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Russian Physical Literature

Report No 21 - October 1956

(Finished 25th of October 1956)

Covering 100 Selected Reviews of Papers published in

Doklady Akad. Nauk SSSR

Uspechi Fis. Nauk

Zhurnal Exper. i. Teor. Fisiki

Zhurnal Technic̆eskoj Fisiki

Radiotechnika

Atomnaja Energija

Continously reported from

1. 9. 1954

This report covers 100 papers published in these journals later than 15th of April 1956 and earlier than 21st of September. These Reviews are

No 1301 - 1400

The Report contains 4 papers published in April 1956
38 papers published in May 1956
22 papers published in June 1956
16 papers published in July 1956
9 papers published in August 1956
11 papers published in September 1956

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1. List of Reviewed Journals

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	108	No 2	11.5.56	5.7.56
	108	No 3	21.5.56	2.8.56
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	109	No 5	11.8.56	10.10.56
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	30	No 5	15.5.56	2.8.56
	30	No 6	15.6.56	20.8.56
	31	No 1	15.7.56	21.9.56
T	Žurnal techn. fis.			
	26	No 5	15.5.56	7.6.56
	26	No 6	15.6.56	17.7.56
	26	No 9	15.9.56	5.10.56

U	Uspechi fis. nauk			
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2. List of Selected Papers

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Doklady

109, No 4, published 1.8.56, received 6.10.56, Dr. S.

yes (10): 713, 721, 728, 735, 737, 740, 743, 750, 753, 769

no (7): 717, 725, 731, 746, 757, 761, 765

109, No 5, published 11.8.56, received 10.10.56, Dr. S.

yes (7): 916, 919, 923, 926, 929, 931, 935

no (1): 913

Radiotechnika

11, No 9, published 15.8.56, issued 18.9.56, received 19.10.56, Ing. K.

yes (11): 3, 8, 12, 28, 39, 46, 54, 59, 72, 75, 80

no (1): 21

Uspechi

59, No 4, published 15.8.56, issued 15.9.56, received 19.10.56, Dr. S.

yes (5): 591, 603, 619, 673, 755

no (1): 593

Žurnal techniceskoj fis.

26, No 9, published 15.9.56, received 5.10.56, Ing.K.

yes (21): 1865, 1870, 1880, 1884, 1890, 1902, 1917, 1929, 1966, 1969, 1978, 2002, 2008, 2032, 2049, 2086, 2100, 2108, 2126, 2127, 2129

no (17: 1912, 1924, 1941, 1955, 1991, 1994, 2005, 2021, 2037, 2046, 2057, 2060, 2062, 2067, 2076, 2119, 2125

3. List of Finished Issues of Journals

Gives fascicules all "yes" papers of which are made or put into the list of remaining papers (see page 8); all "no" papers (see list of selected papers) not done.

D Total of material dealt with since September 1954 and volumes

100, 101, 102, 103, 104, 105 (1955) 106, 107 108, No 1, 2, 3, 4, 5 (11.6.1956)

in preparation: 108, No 6, 109, No 1, 2, 3, 4, 5 (11.8.56, received 10.10.56)

R (included in the programm since January 1956)

11, No 1, 2, 3, 4, 5, 6, 7, 8 (15.8.1956)

in preparation: 11, No 9 (15.9.1956, received 19.10.1956)

T 24 (1954) since September; 25 (1955) 26 (1956) No 1, 2, 3, 4, 5, 6, 7, 8

in preparation: 26, No 9 (15.9.56, received 5.10.1956)

U 54 (1954) since September 1954, 55, 56, 57 (1955) 58 (1956), 59, No 1, 2

in preparation: 59, No 3, 4 (published 15.8.56,received 19.101956)

A 17, No 1 - 5. No more included in the Project

Z 27 (1954) since September, 28, 29 (1955) 30, No 1, 2, 3, 4, 5

in preparation: 30, No 6, 31, No 1(7), 2(8) (15.8.1956, received 5.10.1956)

E 1 (1956), No 3

in preparation: No 4 (published 17.9.56, received 19.10.56)

4. List of Remaining Papers

(21th Report)

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D: 108, No 6, 109, No 1, 2, 3, 4, 5 (in preparation)

R: no remainder

T: 25 (1955) No 8,9

U: no remainder

Z: 30 (1956) No 6

5. Index of Very Important Papers

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1333 Observation of the Einstein Effect during a Solar Eclipse

1336 On the Premature Changes in the Serum of the Blood found to occur by the Method of Ultraviolet Spectrography in the Case of an Integral Effect Exercised by X-Rays

1337 The Elastic Scattering of Positive Pions with an Energy of 310 MeV by Protons

1338 The Creation of Charged Mesons by 660-MeV Protons on Beryllium and Carbon

1339 On the Application of Non-Selfconjugate Operators in the Theory of Scattering

1345 The Angular Distribution of the Neutrons Produced on the Occasion for the Reaction $T(p,n)He^3$

1355 On the Dependence of the Heat Conductivity of Steam on Temperature

1356 The Heat Transfer on the Occasion of the Transversal Passing of a Two-Phase Flow Round a Heated Cylindrical

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Physical-Technical Institute of the Academy of Science of the Ukrainian SSR: 1326.

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Institute for Crystallography of the Academy of Sciende in the USSR: 1306.

Moscow MEI (Moscow electrotechnical Institute): 1327

Kiev Polytechnical Institute: 1389.

Institute for Silico-Chemistry of the Academy of Sciende of the USSR, Leningrad: 1382.

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SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1301
AUTHOR CAJKOVSKIJ, V.I.
TITLE The Resistance of a Filter-Autocorrelation Receiver for Impulse Signals Against Disturbance.
PERIODICAL Radiotechnika, 11, fasc. 4, 24-30 (1956)
Issued: 5 / 1956 reviewed 9 / 1956

Here the ratio (signal / fluctuationlike disturbance) at the output of a filter autocorrelation receiver is investigated. When computing the correlation coefficient the product $y(t)y(t+\tau)$ must be averaged over a certain finite interval of time. A correlation receiver, which contains a low frequency filter as an averaging device, is here called "filter correlation receiver"; the basic scheme of such a receiver is illustrated on the basis of a drawing. The ratio (signal / obstacle) is defined as the ratio (maximum increment of the constant component at the output of the system on the occasion of the occurrence of the useful signal ΔU_c / average square of the fluctuations at the output of the system when the useful signal is lacking).
When determining the ratio at the output of a simple filter autocorrelation receiver an idealized low frequency filter is used as averaging device. The useful signal at the output of the device is represented as the consequence of radio impulses, and the disturbance as a chance stationary process with continuous uniform energy spectrum.
An integral expression for the dispersion of the fluctuations at the output of the investigated system is given and discussed. The correlation function

Radiotechnika, 11, fasc.4, 24-30 (1956) CARD 2 / 2 PA - 1301

occurring therein contains a term that is independent of τ.
Next, an expression which is true for the useful effect at the output of the multiplier, while the distortion of the impulse of the useful signal at the output of the filter is neglected, is given. Furthermore, a formula for the signal occurring at the output of the idealized low frequency filter is written down.
Next, the ratio A = (signal/obstacle) which is true for the output of a simple filter autocorrelation receiver is given and the course of A as a function of the time of shift is investigated. This dependence is rather complicated, A may become equal to zero in the case of shift times of $\tau_o = m\pi/2\omega_o$ with $m = 1,3,5\ldots$, but with $\tau_o = n\pi/2\omega_o$ with $n = 0,2,4\ldots$ it may assume certain maximum values. Here ω_o is the frequency to which the band filter is tuned. In practice, one of the maximum values must, of course, be selected. With an omptimum band breadth $\Delta\omega$ of the filter, a simple auto-correlation receiver offers no advantages whatever as regards the ratio (signal/disturbance) if compared with the equivalent scheme filter-detector-filter. However, in the case of a sufficiently broad transmission band, this ratio may be doubled with respect to the filter-detector-filter system.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1302
AUTHOR SAMOILOV, V.F., RODIONOV, V.M.
TITLE On a Possible Method of Improving the Accuracy of a Television Picture.
PERIODICAL Radiotechnika, 11, fasc. 4, 44-48 (1956)
Issued: 5 / 1956 reviewed: 9 / 1956

The distinctness of the image is determined by the transmission capacity of the "fronts" of a television signal (sharp transition from bright to dark and vice versa) and by the capacity of reproducing fine details. A decrease of sharpness is connected with the finite diameter of an electron beam in reception- and transmitter tubes.
The device described in this case only increases the contrast of the fine details, it does, however, not exercise any influence upon the front of the television signal; it does not react to the steepness of the front of the impulses, but on the duration of these impulses. The "contrastor" for fine details must satisfy the following demands: 1.) Differentiation of the television signal for the purpose of determining its derivative. 2.) Shift of the signal of the derivative by the time approximately necessary for the transmission of the element of a picture. 3.) Comparison of the signs of the shifted and of the not shifted signal of the derivative. 4.) If signs differ the contrasts of the television signal must increase. In all other cases (++,--,0+,+0,-0,0-,00) the television signal must pass unchanged through the contrastor. By way of an explanation of what has just been said the trans-

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formation of a television signal (fine detail and front) is studied as an example.
A drawing illustrates the simplified block scheme of the device which satisfies these conditions. On this occasion the television signal is differentiated and, after suitable amplification, transferred to the inputs of two uniform shift lines with tuned load. The circuit of this device is arranged for the separate regulation and control of all three components, i.e. of the main video signal, as well as of the "white" and "black" contrasting impulses. The here discussed variety of the block scheme is not the only one, for the order of differentiation and separation as to time of the "video signal" is not of essential importance. The variety with separation as to time of the signal after differentiation is more simple and more economical.
The television signal is differentiated in the contrastor by means of an amplification cascade with penthode switched on to inductive load. A bilateral limiter with germanium diodes should be switched on to the channel for the amplification of the differentiated signal. The main video signal and the contrasting impulses are superimposed by means of cascades which are switched on to a common load resistance.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1303
AUTHOR GONCARSKIJ, L.A.
TITLE On the Computation of the Principal Parameters of Electron Tubes used for Measuring Accelerations.
PERIODICAL Radiotechnika, 11, fasc.4, 49-58 (1956)
Issued: 5 / 1956 reviewed: 9 / 1956

Here the main types of electron tubes used for the measuring and the registration of accelerations on the occasion of the mechanical testing of the resistance to oscillation and shock and the behavior in the case of great acceleration of an apparatus are described, and the technological computation of these tubes is explained. In this connection the theory of mechanically scatterable electron tubes is used as a basis. (L.A.GONCARSKIJ, Radiotechnika, 9, No 1, 63 (1954)). Such an electronic acceleration transmitter consists of an electron tube with an interior inert mass in form of a movable electrode which is fastened to a plastic thrust or abutment. This thrust or abutment is deformed on the occasion of the accelerated motion of the electron tube. The sensitivity of the tube is great when vertical to the working surfaces of its electrodes, and small in a parallel position. The movable electrode together with the elastic kinematic system of the acceleration transmitter forms a mechanical oscillation system; its differential equation is given. The sensitivity of the acceleration transmitted with respect to voltage and current does not depend on the selection of the kinematic system of the movable electrode, but is determined only by the value of the resonance frequency of the

Radiotechnika, 11, fasc.4, 49-58 (1956) CARD 2 / 2 PA - 1303

mechanical oscillations of this system. After determination of the resonance frequency of the kinematic system it is possible to regulate the sensitivity of the apparatus by modifying the distance between its electrodes (in dependence on resonance frequency). Some main types of movable electrodes are described by means of drawings.
A kinematic system of a movable electrode in form of a bar fastened at its end is sensitive in the case of longitudinal and angular accelerations. In devices for the selective measurement or control of these two components a pair of suitably arranged and connected electronic transmitters is used. For this purpose also systems with selective sensitivity for the longitudinal or angular component of accelerations are well suited.
Also a two-cathode transmitter is interesting when used in a bridge circuit. If the cathode is suitably shifted in the gap of an own electrode, the increase of the amperage in one anode is accompanied by a decrease of amperage in the other. The transmitters of angular accelerations have an inert mass the rotation axis of which passes through its center of mass. The position of the inert mass is fixed by means of an elastic element with respect to this axis. In conclusion some concrete types of such elements are discussed.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1304
AUTHOR KAGAN, JU.M., PEREL', V.I.
TITLE On the Mobility and the Space Charge of Ions in an Inhomogeneous Field.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 2, 222-225 (1956)
Issued: 7 / 1956 reviewed: 9 / 1956

The most important interaction process of ions with atoms of the same gas is the pure charge exchange without any important modification of the velocity of the particles concerned. In some cases of practical interest the fields in the layers are so strong that the average energy of the heat motion of atoms is small against the energy taken by the ion on a free path. Therefore the atoms may be considered to be at rest, and the product of the δ-functions of the velocity components v_x, v_y, v_z may be taken as velocity distribution function. At first, the kinetic equation is given for the case that the direction of the field E(z) is at every point identical with the positive direction of the Z-axis. This kinetic equation is then transformed and adapted to initial conditions. The solution found is explicitly given and specialized for the limiting case of a constant field E = const.
Next, the expressions for the drive velocity and the concentration of the ions for inhomogeneous fields are given. The usual opinion that the drive velocity at a given point depends only on the field strength at this point is correct only if the modification of field strength along the free path is small as against the field strength itself. In this case the expression for the drive

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velocity has the same form as in the case of a constant field.
A charged layer in the interval $0 < z < d$ is now studied. For the determination of the concentration of ions within this layer it is necessary to know the distribution of the potential at z = 0. It is shown that this distribution is fully determined by assumption of the function $f_o(v_z)$. (f here denotes the number of ions in the unit of the phase space).
In some cases of practical importance the space charge in the layer contains only positive ions. Next, the potential distribution in the layer is determined by a POISSON equation. This POISSON equation is explicitly given for great field strengths and at low pressures it changes over to LANGMUIR'S equation for the plane case. Also the case of high pressures is dealt with in short. In the case of low pressures the exact LANGMUIR solution of POISSON'S equation for the plane case with no collisions is obtained. However, the general expression found also holds good for the domain of medium pressures, and a generalization of the 3/2 law is given for any pressures. The criterion for the applicability of the 3/2 law is $0{,}3\ d/\lambda \ll 1$.

