USSR

ACCESSION NR: AP4002952 S/0286/63/000/018/0028/0029

AUTHOR: Bonch-Bruyevich, A. M.

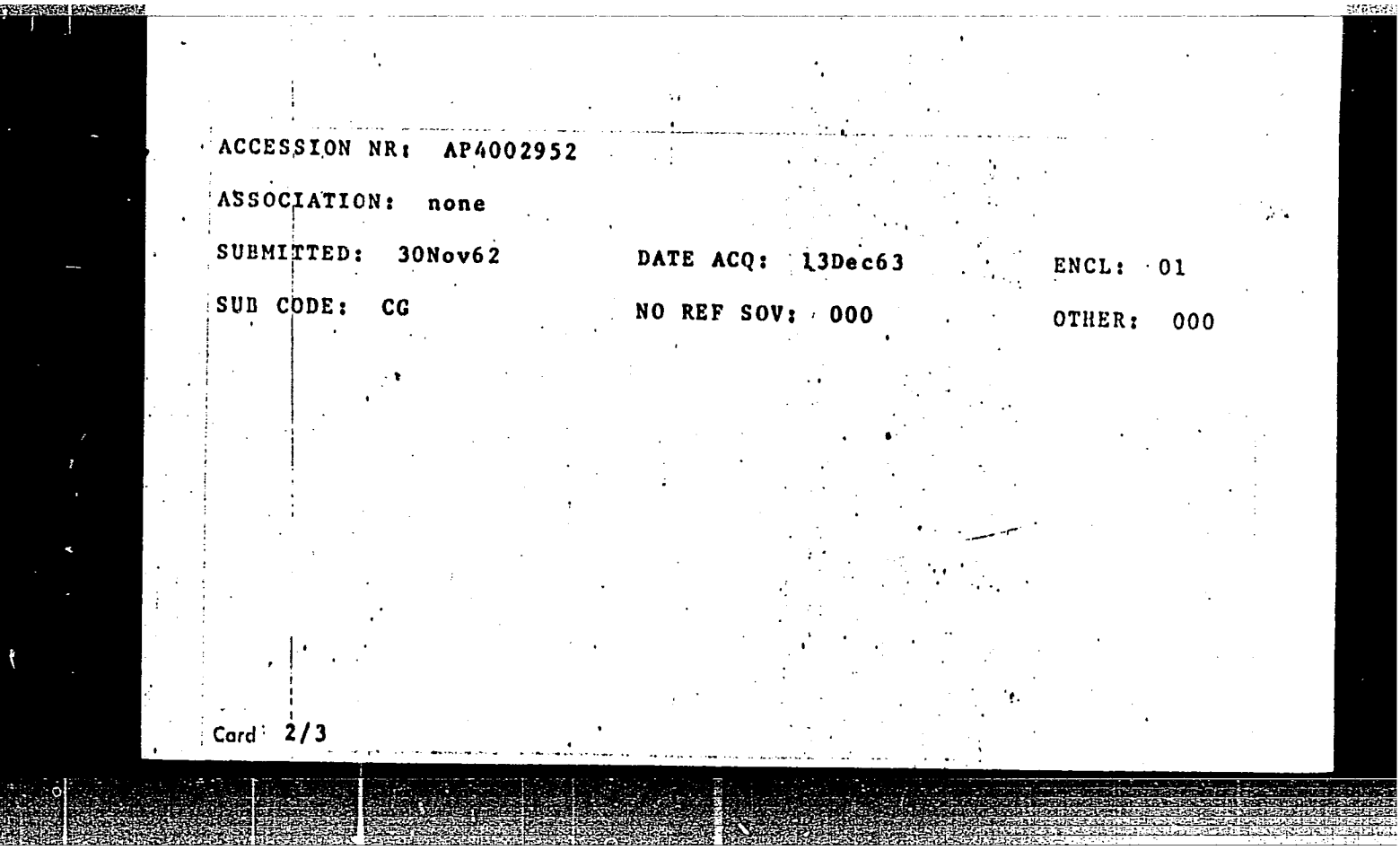
TITLE: Optimalizing control system. Class 21, No. 157390

SOURCE: Byul. izobret. i tovarn. znakov, no. 18, 1963, 28-29

TOPIC TAGS: optimalizing control system, optimalizing control, step by step regulator, automatic optimization

ABSTRACT: This Author Certificate introduces an extremum-seeking control system containing a step-by-step regulator, a unit for adjusting the controlled variable, a memory unit, and a synchronization unit. A second step-by-step regulator is used to achieve high accuracy in maintaining extreme values of the performance function. The output of the second regulator is connected to the adder and the output of the first regulator is comected to the second input of the adder. The output of the adder is then connected through a divider to the unit which adjusts the controlled variable. Orig. art. has: 1 figure.

Card 1/ 3



ACCESSION NR: AP4002952

ASSOCIATION: none

SUBMITTED: 30Nov62 DATE ACQ: 13Dec63 ENCL: 01

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

Card 2/3

ACCESSION NR: AP4002952

ENCLOSURE: 01

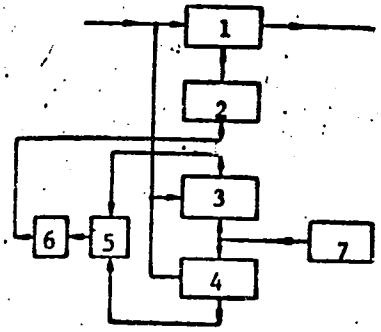


Fig. 1. Optimalizing control system

1 - Controlled object; 2 - unit for setting the controlled variable unit; 3 - first step-by-step regulator; 4 - second step-by-step regulator; 5 - adder; 6 - divider 7 - memory unit.

Card 3/3

BONCH-BRUYEVICH, A.M.

AID Nr. 995-19 21 June

LUMINESCENCE AND STIMULATED EMISSION OF NEODYMIUM-ACTIVATED GLASS (USSR)

Feofilov, P. P., A. M. Bonch-Bruyevich, V. V. Vargin, Ya. A. Imas, G. O. Karapetyan, Ya. Ye. Kriss, and M. N. Tolstoy. IN: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 27, no. 4, Apr 1963, 466-472. S/048/63/027/004/002/026

Studies of luminescence and induced emission of neodymium-doped glass have been carried out, and optimum glass composition was determined. Glasses were developed which are superior to those used by E. Snitzer. Absorption and luminescence spectra were obtained, and the dependence of the duration of luminescence on concentration was determined. Induced emission was observed both in glass fibers encased in glass and in highly homogeneous glass cylinders. The dependence of time characteristics and spectral composition of induced emission on pumping energy was established. The prospects of application of the material to practical lasers and to study of induced emission phenomena are discussed. [BB]

Card 1/1

ALEKSANDROV, Ye.B.; BONCH-BRUYEVICH, A.M.; KHODOVOY, V.A.

Spin exchange. Izv. AN SSSR. Ser. fiz. 27 no.8:1070-1077 Ag '63. (MIRA 16:10)

L 13145-65 EWT(d)/EPF(n)-2/EWP(1) Po-4/Pq-4/Pg-4/Pae-2/Pu-4/Pk-4/Pl-4 SSD/
IJP(c)/AFETR/AFMDC/AEDC(a)/ASD(d)/ASD(a)-5/AFTC(p) WW/BC

ACCESSION NR: AP4049187 S/0102/64/000/005/0031/0035

AUTHOR: Bonch-Bruyevy*ch, A. M. (Bonch-Bruyevich, A. M.)(Moscow)

TITLE: Optimization of the threshold level of a decision device

SOURCE: Avtomaty*ka, no. 5, 1964, 31-35

TOPIC TAGS: automatic control, automatic control design, automatic control system, automatic control theory

ABSTRACT: The securing of the minimum total probability of error in discerning a noise-distorted received signal by means of a threshold-type decision device is analyzed. The problem can be solved by using either a searching extremal controller or a feedback controller. Both controllers are compared from the viewpoint of their noise immunity. Curves of the performance quality index vary their shape and position with the signal-to-noise ratio; this feature is peculiar to

Card 1/2

L 13545-65
ACCESSION NR: AP4049187

the decision device regarded as a controlled plant. Orig. art. has: 4 figures and 7 formulas.

ASSOCIATION: none

SUBMITTED: 13Apr64 ENCL: 00

SUB CODE: IE NO REF SOV: 004 OTHER: 000

Card 2/2

L 16970-65 EWG(j)/EWA(k)/FBD/EWT(1)/EEC(k)-2/EEC(t)/T/EEC(b)-2/EWP(k)/EWA(h)/
EWA(m)-2 Pr-4/Po-4/Pf-4/Pi-4/Pl-4/Peb IJP(c)/BSD/SSD/ASD(a)-5/APETR/RAEM(a)/
AFWL/AFTC(p)/ESD(gs)/ESD(t) WG
ACCESSION NR: AP5001062 S/0286/64/000/022/0029/0030

AUTHORS: Bonch-Bruyevich, A. M.; Imas, Ya. A.; Molchanov, V. A.

TITLE: A stimulated emission generator (laser). Class 21, No. 166382

SOURCE: Byulleten' izobreteniy i tovarnykh znakov, no. 22, 1964, 29-30

TOPIC TAGS: laser

ABSTRACT: This Author Certificate represents a laser containing an operating body in the form of a parallelepiped and of a prism with total internal reflection. To increase the concentration of the energy beam and the brightness of the radiation, prisms of total internal reflection are displaced relative to each other.

ASSOCIATION: Leningradskiy gosudarstvennyy opticheskiy institut im. S. I. Vavilova (Leningrad State Optical Institute)

SUBMITTED: 02Sep63 ENCL: 00

SUB CODE: EC, OP NO REF SOV: 000 OTHER: 000

Card 1/1

L 62976-65 EWA(k)/FBD/EWG(r)/EWT(l)/EEC(k)-2/T/EEC(b)-2/EWP(k)/EWA(m)-2/EWA(h)
SCTB/IJP(c) WG

ACCESSION NR: AR5019160 UR/0272/65/000/007/0007/0007
UDC389:621.375.8:621.317.337

42
B

SOURCE: Ref. zh. Metrologiya i izmeritel'naya tekhnika. Otdel'nyy vypusk, Abs. 7.32.51

AUTHOR: Bonch-Bruyevich, A. M.; Imas, Ya. A.; Sokolov, A. P. 44,55

TITLE: Elimination of parasite modes in induced emission lasers 25,44,55

CITED SOURCE: Zh. prikl. spektroskopii, v. 1, no. 1, 1964, 80-83

TOPIC TAGS: induced emission laser, parasitic trapped mode, crystal surface frosting, laser emission

TRANSLATION: The authors discuss a method of eliminating parasitic oscillations on modes trapped on crystals inside the laser's working medium. It is proposed that the Q-factor be reduced sharply for the cited modes by frosting areas of side surfaces of the crystals. Experimental results and recommendations on selecting frosting techniques are given. Bibl. with 2 titles; 2 illustrations

SUB CODE: EC, OP ENCL: 00

Card 1/1

L 63053-65 EEO-2/EWT(d)/EED-2 Pn-4/Pj-4
ACCESSION NR: AP5013028 UR/0106/65/000/005/0007/0014
621.396:621.34-506

AUTHOR: Levin, G. A.; Bonch-Bruyevich, A. M. 18 6

TITLE: Synthesizing detectors with a self-optimizing threshold level in radio-communication receivers 40

SOURCE: Elektrosvyaz', no. 5, 1965, 7-14

TOPIC TAGS: radio detector, optimal detector

ABSTRACT: A brief review is presented of ways to synthesize decision devices intended for simple binary detecting of signals pertaining to a pulse-code sequence distorted by noise. The open-loop threshold-control detectors are most complicated because measuring the signal-to-noise ratio requires complex receiving and transmitting equipment. The closed-loop threshold-control detectors are much simpler and can operate within a wide signal-to-noise ratio range without any essential reduction of the accuracy of threshold determination; such detectors,

Card 1/2

L 63053-65
ACCESSION NR: AP5013028

however, require knowledge of an a-priori probability p(1); this limitation is very important in a communication system. Detectors with an extremal search system of threshold control permit determining the optimal threshold in the cases when error-detecting codes are used and when p(1) is unknown. The time of determining the optimal threshold is longer (because of the time loss for searching) than in other types of detectors. Besides, the searching may cause errors in the setting of the threshold level, the errors increasing with the signal-to-noise ratio; in this case, the radius of curvature of the control-performance function increases, and with the increasing signal-to-noise ratio, no proportional increase of the detection probability results. Orig. art. has: 5 figures and 3 formulas.

ASSOCIATION: none

SUBMITTED: 17Aug64 ENCL: 00 SUB CODE: EC

NO REF SOV: 012 OTHER: 001

Card 2/2

L 8099-66 EWT(1)/EWA(h)

ACC NR: AP5027020 SOURCE CODE: UR/0120/65/000/005/0110/0113

AUTHORS: Aleksandrov, Ye. B.; Bonch-Bruyevich, A. M.; Koklov, V. P. 42 B

ORG: State Optical Institute, Leningrad (Gosudarstvennyy opticheskiy institut)

TITLE: Observing signal shapes at high noise levels by means of multiple oscillographs 25

SOURCE: Pribory i tekhnika eksperimenta, no. 5, 1965, 110-113

TOPIC TAGS: signal to noise ratio, signal shape, signal distortion, oscillograph

ABSTRACT: Two methods are described for obtaining signal shapes on oscillograms with noise levels four times larger in amplitude than the original signal. The first method involves a cumulative photographic technique consisting of multiple exposure of the same film to a large number of oscillograph displays of the recurring signal. The film is then developed and treated photometrically, and the

Card 1/2 UDC: 621.391.828

L 8099-66

ACC NR: AP5027020

0

original signal is recovered with great accuracy from the excessive background noise. This method is shown to be simpler and more advantageous than the stroboscopic technique presently in common use. The second method involves a cumulative photoelectric process which is a variation of the stroboscopic technique. It is based on the use of a narrow slit placed in front of the oscillograph and covered by an optical key with density gradients which can transform signal ordinates into light signals. These, in turn, pass through an RC integrating circuit and a photomultiplier which gradually increases the signal-to-noise intensity ratio. The signal is then registered on an automatic recorder. Orig. art. has: 3 figures. [04]

SUB CODE: 09/ SUBM DATE: 08Aug64/ ORIG REF: 006/ OTH REF: 003/ ATD PRESS: 4146

Card 2/2 pw

BONCH-BRUYEVICH, A.M. [Bonch-Bruievych, A.M.] (Moskva); MILOKHIN, M.T. (Moskva)

History of the origination of optimalizing control systems. Avtomatyka 10 no.3:79-84 '65. (MIRA 18:7)

L 36198-65 EWA(h)/EWT(1) Peb

ACCESSION NR: AP5007084 S/0109/65/010/003/0403/0412

AUTHOR: Levin, G. A.; Bonch-Bruyevich, A. M.

