hamiltonian which describes the scattering of paraexcitons on electrons and holes with regard to the conversion of paraexcitons into orthoexcitons and back to paraexcitrons is examined. This phenomenon can be used to determine experimentally the diffusion line of excitons by an optical method which is to observe the scattering between the region where the excitation of excitons by light occurs and the region where the annihilation takes place.

49. Certain Effects in Antiferromagnetics

"Some Galvano and Thermomagnetic Effects in Antiferromagnetics," by Ye. A. Turov and V. G. Shavrov, Institute of the Physics of the Physics of Metals, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2273-2276

A general phenomenological analysis of the galvano and thermomagnetic phenomena in antiferromagnetic crystals with different crystallographic and magnetic structures is given. A number of new effects connected with the presence of antiferromagnetic ordering are predicted.

50. Structure Factors in Inelastic Scattering of Slow Neutrons

"Calculation of Structure Factors in Inelastic Scattering of Slow Neutrons by NaCl Type Crystals," by Z. A. Demidenko, Institute of Semiconductors, Academy of Sciences Ukrainian SSR, Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3359-3366

The structure factors in the scattering of neutrons for three directions of the wave vector q (0, 0, 1), (1, 1, 0), and (1, 1, 1) are calculated on the basis of previous calculations of the characteristic amplitudes of oscillations for the alkali-halide crystals NaCl, KCl, KBr, NaI, and LiF. The behavior of the structure factor for the these crystals is compared, and an approximate method is proposed to construct the diagrams of the parameters of the crystals and the magnitude of the amplitude of osscillations for q = 0.

51. Lithium Doped Silicon

"Radiation Damage in Lithium Doped Silicon," by I. V. Smirnova, V. A. Chapnin, and V. S. Vavilov, Moscow State University imeni M. V. Lomonosov; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3373-3380

By measuring the temperature dependence of the Hall effect, the energy spectrum of local center levels arising in silicon which contain lithium from bombardment by fast electrons is investigated. Deep energy levels were detected in the upper and lower halves of the forbidden zone. The capture radius characterizing the interaction between the ion and the vacuum is estimated by the kinetics of the interaction between lithium ions and the point defects (vacancies). Data are obtained on the temperature stability of the radiation local centers studied.

52. Resonance and Relaxation of $Ti^{3+}$ in Corundum

"Paramagnetic Resonance and Spin Lattice Relaxation of $Ti^{3+}$ in Corundum," by S. A. Al'tshuler, Sh. Sh. Bashkirov, and M. M. Zaripov, Kazan State University; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3367-3372

A theoretical calculation is given of the spectrum of paramagnetic resonance and the spin lattice relaxation of corundum with a titanium alloy which is based on the assumption that $Ti^{3+}$ ion in the ground state being introduced into the lattice of corundum retains an orbital magnetism. An explanation of the properties discovered experimentally for the spin lattice relaxation and the location and the kind of resonance line are given.

53. Spectral Distribution of Photoconductivity in CdS

"Investigation of Spectral Distribution of Photoconductivity in CdS Single Crystals in the Case of Excitation by Modulated Light," by F. I. Kreyngol'd, Leningrad State University; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, pp 3415-3417

The effect of the modulated illumination on the shape of the spectral distribution curves for the photocurrent in CdS is examined. It is found that for modulated excitation with T = 77°K, the maximums on the curve of the spectral distribution of the photocurrent correspond to the lines of exciton absorption.

54. Kinetics of Nonequilibrium Conductivity

"Kinetics of Nonequilibrium Conductivity in the Case of High Levels of Generation," by G. M. Guro and A. V. Rzhanov, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3441-3445

The effect of finite "time fixings" of charge carriers in a recombination center on the kinetics of nonequilibrium conductivity for high levels of generation is examined. It is shown that the rate of recombination may obstruct the establishment of fixed concentrations of nonequilibrium charge carriers at a constant rate of generation which exceeds some limit.

55. Structure Defects in Silicon Single Crystals

"Investigation of Structural Defects in Silicon Monocrystals by the Photoconductivity Method," by V. S. Vavilov, A. F. Plotnikov, and B. D. Tkachev, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3446-3454

Data are given on the energy spectra and on the nature of structural defects in silicon crystals subjected to electron bombardment. The data were obtained by analyzing the photoconductivity spectra in the infrared region. New defect levels in the forbidden zone of the crystal were detected. Increases in the defects were investigated for irradiation at room temperature and at a temperature of 100°K. The effect of the temperature treatment on the stability of individual types of defects is investigated

56. Annihilation of Radiation Defects

"Theory of Annihilation of Radiation Defects in Semiconductors," by A. V. Spitsyn and L. S. Smirnov, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3455-3460

Based on an analysis of experimental data on the annealing of radiation damage in germanium and silicon, a conclusion is drawn concerning the essential effect of impurity on the annihilation of radiation defects. It is assumed that the impurity atoms are able to "trap" the vacancy which is one of the components of the simplest structural defect -- the Frenkel pair. A scheme is proposed to describe the kinetics of annihilation, taking into account the effect of the impurity. On the basis of the above, an expression is obtained for the dependence of the concentration of radiation defects on the annealing time. It is found that the dependence obtained agrees satisfactorily with published experimental data.

57. Neutron Scattering on Magnetic Structures

"Slow Neutron Scattering on Complex Magnetic Structures," by S. V. Maleyev, V. G. Bar'yakhtar, and R. A. Suris, Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3461-3470

Elastic scattering of slow neutrons on magnetics which have a complex periodic magnetic structure is examined. A general expression is obtained for the cross section and the polarization of such scattering, during which the incident neutrons are also considered polarized. The reconstruction of the magnetic structure is analyzed by experimental data. Formulas are given for the cross section and the polarization of a number of concrete structures.

58. Light Dispersion in Exciton Absorption Region

"Light Dispersion in Exciton Absorption Region in Ionic Crystals Containing Microdefects," by Yu. P. Krasnyy, Odessa State University imeni I. I. Mechnikov; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3512-3521

The dependence of the index of light refraction in the exciton absorption region on the concentration of microdefects in ion crystals is derived. Quantitative calculations are given for F centers.

59. Energy Distribution of Autoelectrons

"Experimental Study of Energy Distribution of Autoelectrons From CdS Single Crystals," by G. P. Shcherbakov and I. L. Sokol'skaya, Leningrad State University; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3562-3536

The energy spectra of autoelectrons and thermoelectrons with tungsten indicated indicated the suitability of the experimental device used in the study of the distribution of autoelectrons by semiconductors according to energies.

It is shown that with a rise in the internal field of the emitter, the warming up of the electron gas takes place, and the generation of carriers appears when the complete width of the energy distribution of the autoelectrons coincides roughly with the width of the forbidden zone of CdS. The rising temperature of the emitter leads to the expansion of the energy distribution and to the displacement of the maximum of the distribution on the side of the large energy electrons.

60. Van Vleck's Theory of Spin System Specific Heat

"Experimental Verification of Van Vleck's Theory of Spin System Specific Heat in Paramagnetics," by K. P. Sitnikov, Kazan' State University imeni V. I. Ul'yanov Lenin; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3540-3542

The magnitudes measured for the magnetic components of a constant spin system specific heat are compared with those calculated by the Van Vleck formula. It is shown that the measured values of this quantity differ from the computed by an entire order.

61. Electroconductivity of Polar Semiconductors

"Electroconductivity of Polar Semiconductors Taking Into Account the Interelectron Interaction," by I. M. Dykman and P. M. Tomchuk, Institute of Semiconductors, Academy of Sciences Ukrainian SSR, and Institute of Physics, Academy of Sciences Ukrainian SSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3551-3563

The temperature and concentration dependences of the mobility of electrons in polar semiconductors are calculated. The scattering of electrons on longitudinal optical oscillations, on impurity ions, and on one another is taken into account. It is shown that with a decrease in the temperature of the lattice, the role of the Coulomb scattering mechanisms increases. Errors connected with the neglect of the impurity effect and of interelectron scattering on the mobility are considered. The results obtained compare with those of D. I. Howarth and E. H. Sondheimer (Proc. Roy. Soc., 219A, 1953, p 63) and R. Stratton (Proc. Roy, Soc., Vol 246A, 1958, p 405).

62. Second Order Phase Transition

"Theory of Second Order Phase Transition From the Ferromagnetic State to the Ferromagnetic and Ferroelectric States," by G. M. Nedlin, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3568-3574

The phase transition is examined for the arbitrary (not small) value of spontaneous magnetization at the transition point. The case when the ferroelectric and the ferromagnetic axes decrease is examined. The nature of the behavior close to the phase transition of susceptibilities is explained in zero electrical and magnetic fields parallel to the axis of light polarization and the temperature dependence for spontaneous polarization.

63. Photoconductivity Spectra of Si Single Crystals

"Photoconductivity Spectra of Silicon Single Crystals Due to Residual Impurities," by A. F. Plotkinov, V. D. Tkachev, and V. S. Vavilov, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3575-3577

Photoconductivity spectra for n and p type silicon monocrystals obtained by the method of crucibleless zone fusion in a vacuum and grown in quartz crucibles are investigated. The impurity photoconductivity observed is explained by the presence of gold and copper atoms in the crystals. The concentrations of these impurities are estimated.

64. Ferroelectromagnetics

"Thermodynamic Theory of Ferroelectromagnetics," by A. I. Mitsek and G. A. Smolenskiy, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3581-3592

A theory of ferroelectromagnetics is constructed on the basis of the generalization of the thermodynamic theory of ferromagnetics and ferroelectricity. The elastic properties, the magnetic anisotropy, and the behavior in the external electric and magnetic fields are investigated, as well as the phase transition connected with the magnetic or the electric ordering. The nature of the magnetoelectric energy is examined.

65. Thermoelectric Properties of Tellurium

"Thermoelectric Properties of Tellurium and the Effective Mass of Hole Carriers," by I. N. Timchenko and S. S. Shalyt, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3612-3617

Thermoelectric properties of annealed single crystals samples of tellurium with various carrier concentrations ($10^{14}$ - $10^{19}$ $cm^{-3}$) between 77 and 200°K are investigated, and on the basis of data obtained, the effective mass of hole carriers is determined.