INSTITUTION: Karelo-Finnish State University.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1305
AUTHOR BONC-BRUEVIC, A.M.
TITLE The Experimental Verification of the Independence of the Velocity of Light with Respect to the Velocity of Motion of the Radiation Source Relative to the Observer.
PERIODICAL Dokl. Akad. Nauk, 109, fasc.3, 481-484 (1956)
Issued: 9 / 1956 reviewed: 9 / 1956

The direct proof of this independence is based upon the comparison between the time of passage of light through a certain length L in the case of two different velocities of the radiation source. Such an experiment has hitherto not been undertaken because of the great technical difficulties it entails. The difference of time of passage through L was measured by means of the phase method for measuring small intervals of time. Before passing through L light intensity was modulated with the frequency F = 12 kc by means of a diffraction modulator with standing ultrasonic waves in a liquid. At first a modulator with one radiator and later one with two radiators of ultrasonic oscillations was used. According to ballistic theory, but not according to the theory of relativity a phase shift ought to occur after the passage through L.
As movable radiation sources the right and the left equatorial solar edge might be used, the velocity difference amounting to at least 3,5 km/sec. The observed track with L = 2000 m was on the site of the observatory of Pulkovo. For the determination of the very small phase differences $\Delta t_b = 75.10^{-12}$ sec, which ought to occur according to the ballistic theory, the phasometric part of a fluorometer

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with high resolving capacity was used. The admissibility of the use of mirrors in the experimental arrangement is based upon the interference test by TOLMAN with solar rays and upon other tests concerning sun rotation.
Measuring consisted in observing recordings of the apparatus at the output of the phasometer when light at first of the one and then of the other equatorial solar edge was directed towards the basis (by a suitable position of the coelostat mirrors). The phase difference on transition from one to the other solar edge was together measured 1700 times. The statistical treatment of the measuring result furnished the value $\Delta t_c = 1,4.10^{-12}$ sec
as the most probable difference of time during passage of the light through the base, the average quadratic deviation herefrom amounted to

$$5,1.10^{-12} \text{ sec.}$$

The result found here corresponds to the assumptions made by the theory of relativity, whilst the result predicted by the ballistic theory is far beyond the limits of errors. Thus, as far as the author knows, the second postulate of the special theory of relativity was directly confirmed for the first time by comparison of the velocities of the light rays originating from light sources moved with different velocities. (Apparently the author knows nothing about the double star tests made by Ritz. - The reviewer).

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1306
AUTHOR BUTUSOV, V.P., PONJATOVSKIJ, E.G., SACHOVSKOJ, G.F.
TITLE The Melting Temperature of Zinc, Cadmium, Thallium, and Antimony at Pressures of up to 30.000 kg/cm^2.
PERIODICAL Dokl.Akad.Nauk, 109, fasc. 3, 519-520 (1956)
Issued: 9 / 1956 reviewed 9 / 1956

The influence exercised by pressure on the melting temperature of chemically pure Zn, Cd, Tl and Sb is studied. A diagram illustrates the melting curves of these elements up to 30.000 kg/cm^2 pressure, which were plotted on the basis of experimental data. If pressure is increased from 0 to 30.000 kg/cm^2, the melting temperature of Zn, Cd and of Tl increases by 129°, 187° and 190° respectively. This increase is linear in the case of Zn and Cd, but in the case of Tl this increase is somewhat accelerated with increasing pressure. However, the melting temperature of antimony decreases if pressure is increased from 0 to 30.000 kg/cm^2, and this decrease accelerates somewhat with growing pressure. Thus, antimony, like bismuth and thallium, has an abnormal course of the melting curve in dependence on pressure.
Because of the anomalous pressure dependence of the melting temperature of antimony as well as because of the similarity of the physical and chemical properties with bismuth and antimony, it may be assumed that antimony passes through a polymorphous transformation at excessively high pressures just like Bi I → Bi II. On the occasion of the thermal examination of antimony at pressures of up to 30.000 kg/cm^2 in the temperature interval of between room temperature and melting

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temperature no polymorphous transformation was found to occur. Probably polymorphous transformation occurs only at pressures of more than 30.000 kg/cm^2. P.W.BRIDGMAN, Phys.Rev. 48, No 11, 692 (1935) found a jump of the amount of fissional stress of antimony to occur at room temperature at a pressure of ~50.000 kg/cm^2. This experimentally determined value is registered in a pressure-temperature diagram, and the probable continuation of the melting curve as well as the line of separation between the two polymorphous modifications of antimony is indicated. It may thus be assumed that the position of the triple point in the state diagram of antimony is determined by the following parameters:

T ~ 550° and p ~ 40.000 kg/cm^2.

I.S.ŽDANOV participated in this work.

INSTITUTION: Institute for Crystallography of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1307
AUTHOR TURBOVIC, I.T.
TITLE On the Multiplication and Division of the Frequency of Modulated and not Modulated Oscillations.
PERIODICAL Radiotechnika, 11, fasc. 8, 3-13 (1956)
Submitted: 9 / 1956 reviewed: 9 / 1956

In 1955 MARCOU and DAGUET, on the "3rd Symposium on Information Theory", describe a system which permits the transmission of spoken words without any serious qualitative deterioration over a channel with a band breadth of 600-1200 c. The basic element is the frequency divider. As frequency multiplication has already been sufficiently well described in literature, the present work gives a short summary of the results known in this respect, namely concerning the multiplication of the frequency of a sinusoidal non-modulated oscillation and of a modulated oscillation. Hereafter, the division of the frequency of the sinusoidal not modulated oscillation is examined, in which case the existence of back-coupling is, in principle, necessary. This process is best dealt with in the same manner as that for the excitation of oscillations in the generator by means of self-excitation. A single-tube divider of frequency, the frequency division in the case of ferroresonance, and, eventually, a twofold frequency divider are investigated. The latter, which is suggested by the author, is described in detail. It consists of a modulator, two stripe-filters, an amplifier, and a limiter. Its properties are: the frequency of the exterior emf is divided twofold, the amplitude of the voltage U at the output I of the divider is proportional to the voltage of the exterior emf E, the

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amplitude of the voltage U_4 at the output of II does not depend on the voltage amplitude of the exterior emf, and the phase of the voltage at the output is, in the case of a suitable selection of the parameters for the division, equal to the phase of the emf, which is divided twofold and independent of the frequency of the emf. The division of the frequency of the modulated oscillation is then examined with the result that the processes occurring in frequency dividers have until now never been investigated with sufficient thoroughness, which may be explained by the great mathematical difficulties presenting themselves in connection with such an investigation. On the other hand, it is possible in a very simple manner to carry out a complete investigation of the process of frequency division in the case of the frequency divider suggested by the author. After a thorough mathematical examination the author comes to the following conclusions: 1.) By multiplication of the oscillation frequency modulated after the phase a distorted multiplication of the phase may be obtained. 2.) On the occasion of the frequency division of such an oscillation the division of the phase is, in principle, marked by such errors as result from delayed back-coupling. 3.) It is possible to construct a frequency divider in which the dividing error of the phase does not depend on the first derived phase of the input voltage with respect to time. 4.) It is possible to transfer two voltages from the described divider of which the one is without distortion but repeats with delay the modulation occurring at the input, while the other voltage is modulated only with respect to the phase.
INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1308
AUTHOR RADENENKO, S.I.
TITLE Ways and Means of Increasing the Efficiency of Simple Broad Band Antennae.
PERIODICAL Radiotechnika, 11, fasc. 8, 25-30 (1956)
Issued: 9 / 1956 reviewed: 9 / 1956

There are cases which make it necessary to broaden the antenna band and to increase its range. The first task was solved by EISENBERG. The easiest way of solving the second task is to use a passive reflector. This would, however, reduce its band, because every reflector must be tuned in to every operating wave. The author shows how it is possible to treble the amplification coefficient of the antenna by using a flat aperiodic reflector consisting of wire grids. If, however, two vibrators with grid reflector working parallel to it are used, an antenna is obtained which is by far superior to the rhombic antenna of the type RC 65/4 I. The characteristic of the range of this RGD antenna in the vertical plane is computed as being:

$$\frac{\lambda_{opt}}{\lambda}, F_{max}(\varphi), \varphi_{max}, \Delta_{\frac{1}{2}}, \Delta_{o}.$$

The author compares the RGD antenna with such otherwise in use and shows that with the former 1.) though the maximum amplification coefficient is lower only by 5-10%, its amplification in the long wave domain is nearly twice as high as with the others, 2.) that the amplification coefficient is modified with much

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greater regularity within the wave band and, with respect to its absolute value, surpasses rhombic antennae within a considerable part of the working domain. 3.) If the value of the input resistance is known, coordination of the antenna can be computed by means of the feeder, and the value of the coefficient of the propagated wave in the feeder may be found in the wave band.

The RGD-2 antenna for the optimum wave 20 m must have the following screen: height of mast 30-35 m, length of screen 50-60 m. Such an antenna may be fixed on to two masts with (speader-) yards. In form of a summary the author maintains that, with costs being the same, the RGD-2 antenna needs only one tenth of the space, which fact is of considerable importance when building radio centers.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1309
AUTHOR ROSENBLAT, M.A.
TITLE Theory and Computation of a Magnetic Modulator Operating According to the Principle of Frequency Doubling.
PERIODICAL Radiotechnika, 11, fasc. 8, 36-51 (1956)
Issued: 9 / 1956 reviewed: 9 / 1956

Such modulators are characterized by a very low sensitivity threshold. The magnetization curve of the core is approximatively described by the formula $B = \alpha \operatorname{arc\,tg} \beta H + \gamma H$, from which, after several transformations, a formula in dimensionless units is obtained:

$$\frac{b_2}{h_0} = \frac{4}{h_1^2}\left(\frac{1 + \frac{h_1^2}{2}}{\sqrt{1 + h_1^2}} - 1\right)$$

Results have been represented by curves as follows: $\frac{b_2}{h_0}$ in dependence on h_1 and $\frac{b_2}{h_0}$ in dependence on h_1 in the case of different h_0=const. These curves show that the first formula actually holds good approximately for all modulators without exception. The minimum signal is determined: 1.) By the influence exercised by the unbalanced character of the modulator, as it is impossible to obtain two cores of identical geometrical dimensions and magnetic characteristics. It is therefore necessary to select such cores for each moderator as differ only little in this respect. 2.) By the drive of the

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zero, which is caused a) by the exterior magnetic fields; the decrease of the influence exercised by them is attained by the selection of a suitable magnetic screening. b) The existence of a second harmonic in the feed voltage. The latter must not be allowed to become greater than (10-100) $\frac{w_1}{w_2} K_U \cdot U_{yo}$ (in dependence of the degree of identity of the modulator core). c) The hysteresis phenomenon, which is the essential cause of zero drive. The curves show that zero-drive as a result of hysteresis may be eliminated by selecting the corresponding voltages of the alternating field.
3.) By the noise made by the magnetic modulator, the influence of which always remains, in contrast to the two aforementioned factors: the zero drive and the influence exercised by theunbalanced character of the modulator, which may be reduced down to the level of quite insignificant quantities. The noise determines the final value of sensitivity of the lowest threshold that may be attained. Magnetic noise, in contrast to electric noise, has hardly been investigated at all: The following curves were plotted:

$G_H = \frac{U_2}{H_0}$ (sensitivity) E_{noise} (noise voltage) and $H_{o\,noise} = \frac{E_{noise}}{G_H}$

in dependence on the amplitude value of the voltage of the alternating field

of the excitation H_1 for modulators with a core of nickel-zinc-ferrite. Next, the dependence of G_H and of the noise level $H_{c\ noise}$ on H_1 is shown for a Russian kind of molybdenum-permalloy at f = 2000 c. As with increasing H_1 the excitation capacity of the modulator and the content of the highest harmonic increase at the output, it is often not advisable to reduce τ by increasing H_1. If τ is to be reduced and, at the same time, the minimum sensitivity threshold is to be secured, it is best to reduce the cross section of the core. Therefore also the influence exercised by the shape of the curves as well as that exercised by load is examined. It was found that in the case of a constant ratio between the load resistance R and the reactive resistance of the winding w_2 of the modulator the power at the output of the modulator is directly proportional to the volume of the core and to the frequency voltage of the source.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1310
AUTHOR ALEKSEJEW, N.F.
TITLE On the Problem of Determining Oscillations in Autogenerators for Waves in the Decimeter Band.
PERIODICAL Radiotechnika, 11, fasc 8, 52-63 (1956)
Issued: 9 / 1956 reviewed: 9 / 1956

The attempt is made to determine: the point of time of the creation of oscillations in the autogenerator, the value of the initial amplitude of self-oscillation, noises in the autogenerator until oscillations begin, as well as the possibility of diminishing the average delay of the high frequency impulse and of reducing the "scattering" of delays. In autogenerators the process for the determination of oscillations can be represented by four stages. In the first two stages super-high-frequency nonstationary processes are rendered more difficult by large angles of the passage of electrons, because voltages at tube electrodes are low. In this case the excitation of the oscillation does not occur at the end of the first stage, but only after the angles of the passage of electrons have adjusted themselves, and this takes place in accordance with the phase equilibrium in the autogenerator. The increase of the working frequency of the autogenerator (in the case of a constant steepness of front of the feeding impulse) leads to the initial conditions of self-oscillation being determined mainly by the noises of the partial effect beginning from a certain frequency onwards. Theoretical- and test data are in agreement: The initial amplitude of self-oscillations is determined by pre-oscillation noises of the

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partial effect and is of the order of a millivolt; the initial amplitude of free oscillations receives not more than 4-6 mV, and the free oscillations at the beginning of the creation of self-oscillations practically fade out. If the back-coupling for the excitation of oscillations with an anode voltage in the impulse = 1000 V is an optimum, self-oscillations are produced at an anode voltage of about 150-200 V. The end of the first stage in connection with the determination of oscillations corresponds to an anode voltage of 40-42 V. Tables for various anode voltages were set up both with back-coupling in action and also with back-coupling out of action. By means of a test GONOROWSKI'S thesis was confirmed concerning the existence and order of magnitude of the frontal scattering of the high frequency impulse in those cases in which the initial conditions of the excitation of self-oscillations are determined by fluctuations.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1311
AUTHOR KONONOWIC, L.M.
TITLE The Computation of Parasitic Capacities on the Occasion of the Mounting of a Radio Apparatus from Printed Elements.
PERIODICAL Radiotechnika, 11, fasc. 8, 64-70 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The application of printed schemes in the production of radio apparatus is one of the best ways that lead to the mechanization and automatization of the mounting of radiotechnological produces. In the present work methods are described by means of which it is possible to carry out the computation of parasitic capacities between printed conductors for the most typical configurations. Also the formula for the computation of capacities between the printed conductor and the apparatus body is described. For the setting up of the formulae the method of conformal representation is employed. Two concentric lines are taken as a basis the capacity of which per unit of length is known and which may be expressed by the formula:

$$C = \frac{2\pi\varepsilon}{\ln \frac{R_2}{R_1}}$$

where R_1 and R_2 are the radii of the exterior and of the interior conductor respectively. For purposes of the examination it is assumed that the thickness of the conductor is smaller by a multiple than its length. If these conditions are satisfied, all characteristic configurations of the conductors can be con-

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formally transformed into concentric lines with the help of elliptic functions. Once the formula for conformal representation and the formula for the capacity of the concentric line is known, it is possible to obtain the formula for the capacity of the conductors of the various configurations.
At first the capacity between parallel printed conductors of equal breadth located on one side of the insulating plate is investigated. The latter are located on the plane w and are conveyed on to the concentric line on the plane z by means of a conformal representation. This is done according to the formula:

$$w = Sn\left(K \frac{\ln z}{\ln R}\right)$$

where Sn is the elliptic sine and ln is $R = \pi \frac{K}{K'}$. The quantities K and K' are completely elliptic integrals. If we denote $\frac{K}{K'} = G_1$ we obtain

$$C = 8{,}85\ G_1 \quad \left[pF/m\right]$$

If the conductor and the conducting plane differ considerably in breadth, we obtain:

$$C = 17{,}7\varepsilon\ G_2$$

Next, the capacity between parallel printed conductors is investigated which lie, one beneath the other, on different sides of the insulating plane. For

conductors of the same breadth one obtains

$$C = 8{,}85 \frac{\varepsilon_\delta}{G_3} \left[pF/m \right]$$

where ε_δ is the relative dielectricity constant of the plate.

For the second case (with considerably differing breadth) one obtains

$$C = 17{,}7 \frac{\varepsilon}{G_3} \left[pF/m \right]$$

For the capacity between printed conductor and apparatus body one obtains, if the nearest wall of the apparatus body is vertical to the plate:

$$C = 17{,}7 \varepsilon G_1 \left[pF/m \right]$$

and, if the wall is parallel to the plate it is necessary to put the dielectricity constant of air, i.e. = 1, for ε .

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1312
AUTHOR KULIKOWSKIJ, A.A.
TITLE The Transitron Generator as a Device with Back-Coupling.
PERIODICAL Radiotechnika, 11, fasc. 8, 71-73 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The basic characteristic of the penthode in connection with transitron operation is a curve which represents the dependence of the current of the second grid on the voltage of the third grid. In the case of a reduced anode voltage this characteristic has a declining branch which is utilized in the transitron schemes.
In the case of such an operation, the points: third grid - cathode are counted as tube "input" which has the control voltage. As "output", where the control current flows, the points are: second grid - cathode. An equivalent scheme of the tube for transitron operation may take the form of an active four-pole with a current generator. The results obtained will differ from those obtained with an ordinary tube used in the same way mainly by the negative rise and, to a small extent, by other values of interelectrode conductivities. The transitron scheme with a common third grid and also with a common second grid must have a negative initial conductivity. This makes it possible to construct autogenerators which utilize negative conductivities.
The most wide-spread are transitron generators with a common cathode and an artificially fitted exterior back-coupling by which the tube receives a negative

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conductivity from the input side. - A formula is set up for the detailed investigation of the influence exercised by various factors on the stability of the generator. The capacity between the 3. grid and the cathode is not high because the two first grids produce a screening effect. Here there are two extreme cases: That of frequencies of more than several kc and that of low frequencies at a not very high capacity C. In the former case the effect produced by the reactive component of input conductivity is equivalent to the effect produced by the low capacity C_{3k} (third grid - cathode), and is independent of the mode of operation of the tube. This gives proof of a great stability of the frequency and of the impossibility of controlling frequency by means of the tube. In the latter case the negative active component diminishes considerably, which renderes self-excitation difficult. But, if the latter nevertheless occurs, frequency stability yet remains low. It is possible, by modifying the operation of the tube to control the frequency of oscillations. It is therefore necessary, in the latter case, to increase capacities in order to obtain conditions that are characteristic of the former case.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1313
AUTHOR Author not mentioned.
TITLE The All Unions Scientific Session, Dedicated to Broadcasting Day
PERIODICAL Radiotechnika, 11, fasc. 6, 74-77 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

A.N. SEMEJONOW discussed the method of investigating transition processes in linear systems as characterized by their frequency characteristics. The method is characterized by the approximative computation of FOURIER'S integral.
JU.I. NEIMARK, JU.K.MAKLANOW, and L.P.NOSLOWA examined the system with delayed backcoupling while taking account of dispersion and nonlinearity, and obtained experimental results which confirmed the theory.
W.M.AGAFONOW used a nomogram for the solution of analysis tasks, which makes it possible to explain the general properties of fourpoles.
W.I.SIFOROW had the task of finding the quantitative relations between disturbance-proof transmission and the parameters of the code to be used for the binary reproduction of a perfect coding according to CHEFFON.
I.F.TURBOWIC in "Some generalizations of KOTELJNIKOW'S theorem" dealt with the analysis of the time function which has an unlimited frequency spectrum.
A.A.PISTOLKORS spoke about the problem of the influence exercised by the flat dielectric layer on the field of the linear current.
W.A.SOWOROWA spoke about the "approximative computation of the propagation of electromagnetic waves by means of the grid method".

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N.G.TRICHOW examined the problem of the diffraction of surface waves on a semi-infinite slowing down structure.
JU.I.SCHERBAJAKOW investigated the detectors of low inertia for the purpose of measuring frequency characteristics of connecting channels within the range of from 150 to 4000 c.
T.M.MICHAILOW spoke about the application of piezoquartz resonators in the technology of frequency stabilization.
A.I.SIFOROW dealt with the theory on the accumulation of noises and fading on the principal radio lines.
JU.B. analyzed the accumulation of fluctuation noises in consideration of the influence exercised by amplitude limiters.
S.A.SNODIC showed that the essential characteristic feature of the telephone channel of radio relay lines is the voltage of the noise.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1314
AUTHOR No Author mentioned
TITLE New Books.
PERIODICAL Radiotechnika, 11, fasc. 8, 79-80 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The successes attained by electrovacuum technology. Under the editorship of G.A.TJAGUNOW. Gosenergoisdat. M.-L. 1956, 256 pages, price 10.25 roubles. Articles containing a survey of various electrovacuum devices. Types and computation methods are described, properties and physical phenomena are mentioned.

N.A.KAPZOW. Electronics. Second enlarged edition. State Publishing House for technical and theoretical literature. M., 1956, 459 pages, price 10,15 roubles.

(Physical bases of radiotechnical electronics). Problems dealt with are: the technology and production of electron- and ion apparatus in-so-far as this is necessary in order to be able to understand physical processes. Some knowledge of physics and quantum mechanics is necessary.

W.O.BUKLER, I.N.WALJAEW and JU.J.RABINOWIČ. Mounting of radio apparatus. Gosenergoisdat, M.-L., 1956, 312 pages, price 11 roubles. Mounting of various elements, building groups and entire radio plants. Control methods for mounting and checking. Material and tools for mounting and assembly.

Collection of works of the Leningrad Electrotechnical Institute for Communi-

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cation. Swjasisdat, M. 1955, 170 pages. Free of charge.
I.M.ZDANOW: "On the question of the formation of nodes in municipal telephone lines".
E.W.SELJACHA: "The analysis method of the stability of linear electric systems".
O.A.SOBOLJOW: "The structural principles of the electron-automatic telephone exchanges".
K.N. LEBEDEW: "On the computation of amplitude correctors".
E.W.RYŽKOW : "On the question of the reflection of long radio waves of the ionosphere".
A.S.FRADIN and W.A.OLENDSKIJ: "On the frequency characteristic of the aircraft spider-antenna."
W.A.CHAZKELEWIČ: "Cascade modulation, its application and method of computation".
W.S.PALSCHKOW: "Input chains in television receivers".
A.M.SAJESDNYJ and N.N.PAWLOW: "Some questions connected with the measuring of nonlinear distortions."
W.B.ROMANOWSKIJ:"The determination of the set characteristic in the electric circuit which is switched on to a periodic voltage and is expressed by a partly steady function."
A.F.GAWRILOW: "The application of the method of approximative iterations by PICCARD for the integration of some equations of mathematical physics."

Collection of the works of the Leningrad Electrotechnical Institute for Communications (fasc.1). Free of charge. M.1956, 110 pages.

N.B.ROMANOWSKIJ: "Recurring formulae for the computation of some elliptic integrals containing trigonometrical functions of multiple ares". and "On the structure of diagrams of partly steady functions".

K.R.SERGEJEWA: "The resistance of the multi-wire conductor".

Ch.I.CERNE: "The computation of the fourpole with a logarithmic frequency characteristic".

D.M.SCHAPIRO: "On the application of steel cores in chokes which suppress disturbances".

A.W.BUJNOW: "The determination of admissible irregularities of the frequency characteristic of the $\gamma\gamma$ full extinction in high frequency telephone channels".

A.S.FRADIN and W.A.OLENDSKIJ: "The method of the general solution of the task concerning the antenna effect of the feeder which is formed under the influence of the asymmetry on the receiver input."