TITLE: Ultimate probability of the detection error of a decision device having a quasi-optimal threshold

SOURCE: Radiotekhnika i elektronika, v. 10, no. 3, 1965, 403-412

TOPIC TAGS: quasioptimal detector, decision device

ABSTRACT: A decision-device-type detector having a quasi-optimal threshold is theoretically considered. Formulas for the optimal and quasi-optimal thresholds are developed for the cases of normal and Rayleigh laws of joint distribution of signal and noise density at the detector input. Plots of these thresholds vs. signal-to-noise ratio are presented. A principle (block diagram) of synthesizing a quasi-optimal detector with a self-adaptive level is indicated; it is connected with formulas (10) and (12). It is found that: (1) The quasi-optimal threshold

Card 1/2

L 36498-65

ACCESSION NR: AP5007084

value quickly converges to the optimal value as the signal-to-noise ratio increases; (2) The noise immunity of a quasi-optimal detector is only slightly lower than that of an optimal detector and approaches the latter asymptotically as the signal-to-noise ratio increases; here, the "noise immunity" means an ultimate probability of the siganl-detection error at the output of a threshold-type detector; (3) With a specified measurand, the quasi-optimal detector is a closed-loop control system comprising a variable threshold device and an automatic stabilizer of the error-probability increment Δp. Orig. art. has: 5 figures and 40 formulas.

ASSOCIATION: none

SUBMITTED: 21Oct63 ENCL: 00 SUB CODE: EC, DP

NO REF SOV: 011 OTHER: 001

Card 2/2

ALEKSANDROV, Ye.B.; BONCH-BRUYEVICH, A.M.; KOZLOV, V.P.

Observation of the signal shape in the presence of a high noise level by means of repeated oscillographing. Prib. i tekh.eksp. 10 no.5:110-113 S-O '65.

(MIRA 19:1)

1. Gosudarstvennyy opticheskiy institut, Leningrad. Submitted Aug.8, 1964.

L 14627-66 EWT(1)
ACC NR: AP5025309 SOURCE CODE: UR/0051/65/019/004/0643/0645

AUTHOR: Bonch-Bruyevich, A.M.; Razumova, T.K.

ORG: none

TITLE: Dependence of duration of radiation on wavelength within the contour of the luminescence line at a high excitation level

SOURCE: Optika i spektroskopiya, v. 19, no. 4, 1965, 643-645

TOPIC TAGS: luminescence quenching, ruby, chromium, neodymium, glass

ABSTRACT: Luminescence kinetics associated with a considerable population of the upper excited metastable states, when the role of induced radiation is substantial, were studied on ruby single crystals with Cr^{3+} ion concentrations of 0.02 and 0.04 wt. % and on silica-barium oxide glasses containing Nd^{3+} ions in the amount of 6 mole %. The results are interpreted by taking into consideration the change in the ratio of spontaneous to induced radiation as the excitation level is varied, and also during luminescence quenching. The change in the number of excited states at the end of the excitation is described in a general form by the expression

$$\frac{dn_M}{dt} = -A_{MF}n_M + B_{FM}\rho(n_F - \frac{g_F}{g_M} n_M),$$

Card 1/2 UDC: 535.373.3

where n_M and g_F are the population and statistical weight of the final level, and n_M and g_M are those of the metastable level; ρ is the radiation density in the spectral region studied in the volume of the sample; A_{MF} and B_{FM} are the Einstein coefficients. In the case of Nd^{3+} for the line with $\lambda_{max} = 1.06\mu$, this expression is simplified:

$$\frac{dn_M}{dt} = -A_{MF}n_M - B_{MF}\rho n_M.$$

When the value of n_M and hence ρ is large, induced radiation plays an important part. From this it is shown that during quenching, owing to the change in the contour of the line, its central part should quench faster than the lateral parts, i.e., the rate of luminescence quenching within the bounds of the radiation line should depend on λ; this is confirmed by the experiment. Authors thank B. A. Kiselev, who kindly supplied the monochromator. Orig. art. has: 2 figures and 2 formulas.

SUB CODE: 20 / SUBM DATE: 18Feb65 / ORIG REF: 005/OTH REF: 006

Card 2/2

L 10789-66 EPD/EWT(l)/EWP(e)/EWT(m)/EEC(k)-2/EPF(n)-2/T/EWP(k)/EWA(m)-2/EWA(h)/
ACC NR: AP6001660 ETC(m) SCTB /IJP(c) SOURCE CODE: UR/0051/65/019/006/0982/0984
44,55 WG/WW/WH 44,55 44,55 44,55

AUTHOR: Aleksandrov, Ye. B.; Bonch-Bruyevich, A. M.; Kostin, N. N.; Khodovoy, V. A.

ORG: none

TITLE: Stimulated Raman scattering in a selective resonator

SOURCE: Optika i spektroskopiya, v. 19, no. 6, 1965, 982-984

TOPIC TAGS: laser, Raman scattering, stimulated emission, laser cavity, Raman laser

ABSTRACT: The stimulated Raman scattering was investigated at an excitation power just above the threshold using the following three different setups: 1) a Raman cell in the resonator of a laser; 2) a longitudinal selective resonator (the term used by the authors for the case when the Raman laser resonator is in the direction of the ruby laser resonator); and 3) a transverse selective resonator (the term used for the case when the Raman laser resonator is rotated 90° from the direction of the axis of the ruby laser, i.e., a 90° off-axis Raman laser resonator). In the first setup the giant pulses were produced by a ruby crystal. Using two variable-transmission-coefficient filters (transmission coefficient 30—50% at λ = 694 mμ) the effective intensity of the 30—300 nsec-duration pulses in the resonator reached 100 Mwt/cm^2. The maximum energy per pulse was 3—4 j. Two dielectric mirrors with a transmission coefficient of 0.4% at λ = 694 mμ, 0.8% at λ 745 mμ (the fundamental

Card 1/2 UDC: 535.375+621.375.9:535

L 10789-66

ACC NR: AP6001650

SRS line in benzene), 40% at λ = 805 mμ (first harmonic) and 70% at λ = 875 m (second harmonic) were used in the experiments. The SRS in benzene had thresholds for a specified length of the Raman cell (l) and the laser input power. No SRS was observed at l < 2; however, SRS was stable for 5 < l < 60 cm. The threshold power decreased almost linearly with increasing l. At l = 60 cm the efficiency of energy conversion reached 10% of the power in the cavity. It was observed that an increase in the energy of the pulses from the ruby 1.5—2 times above the threshold resulted in a three-order increase in SRS. In the longitudinal selective setup the additional reflector between the ruby rod and the Raman cell had a transmission coefficient of 90% at λ = 694 mμ, 10% at λ = 745 μ, and 1% at λ = 805 and 875 mμ. In this mode of operation the efficiency of energy conversion was at least as high as that in the previous case. Two higher harmonics at λ = 745 and 805 mμ which reached saturation at ~10% of the input power were observed. Results similar to those of the longitudinal setup were achieved with a transverse selective setup. However, SRS was achieved in a Raman cell the length of which along the laser beam was only 1 cm. Stimulated Brillouin scattering in benzene was also observed in this setup. Orig. art. has: 1 figure. [CS]

SUB CODE: 20 SUBM DATE: 15Apr65/ OTH REF: 004/ ATD PRESS: 4168

Card 2/2

BONCH-BRUYEVICH, A.M.; RAKOVSKIY, A.R.

Brief news. Radiotekhnika 20 no.5:78-80 My '65.

(MIRA 18:10)

1. Deystvitel'nyye chleny Nauchno-tekhnicheskogo obshchestva radiotekhniki i elektrosvyazi imeni Popova.

L 10242-66 FBD/EWT(l)/EWP(e)/EWT(m)/EEC(k)-2/T/EWP(k)/EWA(m)-2/EWA(h) SCTB/IJP(c)

ACC NR: AP6000197 WG/WH SOURCE CODE: UR/0056/65/049/005/1435/1444

55 44 55 44 55 44

AUTHOR: Aleksandrov, Ye. B.; Bonch-Bruyevich, A. M.; Kostin, N. N.; Khodovoy, V. A.

ORG: none

TITLE: Investigation of stimulated Raman and Brillouin scattering in selective resonators

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 5, 1965, 1435-1444

TOPIC TAGS: laser, second harmonic nonlinear optics, Raman scattering, Brillouin scattering, resonator

ABSTRACT: The stimulated Raman scattering was investigated at an excitation power just above the threshold using the following three different setups: 1) a Raman cell in the resonator of a laser; 2) a longitudinal selective resonator [the term used by the authors for the case when the Raman laser resonator is in the direction of the ruby laser resonator]; and 3) a transverse selective resonator [the term used for the case when the Raman laser resonator is rotated 90° from the direction of the axis of the ruby laser, i.e., a 90° off-axis Raman laser resonator] (see Fig. 1). In the first setup (Fig. 1a) the giant pulses were produced by a ruby crystal 10 to 12 cm long and 12—16 mm in diameter. With two variable-transmission-coefficient filters (transmission coefficient 10—80% at λ = 6943 Å) the effective intensity of

Card 1/4

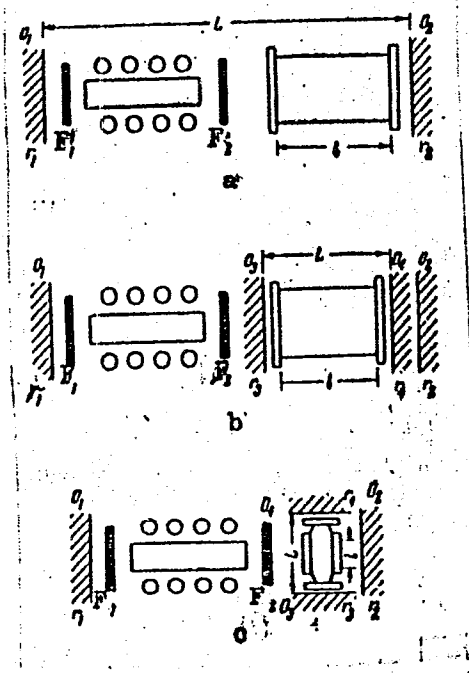


Fig. 1. The experimental setup

a - SRS in the ruby laser resonator; b - SRS in the longitudinal selective resonator; c - SRS in the transverse selective resonator.

L - resonator length for scattered radiation; l - length of the "active" path for the scattered radiation in the resonator; 0 - mirrors; r - coefficient of reflection; F - variable coefficient of absorption filters.

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000206210009-1"

the 20—200 nsec-duration pulses in the resonator reached 100 Mwt/cm^2. The maximum energy per pulse was 5—6 j. Two dielectric mirrors O_1 and O_2 with a transmission coefficient of 0.4% at λ = 694 mμ, 0.8% at λ = 745 mμ (the fundamental SRS line in benzene), and 40% at λ = 805 mμ (the first harmonic) were used in the experiments. The sensitivity of the detectors was sufficient to register 10^{-4} of the energy of the laser pulse. The setup shown in Fig. 1a was used to investigate SRS in benzene. It was observed that an increase in the energy of the pulses from the ruby laser 1.5—2 times above the threshold resulted in a three-order increase in SRS at the fundamental frequency. Saturation was reached when the intensity of SRS was about 10% of the energy input, at which time the second harmonic whose energy output quickly reached the level of SRS at the fundamental frequency (at saturation), appeared. When the second harmonic reached saturation the duration and the intensity of the laser pulses decreased sharply due to the reverse effect of SRS on the ruby laser pulses. When the length of the Raman cell (l) was increased, the threshold power and the pulse energy required to achieve SRS decreased. Also, the larger the cell, the smaller the energy above the threshold at which second harmonics were generated. The SRS was stable when l was between 5 and 60 cm. In the longitudinal selective setup (Fig. 1b) reflector O_2 replaced O_4 and the transmission coefficient of O_3 was very high at λ = 694 mμ and was at a minimum at λ = 745 mμ. The gain of SRS at l = 5, 20, and 60 cm was at least as high as in the previous case, although the pump power and the pulse energy required were considerably smaller. For example, when the output of a ruby laser pulse of 30 nsec duration was 40 Mw (l = 20 cm) three 10 Mw SRS pulses of 20 nsec duration were observed in the Raman laser cell. Similar re-

ACC NR: AP6000197

sults were obtained using the selective transverse setup shown in Fig. 1c. The authors also observed stimulated Brillouin scattering in benzene, carbon disulfide, and nitrobenzene (the angle of the exciting beam was 90°). Use of the 90° off-axis Raman laser made it possible to obtain stimulated Brillouin scattering at lower pump power. Orig. art. has: 5 figures and 1 table. [CS]

SUB CODE: 20/ SUBM DATE: 15Jun65/ ORIG REF: 003/ OTH REF: 015/ ATD PRESS: 4161

Card 4/4

L 41369-65 EWT(1)

ACCESSION NR: AP5004258 S/0053/65/085/001/0003/0064

AUTHOR: Bonch-Bruyevich, A. M.; Khodovoy, V. A. 5 B

TITLE: Multiphoton processes 21

SOURCE: Uspekhi fizicheskikh nauk, v. 85, no. 1, 1965, 3-64

TOPIC TAGS: multiphoton process, nonlinear optics, quantum effect, laser effect, nonlinear process, frequency conversion, harmonic generation, Raman scattering, parametric resonance

ABSTRACT: The present review of multiphoton processes is based on 145 references published prior to July 1964. Only 21 of the references are Soviet. The review is divided into 3 sections. The first section is devoted to the basic theory of multiphoton processes and to a general review of experiments performed in this field. The second section deals with multiphoton processes not requiring consideration of the interference effects. An analysis is presented of multiphoton transitions between Zeeman sublevels of sodium occurring in a rotating field and in a field applied in any arbitrary direction. An analysis is made of two-photon absorption in CaF_2 doped with Eu^{2+},

Card 1/2

L 41369-65

ACCESSION NR: AP5004258

cesium vapor, liquids in which Raman scattering can be generated, and in KJ crystals. Two-photon excitation of fluorescence in anthracine is also discussed. The third section is a review of multiphoton processes requiring consideration of interference effects. This section is divided into two parts. Part one is an analysis of processes associated with interference effects in each atom of an ensemble (level crossing and parametric resonance). Part two deals with multiphoton processes associated with interference effects in an ensemble on noninteracting systems. This last subdivision deals with harmonic generation in the SHF frequency range, second harmonic generation in the optical range, and certain effects in Raman scattering of laser radiation. Orig. art. has: 71 formulas, 30 figures, and 4 tables.