66. Defects in Exciton Luminescence

"Role of Defects in Exciton Luminescence of Molecular Crystals," by Yu. V. Konobeyev; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3634-3639

A calculation for the probability of exciton transformation in view of the defect of the crystal structure which is not accompanied by the localization of the energy of electron excitation on the defect is given. It is shown that the process indicated is real in a number of favorable cases but may compete with exciton capture by the impurity.

67. Electron Conductivity Silicon

"Influence of Oxygen on Electrical Properties of Electron Conductivity Silicon," by V. N. Mordkovich; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3640-3643

In n-type silicon containing a high concentration of oxygen, an attachment is detected which occurs roughly at room temperature, increases with a rise in temperature, and then disappears at temperatures on the order of 200°C. The attachment is made on the acceptor center at a depth of 0.38 ev from the bottom of the conductivity zone.

68. Silicon p - n Junctions

"Neutron Irradiation of Silicon p - n Junctions," by Yu. R. Nosov; Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3665-3667

Determining the possible use of neutron bombardment of silicon to obtain small lifetimes for nonequilibrium carriers in silicon devices is given in this article.

69. Thermal Energy Into Electrical Energy

"Possibility of Transforming Thermal Energy Into Electrical Energy," by E. V. Teodorovich, All-Union Correspondence Polytechnic Institute; Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 32, No 12, Dec 62, pp 1490-1492

Along with the possibilities examined recently for the direct conversion of thermal energy into electrical energy which are based on the use of thermoelectric emission and the contact difference of the potentials, another approach based on the effect of partial ordering of the chaotic thermal motion of charged particles (electrons) in a heterogenous magnetic field, which leads to the appearance of a current and an effective electromotive force, is also of interest.

70. Fusion Curve for Tellurium

"Fusion Curve for Tellurium Up to 23,000 kg/cm$^2$," by N. A. Tikhomirova and S. M. Stishov, Institute of Crystallography, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2321

Under extremely high pressure, all matter turns into the metallic state. With transitions of a similar nature, a number of authors connect a sharp change in velocity of seismic waves and the increase in the density at the boundary of the telluric nucleus.

Earlier, S. M. Stishov (Geokhimiya, No 11, 1962), while examining the boundary of the telluric nucleus from the point of view of the transition of matter from the shell of the earth into the metallic state, arrived at the conclusion that the fusion curve of the nonmetallic phase of several substances may possess a maximum before the three points which correspond to equilibrium: fusion, nonmetallic phase, and metallic phase. The point here is to verify experimentally this hypothesis.

Tellurium which, according to P. W. Bridgman (Phys. Rev., Vol 48, 1935, p 893; Proc. Am. Acad. Sci., Vol 81, 1952), turns into the metallic state with a 5.5% increase in volume at a pressure of approximately 45,000 kg/cm$^2$ at room temperature was chosen for the experiment.

The pressure was created in an intensifier of ultrahigh pressure with a double mechanical support and an interior heating instrument. A polysiloxane liquid was used as the pressure transmitting medium. The pressure was measured by a manganin resistance manometer accurate to $\pm$ 100 kg/cm$^2$. The temperature was measured by a platinum rhodium thermocouple with an accuracy of $\pm$1.5 deg C.

A diagram shows the pressure curve for tellurium up to a pressure of 23,000 kg/cm$^2$. It can be seen from the diagram that the pressure curve has a maximum at 10,800 kg/cm$^2$ and 482 deg C.

It is evident that at pressures above 10,800 kg/cm$^2$, tellurium melts with a reduction in volume, which in our opinion is linked with the transition of liquid tellurium to the metallic state accompanied by a change in short-range order.

71. Equation for Linear Resistance-Thermistor Circuit

"Analytical Solution of an Equation for the Transient Process in a Linear Resistance-Thermistor Circuit," by I. F. Voloshin; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 5, No 10, Oct 62, pp 93-96

The author derives an equation for a transient region in the circuit which consists of a linear resistance and a thermistor, when the static current-voltage characteristic in its working section may be approximated by a straight line. Examples of its application to actual thermistor circuits are given.

72. Relaxation of Spin Waves of Various Lengths

"Effect of Volume and Surface Imperfections on the Relaxation of Spin Waves in Ferrites," by G. A. Petrakovskiy, Siberian Physicotechnical Institute at Tomsk State University imeni V. V. Kuybyshev; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 6, 1962, pp 125-131

The effect of volume and surface imperfections for monocrystals of ferrites on the relaxation of spin waves of various lengths is investigated experimentally. The phenomenon of excitation for spin waves by longitudinal UHF magnetic field in a magnetized ferrite sample was used to measure the spin wave line widths. The results obtained are in substantial agreement with existing theories.

73. Energy Zones in Crystals

"Calculation of Spin-Orbit Interaction for the Computation of the Energy Zones in Crystals," by V. S. Mospanov, Moscow Engineering Physics Institute; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 6, 1962, pp 163-166

A secular equation which connects the energy of the electron to the wave vector when the spin orbit interaction is substantial is obtained. It is shown how the equation changes at the points of a crystal having a high degree of symmetry.

## Optics and Spectroscopy

### 74. Vacuum Ultraviolet Rays

"Investigation of Vacuum Ultraviolet Rays From a Powerful Pulsed Discharge," by V. D. Pis'mennyy, I. M. Podgornyy, and Sh. Sukever, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6 (12), Dec 62, pp 2008-2014

Results of an investigation of the radiation between 150 and 2200 A from a powerful pulsed discharge are presented. It is shown that for a discharge current of 200 kA the ion temperature is 200 ev, and the electron temperature is 20 ev. The cause of the difference between the electron and ion temperature is discussed.

### 75. Laser Type Actions in the Cosmos

"Pressure in Evaporating Matter in a Radiation Beam," by G. A. Askar'yan and Ye. M. Moroz, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2319-2320

Recently a high concentration of light capable of producing intensive evaporation of even heat-resistant materials was attained with lasers. The heating up and the evaporation of materials under the action of an intensive beam of charged particles (electron and ion cutting of metals, cathode and anode sputtering of electrodes, etc.) are also known and widely applied.

Possible manifestations of these effects in the cosmos and under pressure are the dust particles of comets, the surfaces of artificial cosmic bodies, meteors, etc. Direct pressure of solar radiation on artificial cosmic bodies can shift their orbits noticeably up to ~ 1 km per day). Therefore, the role of the effects examined can be useful, for example, in guiding motion by changing the surface evaporation of such bodies (special platings, focusing of solar light to intensify evaporation, shutters for regulating the intensity of evaporation, etc.).

## Mechanics

### 76. Elastic Nonhomogeneous Layers With Curvilinear Boundaries

"Oscillation of an Elastic Nonhomogeneous Layer With a Curvilinear Boundary and Lying in an Elastic Nonhomogeneous Half-Space," by L. B. Levitin, G. A. Skuridin, and K. P. Stanyukovich; Moscow, Prikladnaya Matematika i Mekhanika, Vol 27, No 1, Jan/Feb 63, pp 116-125

The problem of oscillation of an elastic nonhomogeneous layer, with a curvilinear boundary and lying in an elastic nonhomogeneous half-space, is studied. The exact statement of this problem presents considerable mathematical difficulties. In this connection, an attempt is made to develop approximation methods for the solution of similar problems for the case in which the ratio of the length of a seismic wave to the thickness of the stratum is small i.e., $\lambda H \ll 1$.

By means of an approximation, the authors study the problem of oscillation of an elastic layer, assuming that the constants of elasticity depend only on the nonhomogeneity of the layer along the strata.

### 77. Action of Concentrated Forces and Moments on Elastic Shells

"The Action of Concentrated Forces and Moments on an Elastic, Thin Shell of Arbitrary Shape," by G. N. Chernyshev; Moscow, Prikladnaya Matematika i Mekhanika, Vol 27, No 1, Jan/Feb 63, pp 126-134

The characteristic of singularity in the vicinity of the point at which are concentrated the forces and moments for the functions u, ..., $T_1$, ..., $H_1$ is studied, and the shifting of forces and moments in a shell is given. The problem is solved in the general case (for a shell of arbitrary shape) for general moments of equations in the linear theory of shells. For shells of positive Caussian curvature, this problem is considered also for equations in the "momentless" theory of shells.

The problem is solved by finding the principal singularities of solutions u, v, and w to the differential equations for the equilibrium of shells, giving the shifts of u, v, and w for the case in which a concentrated force or moment acts on the shell.

The solution of the operator equation $L(\Phi) = \delta(\xi - \xi_0)$, where L is a differential operator, $\xi = \{\xi_1, \ldots, \xi_n\}$, $\xi_0 = \{\xi_{10}, \ldots, \xi_{n0}\}$ are vectors in n-dimensional space, and $\delta$ is the symbol of the Dirac function, is called the fundamental solution of the differential equation $L(\Phi) = 0$.

## 78. Use of Navier-Stokes Equations in Streamlined Flow of Viscous Liquids

A Complete System of Solutions of Linearized Navier-Stokes Equations and Its Application to Boundary Value Problems Concerning Streamlined Flow Over Spheres, by R. N. Kaufman, Novosibirsk State University; Moscow, Prikladnaya Matematika i Mekhanika, Vol 27, No 1, Jan/Feb 63, pp 179-182

The author derives a complete system of solutions to linearized Navier-Stokes equations for the smooth flow of a viscous liquid free from external forces. This flow is expressed by the equations

$$\nu \Delta v = \frac{1}{\rho} \operatorname{grad} p, \quad \operatorname{div} v = 0,$$

where v is the rate of flow, p is the pressure, $\nu$ is the kinematic coefficient of viscosity, and $\rho$ is the density of the liquid.

The results obtained are applied to the study of the streamlined flow of a viscous liquid over two separated spheres, such that the rate of flow at infinity is equal to v and the direction of flow is parallel to the center line of the two spheres.

## 79. Planar and Axisymmetric Flow in Magnetic Hydrodynamics

"Properties of Uniform Planar and Axisymmetric Flow in Magnetic Hydrodynamics," by Yu. P. Ladikov; Moscow, Prikladnaya Matematika i Mekhanika, Vol 26, No 6, Nov/Dec 62, pp 1087-1091

Uniform planar and axisymmetric flow of an infinitely conducting gas is studied. With the conditions $\operatorname{div} \rho v = 0$ and $\operatorname{div} H = 0$, it is possible to obtain a current function $\varphi(x, y)$ and a magnetic force function $\chi(x, y)$. The equations of motion of the gas are transformed into the variables $\Psi$ and $\chi$. With certain additional assumptions, equations are derived containing two integrals, one of which is similar to the Bernoulli integral and the second of which does not have a counterpart in ordinary gas dynamics. In the case of orthogonality of the magnetic field and field of velocities, the solution of the problem reduces to a linear second-order partial differential equation. Certain particular solutions are considered.