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1315
AUTHOR TROICKIJ, V.N.
TITLE The Propagation of Ultrashort Waves at Great Distances Beyond the Horizon.
PERIODICAL Radiotechnika, 11, fasc. 5, 3-20 (1956)
Issued: 6 / 1956 reviewed: 9 / 1956

Here the tropospheric propagation of ultrashort waves is studied under the assumption that phenomenon is due to laminary and turbulent properties of ε. After corresponding experimental data had been collected it became clear that, besides irregular "voltage jumps" of the field of ultrashort waves at great distances (beyond direct visibility) there exists in quite a regular manner a certain and rather constant level of the field strength. Though this level is low, it surpasses many times the level predicted by the diffraction theory. The theories of the scattering of ultrashort waves assumed the atmosphere to be homogeneous and isotropic, but neither is the case. The atmosphere is anisotropic even in low altitudes with respect to inhomogeneities of ε. In the case of the small angles of irradiation occurring in practice the vertical inhomogeneities play the most important part in connection with the propagation of ultrashort waves over long distances. The pulsations of ε are represented with the help of chance functions. There follows the determination of the average field strength which is produced by the inhomogeneities beyond direct visibility. The field strength depends only little on the wave length and also only little on altitude. The latter

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is the case particularly for long distances.
On the stability of field strength: The total field is created by the superposition of very many waves with chaotically changing phases. The amplitude of the total field then obeys RALEIGH'S distribution. The "period of solidification" is proportional to the wave length and inversely proportional to drive velocity and the distance up to the point of reception.
On the distortions of the signal: The average value of the field strength of the reflected wave depends only little on frequency, but on the occasion of the transmission of the signal distortions nevertheless occur. The principal distortions are due to the fact that at the place of reception waves with different distortions arrive. Besides, the theorem of KOLMOGOROV-OBUCHOV holds good only for the average values of $\Delta\varepsilon$. The distortions connected with rapid "solidification" need not play an important part.
Comparison of the results obtained with experimental data: The experimental data concerning the field strength of ultrashort waves and their dependence on altitude agree well with theoretical dependence.
In the appendix the inhomogeneities of the dielectricity constant of the earth-near stratum of air are discussed.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1316
AUTHOR ZAEZDNYJ, A.M.
TITLE The Method of Harmonic Synthesis and its Application to the Problems of Radiotechnology.
PERIODICAL Radiotechnika, 11, fasc.5, 44-55 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

General part: The harmonic synthesis is the opposite of harmonic analysis and is based upon the following: Given are the arbitrary coefficients A_k and B_k of a harmonic polynomial $A_0 + \sum_{k=1}^{n} (A_k \cos kx + B_k \sin kx)$ and required is the function f(x), which represents this polynomial on an unlimited domain. The special properties of the function f(x) must be named in each case. The carrying out of harmonic analysis is based upon the following: f(x) must contain one single steady variable and be better suited for computations and analytical investigations than the trigonometric sum. In the functional $y = M[v(x)]$ (where M is called modulating function and v initial function) sin x or cos x is chosen as initial function. The modulating function must be selected in such a manner that it reproduces the properties of the coefficients of the polynomial. Thus, the modulating function M(x) must be determined from the assumed coefficients of the harmonic polynomial. Some auxiliary theorems are discussed. Because of the possible transition from a harmonic polynomial to a trigonometric power polynomial it is possible to pass over to a composed periodic function. By means of the method described an equation of the curve to be synthetized may be

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obtained in closed form with respect to a steady variable. The specialities and possibilities of the essentially numerical method are demonstrated.
On the occasion of the computation of transition processes by the method of harmonic synthesis the complicated nature of the system is of no importance if the frequency characteristics are known. The frequency characteristics may also be given graphically or in tables.
As an example the determination of the equation of the curve of the output voltage of an elementary RC-circuit is studied at the input of which a periodic "rectangular" voltage is connected.
Next, the computation of the characteristic of a nonlinear element from an assumed form of the transformation is discussed. The period of the primary oscillation and the FOURIER coefficients of the output oscillation are known. Required is the modulating function, i.e. the coefficients of the trigonometric power polynomial.
An appendix contains formulae for the computation of the coefficients of the trigonometric power polynomial and a harmonic polynomial.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1317
AUTHOR PESKOV, V.P.
TITLE Experiments in Connection with the Enrichment of Helium with the Isotope He^3.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc. 5, 850-854 (1956)
Issued: 8 / 1956 reviewed: 9 / 1956

The aim of this work which was begun in 1949 and was frequently interrupted was the construction of sufficiently productive devices for the purpose of winning the isotope He^3 from a mixture with He^4 and its purification from He^4.
Devices for obtaining He^3: The first device consisted of a DEWAR vessel with liquid helium (2,3°K), from which the He^3 is obtained. It permits enrichment up to 0,2%, i.e. by the 10^3-fold, which is, however, not enough. Besides, the device does not work continuously. With another device which works continuously, the helium is introduced under atmospheric pressure. The He^4 was led off through a filter in form of a superliquid flow for the purpose of enrichtment by thermoosmosis. Besides, the gas enriched by He^3 was led off by means of rectification on the tube. The helium is in an exterior DEWAR vessel under atmospheric pressure and is, according to necessity, replenished from a liquifier. The device is described in detail on the basis of a drawing. In the interior of the DEWAR vessel temperature was kept on a level of from 1,9 - 2° K. The He^3 was completely removed within the limits of error, and the enrichment coefficient may be put at 2.10^4.

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Estimation of the efficiency of separation methods: At first theoretical deliberations concerning the estimation of the separating coefficient of He^3 in the case of superliquid infiltration are discussed. In the case of a length of filter of 1 = 5 cm one obtains the following values for the separating coefficient A: at 1,3° K A = 10^4, at 1,6° A = 8.10^4, at 2,0° K A = 6.10^5 and at 2,1 A = 5.10^5, which means that at ~ 2° K the separation coefficient is largest. In practice the separation coefficient is lower because of interruptions of the process with continued diffusion whilst the superliquid flow ceases, and because of imperfectness in the filter. The enrichtment caused by thermoosmosis cannot continue up to any degree of concentration. Therefore the enrichment of mixtures beyond 10 He^3 and the purification from He^4 is best carried out by means of rectification. As a result of these deliberations the volume of experimental work could be considerably reduced in connection with the construction of concentration plants.
In conclusion the concentration device was discussed on the basis of a drawing. Its mode of operation is similar to that of previous devices, but the rectification column was considerably increased and rectification mainly took place in this rectification column.

INSTITUTION: Institute for Physical Problems of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1318
AUTHOR GAVRILOV, B.I., LAZAREVA, L.E.
TITLE The Yields of Photoneutrons of Medium and Heavy Nuclei.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 855-861 (1956)
Issued: 8 / 1956 reviewed: 9 / 1956

The yield of photoneutrons at various maximum energies of γ-bremsstrahlung from the threshold value of reaction (γ,n) - E_n up to E_{max} = 27 MeV for Cu,Zn,Cd,J, Ta,Au,Tl,Bi,Th,U was measured. These measurements were carried out with the synchrotron of the Physical Institute of the Academy of Science (for 30 MeV), which furnishes 150 γ-momenta of 20 μ sec duration each per second. The samples to be irradiated were fixed in the center of a paraffin block and the slowed down photoneutrons were registered at certain intervals of time between the γ-momenta by means of an ionization chamber filled with BF_3. The curves obtained for the photoneutron yield are illustrated by diagrams. From the integral curves of the neutron yield it is possible to compute the cross sections of the photoneutrons σ_n for different energies of the γ-quanta. The following characteristic values of the obtained cross section curves are shown in a table: cross section $\sigma_{n\ max}$ in the maximum, the energy $E_{\sigma n\ max}$ corresponding to the maximum cross section, the half width of the curve, and the total cross section. The total cross sections and the cross sections in the maximum increase in a similar manner with growing Z($\sim Z^{1,6}$). In rough approximation the total cross section, which is expressed in

MeV barn, is connected up to 27 MeV with the maximum cross section (in barn) by the relation $\int_{E_n}^{\infty} \sigma_n dE \sim 8\sigma_{n\ max}$.

The absorption cross sections of γ-quanta: For nuclei with $Z \gg 0$ the measured photoneutron cross sections are $\sigma_n(E) \sim \sigma(\gamma,n) + 2\sigma(\gamma,2n) + 3\sigma(\gamma,3n) + \ldots \sim \sigma_\gamma(E)\bar{n}(E)$. Here $\bar{n}(E)$ denotes the average number of neutrons emitted by the nucleus at the excitation energy E. After computation (by means of the statistical theory) of the relative probabilities (γ,n), $(\gamma,2n)$, ... and of $\bar{n}(E)$ at different excitation energies, the curves of the absorption cross sections $\sigma_\gamma(E)$ of the γ-quanta are obtained. The relative yields of the reaction which were experimentally measured for various isotopes agree well with theoretical values. The threshold values of the photoneutronic reactions which are possible at excitation energies of up to 27 MeV are shown in a table. At energies of more than 30 MeV the cross sections σ_γ have a noticeable size. If the absorption of γ-quanta is based on a dipole-like mechanism, a qualitative agreement of experimental and theoretical results is obtained. The qualitative comparison makes it necessary to measure neutron yields at higher energies. This work is best carried out with monochromatization of measuring.

INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1319
AUTHOR ACHIEZER, A.I., POLOVIN, R.V.
TITLE On the Theory of the Wavelike Motion of an Electron Plasma.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc. 5, 915-928 (1956)
Issued: 8 / 1956 reviewed: 9 / 1956

This work deals with a general investigation of the nonlinear wavelike motions of an electron plasma at any velocities of the electrons. On this occasion temperature effects are not taken into account, i.e. the temperature of the plasma is put equal to zero. Under these conditions the state of the plasma cannot be characterized by a distribution function but by the electron density, which depends on the coordinates and on time. Some conclusions also relate to the fact that the plasma is in an exterior magnetic field. For an infinitely extended plasma at first the basic equations for $\vec{E}$ and $\vec{H}$, the density n and velocity v of the electrons are written down. Here those motions of electrons are investigated in which all the variable quantities occurring in these basic equations do not depend separately on $\vec{r}$ and t, but on the combination $\vec{i}\vec{r} - Vt$. Here $\vec{i}$ is a constant vector and V a certain constant. These basic equations are at first applied to small oscillations of the plasma and can be solved by successive approximation. The longitudinal and transversal oscillations are de-coupled in first approximation, but in the following approximations they are coupled. Thus, inharmonic oscillations are obtained. Next, the longitudinal oscillations are investigated in a plasma without any restriction to small amplitudes of oscillations. The period of the longitudinal

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oscillations depends on the velocity amplitude u_m. The most simple cases are limiting cases of large and small velocity amplitudes. In the case of average $u_m \tau = t - i\vec{r}/V$ and the velocity period can be expressed by elliptic functions.
Transversal oscillations: In the case of purely transversal oscillations the electrons move along closed orbits and only waves with circular polarization are possible. In the case of small amplitudes transversal linearly polarized oscillations occur. The magnetic field H is parallel to the momentum of the electron. Next, nearly transversal oscillations are studied in which the orbits of electrons are nearly circular.
The investigation of the general case of coupled transversally longitudinal oscillations is a very difficult problem which can be solved only in some limiting cases as e.g. if $\beta = V/c$ and $\beta \sim 1$ are large. The cases $\beta \gg 1$, $\beta \sim 1$ and the case of high energies with arbitrary β are investigated individually.

INSTITUTION: Physical-technical Institute of the Academy of Science of the Ukrainian SSR.
State University of Charkov.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1320
AUTHOR INGRADEN, R.S.
TITLE On the Theory of Hyperons.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc. 5, 951-953 (1956)
Issued 8 / 1956 reviewed 9 / 1956

Here the nucleon is considered as a system of two hypothetical particles ("m-particles") which are in interaction through a field of force χ. This model is distinguished from the hydrogen atom by the fact that the field of force is not COULOMB-like and differs also from previously studied potentials (YUKAWA-potential etc.). This field χ could have a potential $V(r) = -(\pi a/\sqrt{2}\, r)e^{-r^2/2\lambda^2}$ and could satisfy the equation $(\Box - \lambda^{-4}(x^\mu - x_0^\mu)(x-x_0^\mu))\chi = -4\pi a\delta(x-x_0)$. Here r denotes the distance from the source, a - the χ-charge of the source, λ - a certain positive constant "elementary length". From the physical point of view it must be pointed out that there is no free χ-field without sources. The quantization of the above equation can produce no state with a certain four momentum but only states with a certain four moment. Above all, no stationary states with a certain energy correspond to this equation. Therefore it is also not possible to detect possibly existing particles of the χ-field with counters, Wilson chambers etc. The above potential can be considered either as a fourth component of a four vector or as a scalar or pseudoscalar; the first possibility is of greater interest.

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Next, the field equation is given on which occasion the spin of these hypothetical particles is neglected. These particles are assumed to have the same mass m, a χ-charge, and a meson charge $\chi = e/2$ (e - meson charge of the nucleon as a whole). Interaction with the electromagnetic field is neglected. Next, the field equation for the nonrelativistic part is specialized. With an $a \sim 10^{-8}$ CGS only nucleons of the type "(m- χ)-atoms are possible because of $a^2/c\hbar < 1/2$. The binding energy of this system would amount to $\mathcal{E} = 450$ MeV and $\lambda = 0{,}8 \cdot 10^{-14}$ cm. The above conditions, contrary to M.A.MARKOV, Dokl.Akad. Nauk, 101, 51 (1955) lead to a"dissociation" of nucleons at energies of more than 450 MeV, on which occasion the m-particles would be found among the heavy mesons with $\sim 1400\, m_e$. The dissociation level is above the mass of the hyperon Y_2 (its mass is $\sim 2570\, m_e$, its excitation energy ~ 360 MeV). The excited states of the nucleon can be computed only numerically in this model. Only coupled states with $l = 0$ (l - orbital momentum) and different main quantum numbers n are possible. Apparently there exist only few (3-4) such states. The selection rules connected with interaction with the meson field may possibly facilitate an explanation of the rather long life of the hyperons. If the spin of the m-particles is taken into account, an analogous if somewhat more complicated deliberation is possible.