[CS]

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: NP, OP

NO REF SOV: 021 OTHER: 124 ATD PRESS: 3196

mel

Card 2/2

L 27744-66 EWT(1) IJP(c) GG/WW

ACC NR: AP6018698 SOURCE CODE: UR/0386/66/003/011/0425/0429

60
56
B

AUTHOR: Bonch-Bruyevich, A. M.; Kostin, N. N.; Khodovoy, V. A.

ORG: none

TITLE: Resonant birefringence in the electric field of a light wave

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 3, no. 11, 1966, 425-429

TOPIC TAGS: potassium, double refraction, laser application, resonance absorption, light absorption

ABSTRACT: The authors observed the occurrence of birefringence in potassium vapor under the influence of the electric field of ruby laser emission by passing simultaneously light from a potassium lamp and from a ruby laser through a vessel containing saturated potassium vapor at 150C. At this temperature, the vapor absorbed approximately 50% of the resonant light from the lamp. When the laser pulse was applied (20 nsec duration), a clear-cut signal was observed, indicating an increase in the resonant radiation from the lamp passing through the vessel. At a laser emission power density of the order of 5 Mw/cm^2 the amplitude of the signal corresponded to transmission of several times ten per cent of the intensity of the light from the lamp. The greatest signal was observed when the lamp radiation and laser emission electric fields were at a 45° angle. There was no signal when this angle was 0 or 90°. There was likewise no signal when the potassium vapor in the vessel

Card 1/2

was frozen out, when the potassium lamp was turned off, or when the filters used to polarize the light were removed. The latter, together with the dependence of the signal on the angle between the electric vectors, proves that the observed effect is due to birefringence induced by the laser pulse because the shift of the absorption line in the laser-emission electric field has different values when the electric vector of the light is parallel and perpendicular to the vector of the laser. The value of this line shift is calculated and the wavelength dependence of the laser emission intensity required to obtain a signal of prescribed magnitude is measured and found to be linear in the wavelength difference between the resonant transition and the laser emission. This agrees with the theoretical calculations. The authors thank V. M. Zakharova and N. A. Vorob'yeva of LGU for the opportunity to measure the line contour with their apparatus, and Ye. B. Aleksandrov for help and a discussion. Orig. art. has: 3 figures and 1 formula.

SUB CODE: 20/ SUBM DATE: 28Mar66/ ORIG REF: 003/ OTH REF: 001

L 29967-65 EWT(1) IJP(c)
ACC NR: AP6002883 SOURCE CODE: UR/0286/65/000/024/0041/0041

INVENTOR: Aleksandrov, Ye. B.; Bonch-Bruyevich, A. M.; Khodovoy, V.A.

ORG: none

31
B

TITLE: Method of measuring the modulus and direction of the vector of force of weak magnetic fields. Class 21, No. 176976

SOURCE: Byulleten' izobreteniy i tovarnykh znakov, no. 24, 1965, 41

TOPIC TAGS: magnetic field measurement, vector, weak magnetic field, magnetic field intensity, paramagnetism, measurement

ABSTRACT: The method of measuring the modulus and direction of the vector of force of weak magnetic fields, based on the optic orientation of atoms, is characterized by the fact that the effect of the action of the measured magnetic field and of the known light intensity on the paramagnetic atoms is compared and the magnetic field strength is determined by the intensity of the orienting light. These characteristics are incorporated in order to widen the measurement range of weak magnetic fields.

SUB CODE: 20/ SUBM DATE: 13Apr64

Card 1/1

L 30171-66 EWT(1) IJP(c)

ACC NR: AP6012510 SOURCE CODE: UR/0181/66/008/004/1291/1293

59
B

AUTHORS: Bonch-Bruyevich, A. M.; Burlakov, A. V.

ORG: none

TITLE: Electroluminescence under unipolar voltage pulses and the mechanism of glow excitation

SOURCE: Fizika tverdogo tela, v. 8, no. 4, 1966, 1291-1293

TOPIC TAGS: electroluminescence, light excitation, luminescence center, impact ionization

ABSTRACT: The authors discuss attempts to reconcile several contradictions in the mechanism customarily proposed to explain the excitation of luminescence centers by electric field pulses, and in particular the fact that according to the currently held hypotheses a difference should exist between luminescence produced by unipolar and bipolar pulses, although recent experiments by one of the authors (Bonch-Bruyevich et al., Opt. i spektr. v. 11, 87, 1961) have proved conclusively that no such difference exists. Several hypotheses advanced to explain this contradiction are briefly discussed and it is concluded that the reason why the symmetry of the luminescence distribution is not connected with the symmetry of the external voltage calls for further research, as does the

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ACC NR: AP0012510

question of the electroluminescence mechanism in general. This calls for a review of the notion that the impact ionization is brought about by a local rise in the field concentration near inhomogeneities. Orig. art. has: 2 figures.

SUB CODE: 20/ SUBM DATE: 09Nov65/ ORIG REF: 005/ OTH REF: 003

Card 2/2

L 42945-66 EWT(d)/EWP(v)/EWP(k)/EWP(h)/EWP(l) GD/BC

ACC NR: AT6017621 (N) SOURCE CODE: UR/0000/65/000/000/0358/0370

AUTHOR: Bonch-Bruyevich, A. M.

ORG: none

TITLE: Self-tuning filter with two optimizers

SOURCE: Vsesoyuznaya konferentsiya po teorii i praktike samonastraivayushchikhsya sistem. 1st, 1963. Samonastraivayushchiyesya sistemy (Adaptive control systems); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 358-370

TOPIC TAGS: electric filter, filter circuit, optimal automatic control, nonlinear automatic control system, signal to noise ratio, receiver signal to noise ratio, signal noise separation, random noise signal

ABSTRACT: An automatic self-tuning filter intended to improve signal-to-noise ratio in receiving equipment is described. Only binary code transmission is considered. Figure 1 shows a receiver in which the output signal is analyzed to derive information for the parameter control. The transfer function is realizable with a filter consisting of a multi-tap delay line, a set of narrow band-pass filters and associated variable attenuators which determine the transmission of the particular portion of the frequency spectrum. The attenuators are continuously adjusted by the optimizer which makes the control decisions on the basis of the gradient of signal to noise ratio in

Card 1/2

Card 2/2 MLP

L 35955-66

ACC NR: AP6027356 SOURCE CODE: UR/0102/66/000/002/0082/0084

AUTHOR: Bonch-Bruyevich, A. M. (Moscow)

22
E

ORG: none

TITLE: Modeling of nonlinear static characteristics of elements with parametric control

SOURCE: Avtomatyka, no. 2, 1966, 82-84

TOPIC TAGS: electronic component, electronic amplifier, automatic control system technology

ABSTRACT: It is shown that the nonlinearity of static characteristics can be readily modeled with the aid of a standard nonlinearity unit. For the amplifier, sensor and servo elements of certain control systems, however, the static characteristics depend not only on the argument x but also on the level of the external effects considered, such as the variation in supply voltage, the variation in the illumination level, etc., and this complicates the modeling because allowance must be made for the parameter p of external influence. This difficulty can be resolved by calculating two auxiliary functions which relate the changes in x* to those in the values of the environmental parameter p.
Orig. art. has: 4 figures. [JPRS: 36,517]

SUB CODE: 09 / SUBM DATE: 02Dec65 / ORIG REF: 002

Card 1/1

L 37000-66 EEC(k)-2/EWP(k)/EWT(l)/EWT(m)/FBD/T/EWP(t)/EWP(b)/EWA(c)/ETC(f) IJP(c)

ACC NR: AP6025255 WH/WG/JD/JG SOURCE CODE: UR/0057/66/036/007/1269/1272

AUTHOR: Bonch-Bruyevich, A. M.; Imas, Ya. A.; Molchanov, V. A.; Pavlenko, N. A.

ORG: none

TITLE: A neodymium glass laser with a rectangular cross-section rod

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 7, 1269-1272

TOPIC TAGS: solid state laser, paramagnetic laser, neodymium glass laser, laser r and d / GSI-1 laser, GSI-1M laser

ABSTRACT: A rectangular-rod neodymium glass laser described by the authors elsewhere (ZhPS, 1, 1, 45-50, 1964) was produced with slight modifications and marketed under the industrial designation GSI-1 (Fig. 1). The GSI-1 is being used currently for scientific research and in the solution of certain technological problems. Its characteristics are essentially the same as those of the laser described earlier, provided the same glasses and resonator mirrors are used. The marked disadvantages of the GSI-1 are the comparatively low effectiveness of its eight IFK-2000 standard flashlamps and its consequent low efficiency (0.3—0.4%), and the saturation of the lamp characteristics. These disadvantages were partly remedied when a rectangular cross-section spiral flashlamp was used instead of the IFK-2000 lamp. This led to a twofold increase in the laser efficiency and increased pulse energy of up to 100 j.

Card 1/4

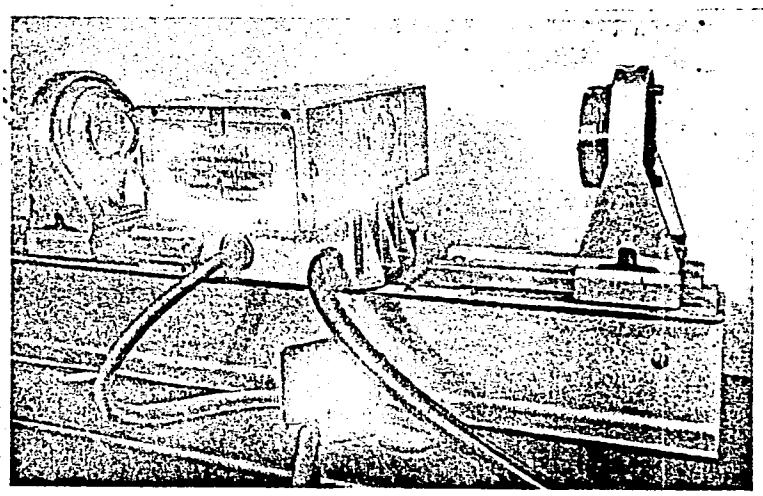

Fig. 1. External view of the GSI-1 laser

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ACC NR: AP6025255

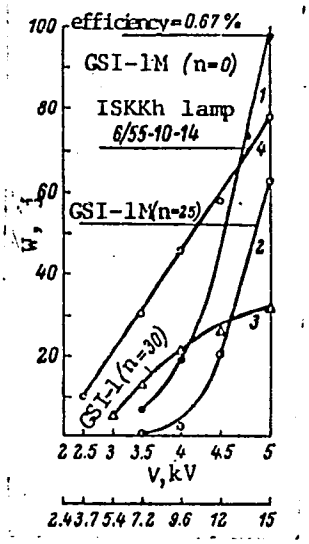

Fig. 2. Dependence of laser (GSI-1 and GSI-1M) output pulse on the pump energy

The present article deals with the GSI-1 laser and its modified version, GSI-1M. The output pulse energy of each laser was shown as a function of the pumping energy (Fig. 2).

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L 57000-CO

ACC NR: AP6025255

O

The effects of radiation noise on the emission from the GSI-1M laser were also evaluated. The authors showed that the lifetime of the excited state of neodymium ions decreased at high pump densities, resulting in corresponding elevation of the threshold and a drop in the laser efficiency. Orig. art. has: 3 figures and 6 formulas.

[YK]

SUB CODE: 20/ SUBM DATE: 26Jun65/ ORIG REF: 004/ ATD PRESS: 5141

Card 4/4

ACC NR: AP6018444 SOURCE CODE: UR/0051/66/020/006/1040/1044

AUTHOR: Bonch-Bruyevich, A. M.; Razumova, T. K.; Imas, Ya. A.

ORG: none

TITLE: Spectrum of excited absorption in ruby

SOURCE: Optika i spektroskopiya, v. 20, no. 6, 1966, 1040-1044

TOPIC TAGS: ruby laser, absorption band, xenon lamp, laser pumping, RUBY

ABSTRACT: In connection with a study of certain features of the decay kinetics of excited absorption bands in ruby, the transverse absorption cross section σ_ν was measured as the ratio of the variation in the absorption coefficient Δk_ν to the population n_2 of the metastable level. Samples tested were polished cylinders 6 mm in diameter and 50 mm long, cut from ruby single crystals containing 0.02 and 0.04% Cr^{+3} by weight. The rod ends were masked leaving rectangular 1 × 3 mm windows. The 400 μ pumping light was provided by a pulsed xenon lamp excited by a 500 mf bank of condensers. The test radiation was generated by a lamp that has a continuous spectrum in the near UV, visible, and near IR regions. The dispersion element was a double monochromater, and the light modulator was an ultrasonic device operating at 10 Mc with standing waves in orthoxylene. The recording portion of the test instrumentation consisted of a photomultiplier and a two-gun oscilloscope which showed the time dependence of the inten-

UDC: 535.343:553.824

Card 1/2

ACC NR: AP6018444

sity of the test light passing through the sample. A special electronic circuit was available to shift the firing instant of the pumping light with respect to the triggered sweep of the oscilloscope. It was thus possible to estimate the intensity of the transmitted light immediately prior to the excitation of the ruby sample and also the variation in this intensity due to the pumping excitation. The second gun of the oscilloscope recorded the scattered light pulse of the pumping lamp. Typical photographs of the screen showing brightening (λ=530 mμ) and darkening (λ=474 mμ) of the sample are given, as well as curves of the variation in the absorption coefficient and the absorption spectrum between 400 and 660 mμ at a high level of excitation. Two additional absorption bands, overlapping the principal ones, are observed in this region. A curve is plotted for the effective cross section of absorption for transitions from the ^2E level which accomodates 66% of all the Cr^{+3} ions. Results are compared with those of other authors, and possible errors are estimated. Orig. art. has: 5 figures, 1 table.

SUB CODE: 20/ SUBM DATE: 18Feb65/ ORIG REF: 003/ OTH REF: 006

Card 2/2 hs

L [illegible] EWT(l)/EWT(m)/EPF(k)-2/T/EWP(t)/ETI/EWP(k) IJP(c) [illegible]

ACC NR: AP6025256 SOURCE CODE: UR/0057/66/036/007/1273/1284

AUTHOR: Anisimov,S.I.; Bonch-Bruyevich,A.M.; Yel'yashevich,M.A.; Imas,Ya.A.; Pavlenko,N.A.; Romanov,G.S.