80. Magneto-Sonic Oscillations in a Conducting Liquid

"Excitation of Magneto-Sonic Waves in a Conducting Liquid," by S. V. Iordanskiy (presented by Academician L. I. Sedov, 11 May 1962); Moscow, Doklady Akademii Nauk SSSR, Vol 146, No 3, Sep 62, pp 557-560

It was proposed in a number of works to use the resonance excitation of magneto-sonic oscillations in a restricted volume of plasma for its heating. In this connection, for calculation of the rate of heating, the linear theory is used, according to which the amplitude of the emerging oscillations rises indefinitely during the decrease of dissipation. However, at a fixed amplitude of the outer field, the relative role of the nonlinear members increases with the decrease in the dissipation coefficient although the amplitude of the oscillations may still remain small.

In the present paper, the author investigates the excitation of a one-dimensional magneto-sonic oscillation in a restricted volume of a conducting liquid in a hydrodynamic approximation with infinite conductivity. A case where the straight dissipative processes may be disregarded as compared to the nonlinear effects is investigated.

81. Stability of Bodies With Cavities Filled With Liquid

"Stability of the Smooth Motion of Rigid Bodies With Cavities Filled With Liquid," by V. V. Rumyantsev; Moscow, Prikladnaya Matematika i Mekhanika, Vol 26, No 6, Nov/Dec 62, pp 977-991

The article concerns the stability and smooth motion of a rigid body with a cavity partially or completely filled with a homogeneous, incompressible liquid. The study is based on an idea developed by Lyapunov ("Stability of an Ellipsoidal Shape of a Rotating Liquid in Equilibrium," Sobr. Soch., Vol 3, AN SSR, 1959; and "The Question of the Minimum in a Problem on the Stability of the Shape of a Rotating Liquid in Equilibrium, ibid.) in the theory of the stability of the shape of a rotating liquid in equilibrium. It is shown that the problem of stability of a uniformly rotating rigid body with a cavity filled with liquid leads to the study of minimum conditions of some expression W. In the case of a liquid's completely filling the cavity of the body, W is a function of a finite number of variables; in the case of incomplete filling, W is a functional depending on the coordinates of the rigid body and the shape of the liquid.

The theorem is illustrated by the solution of two problems concerning the stability of the smooth motion of a rigid body with a cavity filled with a liquid, for the cases in which: (1) a free rigid body is acted upon by a Newtonian attraction with a fixed center; (2) a rigid body moves around a fixed point in a homogeneous field under the force of gravity.

82. On Turbulence in Nonuniform Flows

"On the Theory of Turbulence in Nonuniform Flows," by E. M. Khazen; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 1, Nov/Dec 62, pp 60-63

The author investigates a nonuniform flow where the initial disturbance is such that the maximum degree of turbulence l is smaller than the typical degree of turbulence of the average flow L.

For the description of the nonuniform turbulence, spectral functions $\Phi_{ij}(k,x,t)$ were introduced. A closed system of equations for average velocities $U(x,t)$ and spectral functions of the turbulent pulsations in the nonuniform flows with small degree of turbulence is obtained. On the basis of this system, the mechanism of the rise of turbulence and the transition of the energy from large-scale to small-scale motion is revealed.

83. Turbulent Jets in Counterflows

"Turbulent Flat and Round Jets Developing in Counterflow," by E. Timma; Tallin, Izvestiya Akademii Nauk Estonskoy SSR, Seriya Fiziko-Matematicheskikh Nauk, No 4, 1962, pp 253-262

An experimental study of turbulent flat and round jets developing in counterflows was made. On the basis of the experimental data, the problem of the similarity of the profiles of relative velocity $\frac{u-u_H}{u_m-u_H}$ and temperature $\frac{T-T_H}{T_m-T_H}$ in different crossections of the jet has been explained, and formulas have been presented for computing these profiles. Corresponding formulas have been found for determining the extension of turbulent round and flat jets in counterflow and have been compared with the experimental data of various authors.

84. Specific Inductive Capacitance of Polar Substances

"Thermodynamics of Critical Phenomena in an Electric Field," by V. A. Zamkov; Moscow, Vestnik Moskovskogo Universiteta, Seriya III, Fizika, Astronomiya, No 6, Nov/Dec 62, pp 32-36

The author shows that the specific inductive capacitances of polar substances pass through a maximum at the critical point and that the increase of the critical temperature during superposition of a field is proportional to the ratio of molecular dipole energy to the energy of the rotational degrees of freedom.

85. Relative Gravitational Field

"On Relative Energy of the Static Centrally Symmetric Gravitational Field," by Yu. A. Rylov; Moscow, Vestnik Moskovskogo Universiteta, Seriya III, Fizika, Astronomiya, No 6, Nov/Dec 62, pp 45-55

On the basis of the concept of a relative gravitational field, the energy and impulse of a static centrally symmetric field were calculated with respect to the center of the system.

86. Relaxation of Quantum Systems

"Theory of Relaxation of Quantum Systems," by V. N. Genkin, Girkiy State University Leningrad, Fizika Tverdogo Tela, Vol 4, No 12, Dec 62, pp 3381-3389

A derivation of the controlling equation is given without assuming a diagonal density matrix at all moments of time. The derivation is based on an examination of the operator of the time development of the system from two interacting subsystems with a continuous and discrete spectrum; moreover the interaction of the subsystems satisfies the condition of diagonal singularity and is within infinitesimal limits.

87. Resonance in Nonlinear Systems

"Resonance in an Essentially Nonlinear System," by F. L. Chernous'ko; Moscow, Zhurnal Vychislitel'noy Matematiki i Matenaticheskoy Fiziki, Vol 3, No 1, Jan Feb 63, pp 131-144

By means of a method of averaging, the author studies resonance in an essentially nonlinear system closely resembling an integrating Hamiltonian system in which the conditions of oscillation and torsional vibration are present. The averaging equations enable him to find conditions of unifirm resonance and to study their stability. As examples, nonlinear resonance oscillations and torsional vibrations of a pendulum are investigated, with resistance proportional to the velocity. It is shown that both uniform resonance conditions of torsion of the pendulum are unstable.

88. Heat and Mass Transfer

"Heat and Mass Transfer in Anisotropic Bodies," by N. I. Gamayunov; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 6, No 2, Feb 63, pp 118-121

A heat and mass transfer equation for an anisotropic cappillary-porous colloidal body is solved. The body is a parallelepiped of $2l_1 \times 2l_2 \times 2l_3$ size; however, the proposed method of solution could be easily extended to bodies of other configurations.

89. Temperature Measurement of Arc Jet

"Temperature Measurement of an Arc Jet," by Ye. V. Garkavyy; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 6, No 2, Feb 63, pp 20-24

From the experimental data, the dependence of temperature on the axis of arc jet upon discharge power is determined. Temperature distributions with respect to the jet radius are ploted and dicussed for various discharge parameters. The results of temperature measurements obtained by two different methods are compared.

90. Equations of Motion for Nonholonomic Systems

"Various Forms of Equations of Motion for Nonholonomic Systems in Holonomic Coordinates," by L. G. Lobas, Institute of Mechanics, Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 11, 1962, pp 1436-1440

A new method is proposed for constructing equations of motion for nonholonomic systems. It consists of the successive transformation of the general equation of dyamics of independent variations and derivatives of Cartesian corrdinates and then to independent variations and and derivatives of Lagrangian coordinates. This method lies between that of Appel and Chaplygin. The equations obtained contain the kinetic energy of "the points of constraint" and the kinetic energy of "the principal points."

91. Rotational Oscillation

"Asymptotics of Rapid Rotations," by N. N. Moiseyev; Moscow, Zhurnal Vychislitel'noy Matematiki i Matematicheskoy Fiziki, Vol 3, No 1, Jan Feb 63, pp 145-158

An oscillatory system in a periodic phase plane of period $2\pi$ with a high initial energy is expressed by the second-order differential equation $y'' + f(y, \tau) = \mu F(y, y', t)$, where $\mu$ is a small parameter and $\tau = \mu t$ is slow time. The equation $y'' + f(y, \tau) = 0$ is considered to be a generating equation if $\tau$ is some fixed number..

It is shown that, as in the case of a low initial energy, it is possible to obtain asymptotic solutions of the generating equation. If it is possible to express the solution for a low initial energy in the form of a partial series arranged by positive powers of the energy, then for a high initial energy the solution can be put in the form of a partial series arranged by negative powers of the energy.

As soon as the solution of the generating equation is found, the original equation cited above can be put in standard form:

$$x' = \mu X(x, y, t, \mu),$$
$$y' = Y_0(x, t) + \mu Y_1(x, y, t, \mu).$$

The author draws two conclusions from his investigations:

1. It is possible to state a theory for the study of high energy in as full and detailed a manner as that for the study of nearly quasi-linear oscillations.

2. Those sections of the paper devoted to nonresonance solutions are based on numerous works employing the method of averaging.

92. Turbulent Heat and Mass Transfer on a Plate

"Turbulent Heat and Mass Transfer on a Plate With Porous Suction and Injection of Difference Gases," by V. P. Motulevich; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 6, No 1, Jan 63, pp 3-13

A method for estimating the effect of suction and injection of different gases on heat transfer and friction of a plate in a supersonic flow is proposed.

Comparison of theoretical results with experimental data shows that in principle the method presented is adequate.

For subsonic flows, the data are in good quantitative agreement, though scattering is observed.

As for supersonic flows, the theory proposed, though it gives true qualitative relation between relative coefficients of friction and heat transfer and the Mach number, leads to overestimated values of injection efficiency. It should be noted, however, that experimental data of various investigators (B. Leadon and C. Scott, JAS, 23, No 28, 1956, and C. Pappas and A. Okuno, JA/SS, 27, No 5, 1960) greatly differ; hence, further investigations in this direction are required.