INSTITUTION: Physical Institute of the Polish Academy of Science.
Breslau University "B.BERUT" WROCLAV (Breslau)

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1321
AUTHOR VDOVIN, JU.A.
TITLE The Excitation of "Nuclear Stars" by γ-Quanta.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 955-957 (1956)
Issued: 8 / 1956 reviewed: 9 / 1956

Here a peculiar mechanism of such an excitation is investigated, in which the quantum produces a virtual meson pair at a large distance from the nucleus, which is then absorbed by the same nucleus and excites a "star". All this refers to the domain of high energies $\omega \gg \mu$ (ω - frequency of the quantum, μ - rest mass of the meson). The method used in the previous work by JU.A.VDOVIN, Zurn.eksp.i teor. fis, 30, 782 (1956) is suited also for the present case, i.e. the cross section can be determined by means of the matrix element of the radiation transition.

The nucleus is assumed to be "absolutely black" with respect to pions, and the result is generalized for semitransparent nuclei. The expression for the matrix element is explicitly given, as also the cross sections of this process. The law of conservation $\omega = E_1 + E_2$ is used because, in the case of the process studied, as well as on the occasion of the production of a free pion pair, mesons are created mainly at great distances $r_{eff} \gg R \gtrsim 1/\mu$ from the nucleus. With logarithmic accuracy we obtain $\sigma = (e^2R^2/12) \cdot \ln(\omega^3 R/\mu^2) \cdot |\bar{F}|^2$. With $3 \ln(\omega/\mu) \gg \ln \mu R$ there follows herefrom $\sigma = (e^2R^2/4)\ln(\omega/\mu) \cdot |\bar{F}|^2$. and with $\bar{F} = 1$ $\sigma = (e^2R^2)\ln(\omega/\mu)$. In this case the cross section grows logarith-

mically with the energy of the γ-quanta. The logarithm is, however, due to the domain of large angles between the momenta of mesons and γ-quanta, and within this domain it may be forbidden to neglect the "form factor" $\bar{F}$. The cross section of the process with $R \gg 1/\mu$ amounts to $\sigma = (e^2R^2/12)\left[\ln((\mu^2 + \varepsilon_{max}^2)/\mu^2) - \varepsilon_{max}^2/(\mu^2 + \varepsilon_{max}^2)\right]$. In this case the cross section therefore does not depend on the energy of the γ-quantum. The cross section obtained is identical with the total cross section for the production of a free pion pair. The influence exercised by the "form factor" of the pion can be determined by comparing theoretical conclusions with experimental data. The results obtained can be generalized if a semitransparent nucleus is assumed, the corresponding cross section is given. Integration can, however, not be carried out in a general form in this case. Apart from those studied here, a number of other processes for the production of nuclear "stars" by means of γ-quanta is possible. In view of the fact, however, that, in the case of the above described process a domain that is large as against the dimensions of the nucleus plays the effective part, the process studied is probably the most important at high energies $\omega \gg \mu$.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1322
AUTHOR ZDANOVA, N.F.
TITLE The Temperature Dependence of Viscosity on Liquified Nitrogen with Density being Constant.
PERIODICAL Žurn.eksp.i teor.fis, 31, fasc. 1, 14-17 (1956)
Issued: 9 / 1956 reviewed: 9 / 1956

The present work extends the investigation of this temperature dependence to a voluminous range of values of the density of the liquid comprising values ranging from near triple point up to the critical point. As a test object liquid nitrogen was used, i.e. a simple nonpolar liquid. The systematic and thorough study of these substances is interesting with respect to the setting up of a theory of the liquid state of matter.

Measuring method and apparatus: For these investigations the viscosimeter designed by B.I.VERKIN and N.S.RUDENKO, Žurn.eksp.i teor.fis, 20, 923 (1955) and produced by the laboratory for low temperatures of the Physical-Technical Institute of the Academy of Science was used. The viscosity coefficient of the liquid nitrogen was measured by the relative method. The liquid nitrogen was distilled before condensation in the viscosimeter.

Test results are illustrated by means of a diagram. On this occasion the values of the viscosity are represented as functions of temperature. According to VERKIN and RUDENKO the temperature coefficient of the viscosity of Ar and N_2 changes its sign when passing through the density domain near critical density, which was experimentally confirmed on this occasion. However, the character of the temperature dependence of the viscosity of liquid nitrogen

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does not change near critical density, but at about the double value of critical density. In liquid nitrogen there are two domains with different characters of the temperature dependence of viscosity. With densities $\varrho > 2\,\varrho_k$ (ϱ_k here denotes the density at the critical point) its viscosity decreases with rising temperature (like in the case of liquids), but with $\varrho < 2\,\varrho_k$ viscosity increases with rising temperature (like in the case of gases. In the case of a density of $\varrho = 0{,}60$ ($\varrho \sim 2\,\varrho_k$) viscosity does not depend on temperature. In a diagram (abscissae-density ϱ, ordinates-viscosity η) the family of viscosity isothermes is represented. In the case of liquid nitrogen all isothermes intersect at $\varrho \sim 2\,\varrho_k$. At $\varrho > 0{,}6$ g/cm^3 $\sim 2\varrho_k$ it is true (with liquid nitrogen) that $\eta = Ae^{U/kT}$. This exponential law holds good up to temperatures near T_k. In the case of liquid nitrogen it is true that with $\varrho < 2\varrho_k$ $(\partial\varphi/\partial T)_\varrho < 0$ and with $\varrho > 2\varrho_k$ $(\partial\varphi/\partial T)_\varrho > 0$. This change of the character of temperature dependence is probably due to a change of the mechanism of viscosity.

INSTITUTION: State University of CHAR'KOV

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1323
AUTHOR BOROVIK-ROMANOV, A.S., PARASIN, V.R., PRELNAS, N.M.
TITLE The Antiferromagnetism of the Dehydrated Sulphates of Ni^{++}, Fe^{++}, Co^{++}, Cu^{++}.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc. 1, 18-24 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

Apparatus and samples: Magnetic susceptibility is measured by the FARADAY method by means of an apparatus developed by BOROVIK-ROMANOV and KRUGNAS. This apparatus is suited for measuring within the temperature range of 12-300°K. Temperature was measured by means of a copper-constantan thermocouple. Susceptibility was measured at different values of field strength of from 500-2500 oersted. All samples examined were won by eliminating water from the corresponding crystal hydrates.

Measuring results: The magnetic susceptibility of all 4 dehydrated sulphates was measured at temperatures of from 13 to 300° K. For the molar susceptibility of $NiSO_4$, $FeSO_4$ and $CoSO_4$ 4,27; 13,4 and 9,87 respectively was found. All these three sulphates have a characteristic maximum of susceptibility at the CURIE temperature of T_C = 37°K for $NiSO_4$; 21°K for $FeSO_4$, and 15,5°K for $CoSO_4$. At temperatures that are considerably higher than CURIE-temperature the CURIE-WEISS rule $\chi = C/(T + \Theta)$ holds good for all sulphates. The susceptibility of $CuSO_4$ increases noticeably at temperatures below 20° K, and it diminishes considerably at ~ 35° K. Various differences as against the results obtained by

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the laboratory of LEYDEN are pointed out and discussed.
Conclusions: The 3 dehydrated sulphates $NiSO_4$, $FeSO_4$ and $CoSO_4$ pass over into the antiferromagnetic state at the temperatures 37.21 and 15.5° K.
The sharp break of the curve of the temperature dependence of the magnetic susceptibility of $CuSO_4$ and the course taken by the curve below 35° K may be explained by the fact that below this temperature half of the magnetic copper ions arranges itself antiferromagnetically. The other half of the ions remains unarranged and is responsible for the increase of susceptibility.
The temperature dependence of the magnetic susceptibility of $CoSO_4$ deviates considerably from the CURIE-WEISS rule at low temperatures in the paramagnetic domain, and diminishes with abnormal rapidity in the antiferromagnetic domain. This is explained qualitatively by the splitting up of the main level of the Co^{++} ion by the crystal field.
In the range of temperature of from 14 to 34° K the magnetic susceptibility of the $NiSO_4$ which is in the antiferromagnetic state depends quadratically on temperature.

INSTITUTION: All-Soviet Scientific Research Institute for Physical-Technical and Radiotechnological Measurements.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1324
AUTHOR ZINOV'EVA, K.N.
TITLE The Coefficient of the Spatial Absorption of the Second Sound and the Viscosity of the Normal Component of Helium II up to 0,83° K.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc. 1, 31-36 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

Here the measurements of a previous work (K.N.ZINOV'EVA, Zurn.eksp.i teor.fis, 25, 235 (1953) are continued up to 0,83° K by means of the method previously worked out. Furthermore, the values and the course of temperature of the kinetic coefficients from 1 to 1,3° K were improved by exact measuring.
Measuring method: Measuring was carried out as before in cylindrical glass resonators by investigating the width of the resonance curves in the standing waves at the frequencies of 200 c and 4 kc. Three resonators of different sizes were used. The temperatures below 1° K were attained by evacuating the helium vapors by means of two pumps connected in series. The lowest temperature attained in the course of these experiments corresponds to the velocity of the second sound 22,9 m/sec.
Conclusions: The tests carried out at temperatures of up to 0,83° K concerning the absorption of the second sound fully confirm the correctness of the theory developed by I.L.LANDAU and I.M.KHALATNIKOV, Zurn.eksp. i teor.fis. 19, 637, 709 (1956), ibid. 20, 243 (1950), ibid. 23, 8.21 (1952).
In full agreement with the theory the spatial absorption of the second sound increases sharply also below 1° K with diminishing temperature; in this connection

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the losses caused by the heat conductivity of the He II are larger by one order of magnitude than the viscous losses.
The viscosity of the normal component of the He II grows below 1° K with great rapidity if temperature is reduced. The values of viscosity are, as regards absolute magnitude, identical with the measuring results obtained by the method of rotating cylinders by J.G.DAUNT and A.C.ROLLINS-HALLETT, Canad.J.Phys. 33, 420, 1955. However, a considerable difference compared with the results obtained by K.ANDRONIKASHVILI and other authors by the method of the oscillating disk is noticed.
The quantity which is analogous to the heat conductivity coefficient increases in He II considerably with diminishing temperature, on which occasion it changes in the interval 0,83 - 1,31° K from $1,2.10^{-2}$ to $2,7.10^{-4}$ kal/grad cm.sec.

INSTITUTION: Institute for Physical Problems of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1325
AUTHOR BALASOVA, B.M., ŠARVIN, JU.V.
TITLE The Structure of the Intermediary State of Semiconductors.
PERIODICAL Žurn.eksp.i teor.fis, 31, fasc. 1, 40-44 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The topography of s- and n domains on the surface of tin samples was investigated for various values η of the relative content of the normal phase. On this occasion particularly the qualitative peculiarities of the real structure with stable, equilibrium-like character were cleared up, in order to compare them with the results obtained by theoretical works, in which only the thermodynamic equilibrium was assumed.

Investigation method: The form of the n-domains was investigated by applying (spraying during the test) of a fine ferromagnetic powder (in this case a powder of round particles with $\sim 1\mu$ diameter) on to the surface of the superconductor. For this purpose a glass tube with melted-on glass filter with large pores was introduced through the lid of a DEWAR vessel. Thoroughly dried nickel powder was put into this filter. The sample was brought into the intermediary state by modification of field strength and temperature, whereupon a helium flow was blown through the filter which carried the finest particles with it into the DEWAR vessel, where part of them was deposited on the surface of the sample. The figures formed on this occasion were watched through a telescope and photographed.

Results and conclusions: The real structures of the intermediary state are con-

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siderably more complicated and of more manifold character than the hitherto constructed theoretical models, for the real structures are not sufficiently equilibrium-like and above all the equilibrium-like structures which have the lowest free energy must be very complicated and must differ very considerably for different samples and different values of η. The quantitative computation of experimental results and the theoretical computation of structures in the case of arbitrary values of η is very difficult. For quantitative investigation samples with a surface which enclose an acute angle with the field and the cases $\eta \to 1$ and $\eta \to 0$ are much more simple and agreeable. Besides the direct determination of the form and the dimensions of s- and n-domains there exist, without doubt, also other possibilities for the investigation of the intermediary state, but the accurate quantitative interpretation of the results also in those cases requires knowledge of the geometric conditions of the structure of the intermediary state.