ORG: none

TITLE: The effects of intense light beams on metals

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no.7, 1273-1284

TOPIC TAGS: laser effect, metal melting, metal vaporizing, heat of sublimation

ABSTRACT: The authors have investigated theoretically and experimentally the phenomena accompanying the disruption of metals by focused laser beams. In the present paper there is considered the case of a laser producing approximately 1 millisec pulses, each consisting of a sequence of approximately 1 microsec spikes. The phenomena accompanying disruption of metals by giant laser pulses will be discussed in a future paper. In the theoretical part of the paper, fluxes of [illegible] to 10^{16} erg/cm^2 sec on an approximately 1 mm diameter spot are considered. It is shown that under these conditions the transport of energy in the metal by heat conduction during the duration of a spike is negligible, and the problem of the vaporization of the metal is accordingly treated in one dimension. Formulas are derived, and curves are presented for different metals, relating the energy flux in the laser beam, the temperature of the metal surface, the erosion rate of the metal surface (i.e., the rate of increase

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L 40385-66

ACC NR: AP6025256

in the depth of the hole), and the velocity and pressure of the jet of metal vapor. The temperature of the metal surface is not equal to the boiling temperature, as was erroneously assumed by J.F.Ready (J. Appl. Phys., 36, No.2, 462, 1965). The theoretical relations were tested by experiments on some 16 metals and alloys, using neodymium glass lasers producing up to 300 J pulses. The laser beam was focused with a lens onto the parallelepipedonical specimen and the disruptive process was recorded cinematographically at 10^5 frames per sec. In most of the experiments a glass plate was cemented to one face of the specimen and the laser beam was so directed parallel to the glass-metal boundary that about half of the beam passed freely through the glass and the other half penetrated into the metal, vaporizing it. In those experiments the process was photographed through the glass. The mass of metal removed by the laser pulse was determined by weighing the specimen, and the impulse due to reaction of the metal vapor jet was measured. The experiments were in qualitative agreement with the theory, and quantitative agreement in order of magnitude was found. The authors feel that development of a more accurate theory would not be worthwhile, owing to the large variations between different lasers. Three stages were distinguished in the disruption process: in the first stage the temperature of the metal surface increased at the rate of approximately 10^{10} degree/sec; in the second stage metal was vaporized from the specimen and a hole was formed in it; and in the third stage a pressure of 10^2 to 10^3 atmospheres developed within the hole and a powerful jet of metal vapor issued from it at supersonic velocities. The ratio of the laser pulse energy to the mass of metal

Card 2/3

L 40302-65
ACC NR: AP6025256

lost by the specimen was approximately equal to, but in most cases somewhat less than, the heat of sublimation of the metal. An appreciable mass of the metal was ejected as liquid. Orig. art. has: 9 formulas, 9 figures, and 2 tables. [15]

SUB CODE: 20, 11/ SUBM DATE: 26Jun65 ORIG. REF: 005 OTH REF: 004
ATD PRESS: 5053

Card 3/3 vmb

L 04794-67 EWT(l)/EWT(m)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6024465 SOURCE CODE: UR/0181/66/008/007/2062/2067

58
B

AUTHOR: Bonch-Bruyevich, A. M.; Burlakov, A. V.

ORG: none

TITLE: Time dependence of the internal electroluminescence of ZnS-Cu, Al phosphors

SOURCE: Fizika tverdogo tela, v. 8, no. 7, 1966, 2062-2067

TOPIC TAGS: zinc sulfide optic material, electroluminescence, luminor, luminescence center, ionization

ABSTRACT: This is a continuation of earlier work by the authors (FTT v. 8, 124, 1966). In view of the fact that the internal electroluminescence is connected with many processes occurring in the luminor, the interaction between which is quite complicated, the authors have developed a method of exciting electroluminors, in which the state of the luminor at a given instant of time does not depend on its prior history. This is done by separating the rectangular pulses used to excite the luminors with intermediate series of shorter unit polar pulses. The tests were made on powdered ZnS-Cu, Al luminors with copper concentration from 0.22×10^{-3} to 1.2×10^{-3} g/g. and were confined to the luminescence corresponding to the green and blue bands. From an analysis of the time dependences of the pulse amplitudes, and the dependence of the time necessary to reach minimum amplitude in the blue and green bands on the copper concentration it is deduced that in investigations of the time dependences of the internal electroluminescence it is possible to eliminate processes which are usually con-

Card 1/2

Card 2/2 af

ACC NR: AP7001312 SOURCE CODE: UR/0057/66/036/012/2171/2174

AUTHOR: Bonch-Bruyevich, A. M.; Petrun'kin, V. Yu.; Arzumanov, V. N.; Yesepkina, N. A.; Imas, Ya. A.; Kruzhalov, S. V.; Pakhomov, L. N.; Chernov, V.A.

ORG: none

TITLE: A study of a neodymium glass laser with external feedback

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 12, 1966, 2171-2174

TOPIC TAGS: solid state laser, glass laser, neodymium glass laser, traveling wave laser, laser r and d

ABSTRACT: A study was made of a traveling-wave external-feedback neodymium glass laser, the experimental setup of which is shown in Fig. 1. The external cavity consisted of four mirrors arranged in a rectangular pattern (1.5 x 0.5 m). The output mirror (5') was 80% reflective and the three other mirrors were 99% reflective. The active medium was a cylindrical glass rod 240 mm long and 25 mm in diameter. The laser was pumped by two IFK-15,000 flashlamps fed from a condenser bank having a total stored energy of 30 kj. A Faraday-effect cell, consisting of a quartz plate and a polarizer (six plane-parallel Brewster-angle plates) was used to achieve traveling-wave operation. A DFS-8 spectrograph (dispersion 6 Å/mm) and a Fabry-Perot interferometer were used to observe the emission spectra of the laser at various pumping levels and with the Faraday cell in and out of the feedback circuit. It was shown that the emission spectra of traveling-wave lasers are virtually line spectra and

UDC: 621.378.32

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ACC NR: AP7001312

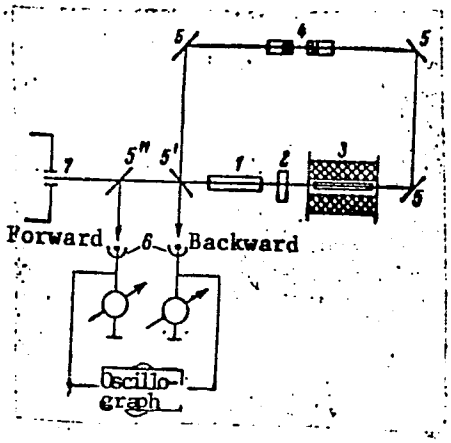


Fig. 1. Experimental setup of a traveling-wave laser

1 - Working substance; 2 - quartz plate; 3 - Faraday cell; 4 - polarizer; 5 - 5" - mirrors; 6 - photocells; 7 - spectrograph slit.

that the spiking sequence is better ordered than that of standing-wave lasers. A reduction of the spectrum to a single narrow line, which has been observed in traveling-wave ruby lasers, was not encountered in the present laser. Such narrowing in the traveling-wave operation will not occur unless the luminescence line of the working substance broadens, as it does in rubies. The high-intensity lines observed in the experiments corresponded to the uniform broadening of luminescence lines of the dopant. Orig. art. has: 5 figures. [YK]

SUB CODE: 20/ SUBM DATE: 01Jun66/ OTH REF: 003/ ATD PRESS: 5110

Card 2/2

ACC NR: AP7007681 SOURCE CODE: UR/0386/66/003/002/0085/0088

AUTHOR: Aleksandrov, Ye. B.; Bonch-Bryevich, A. M.; Kostin, N. N.; Khodovoy, V. A.

ORG: State "Order of Lenin" Institute of Optics im. S. I. Vavilov (Gosudarstvennyy ordena Lenina Opticheskiy institut)

TITLE: Frequency shift of optical transition in the field of a light wave

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu, v. 3, no. 2, 1966, 85-88

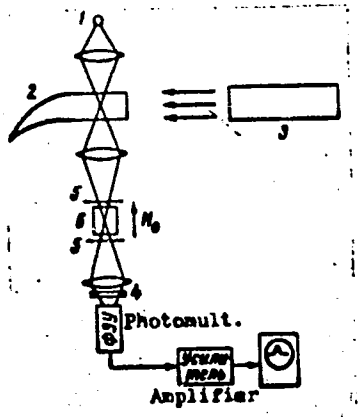
TOPIC TAGS: optic transition, ruby laser, photomultiplier, optic filter, resonance line, laser pulsation, magnetic field intensity, light absorption/FS-7 filter, KS-19 bleaching filter

ABSTRACT: The authors experimentally investigated the frequency shift of the optical resonant transition $4S_{1/2} - 4P_{1/2,3/2}$ of potassium (principal doublet). It can be be shown that the expected frequency shift of this transition is connected principally with virtual transition induced by the laser pulse from the ground level ($4S_{1/2} - 4P_{1/2,3/2}$) and the excited level ($4P_{3/2} - 6S_{1/2}$). The first pair of transitions is still sufficiently far from the resonances (the transition wavelengths are 7665 and 7699 Å, that of the laser is 6943 Å). The $4P_{3/2} - 6S_{1/2}$ transition is much closer to resonance (λ = 6939 Å). In spite of this, all these transitions make comparable contributions to the sought frequency shift of the investigated transition, owing to the difference in the oscillator strengths. It is important that the ground and

Card 1/4 UDC: none

ACC NR: AP7007681

excited levels are shifted here by the ruby-laser light in opposite directions. In the experiment light from potassium lamp 1 was passed through vessel 2 with potassium vapor saturated at 100°C (see the figure). At the selected temperature, the vapor absorbed about 80% of the lamp's resonant radiation. Transmission of light by vessel 2 was expected to increase during the action of the pulse from laser 3, provided the resultant transition frequency shift is commensurate with the line width of the lamp radiation (it was assumed that this line was broader than the absorption line of the vapor). The transmission of the resonant light was recorded with a photomultiplier whose output was fed to a pulsed oscilloscope (4 - glass filters).



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ACC NR: AP7007681

The scattered laser light in the registration channel was reliably cut out with FS-7 filters. Preliminary experiments have shown, however, that the laser pulse is accompanied by scattered radiation with spectral components lying in the region of the registered potassium line. The authors used a special method of filtering the resonant line with the aid of the Faraday effect to combat the mechanism of radiation occurrence. After passing through vessel 2, the light beam of the potassium lamp was made to pass through an auxiliary cuvette 6 filled with potassium vapor and placed between crossed polaroids 5. A local magnetic field of approximately 2 kOe was applied to cuvette 6. The magnetic field produced, besides splitting of the absorption line, strong radiation of the plane of polarization of the light, but only in the nearest vicinity of optical resonance. By magnetic field intensity selection, the system was made to transmit almost all the resonant line, and to absorb the extraneous light. The entire apparatus behaves like a high-transmission optical filter with a bandwidth on the order of 0.1 cm^{-1}. Under the conditions described, a distinct signal was recorded, evidencing a decrease in the absorption of the resonant light by the potassium atoms in vessel 2 during the time of action of the laser pulse (20 nsec); the laser operated in the monopulse mode by using bleaching filters KS-19. To verify that the change in the light absorption was not connected with some experimental errors the authors checked: (1) that the signal vanished when the potassium light was turned off; (2) that the signal vanished when the potassium vapor was frozen out in vessel 2 (with the illumination on the photomultiplier maintained at the previous level); and (3) that the signal vanished when the operating mode of lamp 1 was forced so as to broaden the emission line (the broadening was confirmed by the observations). The minimum laser radiation power density at which

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ACC NR: AP7007681

the bleaching signal was produced was ~10 MW/cm^2, corresponding to an electric field intensity (in the light) of 10^5 V/cm. The half-width of the spectral emission line is estimated at ~3 x 10^9 cps, so that the observed shift was of the same order. The authors thank D. A. Godina for providing the high grade polaroids. Orig. art. has: 1 formula and 1 figure.

SUB CODE: 20 / SUBM DATE: 30Nov65 / ORIG REF: 001 /
OTH REF: 003

Card 4/4

ACC NR: AP7001313 SOURCE CODE: UR/0051/66/036/012/2175/2180

AUTHOR: Bonch-Bruyevich, A. M.; Yesepkina, N. A.; Imas, Ya. A; Pavlenko, N. A.; Pakhomov, L. N.; Petrun'kin, V. Yu.; Potapov, S. Ye.

ORG: none

TITLE: Investigation of a neodymium glass laser with a resonator of spherical mirrors

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 12, 1966, 2175-2180

TOPIC TAGS: solid state laser, neodymium laser, ~~neodymium~~ glass laser, spherical mirror ~~laser~~ resonator, laser pumping

ABSTRACT: The operational characteristics of a neodymium glass laser with a resonator of spherical mirrors were investigated for varying distances between the mirrors. The introductory theoretical considerations proceed from results obtained earlier by other authors (e.g., Boyd and Gordon, Bell. System. Techn. J., 40, 2, 1961, 489) and define the regions occupied by certain modes as determined solely by the distance between the mirrors and the radius of their curvature. Further, the beam divergence is assumed to be determined by the divergence of the highest mode in the system. The minimum divergence is attained when the

 UDC: 621.378.32

distance between the mirrors equals the radius of curvature of the mirrors, corrected for the presence of a rod having a certain length and refractive index. Experiments were conducted with various rod and mirror dimensions, but measurement data are presented only for mirrors with a 150—cm radius and rods 50 cm long and 2.5 cm in diameter. This was done since the dependcies in all cases have the same character. The output energy varied between 200 and 500 J. The oscillograms of the output pulses show a high degree of uniformity in pulse amplitude, shape, and frequency, compared with the rather unsteady characteristics of the output from a plane mirror resonator. The pulse frequency is proportional to the square root of the instant pumping power, and starts to increase gradually when the distance between the mirrors is reduced below the optimal. This increase, however, never exceeds the frequency at the optimum by more than 1.4. The beam divergence increases to either side of the confocal position, in good agreement with the theoretical relations. The beam brightness is at a maximum when the distance between the mirrors is optimal. The cross-sectional energy distribution within the beam is rather uniform and is independent of the distance between mirrors. The emission spectra were studied as functions of pumping power and the distance between mirrors. An increase in pumping power from the emission threshold level to its maximum changes the spectrum width from 5—7 Å to 40—60 Å. An increase in the distance between mirrors from "short" (about one-third of their radius), where the spectrum is diffuse, to "long" (about two-third of the radius)

ACC NR: AP7001313

results in the appearance and separation of lines. The results suggest the existance, within the resonator, of a large number of transverse modes having equal Q. However, the observed multiplicity of spectral lines still requires clarification. Orig. art. has: 6 figures and 9 formulas. [WA-14]

SUB CODE: 20/ SUBM DATE: 01Jun66/ ORIG REF: 003/ OTH REF: 004

Card 3/3

1. BONCH-BRUYEVICH, V. L.

2. USSR (600)

4. Physics and Mathematics

7. Introduction to Theory of Metals, Ya. I. Frenkel'. (Moscow-Leningrad State Technical Press, 1950). Reviewed by V. L. Bonch-Bruyevich, Sov. Kniga, No. 1, 1952.