93. Temperature Distribution in Couette Flow in Presence of Magnetic Field

"Effect of the Magnetic Field on Temperature Distribution in Couette Flow in Anisotropic Magnetic Hydrodynamics," by V. B. Baranov; Moscow, Zhurnal Prikladnoy Mekhaniki i Tekhnicheskoy Fiziki, No 6, Nov/Dec 62, pp 8-12

The effect of anisotropy of electrical and thermal conductivities on the temperature distribution on Couette flow between parallel plates is investigated. The gas is considered to be fully ionized, and an assumption of its incompresibility is introduced. Cases where the magnetic field is perpendicular to the plates and where it is parallel to them but perpendicular to the constant velocity of the upper plate are considered.

94. Exact Solutions of Energy Equations for Couette Flow

"Some Exact Solutions to the Energy Equation for a Plane-Parrallel Flow of Viscous Incompressible Fluid," by I. N. Sadikov; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 10, Oct 62, pp 3-8

The temperature distribution for a Couette flow when the upper wall is heated instantaneously to a given temperature is obtained. It is shown that at high velocities of fluid, when Schlichting numbers $S = \frac{1}{2} PrE > 1$, cooling of the wall stops at $\beta_{cr} = \frac{V t_{cr}}{b}$ (some critical moment), and it is heated by dissipation energy of the fluid due to friction forces.

95. Heat Transfer in "Moving Layer" Type Flows

"Differential Equations of Heat Transfer in Dispersed Flows of the Moving Layer Type," by Z. R. Gorbis; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 10, Oct 62, pp 32-39

An analytical study of heat transfer in two-component media is investigated. A system of equations for continuity, motion, and energy is obtained on the basis of a binary structure of dispersed media and of the application of the reference conditions to each of these components.

96. Optimal Wave Functions for a Calculation of Matrix Elements

"Method of Determining Optimal Wave Functions for an Approximate Calculation of Matrix Elements," by S. I. Vetchinkin, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 6, Dec 62, pp 1328-1331

Conditions are investigated which have to be satisfied by approximate wave functions such that the value of the matrix element $D_{AB}$, which is of interest, would not depend on a certain sufficiently large expansion of the class of variation wave functions for the states A and B.

97. Interactions in Interstitial Solid Solutions

"On Continual Theory of Elastic Interaction Between Atoms in Interstitial Solid Solution," by G. L. Krasko and B. Ya. Lyubov (presented by Academician G. V. Kurdyumov, 12 June 1962); Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 3, Nov 62, pp 562-565

A single-phase binary intersititial solid solution on the basis of a body-centered cubic lattice is studied. It is known that in the body-centered cubic lattice the solute may be situated in three different interstitial positions, i.e., the three mutually perpendicular edges of each of the two simple cubic sublattices. In the equilibrium state during absence of an external field, all three positions are equally probable. However, in the presence of external elastic fields and elastic interaction between atoms, these positions nonequivalent.

98. Nonlinear Boundary Value Problem

"A Nonlinear Boundary Value Problem in the Theory of Analytic Functions Involved in Certain Elastico-Plastic Problems" by G. P. Cherepanov; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 3, Nov 62, pp 566-568

The author proposes a method of solution of a boundary value problem based on its reduction to a nonlinear boundary value problem of Riemann, which is solved in a closed form with the help of methods similar to the classical methods of solutions of linear boundary value problems developed in monographs (N. I. Muskhelishvili, Singulyarnyye Integral'nyye Uravneniya [Singular Integral Equations], M. and L., 1946; and F. D. Gakhov, Krayevyye Zadachi [Boundary Value Problems], M., 1958).

99. Explosion in a Nonhomogeneous Atmosphere

"Propagation of a Strong Explosion in a Nonhomogeneous Atmosphere," by E. I. Andriankin et al.; Moscow, Zhurnal Prikladnoy Mekhaniki i Teknicheskoy Fiziki, No 6, Nov/Dec 62, pp 3-7

A hydrodyamic calculation of a strong explosion in a nonhomogeneous atmosphere was performed. It was found that over a finite period of time the shock front extends upward to infinity.

It is shown that no matter how strong the explosion, the strong shock wave cannot extend downward a distance greater than 16.5 km. Velocity and pressure in the propagating shock wave are determined as functions of time. Conversion formulas for various energies and altitutdes of explosion are given, and their range of application is indicated.

100. Laminar Flow in Presence of Traveling Magnetic Field

"Development of Laminar Flow of Conducting Fluid in a Flat Duct in Presence of a Traveling Magnetic Field," by N. M. Okhremenko; Moscow, Zhurnal Prikladnoy Mekhaniki i Tekhnicheskoy Fiziki, No 6, Nov/Dec 62, pp 18-21

Development of the laminar flow of a conducting fluid in a flat duct under the influence of a traveling magnetic field is investigated by means of approximate equations in which the components of acceleration and viscocity are partially taken into account. With a number of simplifying assumptions (constant velocity at the entry, surface effect is absent, supplementary tangentials stresses due to pulsation are negligible and the use of a Laplace transformation, expressions for average velocity, length of the entrance region, and pressure drop are obtained. The profile of the average velocity does not depend on the frequency and coincides with Shercliff's solution.

101. Uniformly Valid Solutions for Hypersonic Flow Over Blunt-Nosed Bodies

"Method of Small Perturbations in Problems of Hypersonic Flow of Gas Over Blunt-Nosed Slender Bodies," by V. V. Sychev; Moscow, Zhurnal Prikladnoy Mekhaniki i Tekhnicheskoy Fiziki, No 6, Nov/ Dec 62, pp 50-59

The purpose of this work was to find an approximate solution to the problem of the flow over a blunt-nosed slender body based on the unique method of small perturbations.

Fundamentally it consists of utilization of the technique of solution which is uniformly valid for all regions of the flow. Such a technique was proposed by M. J. Lighthill ("A Technique for Rendering Approximate Solutions to Physical Problems Uniformly Valid," Philos. Mag., 1949, Vol 40).

102. Residual Stresses in Plastic Deformations

"Influence of Residual Stresses and Material Heterogeneity on Resistance to Small Plastic Deformations," by I. N. Kidin and M. A. Shtremel'; Moscow, Zhurnal Prikladnoy Mekhaniki i Fiziki, No 6, Nov/Dec 62, pp 94-97

The authors study the influence of residual stresses and heterogeneity of properties on a deformation diagram during expansion and pure bending for samples whose normal cross sections have two axes of symmetry, y and z, while z lies in the plane of the applied forces.

103. Rarefied Gas Dynamics

"Investigation of the Effect of Supersonic Flow Rarefaction on Readings of Total Pressure Probes," by S. I. Kosterin et al.; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 5, No 12, Dec 62, pp 16-22

An investigation shows that the deviation of readings of total pressure probes in a supersonic rarefied flow from the ideal value depends not only on $Re_d/M$, but also on $M_1$. When the parameter $Re_d/M$ is used, one curve satisfactorily correlates all the experimental data.

The relation $P'_{och}/P'_{oid} = f(Re_d/M)$ obtained may be considered as a calibration curve when parameters of a rarefied supersonic air flow are determined by total pressure probes of the given configuration and also makes it possible to define the change in the structure of a normal shock wave.

It is established that the probe diameter in the range investigated ($d/\delta = 0.04$ to 0.32) does not influence the character of the total pressure profile measured.

104. Convective Heating

"Convective Heating of a Stationary Layer of Plates," by V. G. Abbakumov; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 5, No 12, Dec 62, pp 77-79

An analytical solution, describing a nonstationary distribution of temperatures in a material and corresponding changes in gas temperature, is obtained as a result of the mathematical analysis of a convective heat transfer of a stationary layer of plates with gas flow.

105. Measurement of Wall Temperatures

"On Measuring the Wall Temperature," by G. F. Shaydurov; Minsk, Inzhenerno-Fizicheskiy Zhurnal, Vol 5, No 12, Dec 62, pp 86-90

When measuring the surface temperature of a solid, it is sometimes necessary to put thermocouple wires in the interior of the solid. In this case, the heat flow through the thermocouple wires may be a source of essential errors. To estimate these errors, the radial temperature distribution was measured close to a heated metal rod imbedded in a paraffin block. The results obtained made it possible to calculate the temperature distribution along the rod and to obtain a simple expression for temperature correction.

106. Magnetohydrodynamic Boundary Layer

"Magnetohydrodynamic Boundary Layer in a Medium With Anisotropic Conductivity for Small Magnetic Reynolds Numbers," by G. A. Lyubimov; Moscow, Prikladnaya Matematika i Mekhanika, Vol 26, No 6, Nov/Dec 62, pp 1077-1086

A problem on the magnetohydrodynamic boundary layer in an anisotropically conducting incompressible medium is stated. Moreover, the concepts proposed by G. A. Lyubimov (PMM, Vol. 26, No 5, 1962) are used substantially.

The boundary layer is examined in a plate which represents a dielectric for small values of the parameters

$$mL = \frac{\sigma H^2 L}{\rho c^2 U (1 + \omega^2 \tau^2)} .$$

The magnetic field is considered homogeneous and perpendicular to the plate. Unlike the boundary layer in a medium with isotropic conductivity (V. U. Rossow, "On Flow of Electrically Conducting Fluids Over a Flat Plate in Presence of a Transverse Magnetic Field," NACA, 1957, TN 3971), the cross section in a boundary layer in a medium with anisotropic conductivity is not plane; therefore, the corresponding automodel problem does not reduce to one but to two ordinary differential equations.

## Field Theory

107. Interacting Fermi Fields

"Correlation Energy and Collective Excitations for Interacting Fermi Fields," by A. V. Tulub; Leningrad, Vestnik Leningradskogo Universiteta, No 16, Seriya Fiziki i Khimii, Issue 3, 1962, pp 20-29

The collective excitation spectrum in the case of two interacting Fermi-fields is considered. The main approximation is the high density limit in which the correlation energy has been calculated.

108. Model of Scalar Field Theory

"Model of Scalar Field Theory in Quantized Space-Time," by V. G. Kadyshevskiy, Joint Institute for Nuclear Research; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 6, Dec 62, pp 1336-1339

Several generalizations of the apparatus of quantum field theory which are possible in thr formalism of quantized space-time are studied on the model of a simple scalar model. Since in the new scheme the coordinates $x^n$ become noncommuting operators, all constructions are made in p-space, which is of constant curvature in this case. Taking into account the argument of B. G. Kadyshevskiy in the second section of his work (DAN SSSR, Vol 147, No 3, 1962), the 4-pulse $p_m$ (m = o, 1, 2, 3) are determined by means of a relation of Kadushevskiy when $\ell$ = 1.