INSTITUTION: Institute for Physical Problems of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1326
AUTHOR ROZENCVEJG, L.N.
TITLE Polarized Neutrons from Reaction D(γ,n).
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc.1, 166-167 (1956)
Issued: 9 / 1956 reviewed: 9 / 1956

Hitherto there has been nothing in literature to show that the products of the photo dissociation of the deuteron are polarized. It is shown here that this effect is due to the interference of electric and magnetic transition. The polarization $\zeta = \langle \sigma_n \rangle$ of the neutrons originating from reaction D(γ,n) amounts to $\zeta = Sp(\sigma_n \varrho_{\lambda\lambda'} \varrho^+_{\lambda'\lambda''})(\delta_{\lambda\lambda''} + \xi \Omega_{\lambda\lambda''}) / Sp(\varrho^+_{\lambda\lambda'})(\delta_{\lambda\lambda'} + \xi \Omega_{\lambda\lambda'})$
Here Ω is a "matrix vector" with the components

$\Omega_x = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}, \Omega_y = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \Omega_z = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$; ξ_x, ξ_y, ξ_z are the

STOKES parameters characterizing the polarization of the inciding photon bundle, and the matrix element ϱ_λ corresponds to the photo dissociation of a deuteron by a γ-quantum with the momentum $\vec{k} = \omega \mathcal{H}$ ($|\mathcal{H}| = 1$) and with the polarization vector $\vec{e}_\lambda$ ($\lambda = 1,2$). On this occasion $\hbar = c = 1$ is assumed. Next, the expression for ϱ_λ for the approximation of the n - p-central forces with effective radius zero is specialized. On this occasion only dipolelike transitions are taken into account and an unimportant factor is omitted. By inserting the expression

for ϱ_λ into the general expression for ζ the expression for ζ which applies in the case of an unpolarized bundle of γ-quanta is obtained. Near the threshold the maximum value of $|\zeta|$ corresponds to the angle $\Theta = \pi/2$, but if the energy E of the photoneutron exceeds the value $E_k = 0{,}24$ MeV, the maximum value ζ_m of the polarization $\zeta_m = (3/6)^{1/6}(\varepsilon_0+E)^{-1,/2} \sim C^{-1/2}(1 - \varepsilon_0/2E)$
corresponds to the flying-off angle $\Theta = \Theta_m$ with
$\sin \Theta_m = (\mu_p - \mu_n) \quad t\sqrt{\varepsilon_1} + \sqrt{\varepsilon_0})(\varepsilon_1+E)/\sqrt{6ME(\varepsilon_0+E)} \sim 0{,}11(1 + \varepsilon_1/E)$.

In conclusion the generalization of the expression for ζ for the case of a polarized photon bundle is explicitly given.

INSTITUTION: Physical-Technical Institute of the Academy of Science of the Ukrainian SSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1327
AUTHOR FRADKIN, B.M.
TITLE A Ferromagnetic Sphere in a Strong Field.
PERIODICAL Zurn. techn. fis, 26, fasc. 5, 1040-1059 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

With strong fields there is no analytical dependence B = f(H). For this reason the distribution of the field in a ferromagnetic body within a strong magnetic field can be determined only by means of a certain idealization of the hysteresis loop. The hysteresis loop of many magnetically soft ferromagnetica, and above all of such made of permalloy, differs only little from a rectangle. Such an idealization of the hysteresis loop is also well suited for many magnetically hard substances. Also the dependence of magnetic induction on field strength in the spontaneously magnetized domains of ferromagnetic crystals has such a form. This proves the applicability of the ideas mentioned here to such electromagnetic processes as take place on the occasion of the shifting of the boundaries of spontaneously magnetized domains.
The magnetic induction in a sphere: The form of the wave front (i.e. the boundary between the domains Ω and Ω_1, where the vector of magnetic induction has not yet or has already changed its direction respectively) can only have the shape of a cylindrical surface. Because of the axial symmetry of the problem this cylindrical surface can only be circular-cylindrical. The re-magnetization of a previously magnetized sphere: The condition for the rotation of the vector of magnetic induction is: $H_e + H_1 + H_2 + H_T = H_s$. Here H_e denotes the exterior field acting

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upon the sphere, H_1 - the field strength due to polarization of the not re-magnetized domain, H_2 - the field strength due to the polarization of the re-magnetized domain, H_T - the field strength due to eddy currents, H_s - coercitive force. Next, the field strength due to the polarization of matter and the field due to the eddy currents are computed. Now the equation of motion of the wave front of re-magnetization is written down and transformed. The process may begin with a negative value of ΔH and may continue at the expense of the magnetizing effect of the not re-magnetized domain (which, at the beginning of the process comprises the entire sphere). Therefore a supporting exterior field is necessary for the maintenance of a totally magnetized state in a ferromagnetic sphere. The dynamic characteristics of re-magnetization are univocal in the case of arbitrary values of the parameters H_s, J (= magnetization of the matter), σ (= electric conductivity of the matter) and some other parameters. The entire magnetic moment of the sphere consists of the magnetic moment M_1 which is due to eddy currents and the magnetic moment M_2 which is due to the polarization of the material of the sphere. Both moments are computed and discussed.

INSTITUTION: Moscow MEI (probably = Moscow Electrotechnical Institute)

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1328
AUTHOR PUCHOV, V.I.
TITLE On the Average Effective Length of a Beam.
PERIODICAL Zurn. techn. fiz, 26, fasc. 5, 1080-1093 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

The "average effective beam length" $\bar{l}$ is the radius of that hemisphere (filled with radiating gas) in the center of which the same specific flux of radiation energy q exists as in an individually studied case (?). For $\bar{l}$ a general formula is derived. $\bar{l}$ may have different values at different points of the interior surface of the radiating volume. In the course of technical computation tables of $\bar{l}$ are often used, but the values contained therein often deviated from the values computed in consideration of the parameter kpl. Here k denotes the average coefficient of the absorption of radiation, p - partial pressure of the radiated gas, l - thickness expressed in meters of the radiating layer of gas. For the exact computation of the heat yield by radiation the dependence of the average effective length $\bar{l}$ on the product kpl for some special cases is here determined: Spherical radiation on the interior surface: It is found that
$\bar{l}$ (sphere) = $(-2,3D/x)\lg \left\{(1-e^{-x} - xe^{-x})\ (2/x^2)\right\}$. Here D denotes the diameter of the sphere and x the position of the investigated point on the x-axis. With values x = 0 to x = 10 the expression $\bar{l}$ (sphere) = (0,66 - 0,027x) D is sufficiently accurate for technical computations.
Next, formulae for $\bar{l}$ for the basic center, any point on the basis, and for a point on the lateral surfaces of cylinders are given.

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There follows an estimation of the deviations of the values of $\bar{l}$ computed by means of the formulae derived herefrom the values computed with the help of the tables.
Conclusions and summary: $\bar{l}$ depends not only on the geometric properties (form and size) of the radiating spaces, but also on the partial pressure of the radiating gas and its radiation-absorbing coefficient.
Some practical instructions concerning the determination of $\bar{l}$ in some special cases are then given. The formulae found are contained in a table, and the curves computed by means of these formulae are shown in a diagram.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1329
AUTHOR BREJTBART, A.JA., LJUDKINSKIJ, I.L.
TITLE On the Computation of the Reciprocal Capacities between Bodies of Small Dimensions.
PERIODICAL Zurn. techn. fis, 26, fasc. 5, 1094-1105 (1956)
Issued: 6 / 1956 reviewed: 9 / 1956

The here derived formulae make it possible to compute the disturbance levels of television sets and other sources with sufficient accuracy, as also to compute the parasitic couplings which may occur in some nodes of radio receiving- or transmitting sets. The here derived expressions, in spite of several simplifications, do not deviate by more than ± 30% from experimental data. At first the reciprocal capacity of two metal bodies in free space is dealt with. For the coupling capacity $C_{coupl} = C_1C_2/R$ is found. Here C_1 and C_2 may be considered as self-capacities of the corresponding bodies with respect to the earth.
Coupling capacity in consideration of the chassis: The influence exercised by the chassis is determined here only approximatively because of the great difficulty of accurate computation. Coupling capacity is smaller than in free space if a chassis (of a television- or radio-set) exists.
Consideration of the influence exercised by small foreign bodies on coupling capacity: The influence exercised by a third body which is small as against the spacing between the other two bodies, and which is sufficiently far from the other two bodies, is computed. It causes a reduction of the reciprocal

capacity of the other bodies. This reduction increases with an increasing third capacity (i.e. the larger the third body is) and with diminishing distance to the third body.
There follows the discussion of the influence exercised by round holes on the permeability of a screen. The electric lines of force penetrating through the holes cause a residual coupling capacity, and in some cases it is rather easy to determine this capacity. This is done here for the special case of round holes, but deliberations may be extended also to holes of other shapes. If some lateral walls exist near the source an infinite number of mirror images are to be introduced. If the shape of the holes does not deviate considerably from the shape of a circle, an "effective radius" can be used. The thickness of the screen may be taken into account by a certain reduction of the effective radius.
Experimental verification of the formulae found: When investigating the main disturbances of radio connections by television it was found that, with a screened line transformer, the graphite covering of the electron beam tubes is one of the principal sources of disturbance. Agreement between the relative theoretical and experimental data concerning coupling capacity is quite satisfactory, but agreement of absolute values is sometimes less good.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1330
AUTHOR MEDKEVIC, D.D.
TITLE Multisection Mechanical Filters.
PERIODICAL Zurn. techn. fis, 26, fasc. 5, 1113-1125 (1956)
Issued: 6 / 1956 reviewed: 9 / 1956

A two-section mechanical filter is a more progressive system for the stabilization of the velocity of a sound carrier, than a rotating stabilizer, but the oscillations of band velocity can in practice not be reduced to more than from 0,25 - 0,20%. The efficiency of the two-section mechanical filter may be improved with success by different schemes of multisection mechanical filters. Several such schemes will be put into practice by the LENKINAP works.

By means of the method developed by CAMBURGEV it is easy to obtain the equivalent electric scheme of a given filter. In order to be able to increase the efficiency of the filter as much as possible it is necessary to increase the moment of inertia of the flywheel, to diminish the reduced mass of the tension pulleys, to diminish the tension of the springs of the tension pulleys, and, finally, to adjust the tension of the band in such a manner than the band is subjected not to flexual but to tensile stress.
In the case of the system developed here, which is illustrated by a drawing, the tension pulleys are arranged on levers with a common axis. Both pulleys are fitted to a common lever arm, and the band is tightened by a third pulley. Self-oscillations are decelerated by a damper in form of an air- or oil brake. The equivalent electric scheme is composed as usual.

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Selection of the angle of application of the tension pulley: The smaller this angle is, the more nonlinear will the system become, this entailing all disadvantages resulting herefrom. Therefore the angle of application of the tension pulley in velocity stabilizers of a kinematic band should be as near 180° as possible.
There follows a report concerning the computation of the spring with a minimum tension for the necessary tightening of the band and concerning the selection of the place where the spring is to be fastened to the pulley lever.
The following conclusions are drawn: The ratio of the lever arms may be an optimum at $n > 1$, $n = 1$ and $n < 1$. Here $n = \Delta\lambda/l$, $\Delta\lambda$ - deformation of the spring, l - displacement of the pulley. The optimum value of n depends largely on the diameter and on the elasticity of the spring, on the displacement of the pulley as well as on other circumstances.
In conclusion the sequence of computations of the spring in the stabilizer of the band velocity is given.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1331
AUTHOR FOK, V.A.
TITLE The Equations of Motion of a System of Heavy Masses in Consideration of their Inner Structure and Rotation.
PERIODICAL Usp. fis. nauk, 59, fasc. 1, 67-69 (1956)
Issued: 7 / 1956 reviewed: 10 /1956

This is a short summary of a lecture delivered on the meeting held in memory of Einstein by the Department for Physical and Mathematical Science on 1.12.1955. The formulae used on this occasion are omitted here.
Also in the theory of the Galilei space (the so-called special theory of relativity) the problem of the correct selection of the coordinate system exists, but it is mostly not broached in explicit form, for the coordinates are assumed to be Galileian. In Einstein's theory of gravitation equations are from the very outset written down invariantly, and the problem concerning selection of the coordinate system suggests itself automatically. In the theory of gravitation additional conditions for the coordinates must therefore be explicitly formulated. It is possible to formulate conditions which determine the coordinate system univocally (down to one LORENTZ transformation).
According to the author's opinion the basic importance of harmonic systems of coordinates in Einstein's theory is not endangered by the possibility of a generally invariant formulation of the equations. From this point of view, however, the Copernican system must be considered as being privileged. If the basic character of the harmonic coordinate system in Einstein's theory is denied, the

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Copernican system is not entitled to a privileged position. According to the author's opinion the existence of a harmonic coordinate system expresses the objective properties of the space-time continuum. This is, naturally, no reason for the use of a harmonic coordinate system to become compulsory.