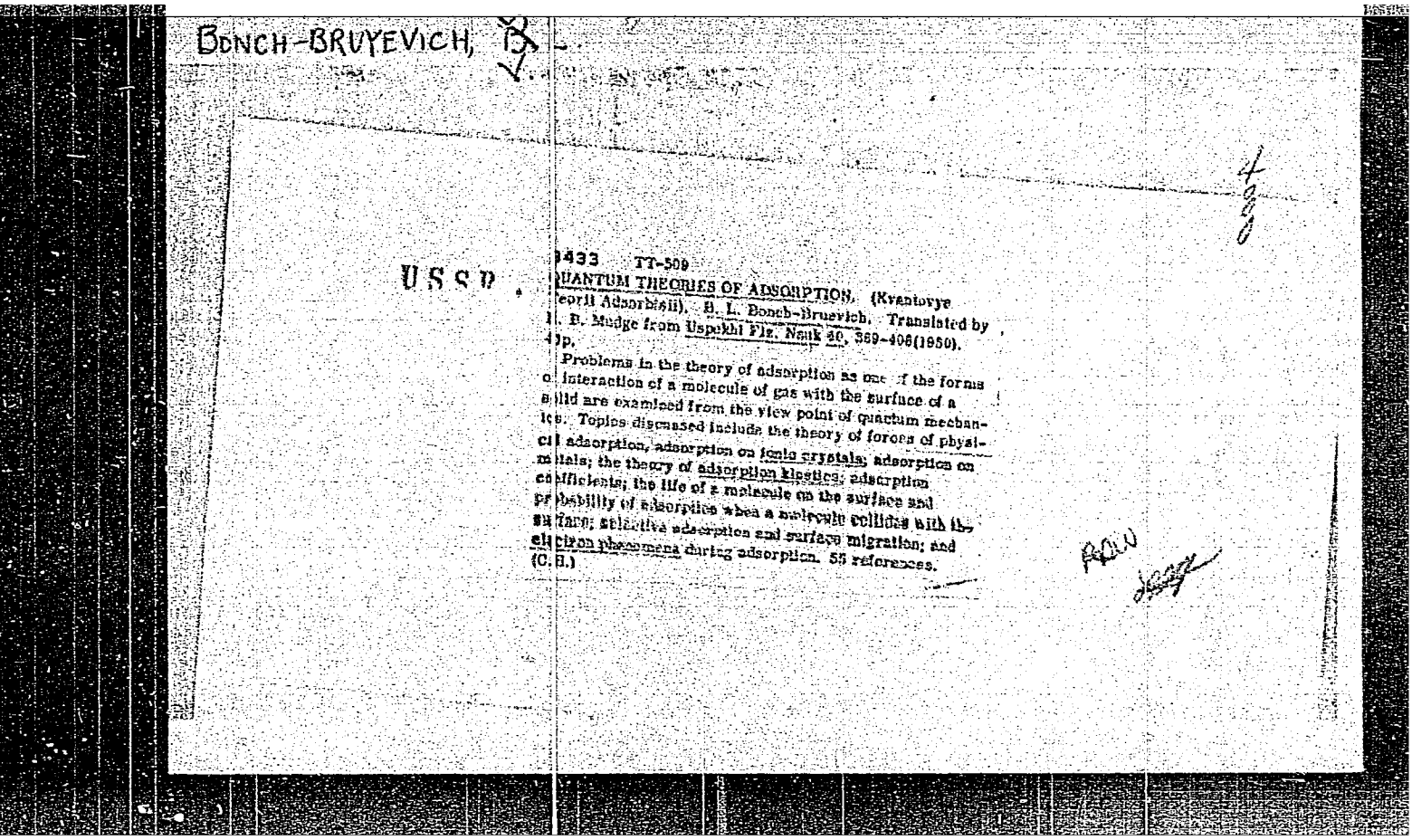
9. [redacted] Report U-3081, 16 Jan 1953, Unclassified.

Bonch-Bruevich, V.L.

Volkenštein, F. F., and Bonč-Bruevič, V. L. On the behavior of electrons in ionic crystals. Akad. Nauk SSSR. Žurnal Eksper. Teoret. Fiz. 20, 624–635 (1950). (Russian)

The theory of conducting electrons in a crystal lattice is generalized by taking into account exchange effects. The starting point is the Schroedinger equation for a many electron system, but only the interaction of two electrons is considered in deriving an explicit solution. It is shown that this solution contains not only electron states of the usual type which correspond to separate electrons, but also states which can be interpreted as indicating the appearance of electrons in "pairs." Such electron "pairs" might adhere to neighboring ions and exert some influence upon secondary effects, for instance upon those due to the polarisation of the ion cores. *E. Gora* (Providence, R. I.).

Source: Mathematical Reviews, Vol 12 No. 9



BONCH-BRUYEVICH, V. L.

USSR

1433 TT-509
QUANTUM THEORIES OF ADSORPTION. (Kvantovye teorii Adsorbtsii). V. L. Bonch-Bruevich. Translated by I. B. Mudge from Uspekhi Fiz. Nauk 40, 389-406(1950). 4p.

Problems in the theory of adsorption as one of the forms of interaction of a molecule of gas with the surface of a solid are examined from the view point of quantum mechanics. Topics discussed include the theory of forces of physical adsorption, adsorption on ionic crystals; adsorption on metals; the theory of adsorption kinetics; adsorption coefficients; the life of a molecule on the surface and probability of adsorption when a molecule collides with the surface; selective adsorption and surface migration; and electron phenomena during adsorption. 55 references. (C.H.)

BONCH-BRUYEVICH, V.

Bogoliubov, N. N., Bonč-Bruevič, V. L., and Medvedev, B. V. On the invariant construction of a quantum theory of fields. Doklady Akad. Nauk SSSR (N.S.) 74, 681–684 (1950). (Russian)

Dirac [Rev. Modern Physics 21, 392–399 (1949); these Rev. 11, 109] has investigated the most general possible form of a classical relativistic dynamics describing a system of localizable fields. In this paper the corresponding general form is determined for a theory of relativistic fields quantized according to Bose statistics, but dropping the condition of localizability. The formulae defining such a general theory are complicated and involve many arbitrary functions. This was to be expected, since all kinds of nonlocal interactions must be included as special cases of the general formulae.

F. J. Dyson (Birmingham).

Source: Mathematical Reviews, Vol. 12 No. 6.

BONCH-BRUYEVICH, V.L.

"Electron States of Atoms and Molecules, Adsorbed on the Surface of Crystals of the Type MgO." Sub 24 May 51, Inst of Physical Chemistry, Acad Sci USSR

Dissertations presented for science and engineering degrees in Moscow during 1951.

SO: Sum, No. 480, 9 May 55

PA 189T91

USSR/Physics - Electron Statistics Jul 51

"Statistics of Electrons in a Crystal Taking the Temperature Dependence of Depth of Local Levels Into Consideration," V. L. Bonch-Bruyevich, Div of Catalysis and Topochem, Inst of Phys Chem Acad Sci USSR

"Zhur Tekh Fiz" Vol XXI, No 7, pp 853-855

As expressed by A. I. Anselm (cf. "Zhur Tekh Fiz" Vol XXI, p 489, 1951), statistics for system whose energy levels depend on temp should be constructed. For this purpose author discusses the case

189T91

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USSR/Physics - Electron Statistics (Contd) Jul 51

where temp, usually of statistic nature, affects coeffs of wave eq. Author was assisted by N. N. Bogolyubov and F. F. Volkenshteyn. Submitted 19 May 51.

189T91

LC

BONCH-BRUYEVICH, V. L.

CA

2

Electronic levels of atoms adsorbed on a crystal surface. H. V. L. Busch-Ilievich. *Zhur. Fiz. Khim.* 25, 1033–42 (1951); cf. Vol'kenshtein, *C.A.* 42, 5340i.—The adsorption of an electropos. atom A on the face of a crystal M^+R^- (body-centered rhombic of parameters a and b) contg. only M^+ ions, is treated as a one-electron problem. Interaction between adsorbed atoms is neglected; they are assumed to form a regular arrangement on the surface, such that between two adsorbed atoms there are $N - 1$ surface ions. The coördinates are: $x_M = \rho a$, $y_M = \rho a$, $z_M = \rho b$ for M^+; $x_R = (\rho_1 + {}^1/_2)a$, $y_R = (\rho_1 + {}^1/_2)a$, $z_R = (\rho + {}^1/_2)b$ for R^- and $x_A = -c$, $y_A = \rho Na$, $z_A = qNb$ for A with $\rho_1 = 0, 1, 2, \ldots$; $\rho = 0, \pm 1, \pm 2, \ldots$; $\rho = 0, \pm 1, \pm 2, \ldots$; $q = 0, \pm 1, \pm 2, \ldots$. The Hamiltonian is $H = (-\hbar^2/2m)\nabla^2 + U(x,y,z)$, where $U = U_A + U_R + U_M$. The wave function Ψ is written as $\Psi = \Sigma_\nu a_\nu \psi_\nu$, where ψ_ν are wave functions for A, R, and M (they are assumed to be orthogonal). The coeffs. a_ν are detd. from the secular equation (variation method). The solution leads partially to a trivial result: if the valence electron of A goes into the conduction band of the bulk or surface states, no adsorption takes place, since the surface has a pos. charge. Adsorption is possible by reason of the formation of two localised surface levels detaching themselves from the conduction band. The energy of these levels is: $W = {}^1/_2[W_A + W_M + \alpha_A + \alpha_M \pm \{(W_A - W_M + \alpha_A - \alpha_M)^2 + 4\beta_A\beta_M\}^{1/2}]$, where the symbols have the following meanings: The integral $\int \psi_{g'}(U - U_{g'})\psi_g d\tau$ has the following values: α_A if $g = g'$ and $g_1 = 0$; β_A if $g_1 = -1$; α_M if $g = g'$ and $g_1 = -1$; β_M if $g_1 = 0$. The first ionization potentials of A and M are resp. $-W_A$ and $-W_M$. An electron in such a level is "distributed" between A and the lattice but does not wander through the lattice. Exptl. evidence for such levels has been found by Putseiko and Terenin (*C.A.* 45, 8018e). The fact that the ψ_ν are nonorthogonal would change this conclusion only qualitatively. The inclusion of electron interactions might, however, introduce important changes, which it is difficult to foresee.

Michel Boudart

1952

187T103

BONCH-BRUYEVICH, V.

USSR/Physics - Solids, Theory of Jun 51

"Bibliography: Review of 'The Modern Theory of Solids' by Frederick Seitz," V. Bonch-Bruyevich

"Uspekh Fiz Nauk" Vol XLIV, No 2, pp 311-315

Subject English-language book by a professor of physics at University of Pennsylvania was translated into Russian under the editorship of G. S. Zhdanov and published by Gostekhizdat at Moscow in 1950; price 36 rubles. Reviewer complains that book does not include latest advances in the theory of the solid state; otherwise it is a valuable book.

187T103

USSR/Physics - Quantum Mechanics Sep 51
Book Review

PA 194T89

"Transitions of Levels of Atomic Electrons and Additional Magnetic Moments of Electron According to Most Modern Quantum Electrodynamics' (Collection of Articles. Translations and References by V. I. Grigor'yev and N. P. Klepikova. Introduction and Editing by D. D. Ivanenko);" V. Bonch-Bruyevich

"Uspekh Fiz Nauk" Vol XIV, No 2, pp 163-168

Book contains collection of translated articles devoted to latest achievements in relativistic

194T89

USSR/Physics - Quantum Mechanics (Contd) Sep 51

quantum mechanics. Reviewer finds quality of references and translations satisfactory, despite some omissions and errors. Published 1950, 222 pp.

194T89

BONCH-BRUYEVICH V.

CA

2

Theory of elementary excitations in a weakly nonideal electron gas in a crystal. V. L. Bonch-Bruevich and S. V. Tyablikov. *Doklady Akad. Nauk S.S.S.R.* 76, 817-19 (1951).—The energy spectrum of a system of weakly interacting electrons in a crystal lattice is calcd. for the case when the d. of electrons is small compared with the no. of atoms (or ions) of the lattice in unit vol. To the 1st approximation the energy of weakly excited states of the system is the sum of the energies of discrete "elementary excitations" that do not interact with one another and occur only together with corresponding "holes" carrying the opposite charge. Obtaining the 2nd order quantities gives terms that represent the interaction of an elementary excitation with a hole. A simple method is obtained of calcg. electron interactions, which may be useful in some semiconductor problems. Ellen H. Dunlap

BONCH-BRUYEVICH, V. L.

USSR/Physics - Semiconductors, Mar/Apr 52
Behavior of Electrons

"The Behavior of Electrons in Ionic Crystals," F. F. Vol'kenshteyn, V. L. Bonch-Bruyevich

"Iz Ak Nauk SSSR, Ser Fiz" Vol XVI, No 2, p 231

Abbreviated text of report, published in "Zhur Eksper i Teoret Fiz" 20, 624, 1951. Behavior of 2 electrons in an atomic chain is analyzed from the Heitler-London viewpoint. It is shown that despite states corresponding to independent motion of both electrons, forming the usual zone,

220T103

still 2 other zones of so-called "doublon" states exist. In these states the wave-function decreases exponentially with distance between the electrons.

220T103

BONCH-BRUYEVICH, V.L.

USSR/Physics - Quantum Mechanics Apr 52

"Invariant Construction of the Field Quantum Theory. II," V. L. Bonch-Bruyevich B. V. Medvedev, Inst of Chem Phys, Acad Sci USSR

"Zhur Eksper i Teoret Fiz" Vol XXII, No 4, pp 425-435

By means of an app previously developed by N. N. Bogolyubov and the authors, they prove the int contradiction of localized variants of quantum relativistically invariant theory of arbitrarily interacting scalar fields. Indebted to N. N. Bogolyubov. Received 5 Jul 51.

215T79

USSR

530 143

3075. On the theory of the [illegible] of quantum systems of many particles. N. N. BOGOLYUBOV. *Dokl. Akad. Nauk SSSR*, 87, No. 5, 711-14 (1952) *In Russian.*

A method for investigation of weak excitations, i.e., excitations in which the ratio of the number of excited particles to the total number of particles is small, is discussed. The formalism employs annihilation and creation operators, which operate on the ground state to form excited states. It is shown that this problem coincides formally with the problem of 2*n* particles. G. E. BROWN

BONCI-BRUEVICI, V.

"Quantic adsorption theories. Tr. from the Russian", p. 27 (Analele Romano-Sovietice. Seria Chimie, Series a III-a, v. 5, no. 2, Apr./June 1953, Bucuresti)

SO: Monthly List of East European Accessions, Library of Congress, September 1953, Uncl. Vol. 2, No 9

BONCH-BRUYEVICH, V.L.