109. Strength of a Magnetic Field

"Method of Measuring the Strength of a Magnetic Field," by G. B. Bordanov; Leningrad, Byulleten' Izobreteniy, No 23, Dec 62, p 22

A way of measuring the strength of a magnetic field has been developed by a method of ferromagnetic resonance with a ferrite thermistor, included in the circuit of the direct current source, enclosed in a high frequency wave guide, connected to a variable frequency generator. To increase the accuracy of the measurement, the thermistor is introduced into the magnetic field being measured, and the frequency of the generator is changed until it coincides with the resonant frequency ofthe thermistor. According to the change, the strength of the magnetic field containing the thermistor is determined.

## Statistical Physics

### 100. Quantum Vortices

"Quantum Vortices in a Fermion System," by L. P. Rapport and A. G. Krylovetskiy, Voronezh State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 43, No 6(12), Dec 62, pp 2122-2127

Superconductivity differential equations are derived for the inhomogeneous case with an arbitrary temperature. It is shown that in a system of fermions in the superfluid state, quantum vortices which possess properties similar to those of vortices in a boson system arise.

### 111. Inverse Problem of Electron Optics

"Solution of the Inverse Problem of Electron Optics by Means of Fields Having Axes of Symmetry" (presented by Academician Yu. O. Mitropol'skiy, Academy of Sciences Ukrainian SSR), by Ye. P. Grankin, Institute of Mathematics, Academy of Sciences Ukrainian SSR; Kiev, Doklady Akademii Nauk Ukrainskoy SSR, No 12, 1962, pp 1546-1549

A method is described for solving the inverse problem of electron optics by means of fields having axes of symmetry. The trajectory for which the appropriate field is sought is a plane curve. The problem is reduced to a solution of Riccati's equation and ordinary first-order differential equations. Two control problems are presented, their solutions by the described method being compared with those of the corresponding linear problems.

## II. MATHEMATICS

### 112. Stability of Solutions to Differential Operator Equations With Time Delay

"Stability of Solutions of Differential Operator Equations With Time Delay and Disturbances Bounded on the Average," by L. Kh. Liberman; Moscow, Sibirskiy Mathematicheskiy Zhurnal, Vol 4, No 1, Jan/Feb 63, pp 138-144

Questions relating to the stability of solutions to equations of the form

$$\frac{dx}{dt} = f[x(t - \tau_1(t)), x(t - \tau_2(t)), \ldots, x(t - \tau_N(t)), t]$$

are considered. For brevity, the author writes these equations in the form $\frac{dx}{dt} = f[x(t - \tau_i(t)), t]$ $(i = 1,2, \ldots, n)$, where $f(x,t)$ is a nonlinear operator satisfying certain conditions, and $x$ is an element of Branch space. Equations of this type are of interest in problems of automatic control.

Theorems on stability for the first approximation and with a constantly acting disturbance of small average magnitude are proven. The existence and uniqueness of the solution of the above equation under several conditions can be shown by the ordinary method of successive approximations.

Submitted on 24 November 1960.

### 113. Thomas-Fermi-Dirac Equation

"A Boundary Value Problem for the Thomas-Fermi-Dirac Equation," by R. I. Anishchenko; Moscow, Sibirskiy Mathematicheskiy Zhurnal, Vol 4, No 1, Jan/Feb 63, pp 3-16

The following boundary value problem is considered:

Find a nonnegative solution $\varphi(x)$ of the equation $\varphi'' = f(x, \varphi)\psi(x)$, defined in the interval $0 \leq x \leq R$ and such that $\varphi(0) = y_0$, $R\varphi'(R) - \varphi(R) = -q$, where $q < 0$, $y_0 > 0$, $R > 0$. Furthermore, the functions $f(x, y)$ and $\psi(x)$ must satisfy certain conditions.

Several theorems are proven for the existence and uniqueness of the solution to this problem, and an approximate solution is found.

Submitted on 12 March 1961.

114. Mathematician Kreyn Praised for Contributions to Mathematics

"Worthy Contribution," by G. Pisarenko, Chief Science Secretary of the Academy of Sciences Ukrainian SSR, Corresponding Members of the Academy of Sciences Ukrainian SSR; Kiev, Pravda Ukrainy, 16 Jan 63, p 2

The contributions of Corresponding Member of the Academy of Sciences Ukrainian SSR M. Kreyn to mathematics -- particularly as applied to the field of mathematical analysis -- are summarized. The author states that there is an important link between the works of Chebyshev and Markov and the theory of operators and that "this has enabled M. Kreyn to introduce a number of new concepts in the theory of operators, namely, finite defective numbers and the theory of the expansion of semibounded operators, and thereby apply these concepts to problems in harmonic analysis, the spectral theory of differential equations, and many others."

In addition to his theory on self-conjugate operators, Kreyn is praised for his theories on cones and boundary points and his studies of spaces with indefinite metrics.

115. Approximation by Analytic Functions and Polynomials

"Average Approximation by Area With Analytic Functions and Polynomials" (presented by Academician S. N. Mergelyan, Academy of Sciences Armenian SSR, 20 June 1962), by S. O. Sinanyan, Moscow State University; Yerevan, Doklady Akademii Nauk Armyanskoy SSR, Vol 35, No 3, 1962; pp 107-112

The article concerns closed sets, any portions of which have positive planar measures. Such sets are said to be "reduced by measure." Eight theorems are given relating to Caratheodory measure and to closed and dense sets. Two are cited as examples:

Theorem 1. Assume F. To be a closed Caratheodory set. Then the set of algebraic polynomials is everywhere dense in the space $H_p$ (F), $p \geq 1$.

Theorem 4. Assume a closed, bounded set F, such that in every circle of any radius $\delta$, with its center at a bounded point of this set, is a closed set e belonging to the complement of F, with $\gamma_p(e) > \lambda \cdot \delta$ where $\lambda > 0$ is an absolute constant. Then any function $f(z)$ whose average module of continuity satisfies the condition $\omega_p(\delta, f) = O(\log \delta)$ in the space $H_p(F)$, $p \geq 1$, can be approximated by functions analytic in F.

$H_p(F)$ is a Branch space; p is an Ahlfors measure of any closed set; and $\gamma(e)$ is some function belonging to e.

116. "Superconvergence" of Series

"'Superconvergence' of Certain Series," by G. L. Lunts, Moscow Institute of Chemical Machine Building; Yerevan, Izvestiya Akademii Nauk Armyanskoy SSR: Seriya Fiziko-Mathematicheskikh Nauk, Vol 15, No 5, 1962, pp 11-26

The article is devoted to the generalization of the Taylor-Dirichlet series $\sum_{N=1}^{\infty} a_N z^{m_N} e^{-\lambda_N z}$ and the Dirichlet series with complex emponents

$$\sum_{N=1}^{\infty} a_N e^{-\lambda_N z} .$$

The term "superconvergence" is used in connection with the covergence of a sequence of powers appearing in convergent series. The convergence and superconvergence of the Taylor-Dirichlet series and the superconvergence of the Dirichlet series with complex exponents are discussed in detail. The evaluation of a partial sum and remainder in the Taylor-Dirichlet series is also considered.

117. Commutative and Anticommutative Free Products of Algebras

"Commutative and Anticommutative Free Products of Algebras," by A. T. Gaynov; Moscow, Sibirskiy Matematicheskiy Zhurnal, Vol 3, No 6, Nov/Dec 62, pp 805-833

The article concerns the concept of the free product within a primitive class of algebras given by the system of identities:

$$p_i (x_1, x_2, \ldots, x_{Ni}) = 0 \ (i = 1, 2, \ldots).$$

Two particular aspects of free products of algebras are presented: commutative and anticommutative free products.

It is proven that the free product of algebras prossesses a number of properties inherent in a nonassociative free product of algebras. For example, this operation on the set of all algebras is commutative and associative.

A theorem on sub-algebras of commutative and anticommutative free algebras is proven. This is a generalization of a theorem of A. I. Shirshov that every sub-algebra of a free commutative (or anticommutative) algebra is itself free ("Sub-Algebras of Free Commutative and Free Anti-commutative Algebras," Matem. Sb., 34, Issue 1, 1954, pages 81-88). Another theorem is proven which is similar to a theorem of A. I. Zhukov for commutative (or anticommutative) free products of algebras. Finally, problems on the isomorphism of commutative (or anticommutative) algebras corresponding to free products are studied.

Submitted on 28 Arpil 1961.

118. Systems of Elements of Nonself-Conjugate Operators

"Completeness of Systems of Eigenvalues and Supplementary Elements of Nonself-Conjugate Operators" (presented by Academician Z. I. Khalilov, Academy of Sciences Azerbaydzhan SSR), by Dzh. E. Allakhverdiyev, computing center; Baku, Doklady Akademii Nauk Azerbaydzhanskoy SSR, Vol 18, No 7, 1962, pp 3-7

The article concerns the question of completeness of systems of eigenvalues and supplementary elements of nonself-conjugate operators of the form $A + \lambda H$, defined in Hilbert space H, where H is a normal operator with eigenvalues on a finite number of rays, and A is a bounded operator. Four theorems are proven relative to this subject.

Submitted on 20 November 1956.

## 119. Quasilinear Systems With One Degree of Freedom

"Stability of Periodic Solutions of Nonautonomous Quasilinear Systems With One Degree of Freedom," by C. V. Plotnikova; Moscow, Prikladnaya Matematika i Mekhanika, Vol 27, No 1, Jan/Feb 63, pp 168-170

The stability of periodic solutions for the case of double roots of equations for basic amplitudes is studied by consideration of the nonautonomous, quasilinear system $\ddot{x} + m^2 x = f(t) + \mu F(t, x, \dot{x}, \mu)$. Here $\mu$ is a small positive parameter; f is a continuous periodic function of time t with a period of $2\pi$ whose expansion in a Fourier series contains no $m^{th}$-order harmonics (m is an integer); F is an analytic function of the variables x, $\dot{x}$, and $\mu$ and a continuous periodic function of t with a period of $2\pi$.