For the derivation of the relativistic corrections of equations of motion of the bodies, it is necessary, because of the weight of the inner energy of the bodies, to apply all nonrelativistic equations of motion of the continuous medium. In the case of liquid rotating bodies this leads to the equation of LJAPUNOV. The problem of the motion of a system of masses belongs to the problems of determining gravitation potentials. Particular interest is caused by the gravitation potentials at "moderately large" distances from thesystem of the bodies. These "moderately large" distances are large compared with the dimensions of the system, but small compared with the length of the gravitation waves radiated on this occasion. In the general case of the rotating elastic bodies there exist simple asymptotic expressions for the gravitation potentials. In the case of extremely large distances (wave zone) asymptotic expressions are of a somewhat different form.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1332
AUTHOR EINSTEIN, A.
TITLE The Causes of the Formation of Bends in Riverbeds and the So-Called Law by BAER.
PERIODICAL Usp. fis. nauk, 59, fasc. 1, 165-168 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

This work was published in "Die Naturwissenschaften", 14 (1926).

Erosion is strongest where the velocity of the flow diminishes most rapidly towards zero. This is the case with mechanical as well as with physical-chemical erosion. Therefore attention must be focussed on to the velocity gradient on the riverbank. In both cases the asymmetry of the velocity gradient is indirectly due to the creation of a circulation motion.
At first a small experiment is described: If tea in a flat cup is made to rotate by stirring it with a spoon, this rotation motion is slowed down on the walls and particularly on the bottom of the cup. The liquid is thereby caused to move along the bottom and towards the center of the cup, where it rises to the surface from where it again moves towards the outer edge. It is by this that the tea-leaves move towards the center of the bottom.

A similar phenomenon may be observed in the case of a curved flow: In every cross section of a curved course of the flow the water on the surface flows to the outside and on the bottom towards the interior. This is the case, because of the rotation of the earth, also with straight courses, though in a much lesser degree. By this a CORIOLIS force is created which also contributes towards causing the liquid to rotate in the cross section of the flow.

Returning to the subject of the velocity distribution in the cross section of flow, we must bear in mind that an initial stationary velocity distribution would be destroyed only gradually by the friction of the liquid. According to the laws of hydrodynamics the vortex threads in the inner part of the cross section are absorbed, and new ones are produced currently on the outer walls. This causes the quasistationary velocity distribution, which is a very slow process. It is for this reason that insignificant but constant causes are able to exercise considerable influence on the velocity distribution in the cross section. Because of the aforementioned reasons erosion on the outside bank is stronger. This explanation is based essentially on the influence exercised by the slow circulation of the water (in the cross section of the flow) on velocity distribution. Besides, erosion is stronger in the entire outer half of the riverbed, and therefore the bed has its greatest depth there. The inertia of the circulating motion also causes the downstream motion of meandering figures.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1335
AUTHOR MICHAJLOV, A.A.
TITLE Observation of the Einstein Effect during a Solar Eclipse.
PERIODICAL Usp. fis. nauk, 58, fasc. 1, 51-66 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

The following deals with a lecture delivered on November 30th 1955 at the Einstein Memorial Meeting held by the Department for Physical and Mathematical Sciences.
According to Einstein the deflection of a beam passing the sun is 0,87"/r; r denotes the arc from the center of the sun in radians. The technique of recording and the treatment and control of plates are discussed. Above all a sufficient number of bright stars near the sun is required. The African and the Brazilian expeditions in 1919 achieved only partial success because of clouds and probably also because of a cylindrical bending of the heliostat mirror by the heat of the sun. The American expedition to Australia (21.9.1922) had more success, but also the results obtained on this occasion (as also the investigations carried out in the same way) were criticized by some specialists. The investigations carried out on 9.5.1929 by the Potsdam Astrophysical Institute in North Sumatra showed distinctly that an independent determination of the scale of the recordings was not possible with the means available at that time. For purposes of observation during the solar eclipse of 19.6.1936 a special lightproof observation pavilion was built at Blagovescensk in Eastern Siberia. For the independent determination of the scale of the pictures, a

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celestial region in the constellation "Berenice's Hair" was photographed at the same time and with the same objective (by means of a planeparallel glass plate fitted in front of the objective). This test did not, however, achieve much success because of inadequate control of the simultaneous motion of the instrument. A second experiment undertaken on the 21.9.1941 at ALMA-ATA failed owing to difficulties caused by the war, and other observation tests carried out by the State Astronomic Institute of the USSR "Sternberg" in RYBINSK, BELO HORIZONTE (Brazil) and DJATIGORSK (30.6.1954) failed because of thick clouds.

The Einstein effect was observed twice more by VAN BISBROOK by means of methods similar to those employed in the USSR; this first observation was also made in Brazil. The only picture taken was very hazy, and besides it was not possible to use the control picture taken by simultaneous operation with the planeparallel plate. The result obtained was A = 2,01" ± 0,27". On February 25th 1952 VAN BISBROOK was able to determine the scale of deflection at Chartoum (Sudan) with the help of stars used for comparison. He found A = 1,70"±0,10", and for the deflection according to the linear formula $\delta r = - 0{,}066r'' \pm 0{,}67''$. In the author's opinion all experiments hitherto undertaken lack accuracy, and no favorable solar eclipse should be neglected. Other possibilities are discussed in short.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1334
AUTHOR SMIRNOV, N.N.
TITLE The Propagation of Waves along an Infinitely Long Spiral.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 2, 243-246 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

At first the dispersion equation for waves in a spiral, which was set up by S.CH.KOCAN (Dokl.Akad.Nauk, 66, 867 (1949)), is given; its numerical solution requires the summation of the series occurring on its right side, which therefore makes it rather complicated. However, not all terms of this series have the same weight. The most important term in the series is that with a finite (or small) argument, because terms with large argument are small. The size of the argument in the case of an assumed average radius r_o of the spiral is determined by the equation $\gamma_n = \sqrt{h_n^2 - k^2}$. γ is small if $h_n \sim 2\pi n/d$, i.e. if a whole number of waves corresponds to one space (d - spacing of the spiral). Such a term may be described as "resonance term", and in this case it is a particular kind of "spatial" resonance.
Next, the expressions for the zero-th and the n-th resonance are given. Furthermore, the dispersion equation for a spiral consisting of a thin band with a breadth of 2B is given. Sorting out of resonance terms is described by V.J.FOWLER, Trans.I.R.E.No 4, A.P. 3, 132 (1954). According to the author's opinion this work contains an error committed when computing the vector potential, which leads to a wrong dispersion equation. The dispersion equation is

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best solved by using dimensionless variables according to $\varkappa = hd/2\pi$ (h - wave number, d - spacing of the spiral). A diagram shows one of the computed phase characteristics. From the comparison of the characteristics constructed for various values of $\cot g\,\psi$ and $2b/d$ (ψ - winding angle of the spiral, b - radius of the conductor cross section) the following conclusions remain to be drawn: If non-resonancelike terms are taken into account the pitch of the phase characteristic within range of the first and second resonance is reduced, and connection among the parts computed with the formulae for different n is improved. As in the case of the first resonance it is approximately true that $\varkappa \sim n/\cot g\,\psi$ (n - ordinal number of resonance) and because the theory is applicable to small $\varkappa_n$, connection is improved if the angle ψ becomes smaller. With a given angle ψ accuracy deteriorates as n increases. The dispersion equation of the n-th resonance can be derived also immediately by using an averaged boundary condition and the continuity condition of the components of the field along the spiral. When determining the dispersion equation of a spiral consisting of a narrow band, a boundary condition mentioned here must be used. Cross currents can be neglected. Furthermore, a more accurate dispersion equation for such a spiral is given.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1335
AUTHOR MARKOV, M.N.
TITLE Bolometers made of an Alloy of Bismuth and Lead.
PERIODICAL Dokl. Akad. Nauk, 108, fasc. 3, 428-431 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

Bolometers may more easily be produced by steaming-on in the vacuum, but such bolometers were found to be less sensitive than others produced by a more complicated method. For the purpose of improving bolometers produced by evaporation the bismuth bolometem F-1 used in the automatic infrared spectrometer of the Physical Institute of the Academy of Science were investigated.
At first an expression for the threshold of the sensitivity of the bolometer is given; the first term of this expression is due to the temperature fluctuations of the bolometer stripe, the second by the so-called "JOHNSON" noise. With most thermal light receivers at present in use, the second term is from 5 to 10 times as large as the first. If the receiver has an additional noise (e.g. "current noises" resulting from various disturbances etc.), the formula contains a further number of terms. Among other things the present work investigates the problem as to how this additional noise may be reduced to a minimum.
In the case of bismuth the sign and the absolute amount of the temperature coefficient of the resistance depend on slight ($\sim$0,1%) admixtures of Pb, Sn and other metals. On the other hand $\beta < 0$ is only half as large in the case of thin steamed-on layers than with massive bismuth. Besides, β depends on the thickness of the steamed-on layer. On the occasion of the steaming-on bismuth is purified

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from lead and silver, and the concentration of the admixtures sinks below 10^{-3}%.

Layers of pure and technical (with 0,1% Pb) bismuth and of the alloy 99,4% Bi and 0,6% Pb were investigated.
Layers with a resistance of $R_{\square} \lesssim 30$ Ohm have no additional "current resistance" and they have a"noise" like wire resistances. Thinner layers have a more highly pitched noise which depends on the amperage in the layer. The layers consisting of a Bi-Pb-alloy have a much lower level of additional noise.
For the reduction of the absorption threshold the absorption coefficient of the receiving surface is of importance. Steamed-on bismuth layers have a very small absorption (particularly within a range of from 4 to 15 μ). Coating the bismuth layers with bismuth blackening increases the absorption within the range of from 1-3 μ by the 2- to 3-fold, and within the range 4-15 μ by the 5- to 20-fold. Taking account of all these investigations, the author constructed a bolometer by using the alloy 99,4% Bi and 0,6% Pb. The threshold sensitivities of such bolometers are shown in a table; if these bolometers are correctly constructed they may be reduced considerably.

INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1336
AUTHOR GRAEVSKAJA, B.M., ORLOV, B.A.
TITLE On the Premature Changes in the Serum of the Blood found to occur by the Method of Ultraviolet Spectrography in the Case of an Integral Effect Exercised by X-Rays.
PERIODICAL Dokl.Akad.Nauk, 108, fasc.4, 623-625 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

Parallel with spectroscopic investigations also the content of amino acid of thyrocine in the serum of the blood of the irradiated animals was determined. 30 white rats, 5 rabbits, and 12 dogs were examined, and the respective results were essentially in agreement. The animals were exposed to the integral effect of X-rays on the following conditions: 190 KV, 20 ma, filter 0,5 mm Cu and 1,0 mm Al. The dogs were irradiated with a skin-focus distance of from 80-100 cm with a dosage of 6,5-11r per minute. Radiation doses were: 130, 500 and 1000 r for dogs, 1000 r for rabbits, and 500 and 1000 r for mice.
In the course of the experiments undertaken with dogs, before and immediately after irradiation, as well as after 2, 7, 14, 21, 33-40 and 90 days after irradiation 3-5 ml blood was extracted from the femoralis artery. The serum obtained was diluted 8-fold in distilled water and spectrographed in the ultraviolet domain of the spectrum. The absorption maxima of the serum of normal animals is between 2800 and 2920 Å In the case of an irradiation with 1000 (or 500) r_o the absorption maximum is considerably (or noticeably) reduced at 2800 - 2920 Å immediately after irradiation. In the case of dogs irradiated with 130 r

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no changes were noticeable immediately after irradiation, and only on the second day a certain decrease of the UV absorption of the serum was found within the domain of the maximum. After 33 days a certain increase of the optical density of the serum occurred, which was not noticed if larger doses were given. This increase is probably a compensation effect.
Parallel with spectrographic investigations a considerable reduction of the thyrocine content in the serum was found by the method developed by CUVERKALOV immediately after irradiation with 1000 or 500 r. With animals that remained alive (500 r), but not with animals that died (1000 r), the thyrocine content after some time again attains its normal level. In the case of relatively small doses (130 r) the thyrocine content decreased only after some days by about 10% and increased again after a period of 30 - 33 days after irradiation.
A certain parallelism between the modifications of the optical density and of the thyrocine content of the serum makes it appear probable that these modifications are connected with previous disintegrating processes in albumen metabolism. These results show that it is possible to use the spectrographic method for the detection of previous damage caused by irradiation.
The method discussed is of great importance for the timely diagnosis of radiation thickness.

INSTITUTION: Central Radiological and Cancer Institute of the Ministry for Health in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1337
AUTHOR GRIGOR'EV, E.L., MITIN, N.A.
TITLE The Elastic Scattering of Positive Pions with an Energy of 310 MeV by Protons.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc. 1, 37-39 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The differential cross section of the elastic scattering of positive 310 MeV pions by hydrogen was measured by means of nuclear photoemulsions. The electron-sensitive photo plates with an emulsion thickness of 400 μ were irradiated with a bundle of positive pions at the output of a magnetic spectrometer. The mesons were produced by bombarding a paraffin target by a bundle of 660 MeV protons of a synchrocyclotron. The scattering processes were selected by means of a microscope with an immersion objective. The acts of elastic scattering were identified by the following criteria: 1.) Angular correlation between the scattered meson and the recoil proton. 2.) Complanarity. The complanarity condition is explicitly given. 427 scattering processes were found in the sector of dial 10-170° (in the center of mass system). The differential scattering cross section found on the basis of these results has, according to the diagram attached, a minimum at 105°. The total scattering cross section of the positive 310 MeV pions was assumed to be 7.10^{-27} cm^2. (The summation interval was 20°). The differential cross section can be expressed by the first three terms of a LEGENDRE series: $d\sigma/d\Omega = [(2,4\pm0,2) + (4,9\pm0,4)\cos\vartheta + (9,3\pm0,7)\cos^2\vartheta]\cdot10^{-27}$ cm^2/sterad.