USSR

39. The bringing of the product of operators to canonical form in the theory of second quantization. V. L. BONCH-BRUEVICH AND B. V. MEDVEDEV. *Zh. eksper. teor. Fiz.*, **25**, *No.* 4(10) 410–16 (1953) In Russian.

In applying the method of second quantization to a number of problems [Abstr. 2366, 6210 (1951), 3075, 7929 (1952)] it was necessary to consider operators, consisting of a product of a number of creation and annihilation operators. The bringing of the product of 2 such operators to canonical form (all elementary creation operators to the left of all annihilation operators) is necessary, e.g. in the evaluation of commutators. This question has been discussed by Wick [Abstr. 853 (1950)], but in the present paper the explicit formulae for the coefficients which achieve the transformation are derived, both for bosons and fermions. It is mentioned that the method can be generalized to the case when the non-vanishing commutators or anticommutators of the elementary creation and annihilation operators are functions more general than the usual δ-functions.

W. J. SWIATECKI

BONCH-BRUYEVICH, V. L.

USSR

761. On the theory of the energy spectra of quantum systems of interacting particles. V. L. BONCH-BRUEVICH. *Zh. eksper. teor. Fiz.*, 23, No. 4(10) 417-28 (1953). In Russian.

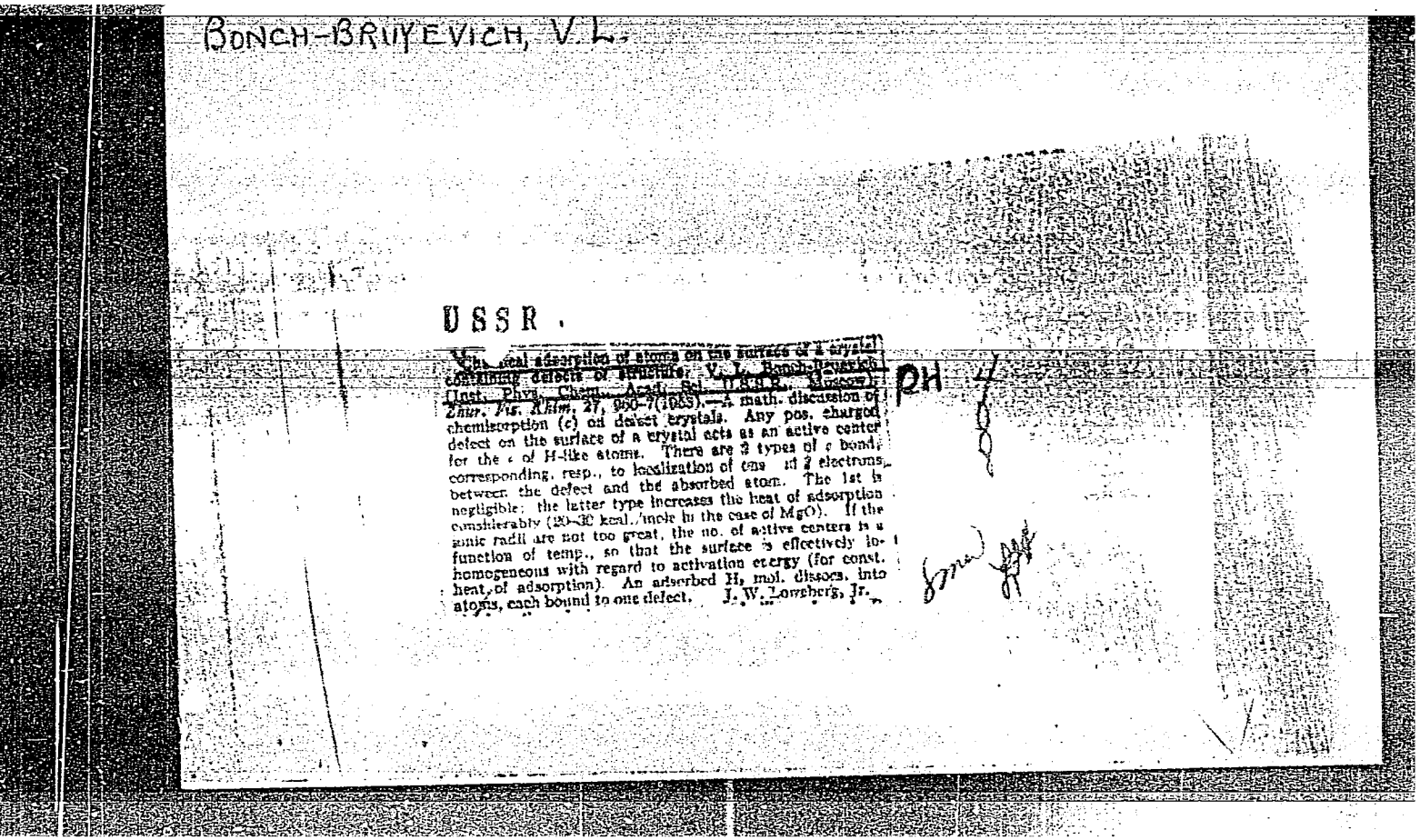
A method of studying weakly excited states of a system of many particles which is applicable to both the Bose and Fermi branches of the spectrum, and also the formulation of conditions for the existence in a given system of the one or the other type of excitation. Only particles with antisymmetrical statistics (electrons) are considered. The ground state of the system is described by a Ψ_0 which, according to the method of second quantization, is a function of the occupation numbers of certain one-particle states n (=0 or 1). Excited states are written as the result of an operation on Ψ_0 with an operator consisting of a sum of products of creation and annihilation operators with weights given by a certain function f. Using the stationary property of the total energy an eigen-equation is derived for f (which plays the rôle of wave-function for a system of "elementary excitations" of Bose or Fermi type). The equation for f is often rather complicated. Allied papers are Abstr. 3324, 5379 (1951), 2688 (1952). W. J. SWIATECKI

BONCH-BRUYEVICH, V.L.

Chemical Abstracts
Vol. 48 No. 5
Mar. 10, 1954
Electronic Phenomena and Spectra

A method of calculation of electron levels of atoms adsorbed on the surface of a crystal. V. L. Bonch-Bruevich (Inst. Phys. Chem., Acad. Sci. U.S.S.R., Moscow). *Zhur. Fiz. Khim.* 27, 663-73(1953); cf. *C.A.* 46, 2962h.—An approx., quantum-mech. method of calcn. is given for the electron levels of adsorbed atoms on an ionic crystal. This method permits calcn. of the polarization of the lattice by electrons. It is predicted that H and alkali metal atoms chemisorbed on a crystal surface will change its cond.
J. W. Loweberg, Jr.

6-21-54



BONCH-BRUYEVICH, V. L.

USSR

Chemical adsorption of atoms on the surface of a crystal containing defects of lattice. V. L. Bonch-Bruevich (Inst. Phys. Chem., Acad. Sci. U.S.S.R., Moscow). *Zhur. Fiz. Khim.*, 27, 950–7(1953).—A math. discussion of chemisorption (c) on defect crystals. Any pos. charged defect on the surface of a crystal acts as an active center for the c of H-like atoms. There are 2 types of c bond, corresponding, resp., to localization of one of 2 electrons between the defect and the absorbed atom. The 1st is negligible; the latter type increases the heat of adsorption considerably (20–30 kcal./mole in the case of MgO). If the ionic radii are not too great, the no. of active centers is a function of temp., so that the surface is effectively inhomogeneous with regard to activation energy (for const. heat of adsorption). An adsorbed H, mol. dissocs. into atoms, each bound to one defect. J. W. Lowsberg, Jr.

PH 4

BONCH-BRUYEVICH, V. L.

USSR/ Chemistry Physical chemistry

Card : 1/1 Pub. 147 - 7/25

Authors : Bonch-Bruevich, V. L., and Vol'kenshteyn, F. F.

Title : Conception of the "heterogeneous surface" in adsorption theories

Periodical : Zhur. fiz. khim. 28/7, 1219 - 1224, July 1954

Abstract : The physical concept of a heterogeneous surface, in adsoprtion processes is elucidated. The electron processes occurring during adsorption, and, which may lead to certain deviations from the Langmuir adsorption laws, are discussed. It is stated that further development of the theory of heterogeneous surfaces depends upon the knowledge of the physics of heterogeneous surfaces, i.e., knowledge of the elementary mechanism of adsorption processes. Nine USSR references (1935 - 1954).

Institution : Acad. of Sc. USSR, Institute of Physical Chemistry and The Electrotechnical Communications Institute , Moscow

Submitted : July 7, 1953

BONCH-BRUYEVICH, V. (Reviewer)

USSR/Physics

Card 1/1

Author : Bonch-Bruevich, V.

Title : Bibliography

Periodical : Usp. Fiz. Nauk, 52, Ed. 2, 338 - 340, 1954

Abstract : Author presents a critique on the book entitled "Nature of Adsorption Forces" written by B. V. Il'in and published by Gostekhizdat in 1952. The first chapter of the book is devoted to the general characteristic of the problem. The second chapter discusses in detail all modern ideas and opinions regarding the nature of forces of physical adsorption. The third and last chapter discusses the development of a general theory and its application to various concrete problems of adsorption and wetting.

Institution : .....

Submitted : .....

BONCH - BRUYEVICH, V. L.

USSR/Physics - Quantum mechanics

Card 1/1 : Pub. 22 - 13/49

Authors : Bonch-Bruevich, V. L.

Title : Operators of real particles and refined determination of the T-product

Pericdical : Dok. AN SSSR 98/4, 561-563, Oct.1,1954

Abstract : Properties attributed to particles for their better manipulation in quantum mechanics are described. One of these properties is the reality of a particle, and the other, the spreading of the particle in a vacuum. Functions expressing the spreading are as follows:

$$S^c(x - y) = \langle T \{\Psi(x)\,\overline{\Psi}(y)\}\rangle_0$$
$$D^c(x - y) = \langle T \{A \quad (x)A_v(y)\}\rangle_0$$

where the T {...} is the T-product of the operators expressing the real particles. A method of refining the determination of the T-product is suggested. Four references (1950-1954).

Institution : Moscow Electrotechnical Institute

Presented by : Academician N. N. Bogolyubov, June 29, 1954

BONCH-BRUYEVICH, V. L.

112-6-11842

Translation from: Referativnyy Zhurnal, Elektrotekhnika, 1957, Nr6, p.9 (USSR)

AUTHOR: Bonch-Bruyevich, V.L.

TITLE: On the Problem of Multielectron Substantiation of the Semiconductor Theory (K voprosu o mnogoelektronnom obosnovanii teorii poluprovodnikov)

PERIODICAL: Fizicheskiy sbornik L'vovskogo universiteta (Fiz. zbirnik L'vivs'k. un-ta) 1955, #1(6), pp.59-70

ABSTRACT: Weakly excited states of a semiconductor having atomic lattice, with no electric or magnetic field, are examined by the method of elementary excitations ("dyads" and holes). Under the condition of even number of electrons in the normal state, a Fermi type spectrum results in the frame of an exciton polar model. Multielectron-theory equations do not differ from the unipolar-theory equations; for that reason, the elementary excitations behave like the free electrons in the zonal theory, the fact substantiating the conclusions of the latter re extra electrons and holes. The behavior of the extra electrons and holes in electric and magnetic fields is determined from the viewpoint of the multielectron theory. Again, the equations obtained do not differ from those in the monoelectron model; elementary excitations in this case do not differ from the extra electrons of the zone theory. Considered are also the energy spectra of junction-metal bearing materials. Bibliography: 19 titles.

M.A.B.

Card 1/1

AF701597 TREASURE ISLAND BOOK REVIEW AID 812 - S

BONCH-BRUYEVICH, V. L. (Moscow Electrical Communication Institute) DISKUSSIYA (Discussion). In Problemy kinetiki i kataliza (Problems of Kinetics and Catalysis), vol. 8. Izdatel'stvo Akademii Nauk SSSR, 1955. Section II: General problems of the theory of catalysis. p. 147-148.

Discussion on the differences between metals and semiconductors. No definite elucidation of this problem is possible at the present time. The local changes in electronic density on metals which move in the crystal lattice and transfer energy, impulse, and possibly charge are compared with electrons. They may interact with the surface, thus performing functions which are inherent on "free electrons" according to the theory of electronic catalysis of semiconductors. Definite energy is required to produce conductivity electrons on a semiconductor; but in metals some conditions may exist which do not require a definite activation energy for their formation.

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AF701597 TREASURE ISLAND BOOK REVIEW AID 824 - S

BONCH-BRUYEVICH, V. L. (Moscow Electrical Communication Institute). DISKUSSIYA (Discussion). In Problemy kinetiki i kataliza (Problems of Kinetics and Catalysis), vol. 8. Izdatel'stvo Akademii Nauk SSSR, 1955. Section III: Connection between the electric conductivity and catalytic activity of semiconductors. p. 198-199.

Discussion of V. I. Lyashenko's paper. The reaction studied by Lyashenko is exothermic. It can be assumed that a local overheating takes place on the surface. The resulting diffusion of oxygen from the surface into the space increases markedly. Since Lyashenko used 2μ -thick films, the entire space can be "impregnated" by acceptors at the expense of a decrease of their number on the surface.

1/1

AF701597 TREASURE ISLAND BOOK REVIEW AID 832 - S

BONCH-BRUYEVICH, V. L. and F. F. VOL'KENSHTEYN (Moscow Electrical Communication Institute and Institute of Physical Chemistry, Academy of Sciences, USSR).
PONYATIYE (NEODNORODNOY POVERKHNOSTI) V TEORIYAKH ADSORBTSII (The concept of "nonuniform surface" in adsorption theories). In Problemy kinetiki i kataliza (Problems of Kinetics and Catalysis), vol. 8. Izdatel'stvo Akademii Nauk SSSR, 1955. Section IV: Nature of the active surface. p. 218-223.

Studies conducted by the authors have been discussed from the viewpoint of the concept of "nonuniform surface" which take place during adsorption may result in deviation from Langmuir's regularities. The concentration of free atoms in semiconductors depends on temperature and concentration of the admixtures in the adsorbent crystal. When the electrons in the conduction zone of the adsorbent surface act as adsorption centers, their number depends on the number of atoms adsorbed. Not only electrons, but lattice defects as well may act as adsorption centers. The distribution functions is a characteristic of the entire system, i.e., adsorbent and adsorbate. 9 references, all Russian (1935-1954).