The generating solution $x_0(t) = A_0 \cos mt + \frac{B_0}{m} \sin mt + \varphi(t)$ depends on the two arbitrary constants $A_0$ and $B_0$. The function $\varphi(t)$ describes the constrained oscillations of the generating system ($\mu = 0$).

## 120. Harmonic and Random Forces in Nonlinear Oscillatory Systems

"The Parametric Effect of a Harmonic and Random Force on a Nonlinear Oscillatory System" (presented by Academician Yu. O. Mitropol's'kyy, Academy of Sciences Ukranian SSR), by V. G. Kolomiyets', Institute of Mathematics, Academy of Sciences Ukranian SSR; Kiev, Doklady Akademii Nauk Ukrainskoy SSR, No 11, 1962, pp 1413-1417

The author determines the density of the distribution of amplitude and phase of an oscillatory system with small nonlinearity when a periodically varying coefficient of rigidity is affected by parametric fluctuations of the white noise type.

121. Study of Gyroscopic Systems by Asymptotic Methods

"Application of Asymptotic Methods to the Study of Gyroscopic Systems" (presented by Academician A. Yu. Ishlinskiy, 25 May 1962), by L. N. Slezkin, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSR, Vol 147, No 1, 1 Nov 62, pp 57-59

The paper concerns the system of equations

$$\ddot{\alpha} + \dot{\beta} = \varepsilon f_1 (\ddot{\alpha}, \ddot{\beta}, \dot{\alpha}, \dot{\beta}, \alpha, \beta);$$
$$\ddot{\beta} - \dot{\alpha} = \varepsilon f_2 (\ddot{\alpha}, \ddot{\beta}, \dot{\alpha}, \dot{\beta}, \alpha, \beta),$$

where $\varepsilon$ is a small parameter. The solution of this system is sought in the form $\alpha = \alpha_0 - a \sin \Psi + \varepsilon u_1 (a, \Psi, \alpha_0, \beta_0) + \varepsilon^2 u_2 (a, \Psi, \alpha_0, \beta_0) + \ldots,$
$\beta = \beta_0 + a \cos \Psi + \varepsilon v_1 (a, \Psi, \alpha_0, \beta_0) + \varepsilon^2 v_2 (a, \Psi, \alpha_0, \beta_0) + \ldots,$
where $u_i$ and $v_i$ are periodic functions of $\Psi$ with a period of $2\pi$.

By means of equations of this type, the author studies the equations of motion of a balanced gyroscope in gymbols on a fixed base, with slight friction in the axes of the gymbols.

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122. Finite Ring Groups

"Finite Ring Groups" (presented by Academician N. N. Bogolyubov 17 May 1962), by G. I. Kats; Moscow, Doklady Akademii Nauk SSSR, Vol 147, No 1, 1 Nov 62, pp 21-24

This is the third in a series of articles by the author on ring groups (DAN, Vol 138 No 2, 1961, p 275; and DAN, Vol 145 No 5, 1962, p 989). It is devoted to questions related to the concepts of homomorphism, subgroups, and factor-groups. These are limited to finite ring groups, i.e., ring groups in which the Hilbert space is finite-dimensional. Four theorems are presented:

1. The order of a subgroup of ring group is the divisor of the order of the group.

2. Given G. and $\hat{G}$, mutually-dual ring groups, and $A \to \hat{A}$, a corresponding Fourier transform. The Fourier transform maps the carrier of any subgroup (factor-group) $\Gamma$ of group G onto the carrier of the dual group $\hat{\Gamma}$, being the factor-group (subgroup) of $\hat{G}$.

3. P. is the principal projector of an ordinary subgroup $\mathfrak{P}_0$ (i.e., $\mathfrak{P}_0$ is isomorphic to an ordinary group). Each ordinary subgroup of a ring group G belongs to $\mathfrak{P}_0$.

4. A ring group is uniquely defined by the representation of its carrier $\mathfrak{U}$ and some exact representation D(A).

## 123. Fourier Transforms of Generalized Functions

"Fourier Transforms of Certain Classes of Generalized Functions" (presented by Academician V. I. Smirnov 9 June 1962), by N. S. Landkof; Moscow Doklady Akademii Nauk SSSR, Vol 147, No 3, 21 Nov 62, pp 544-547

The author proves two theorems on Fourier transforms of certain classes of generalized functions. The work is based on the findings of N. Wiener on a transform of Bochner (Acta Math., 55, 117, 1930; and The Fourier Integral and Certain of its Applications Cambridge, 1933).

## 124. Summation of Fourier Integrals and Approximation by Integral Functions

"Summation of Fourier Integrals and the Best Approximation by Integral Functions" (presented by Academician V. I. Smirnov, 11 June 1962), by V. G. Ponomarenko, Dnepropetrovsk Agricultural Institute; Moscow, Doklady Akademii Nauk SSSR, Vol 147 No 3, 21 Nov 62, pp 556-558

The functions $\|f(x)\|_{L_p} = \left\{\int_{-\infty}^{\infty} f(x)|^p dx\right\}^{1/p} < \infty$ $(1 \le p < \infty)$ and $U_\lambda(f;x;\varphi) = \int_{-\lambda}^{\lambda} \varphi_\lambda(u) F(u) e^{iux} du$ in the space $L_p(-\infty, \infty)$ are given, where F(u) is a Fourier transform of the function f(x) and $\varphi_\lambda(u)$ is some function satisfying the conditions $\varphi_\lambda(u) = \begin{cases} 1 \text{ for } u = 0 \\ 0 \text{ for } |u| \ge \lambda \end{cases}$. Further, $R_\lambda(f;\varphi)_{L_p} = \| f(x) - U_\lambda(f;x;\varphi) \|_{L_p}$, and $A_\sigma(f)_{L_p}$ i. the best approximation of f(x) by integral functions of degree $\le \sigma$ in the space $L_p(-\infty,\infty)$.

The author studies the dependence of the order of decrease of $R_\lambda(f;\varphi)_{L_p}$ $(\lambda \to \infty)$ on the behavior of the function $A_\sigma(t)_{L_p}$ (for $\sigma \to \infty$).

125. Linear Differential Equations With Delayed Argument

"Linear Differential Equations With Exponential Coefficients and Uniform Delay of the Argument; Irregular Cases," by K. G. Valeyev; Moscow, Prikladnaya Matematika i Mekhanika, Vol 26, No 6, Nov/Dec 62, pp 1012-1024

Linear differential equations with periodic and nearly periodic coefficients and uniform delay of the argument are studied. A Laplace transform is obtained which leads to the solution of linear Diophantine equations. The terms of the series defining the transform form a semi-group for which an isomorphism with a semigroup of certain generalized numbers is established.

This isomorphism simplifies the calculations and makes it possible to study the stability of quasi-stationary equations. In particular, asymptotic criteria are established for the stability of solutions of a linear second-order differential equation with nearly periodic coefficients.

126. Boundary Value Problem for Equation With Elliptic Operator

"A Boundary Value Problem for the Equation $\frac{\partial}{\partial t} P\left(\frac{\partial}{\partial t}, \frac{\partial}{\partial x}\right) u = 0$, Where $P\left(\frac{\partial}{\partial t}, \frac{\partial}{\partial x}\right)$ Is an Elliptic Operator," by G. I. Eskin; Moscow, Sibirskiy Matematicheskiy Zhurnal, Vol 3, No 6, Nov/Dec 62, pp 882-911

Given: the $2m^{th}$-order polynomial $P(\lambda, \sigma)$ in two variables with constant coefficients; D, a convex bounded region; $\Gamma$, the boundary of region D; and $\Gamma/2$, the upper part of the boundary $\Gamma$.

A boundary value problem is considered:

$$\frac{\partial}{\partial t} P\left(\frac{\partial}{\partial t}, \frac{\partial}{\partial x}\right) u = 0 \text{ in } D,$$

$$u\Big|_\Gamma = \varphi_0(\xi), \ \ldots, \ \frac{\partial^{m-1} u}{\partial n^{m-1}}\Big|_\Gamma = \varphi_{m-1}(\xi), \ \frac{\partial^m u}{\partial n^m}\Big|_{\Gamma/2} = \varphi_m(\xi),$$

where $\frac{\partial}{\partial n}$ is the derivative with respect to the normal to $\Gamma$.

An "A" class of functions is defined as follows:

1. All derivatives of functions $u(x, t)$ entering into the first of the above equations must be continuous within D;
2. $\frac{\partial^p u(x, t)}{\partial x^i \partial t^j}$ and $\frac{\partial^{m+1} u}{\partial x^i \partial t^j}$ are continuous in a closed region $\bar{D}$ for any $p$ $(0 \le p \le m, \ i + j = p)$.

The following theorem is proven: Given a curve $\Gamma$, (2m+2) times differentiable, such that the highest derivatives satisfies the Holder condition; and given $P(\lambda,\sigma)$, a homogeneous $2m^{th}$-order elliptic polynomial with real coefficients. Then there exists a unique solution to the given boundary value problem belonging to class "A" for all (2m-j) times differentiable bounded functions $\varphi(\xi)$ satisfying the Holder condition.

Submitted on 27 March 1961.

127. Theorem for Solution of Linear Partial Differential Equations

"A Theorem Similar to Fuchs Theorem for the Solution of Linear Partial Differential Equations," by Sh. I. Strelits; Moscow, Matematicheskiy Sbornik: Novaya Seriya, Vol 60, No 2, Feb 63, pp 121-130

A theorem, similar to the Fuchs theorem, is proven for the solution of linear, partial differential equations:

Assume a partial differential equation with

$$L_N(u) = \sum_{k=0}^{N} \sum_{i_1+i_2+\ldots+i_m=k} P^k_{i_1 i_2 \ldots i_m}(z_1, z_2, \ldots, z_m) \times z_1^{i_1} z_2^{i_2} \ldots z_m^{i_m} \frac{\partial^{i_1+i_2+\ldots+i_m} u}{\partial z_1^{i_1} \partial z_2^{i_2} \ldots \partial z_m^{i_m}} = 0,$$

where $P^k_{i_1 i_2 \ldots i_m}(z_1, z_2, \ldots, z_m)$ are polynomials for all k, $i_j$, such that the homogeneous form $\sum_{i_1+i_2+\ldots+i_m=n} P^n_{i_1 i_2 \ldots i_m}(0, 0, \ldots, 0)\, \eta_1^{i_1} \eta_2^{i_2} \ldots \eta_m^{i_m}$ for all nonnegative $\eta_1, \eta_2, \ldots, \eta_m$, $\eta_1 + \eta_2 + \ldots + \eta_m = 1$, does not become zero. Then there exists an infinite number of solutions of the form $u = z_1^{\lambda_1} z_2^{\lambda_2} \ldots z_m^{\lambda_m} f(z_1, z_2, \ldots, z_m)$, where $\lambda_j$, $j = 1, 2, \ldots, m$, are constants, and $f(z_1, z_2, \ldots, z_m)$ is a regular function in some neighborhood of the origin. In particular, if $P^n_{i_1 i_2 \ldots i_m}(z_1, z_2, \ldots, z_m) \equiv \text{const.}$ for all such $i_1, i_2 \ldots, i_m$, for which $i_1 + i_2 + \ldots + i_m = n$, then $f(z_1, z_2, \ldots, z_n)$ is an integral function.

Three examples are given:

a. In the equation $z \frac{\partial u}{\partial z} + w \frac{\partial u}{\partial w} = zwu$, the form $Q(\eta_1, \eta_2) = \eta_1 + \eta_2$ for $\eta_1 + \eta_2 = 1$ gives $Q \equiv 1$ and does not become zero. In accordance with the theorem, the required solutions are $u = z^{\lambda} w^{-\lambda} e^{\frac{wz^{\beta}}{\beta}}$.

b. In the equation $z\frac{\partial u}{\partial z} - w\frac{\partial u}{\partial w} = zwu$, $Q(\eta_1, \eta_2) = \eta_1 - \eta_2$, $\eta_1 + \eta_2 = 1$, which, for $\eta_1 = \eta_2 = 1/2$, gives $Q(1/2, 1/2) = 0$. The general solution has the form $u = f(zw)z^{wz}$, and a solution in the form sought does not exist.

c. For the equation $z\frac{\partial u}{\partial z} = wu$, $Q(\eta_1, \eta_2) = \eta_1$, and $Q(0, \eta_2) = 0$. The general solution has the form $u = f(z)z^{w}$. The solution in the form sought does not exist.

Submitted on 2 June 1960.

128. Boundary Value Problems for Integral-Differential Equations

"Correct Boundary Value Problems for Integral-Differential Equations in a Half-Space" (presented by Academician Z. I. Khalilov, Academy of Sciences, Azerbaydzhan SSR), by F. S. Aliyev, Institute of Mathematics and Mechanics; Baku, Doklady Akademii Nauk Azerbaydzhanskoy SSR, Vol 18, No 18, No 8, 1962, pp 3-6

The system of integral-differential equations of the form

$$\frac{\partial U_j(x, t)}{\partial t} = \sum_{k=1}^{m} \left[ P_{jk}\left(i \frac{\partial}{\partial x}\right) + L_{jk}\left(i \frac{\partial}{\partial x}\right) S \right] U_k(x, t)$$

$$(j = 1, 2, \ldots, m); \quad x = (x_1, \ldots, x_N),$$

where S is an integral function of x, is examined in H space.

Three theorems are proven which give the necessary and sufficient conditions to determine the correct boundary value problem for this system of equations.

129. Averaging in Systems of Differential Equations

"Averaging in Systems of Ordinary Differential Equations," by V. M. Volosov; Moscow, Uspekhi Matematicheskikh Nauk, Vol 17, No 6, Nov/Dec 62, pp 3-126

The article is devoted to the method of averaging, which has wide application in the study of oscillatory systems expressed as ordinary differential equations. The article reviews a number of modern works in which are developed the theoretical bases of the method of averaging and its application to problems in the theory of oscillation. There are five sections in the article.

In (1), the formal description of the method of averaging is given, and the well-known studies of Bogolyubov and others (Statistical Methods in Mathematical Physics, by N. N. Bogolyubov, Kiev, 1945; and others) on the development of asymptotic methods of averaging are discussed. (2) concerns the formulation of theorems on averaging and the proofs of similar theorems. In (3), certain problems are outlined which have to do with the application of averaging to the study of nonlinear oscillation. Concrete examples encountered in physics and engineering are given. (4) For particular types of systems, a problem is solved concerning the calculation of higher asymptotic approximations. (5) concerns calculations of oscillatory phase and periodic solutions of certain natural oscillation systems.

130. Approximate Solutions of Ordinary Differential Equations

"Approximate Solutions of Ordinary Differential Equations by Means of Linearization," by S. F. Shushurin, Chair of Statistical Physics and Quantum Mechanics of the Physics Department; Moscow, Vestnik Moskovskogo Universiteta; Seriya 1: Matematika, Mekhanika, No 6, Nov/Dec 62, pp 3-8

An idea is suggested for a method of piecewise linearization of the right-hand member of an ordinary differential equation with respect to its arguments. Several specific examples show that the method may be useful for a qualitative analysis of solutions.

Submitted on 28 October 1961.

131. Theorems on Intermediate Values and Boundary Value Problem for Second-Order Differential Equation

"Theorems on Intermediate Values and a Boundary Value Problem for a Nonlinear Second-Order Differential Equation," by G. A. Kamenskiy; Moscow, Matematicheskiy Sbornik: Novaya Seriya, Vol 60, No 1, Jan 63, pp 3-16

Two theorems are proven for intermediate values of continuous functions of two variables and two functions of one variable, the inverse of the former. These theorems are applied to the boundary value problem $y'' = F(x,y,y')$, $y(x_0) = y_0$, $y(x_1) = y_1$ $(x_0 < x_1)$ for arbitrary $y_0$ and $y_1$ and $x_1 - x_0 \leq d$ (where $d$ depends on the form of the function $F$) to determine the condition for its solvability for $x_1 - x \leq 2d$ and arbitrary $y_0$ and $y_1$, and in certain cases for arbitrary $x_0$, $x_1$, $y_0$, and $y_1$.

Submitted on 12 February 1961.

132. Unconditional Convergence of Series

"Weyl Factors for Unconditional Convergence," by P. L. Ul'yanov; Moscow, Matematicheskiy Sbornik: Novaya Seriya, Vol 60, No 1, Jan 63, pp 39-62

Several definitions are given as an introduction to the discussion:

An orthonormalized system of functions $\{\varphi_N(x)\}$, defined in the interval [0,1], is called a "system of convergence" if every series $\sum_{N=1}^{\infty} c_N\varphi_N(x)$ converges almost everywhere in [0,1] as soon as $\sum_{K=1}^{\infty} c_K^2 < \infty$.

An orthonormalized system of functions $\{\varphi_N(x)\}$ is defined in the interval [0,1]. The positive sequence $\omega(n)$ $(n = 1,2,\ldots)$ is called the "Weyl factor of convergence" for the system $\{\varphi_N(x)\}$ if every series $\sum_{1}^{\infty} c_N\varphi_N(x)$ converges almost everywhere in [0,1] as soon as $\sum_{N=1}^{\infty} c_N^2\omega(n) < \infty$.

Given the arbitrary functions $f_N(x)$ defined on the set $E \subset (-\infty,+\infty)$. The functional series $\sum_{N=1}^{\infty} f_N(x)$ is said to "converge unconditionally almost everywhere on E" if it converges almost everywhere on E after any rearrangement of terms of the series.

In the article, it is shown that the sequence $\omega(m) \equiv 1$ is not a Weyl factor for unconditional convergence of the series for the Haar system $\{\chi_m(x)\}$. It is also shown that the orthonormalized Haar system does not have an exact Weyl factor for unconditional convergence almost everywhere.

Submitted on 25 September 1961.

133. Theorems on Double Series

"Two Theorems of Chow and Their Generalizations for Double Series," by S. Baron, Candidate of Physicomathematical Sciences; E. Pallum; and M. Peterson, Tartusk State University, Institute of Cybernetics, Academy of Sciences Estonian SSR; Tallin, Izvestiya Akademii Nauk Estonskoy SSR, Vol 11, No 4, 1962, pp 277-287

A positive, nonincreasing sequence $\{U_n\}$ and the relations $\alpha \geq 0$, $\beta > -1$ are given. The series $\sum u_N$ is called $|C_\varphi^\alpha|$-summable if $\sum p_N |u'_N| < \infty$, where $u'_N = \sum_{k=0}^{N} \frac{A_{N-k}^{\alpha-1}}{A_N^\alpha} U_k$.

A sequence $\{U_N\}$ is called $C_\varphi^\alpha$ -bounded ($C_\varphi^\alpha$ -summable) if the sequence $\{\varphi_N U'_N\}$ is bounded (converges), where $U'_N = \sum_{k=0}^{N} \frac{A_{N-k}^{\alpha-1}}{A_N^\alpha} U_k$. Four theorems related to the foregoing are proven.

The purpose of the article is to indicate the necessary and sufficient conditions under which:

(1) the series $\Sigma \varepsilon_N u_N$ is $C^\beta$ - or $|C^\beta|$-summable for all $|C\varphi|$-summable series $\Sigma u_N$ (theorem 1);

(2) the series $\Sigma \varepsilon_N u_N$ is $|C^\beta|$-summable for all $C_\varphi^\alpha$-bounded or $C_\varphi^\alpha$-summable sequences $\{nu_N\}$ (theorem 2).

These theorems are generalized for double series (Theorems 3 and 4).

Submitted on 3 June 1961.

134. Calculating Nonlinear Oscillation by Averaging Method

"Certain Kinds of Calculations Connected With Averaging in the Theory of Nonlinear Oscillations," by V. M. Volosov; Moscow, Zhurnal Vychislitel'noy Matematiki i Matematicheskoy Fiziki, Vol 3, No 1, Jan/Feb 63, pp 3-53

The article is in four parts and presents various methods for the solution of nonlinear oscillatory systems. Part 1 discusses methods of N. N. Bogolyubov and D. N. Zubarev (Ukr. Matem. Zh., 7, 1955, pp 5-17) relating to the averaging of systems with shifting phase and certain generalizations of the method of averaging. In Part 2, a method of averaging is applied to nonlinear oscillatory systems with slowly varying parameters. Peculiarities of systems which are nearly Hamiltonian are investigated. In part 3, systems with one degree of freedom are studied, and methods of solving them are developed. Part 4 consists of a number of concrete examples illustrating the various methods presented. The amplitude of the oscillations of certain actual mechanical models is calculated.