1/1

AF701597 TREASURE ISLAND BOOK REVIEW AID 840 - S

BONCH-BRUYEVICH, V. L. (Moscow Electrical Communication Institute). DISKUSSIYA (Discussion). In Problemy kinetiki i kataliza (Problems of Kinetics and Catalysis), vol. 8. Izdatel'stvo Akademii Nauk SSSR, 1955. Section IV: Nature of the active surface. p. 239-240.

With reference to the paper by Roginskiy the author states that what is involved here is a problem of quantum mechanics and the calculation is applied to the simplest type of model. The lack of quantitative quantum-mechanic calculations for more complicated molecules does not discredit the proposed theory. In the case of "adsorption on the electron", the adsorption centers are restored on the surface, i.e., in place of the electrons combined during the adsorption, a new electron comes from the inside of the crystal. This was demonstrated by F. F. Vol'kenshteyn.

1/1

BONCH-BRUYEVICH,V.L.; MEDVEDEV,B.V. (Moscow)

Albert Einstein, 1879--1955. (Obituary) Fiz. v shkole 15 no.4:89-90 Jl-Ag '55. (MLRA 8:10)

(Einstein, Albert, 1879-1955)

FD-3191

USSR/Physics - Semiconductors

Card 1/1 Pub. 153-21/21

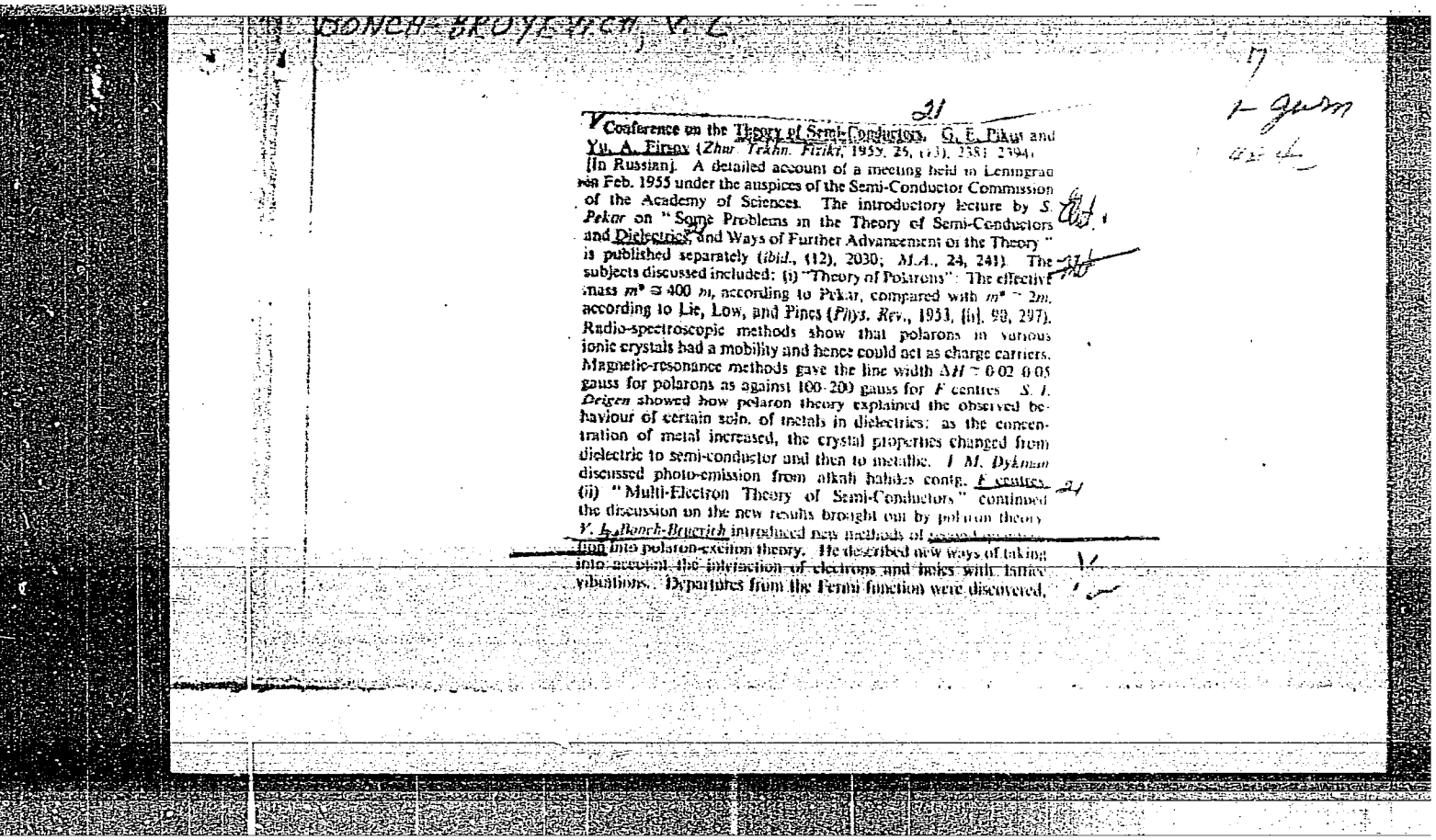
Authors : Bonch-Bruyevich, V. L. and Pumper, Ye. Ya.

Title : On the formula for the volt-ampere characteristics of n-p transfer

Periodical: Zhur. tekh. fiz., 25, No 8 (August), 1955, 1520-1521

Abstract : The authors discuss the well known volt-ampere characteristics formula which is derived on a theoretical basis. They state that the small amount of experimental evidence available indicates a resaonably close harmony between theory and fact. They assert, however, that in certain ranges the formula departs too much from observed values to be of much value. They introduce a factor which they claim will make the formula much more accurate in these critical ranges. They suggest further experiments to establish the validity of their assertions.

Submitted : November 24, 1954

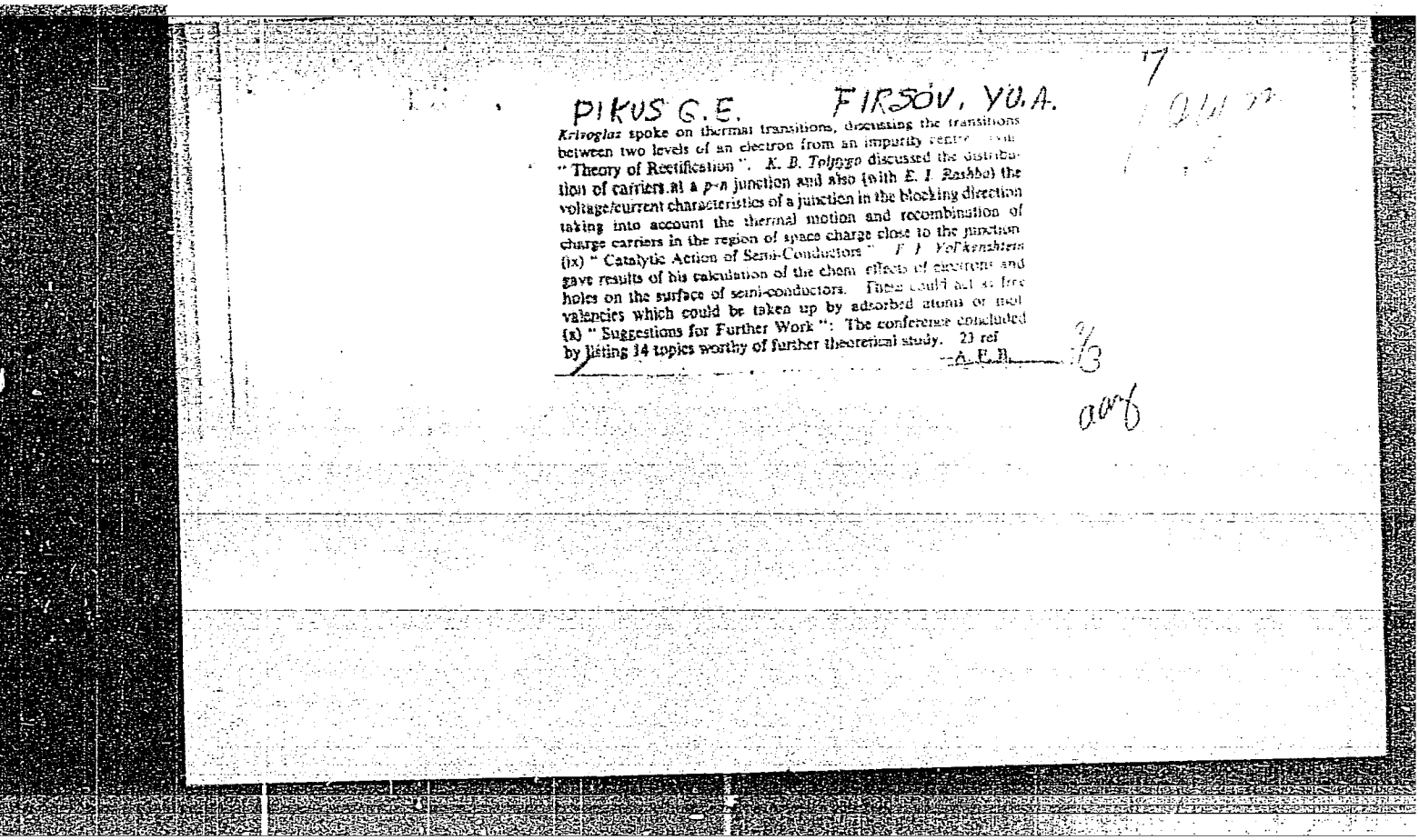


BONCH-BRUYEVICH, V. L.

V Conference on the Theory of Semi-Conductors. G. E. Pikus and Yu. A. Firsov (*Zhur. Tekhn. Fiziki*, 1955, 25, (12), 2381–2394) [In Russian]. A detailed account of a meeting held in Leningrad in Feb. 1955 under the auspices of the Semi-Conductor Commission of the Academy of Sciences. The introductory lecture by *S. Pekar* on "Some Problems in the Theory of Semi-Conductors and Dielectrics, and Ways of Further Advancement of the Theory" is published separately (*ibid.*, (12), 2030; *M.A.*, 24, 241). The subjects discussed included: (i) "Theory of Polarons": The effective mass $m^* \cong 400\ m$, according to Pekar, compared with $m^* \sim 2m$, according to Lie, Low, and Pines (*Phys. Rev.*, 1953, [ii], 90, 297). Radio-spectroscopic methods show that polarons in various ionic crystals had a mobility and hence could act as charge carriers. Magnetic-resonance methods gave the line width $\Delta H \sim 0{\cdot}02$–$0{\cdot}05$ gauss for polarons as against 100–200 gauss for *F* centres. *S. I. Drigen* showed how polaron theory explained the observed behaviour of certain soln. of metals in dielectrics: as the concentration of metal increased, the crystal properties changed from dielectric to semi-conductor and then to metallic. *I. M. Dykman* discussed photo-emission from alkali halides contg. *F* centres. (ii) "Multi-Electron Theory of Semi-Conductors" continued the discussion on the new results brought out by polaron theory. *V. L. Bonch-Bruevich* introduced new methods of [illegible] into polaron-exciton theory. He described new ways of taking into account the interaction of electrons and holes with lattice vibrations. Departures from the Fermi function were discovered,

PIKUS, G.E. FIRSOV, YU. A.

including a temp.-dependence of m^* similar to that of E_F. Interactions of charge carriers with zero-point vibrations gave a finite number of charge carriers in an intrinsic semi-conductor at 0° K. ($\sim 10^3 - 10^{15}$/c.c.). (iii) "Magnetic Properties of Semi-Conductors": *L. L. Kazenblit et al.* showed how measurement of the temp.-dependence of the susceptibility of semi-conductors gave important results on the nature of the chem. binding and the temp.-dependence of E_F. The high diamagnetism of semi-conductors was ascribed to excitons. A method was described for treatment of magnetism by quasi-particles on a multi-electron model. (iv) "Theory of Excitons". *A. I. Anselm and Yu. A. Firsov* calculated the free path of a non-localized exciton in various lattices showing it to $\propto 1/T$ and to depend on dielectric const., m^*_p, m^*_n, and the interaction between p- and n-charge carriers and the lattice vibrations. The abs. magnitude of exciton free paths ranges from ~~$\frac{1}{10}$~~–10 electron free paths. (v) "Theory of Conductivity, Thermo- and Galvano-Magnetic Effects". *T. A. Kontorova* discussed why $\sigma \propto T^{3/2}$ instead of $T^{3/2}$ for multi-valence semi-conductors. *M. I. Klinger* discussed galvanomagnetic effects in polaron semi-conductors and also in ionic semi-conductors with weak binding. (vi) "Theory of Liquid and Amorphous Semi-Conductors". *A. I. Gubanov* discussed the energy spectrum of an electron in a "crystal" with only short-range order in an attempt to explain why there is often little change in elect. properties at the m.p. *I. M. Lifshits* raised the complementary problem of the behaviour of an electron scattered by disturbances with long-range order. (vii) "Theory of Radiationless Transitions". *M. A.*



PIKUS G.E. FIRSOV, YU.A.

Krivoglaz spoke on thermal transitions, discussing the transitions between two levels of an electron from an impurity centre [illegible] " Theory of Rectification ". *K. B. Tolpygo* discussed the distribution of carriers at a *p-n* junction and also (with *E. I. Rashba*) the voltage/current characteristics of a junction in the blocking direction taking into account the thermal motion and recombination of charge carriers in the region of space charge close to the junction. (ix) " Catalytic Action of Semi-Conductors ": *F. I. Vol'kenshtein* gave results of his calculation of the chem. effects of electrons and holes on the surface of semi-conductors. These could act as free valencies which could be taken up by adsorbed atoms or mol. (x) " Suggestions for Further Work ": The conference concluded by listing 14 topics worthy of further theoretical study. 23 ref.

--A. F. B.

BONCH-BRUYEVICH, V.L.

USSR/Nuclear Physics - Electron interaction FD-1695

Card 1/1 Pub. 146-18/21

Author : Bonch-Bruyevich, V. L.

Title : Fermi distribution at absolute zero taking account of the interaction of electrons with the null oscillations of the lattice

Periodical : Zhur. eksp. i teor. fiz. 28, 121-122, January 1955

Abstract : The method of Green's function developed in connection with problems of relativistic quantum theory of the field can be utilized in a number of other problems, particularly in the important investigation into the distribution function for the electron gas taking account of the interaction of the electrons with phonons. The author will publish his detailed calculations connected with the use of the Green's function in finding the distribution. He thanks N. N. Bogolyubov. Three references.

Institution: Moscow Electrotechnical Institute of Communications

Submitted : October 6, 1954

BONCH-BRUYEVICH, V.L.

On the multielectron basis of the theory of semiconductors. Nauk. zap. L'viv. un. 33:59-70 '55.
(Semiconductors) (MLRA 10:6)

BONCH-BRUYEVICH, V.L.