135. Using Operator Calculus in Problems of Analysis

"Some Applications of Operator Calculus in Problems of Analysis," by N. A. Jeller; Moscow, Zhurnal Vychislitel'noy Matematiki i Matematicheskoy Fiziki, Vol 3, No 1, Jan/Feb 63, pp 71-78

V. A. Ditkin (Uspekhi Matem. Nauk, 2, Issue 6, 1947, pp 72-158) has devised an operator calculus for the operator D = d/dt by means of an integral Laplace transform. In this article is presented a method for developing an operator calculus which makes use of an operator calculus already known. This method makes it relatively simple to obtain solutions for certain differential equations, to calculate definite integrals containing special functions, to sum series, etc.

136. Discontinuous Solutions of Quasilinear Equations

"Obtaining Discontinuous Solutions of Systems of Quasilinear Equations, Part II," by B. L. Rozhdestvenskiy; Moscow, Zhurnal Vychislitel'noy Matematiki i Mtematicheskoy Fiziki, Vol 3, No 1, Jan/Feb 63, pp 70-98

This is the second part of an article which was begun by the author in an earlier issue of the same journal (Vol 2, No 6, 1962, pp 1019-1043). In Part I, the author presented a method of successive approximations for discontinuous solutions of the Cauchy problem:

$$\frac{\partial u_i}{\partial t} + \frac{\partial \varphi_i(u,t,x)}{\partial x} = \overline{f_i}\,(u,t,x) \quad (i = 1,2); \qquad u = \{u_1; u_2\};$$

$$u(0,x) = u^\circ(x); \quad r(0,x) = r^\circ(x); \quad |x| \le a,$$

where $r = r(u,t,x) = \{r_1(u,t,x), r_2(u,t,x)\}$ are Riemann invariants.

In Part II, the convergence of the method of successive approximations is discussed, and examples of systems of quasilinear equations satisfying conditions set up in Part I are given. Convergence is proven for the conditions $R_2(r_1^\circ(+0), r_1^\circ(-0), r_2^\circ(-0), 0,0) < r_2^\circ(+0)$, and $R_2(r_1^\circ(+0), r_1^\circ(-0), r_2^\circ(-0), 0,0) > r_2^\circ(+0)$. Convergence is discussed for the case in which the derivatives of the initial functions are unbounded. The uniqueness of discontinuous solutions is also discussed. Finally, discontinuous solutions for a system of hydrodynamic equations are considered.

137. Interpolation With Random Points

"Interpolation With Random Points," by S. M. Yermakov; Moscow, Zhurnal Vychislitel'noy Matematiki i Matematicheskoy Fiziki, Vol 3, No 1, Jan/Feb 63, pp 186-190

The author considers the problem of interpolation with random points which are distributed according to a law formulated in Teoriya Veroyatnostey i yeye Primeneniya (5, Issue 4, 1960, pp 473-476). A simple numerical method of interpolation and calculation of an integral by a random process is given for a special case.

138. Closure of Partially Ordered Sets

"Remarks on Closures of Partially Ordered Sets," by V. V. Pashenkov; Moscow, Uspekhi Matematicheskikh Nauk, Vol 17, No 6, Nov/Dec 62, pp 155-162

In the article, the requirement of minimality placed on the closure L of a partially ordered set P is put in a form satisfying the following definition: A complete lattice L is called "the closure of a partially ordered set P" if $L \supset P$ preserves all exact bounds of the sets of elements existing in P and contains no complete sub-lattice $L_1 \neq L$ possessing these same properties (i.e., $L_1$ is complete, $P \subseteq L_1$ and $L_1$ preserves exact bounds of P).

The equivalence of the following conditions is proven for the closure L of a partially ordered set P:

(1) Lattice L is isomorphic over P to the closure of the set P by cuts.

(2) Lattice L contains no subset $L' \neq L$ which, relative to the induced lattice of order L, would not be a closure for P.

(3) Any element $x \neq 0$ of the closure L of a partially ordered set P is an exact upper bound of elements of P, and, in addition, any element $x \neq 1$ of L is an exact lower bound for some subset of elements of P.

Submitted on 2 July 1960.

139. Theorem on Homeomorphisms and Smoothness of Solutions to Elliptic Equations

"A Theorem on Homeomorphisms and Local Increase in Smoothness Up to the Boundary of Solutions to Elliptic Equations" (presented by Academician I. G. Petrovskiy, 21 August 1962), by Yu. M. Berezanskiy, S. G. Kreyn, and Ya. A. Roytberg, Institute of Mathematics of the Academy of Science Ukranian SSR, Voronezh State University, Stanislav Pedogagical Institute; Moscow, Doklady Akademii Nauk SSSR, Vol 148, No 4, 1 Feb 63, pp 745-748

In this article, a theorem is proven relating to homeomorphisms, brought about by an ellipticoperator, for the case of general homogeneous boundary value conditions. The application of the therorem to a local increase in smoothness up to the limit of the generalized solutions, appearing as elements of spaces with negative norms, is given.

140. Application of Fourier Method to Solution of Hyperbolic Equations

"Applicability of a Fourier Method to the Solution of a Mixed Problem for a Class of Quasilinear Hyperbolic Equations" (presented by Academician I. N. Vekua, 1 August 1962), by A. I. Guseynov and K. K. Gasanov, Azerbaydzhan State University imeni S. M. Kirov; Moscow, Doklady Akademii Nauk SSSR, Vol 148, No 4, 1 Feb 63, pp 761-764

The paper is concerned with different solutions of a mixed problem for a quasilinear hyperbolic equation of the form

$$\frac{\partial^2 u}{\partial t^2} = Lu + f(\lambda, t, x, u, u_t, u_{x_1}, \ldots, u_{x_n}),$$

with initial conditions $u|_{t=0} = \varphi(x)$, $\frac{\partial u}{\partial t}\Big|_{t=0} = \psi(x)$ and the boundary value condition $u|_S = 0$, in an n-dimensional region of points $x = (x_1, x_2, \ldots, x_N)$. S is the boundary of the region; $\lambda$ is a parameter; and L is a linear self-conjugate operator

$$Lu \equiv \sum_{i,j=1}^{N} \frac{\partial}{\partial x_i}\left( a_{ij}(x) \frac{\partial u}{\partial x_j} \right) - a(x)\, u$$

whose coefficients satisfy the conditions $a(x) \geq 0$, $a_{ij}(x) = a_{ji}(x)$,

$$\sum_{i,j=1}^{N} a_{ij}(x)\, \xi_i \xi_j \geq \alpha \sum_{i=1}^{N} \xi_i^2, \quad \alpha = \text{const} > 0.$$

Submitted on 30 July 1961.

141. Infinite Simple Groups

"Remarks on Infinite Simple Groups," by M. S. Tsalenko; Moscow Sibirskiy Matematicheskiy Zhurnal, Vol 4, No 1, Jan/Feb 63, pp 227-231

G. Higman, B. H. Neumann, and H. Neumann (J. Lond. Math. Soc., 24, 1949, pp 247-254) proved that an arbitrary torsion-free group can be embedded in a group with two classes of conjugate elements. In this article, it is proven by the same method that an arbitrary group can be embedded in a simple group. However, in this case the same power is proven for a simple group as for a primative group (if it is infinite), and in each group obtained, all elements of the same order are conjugate. From this follows the embedding of an arbitrary group in a complete, simple group whose elements have this same property.

In particular, it is proven in this article that the power of a set of nonisomorphic simple groups of power m is equal to $2^m$.

Submitted on 20 May 1961.

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UNCLASSIFIED
Central Intelligence Agency

Washington, D.C. 20505

7 September 2004

Ms. Roberta Schoen
Deputy Director for Operations
Defense Technical Information Center
7725 John J. Kingman Road
Suite 0944
Ft. Belvoir, VA 22060

Dear Ms. Schoen:

In February of this year, DTIC provided the CIA Declassification Center with a referral list of CIA documents held in the DTIC library. This referral was a follow on to the list of National Intelligence Surveys provided earlier in the year.

We have completed a declassification review of the "Non-NIS" referral list and include the results of that review as Enclosure 1. Of the 220 documents identified in our declassification database, only three are classified. These three are in the Release in Part category and may be released to the public once specified portions of the documents are removed. Sanitization instructions for these documents are included with Enclosure 1.

In addition to the documents addressed in Enclosure 1, 14 other documents were unable to be identified. DTIC then provided the CDC with hard copies of these documents in April 2004 for declassification review. The results of this review are provided as Enclosure 2.

We at CIA greatly appreciate your cooperation in this matter. Should you have any questions concerning this letter and for coordination of any further developments, please contact Donald Black of this office at (703) 613-1415.

Sincerely,

Nancy Dates Sanfo

Sergio N. Alcivar
Chief, CIA Declassification Center,
Declassification Review and Referral
Branch

Enclosures:

1. Declassification Review of CIA Documents at DTIC (with sanitization instructions for 3 documents)
2. Declassification Status of CIA Documents (hard copy) Referred by DTIC (with review processing sheets for each document)

# Processing of OGA-Held CIA Documents

**The following CIA documents located at DTIC were reviewed by CIA and declassification guidance has been provided.**

| OGA Doc ID | Job Num | Box | Fldr | Doc | Doc ID | Document Title | Pub Date | Pages | Decision | Proc Date |
|---|---|---|---|---|---|---|---|---|---|---|
| AD0336215 | 78-03117A | 197 | 1 | 25 | 4482 | Scientific Information Report Physics And Mathematics (27) | 4/12/1963 | 68 | Approved For Release | 3/29/2004 |
| AD0337652 | 78-03117A | 200 | 1 | 4 | 4579 | Scientific Information Report Physics And Mathematics (28) | 5/10/1963 | 61 | Approved For Release | 3/29/2004 |
| ADB810944 | 78-04392A | 65 | 1 | 130 | 21179 | Investigation Of The Structure Of Metals With An Electron Microscope | 1/26/1952 | 14 | Sanitized | 3/29/2004 |
| ADC051409 | 78-04392A | 22 | 1 | 152 | 6751.49 | Measuring The Partial Beta-Spectrum Of ThB By The Method Of Coincidences With The Aid Of A Double Beta-Spectrometer | 12/12/1949 | 3 | Sanitized | 3/29/2004 |

**The CIA has reviewed 220 DTIC documents with 41,108 pages**