Concepts of physics underlying the hypothesis of "elementary excitation". Usp. fiz. nauk 56 no.1:55-76 My '55.
(Electrons) (Solids) (MLRA 8:6)

Bonč-Bruevič, V. L. Adiabatic approximation in the theory of the Green's function. (Russian) Dokl. Akad. Nauk SSSR (N.S.) 105 (1955), 689–692.

The Green's functions of a pair of interacting fields (one with Fermi and one with Bose statistics) can be expressed as functional integrals [see e.g., N. N. Bogolyubov, same Dokl. (N.S.) 99 (1954), 225–226; MR 16, 778]. The author here proposes to evaluate such integrals approximately by making an "adiabatic approximation" which consists in the neglect of functional derivatives of the Green's functions with respect to the Boson field. Thus it is assumed that the state-functional is in some sense a "slowly varying" functional of the Boson field variables. The formal consequences of this assumption are deduced, but no concrete evaluations of the Green's functions are attempted.

F. J. Dyson (Princeton, N.J.)

BONCH-BRUYEVICH, V. L., (Moscow)

"On the Theory of Ferromagnetism in Imperfect Lattices," paper presented at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, USSR 23-31 May 1956.

"Magnetic Susceptibility of the semiconductors with Impurity Band," a paper submitte at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 56.

Bonch-Bruevich, V.L.

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

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 8972

Author : Bonch-Bruevich, V.L.
Title : Concerning One Problem in Quantum Theory of Many Bodies

Orig Pub : Tr. 3-go Vses. matem. s"ezda. T. 1. M., AN SSSR, 1956, 218

Abstract : Resume of a lecture. A method of approximation is proposed, based on the approximate solution of the equations for the green's function in the classical external field (the latter is assumed to be slowly varying). The method is used to examine the problem of a strongly degenerate non-ideal Fermi gas. It is shown that when the interaction is taken into account (outside the framework of standard perturbation theory), the distribution function of the electrons by momenta in the ground state does not have a purely step-like character. This means that in this system at absolute zero there are current carriers with momenta that exceed the limiting Fermi momentum. The spectrum of the elementary excitations in a given system is also considered.

Card : 1/1

BONCH-BRUYEVICH, V. L.

F-4

Category : USSR/Magnetism - Diamagnetism. Paramagnetism

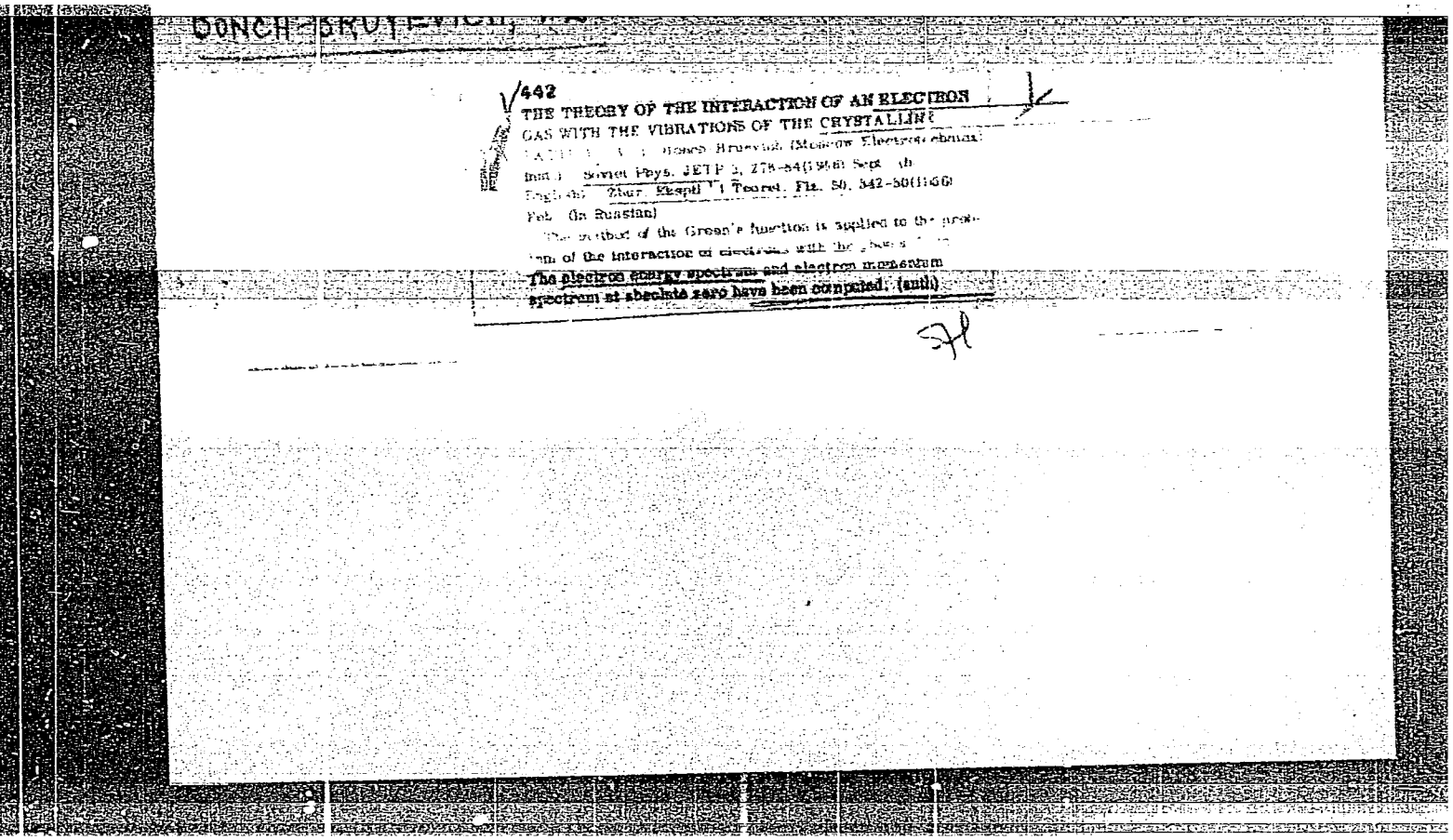
Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4025

Author : Bon'-Bruyevich, V.L.
Inst : Moscow Electrotechnical Institute of Communication USSR
Title : On the Theory of Ferromagnetism in a Non-Ideal Lattice.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 2, No 2, 215-221

Abstract : The character of the spectrum of elementary excitations of a ferromagnetic, having a lattice that contains some structural defects, was studied within the framework of the exchange model. It was shown that defects of a definite type play the role of "demagnetization centers," namely, spins that are oriented in opposition to the magnetization direction are localized near these defects. The dependence of the magnetization on the concentration of the structural defects was calculated at saturation and at the Curie point. The results are applied to an investigation of the ferromagnetism of ferrites, solid solutions, and specimens of small dimensions.

Card : 1/1



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THE THEORY OF THE INTERACTION OF AN ELECTRON GAS WITH THE VIBRATIONS OF THE CRYSTALLIN[E]

[illegible] Brusnin (Moscow Electrotechnical)

Ref: Soviet Phys. JETP 3, 278-84(1956) Sept (h
English: Zhur. Eksptl' i Teoret. Fiz. 30, 342-50(1956)

Pub. (In Russian)

[illegible] method of the Green's function is applied to the prob[lem] of the interaction of electrons with the [illegible] The electron energy spectrum and electron momentum spectrum at absolute zero have been computed. (auth)

BONCH-BRUYEVICH, V. L.

G-3

Category : USSR/Electricity - Semiconductors

Abs Jour : Ref Zhur - Fizika, No 1, 1957 No 1579

Author : Bonch-Bruyevich, V.L.
Title : Concerning Surface Recombination

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 6, 1137-1140

Abstract : A theoretical comparison is made of the magnitudes of the surface-recombination and inhomogeneous impurity distribution effects in a crystal. It is shown that the experimentally-determined quantity called the surface-recombination velocity is actually a complicated expression, which takes both into account.

Card : 1/1

Bonch-Bruyevich, V.L.

Category : USSR/Electricity - Semiconductors G-3

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4206

Author : Bonch-Bruyevich, V.L.
Title : Remarks on the Article by G.K. Pikus and Yu.A. Firsov

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 6, 1372

Abstract : Critical remarks concerning the discussion (Referat Zh. Fizika, 1956, 29045) on the lecture delivered by the author in Leningrad in February 1955 at the Conference on Semiconductor Theory.

Card : 1/1

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1573
AUTHOR BONČ-BRUEVIČ, V.L.
TITLE The Statistics of the Electrons and Holes in a Homoepolar Semiconductor in Consideration of Interaction with the Oscillations of the Lattice.
PERIODICAL Žurn.eksp.i teor.fis, 31, fasc.2, 254-260 (1956)
Issued: 10 / 1956

As the problem concerning the general form suited for all temperatures is very complicated, the present work is confined to the limiting cases of high and low temperatures; (in the second case a semiconductor at absolute zero is concerned). A semiconductor with independent conductivity and with spherical surfaces of constant energy is investigated here, on which occasion only interaction with the acoustic oscillations of the lattice is taken into account. For the conduction electrons and for the holes one and the same coupling constant is assumed. This model, of course, is little suited for accurate computation, but essential conclusions do not depend on these details. Among the aforementioned items there is no interaction with transversal waves. The LAGRANGIAN of the interaction of the electrons with the longitudinal acoustic oscillations of the lattice and the coupling constant g are explicitly written down. All operators of interest here are diagonal with respect to the spin indices.
The semiconductor at absolute zero: The "one-particle density matrix" for electrons and holes at absolute zero is found in the easiest way by computing GREEN'S function for the electron field which is in interaction with the

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phonons. The equations of condition for GREEN'S function of the electron are given. By development in series with respect to the powers of the coupling constant a linear equation for GREEN'S function is obtained. The very voluminous solution of this equation is explicitly written down. Like in the case of the undisturbed problem two permitted zones which are separated by a forbidden domain are obtained here. Thus the excitation spectrum is of typically semiconductorlike shape and the qualitative statements of the zone theory are confirmed for this case. However, because of the interaction between electrons and phonons the density matrix is by no means of "steplike" character. An expression for the evaluation of the effective concentration of the charge carriers in the ground state of the investigated semiconductor is given.
The homoepolar semiconductor at high temperatures: This last paragraph investigates the equilibrium properties of a system of conduction electrons (and holes), which are in interaction with phonons. According to the author's opinion this is the basis for the development of the theory without the help of the kinetic equation.

INSTITUTION: Moscow Electrotechnical Institute for Telecommunications.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1664
AUTHOR BONČ-BRUEVIČ,V.L.
TITLE The Spectral Representations of GREEN'S Functions in the Non-relativistic Many-Body Problem.
PERIODICAL Žurn.eksp.i teor.fis,31,fasc.3,522-523 (1956)
Issued: 12 / 1956

It is interesting to investigate the general properties of GREEN'S functions which are set up independently of any approximation methods. In the nonrelativistic theory there are certain complications which are connected with the lacking of LORENTZ invariance. However, even in this case certain analogous spectral problems exist, which is proved here. For reasons of correctness a system with many electrons is investigated here. Transition of systems with BOSE particles presents no difficulties. With the help of certain ansatzes and the equation of motion $dL/dx_0 = i(HL - LH)$ we find $(\Phi_0, \psi(x)\Phi_{\nu,E}) = e^{-iEx_0}\varphi_{\nu,E}(\vec{x})$, and herefrom further $G_+(x,y) = i\sum_{\nu}' dE e^{-iEx_0} F_{\nu,E}(\vec{x},\vec{y})$. Denotations: L - any operator not explicitly dependent on time, H - the total HAMILTONIAN of the system, $\psi^*(x)$ and $\psi(x)$ - the creation- and annihilation operators of the electrons, Φ_0 - the wave function of the ground state, $\Phi_{\nu,E}$ - the wave functions of the excited states which are characterized by the energy E and possibly by any quantum numbers. Here it is true that $\hbar = 1$ and $F_{\nu,E}(\vec{x},\vec{y}) = \varphi(\vec{x})\varphi^*(\vec{y})$. $F_{\nu,E}(\vec{x},\vec{y})$ is in

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general a certain generalized function. It can, above all, contain δ-shaped singularities, so that the integral over E actually also comprises the sum over the discrete states. The spectral representation is obtained from the latter formula by multiplication by $(1/2\pi)\exp\{ip_o(x_o-y_o)\}$ and integration over x_o-y_o. With the help of

$$G_c(p_{oi}\vec{x},\vec{y}) = (1/2\pi)\int_{-\infty}^{+\infty} e^{ip_o(x_o-y_o)}\, G_c(x,y)\, d(x_o-y_o)$$ one obtains

$$G_c(p_o,\vec{x},\vec{y}) = i\sum_{\nu} dE\left\{\delta_+(p_o-E)F_{\nu,E}(x,y)-\delta_-(p_o-E)F^*_{\nu,E}(\vec{y},\vec{x})\right\}.$$

G_c is in particular specialized for a FERMI gas in the state of total degeneration. - Here W_F denotes the FERMI boundary energy. In principle it is easily possible to find the excitation spectrum by comparison of the corresponding energy differences, but on this occasion some essential particularities of the spectrum may easily get lost, as soon as G_c is computed by any approximation method. (e.g. with the method of mass operators). Therefore it is advisable to introduce yet another GREEN'S function which explicitly expresses the "pair-like" character of the excitations. Expressions for such a function are explicitly given and discussed in short.

INSTITUTION: Moscow State University

BONC-BRUEVIC, V.L.

CARD 1 / 2 PA - 1697

SUBJECT USSR / PHYSICS
AUTHOR BONC-BRUEVIC, V.L.
TITLE The Theory of Semiconductors on the VIII. All-Soviet Conference on Semiconductors.
PERIODICAL Usp.fis.nauk, 60, fasc.2, 213-224 (1956)
Issued: 12 / 1956

The present work does not give a survey of the present stage of development of the theory of semiconductors, but merely of the works actually submitted during the sessions of the theoretical department of this All-Soviet Conference. In the course of 5 sessions of the Department for the Theory of Semiconductors 13 lectures were delivered which may be divided into the following classes: Theory of the stationary states and kinetics of electron processes in semiconductors.

I. The Theory of the stationary States of Electrons in crystal lattices: Most of the works in this class are connected in one way or another with the consistent consideration of interaction between electrons and the lattice on the occasion of the investigation of the kinetics of phenomena and of the equilibria of the system.

II. The kinetics of the electron process in semiconductors: The works belonging to this class may be subdivided into the following groups: a) Theory of the scattering of current carriers in semiconductors. b) The phenomenological kinetics of electron processes. c) The physical theory of the recombination of current carriers.