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The scattering of the positive 310 MeV pions is explained in first approximation by the fact that only S- and P-states participate. The insufficient accuracy of the results obtained does not make it possible to draw conclusions as to the extent of the contribution made by the D-state towards scattering; probably, however, it plays only an insignificant part. The phase shifts in S-, $P_{3/2}$- and $P_{1/2}$ states with the isotopic spin T = 3/2 are $\alpha_3=-23°$, $\alpha_{33}=132°$ and $\alpha_{31}=-9°$. According to experimental data the phase α_{33} passes through 90° within the range of meson energies of about 200 MeV. This fact may be considered to indicate the existence of a resonance interaction of pions with nucleons in the state with total and isotopic spin 3/2. The value $\alpha_{33} = 132°$ at a meson energy of 310 MeV is not in contradiction to the existence of such a resonance interaction. It is interesting to compare these results with computations basing on the assumption of an excited nucleon state. Such computations were carried out by basing on the assumption that only S- and P-states participate in scattering. The justification for the neglect of the contributions made by higher states was confirmed by the measuring results obtained. According to the attached diagram the curve computed in this manner gives a good description of the general character of the angular distribution of the elastically scattered pions.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1338
AUTHOR BLOCHINTSEV, D.I., VZOROV, I.K., ZRELOV, V.P., MEGANOV, B.S. SABUDIN, A.F.
TITLE The Creation of Charged Mesons by 660-MeV Protons on Beryllium and Carbon.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc. 1, 55-62 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The positive and negative pions created on the occasion of the bombardment of Be and C by protons are studied. The energy of these protons suffices to enable one of the impinging nucleons to pass into an excited state with the angular momentum 3/2 and the isotopic spin 3/2 ($P_{3/2,\ 3/2}$ state) on the occasion of nucleon-nucleon collisions, but it is not sufficient for a production of any importance of two pions by one collision. Experimental Method: The energy distribution of the pions was determined by means of a magnetic spectrometer. The pions which were emitted towards the proton bundle under an angle of 24° and had passed through the spectrometer were registered by means of a telescope consisting of three scintillation counters. Conclusions: The creation probability of positive pions referred to a proton of the target nucleus is more than three times as small as the creation probability in free (p-p) collisions. The spectra of positive and negative pions are distinguished from one another by form and amount of the average energy of the mesons. The relative softness and the washed out character of the spectra of the negative mesons suggest the existence of a weak nucleon interaction in part

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of the final states of the reaction $pn \rightarrow pp\pi^-$. On the average, about 75% of the available energy is used for the creation of a charged pion on the occasion of an elementary act of nucleon-nucleon interaction. It is particularly surprising that on the occasion with these experiments the maximum of the π^+ spectrum occurs within the same range of energy as on the occasion of experiments carried out with the proton accelerator at BROOKHAVEN at collision energies of 1720 and 2300 MeV. This result indicates that the creation of single pions on the occasion of nucleon-nucleon collisions at energies of 660 MeV as well as the creation in pairs of pions at 1720 and 2300 MeV is essentially due to the strong interaction of the meson with the nucleon in the intermediary $P_{3/2,3/2}$ state. The ratio of the yields of positive and negative pions increases with increasing energy up to from 160 to 180 MeV in the center of mass system. The ratio of the integral yields of positive and negative yields is considerably smaller than the value predicted by the theory. This theory presupposed the independence of the creation and of the decay of the intermediary state $P_{3/2,3/2}$.

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

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1339
AUTHOR LIFSIC, M.S.
TITLE On the Application of Non-Selfconjugate Operators in the Theory of Scattering.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc. 1, 121-131 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

Here the existence of a close connection between the scattering matrix of a conjugate nucleus and the characteristic matrix function of its energy operator is confirmed. Besides, some new properties of the scattering matrix itself are disclosed. The energy operator is written down in triangle-representation, by means of which the dependence of the equation of motion and of the decay of the compound nucleus on the character of its spectrum (discrete, continuous etc.) is investigated.

The energy operator of the compound nucleus: On the occasion of the investigation of the nature of the method only the reaction $a + A \rightarrow C \rightarrow X + a$ describing an elastic scattering was examined (a - inciding particle, X - target nucleus, C - compound nucleus). No exterior field is assumed to exist. The operator equation for the complex energy levels and for the quasistationary states of the (decaying) compound nucleus as well as for the equation of motion of the compound nucleus are given. Next, the expression for the scattering matrix $S_0(W)$ is determined; it is a characteristic function of the operator H. The function $S_0(W)$ defines the operator H including a unitary equivalence with accuracy, and thus the scattering matrix completely determines the motion of

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the intermediary system C. If $S_0(W)$ is known, the operators H may be determined in the most simple representation. $S_0(W)$ is an analytical function of W. The eigenvalues of the operator H are in the upper semiplane and are roots of the equation $S_0(W) = 0$. The continuous spectrum of the operator H is (if at all existent) on the real W-axis. Next, the energy operator H^* of a compound nucleus with a finite number of eigenvalues W_k^* is determined. The total decay probability of the system is equal to the sum of the decay probabilities of the individual levels. Also the form of the operator is determined for the case of a mixed discrete-continuous and a purely continuous spectrum. Hereupon the decay of a compound nucleus in the case of a continuous spectrum is computed following which an expression for the (onedimensional) scattering matrix for the case of a degenerated real level is ascertained. In conclusion the influence exercised by a potential field on the scattering matrix of a compound nucleus is computed. If a potential field exists the scattering amplitude is a broken-linear function of the amplitude $S_1^{(C)}(W)$. Here $S_1^{(C)}$ is the amplitude of the purely resonancelike scattering on the occasion of the creation of a compound nucleus C in the case of a lacking potential field.

INSTITUTION: Hydrometeorological Institute of CDMSSA.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1340
AUTHOR EVTJANOV, S.I.
TITLE On the Action brought to Bear from Outside on an Autogenerator.
PERIODICAL Radiotechnika, 11, fasc. 6, 3-12 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

The here investigated technical computation is in no connection with the approximation by polynomials of the anode current and makes it possible to take "self-shift" into account. The method of modulation characteristics, which is based upon using two Fourier series, is newly introduced. Here some details of the computations for asynchronous and synchronous operation are discussed. The main difficulty consists in the harmonic analysis of the anode- or grid currents on the occasion of the action of a sum of voltages upon the grid. Here it is necessary to distinguish between two possible modes of operation: Synchronous operation and asynchronous operation; the frequencies of action from without and of the self-oscillations are in a simple (or no) ratio. The method of modulation characteristics used here for the purpose of solving this problem is above all used in the theory of amplitude modulation. The frequency of action brought to bear from without is considered as carrier frequency, and the frequency of self-oscillations as a modulation frequency. When investigating the modulation process such modulation frequencies should be used as represent the dependence of the amplitude of each harmonic on the shift voltage. On this occasion a spectrum is formed from which it is possible to select the components with the necessary frequencies. For this reason such an autogenerator with action from without is best

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computed in two stages: At first the modulation characteristics are computed and plotted (they may e.g. be approximated by a polygonal course). With their aid the necessary harmonics of the anode current are then determined. This method functions also if the voltages of the exterior force and of the back-coupling act upon different grids of a multi-grid tube. It may also be used for the computation of an autogenerator with two degrees of freedom without exterior action.
Asynchronous operation: If the working point is chosen to be to the right of the locking point, and if self-oscillations occurred in the free autogenerator, the conditions of self-excitation may be eliminated by switching on exterior action. This may cause an asynchronous-like dying-down of oscillations. If, however, the working point is to the left of the locking point, a synchronous-like excitation of self-oscillations may occur in the case of an action from without.
Synchronous operation: The frequencies of the action brought to bear from without and of the self-oscillations should be in the ratio m : n. If the self-oscillations in the case of asynchronous operation are suppressed there is no self-excitation of self-oscillations also within the domain of synchronism.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1341
AUTHOR KOLESOV, L.N.
TITLE The Energy Dependences of a Tube Generator for Extremely High Frequencies.
PERIODICAL Radiotechnika, 11, fasc.6, 27-42 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

This work bases upon the following conditions: 1.) Tubes with flat electrodes are studied: The transmission capacity of the grid is assumed to be equal to zero. 2.) The influence exercised by the space charge is taken into account only in the space between the grid and the cathode. 3.) The coefficient of the exploitation of anode voltage is equal to or smaller than one. 4.) The velocity of the passage of electrons through the grid plane is assumed to be equal to zero.

The electronic processes in the tube: The triode of the generator is best divided into two diode sectors: space grid - cathode and space grid - anode. The phenomena in the space grid - cathode are investigated first. Deviations of the form, amount, and phase of the electron flux (for long waves) may be determined in dependence on the inertia coefficient β_c and the cut off angle Θ of the grid voltage. A diagram by way of an example illustrates such a solution for $\Theta = 90^{\circ}$. With increasing β_c the form of the impulse is distorted, it increases somewhat at first, but diminishes considerably again, and the phase of the passage through the grid remains behind that of the grid voltage. Here β_c and β_a characterize

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the inertia of the system in the spaces grid-cathode and grid-anode respectively. In the case of the so-called critical frequency the tube is practically locked. Following this, the phenomena in the space grid-anode are investigated.

The ratio (efficiency of the oscillations produced by the tube / efficiency of the generator in the anode circuit) is here described as the coefficient of the electronic efficiency of the generator. With increasing β_a the coefficient of the electronic efficiency is reduced all the more, the more the coefficient ξ of the exploitation of anode voltage increases. Also the influence exercised by a small detuning of the anode circuit on the contribution made by the coefficient of electronic efficiency is investigated.

Next, the coefficient of total efficiency and the other relations of the generator are discussed.

The optimum mode of operation of the generator for extremely high frequencies may be attained by a suitable selection of the coefficient of the efficiency of the anode voltage and of the cut off angle of the grid voltage. The dependence of the efficiency and of the coefficient of efficiency of the generator on the cut off angle Θ of the grid voltage is investigated.

In conclusion the sequence of the computation of the generator is given.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1342
AUTHOR DOMBRUGOW, R.M.
TITLE On the Problem of the Accuracy of Measuring Total Resistances with the Help of Long Lines.
PERIODICAL Radiotechnika, 11, fasc. 6, 66-70 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

At first a formula for the determination of the active and reactive components R and X respectively of the load on the lines is given from measuring data. On this occasion errors occur because these formulae and the corresponding nomogram do not take the damping occurring with real lines into account. However, these errors may be taken into account by means of the following correction formula: $\sigma = \sigma_a + \left[(\sigma_a^2 - 1) \cdot l_m - a \lambda/4 \right] = \sigma_a + \Delta\sigma_a$. Here σ denotes the coefficient of the standing voltage wave, $\sigma_a = U_{\mu_a}/U_{m_a}$, U_{m_a} is the amount of one of the voltage minima, U_{μ_a} - the amount of the following maximum, calculated from the end of the loaded line, a - the damping coefficient, l_m - the distance from the place where the load is switched on to the voltage minimum (node), λ - wave length in the line. The above correction formula may be described graphically in form of a family of the dependences $\Delta\sigma_a / \lambda = f(\sigma_a, l_m/\lambda)$ for constant a. If the relative errors $\Delta\sigma/\sigma$ and $\Delta\lambda/\lambda$ are known the maximum relative errors $\Delta R/R$ and $\Delta X/X$ can be determined. When determining the position of the node from the minimum of voltage it is possible to show that the

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following relation holds good: $\Delta l_m/\lambda = (2^{2a}/4\pi\sqrt{\sigma^2-1}) \cdot \Delta\sigma/\sigma$. We further find: $|\Delta R/R = \delta_{R1}+\delta_{R2}+\delta_{R3}+\delta_{R4})|$ $\Delta R/R| = \delta_{X1}+\delta_{X2}+\delta_{X3}+\delta_{X4}$. In these two formulae the first two terms describe the errors occurring on the occasion of the modification of the coefficient of the standing voltage wave, the third and the fourth term depend on the frequency of the generator that feeds the line.
In the case $\delta_{R2} \sim 0$ the error is mainly determined by the term δ_{R1}. The maximum error $\Delta R/R$ is observed for $X > 1$ at $R = X$ and for $X < 1$ at $R = 1$. If X is reduced $\Delta R/R$ diminishes and $\Delta X/X$ increases. When using the mentioned diagrams the accuracy of measuring the active and reactive components R and X of the total resistance of the load can be varied up to a certain degree by suitable selection of the wave resistance of the measuring lines. When determining the active and reactive load component the resistance of the measuring line must be high or low respectively. As the terms δ_{R4} and δ_{X4} increase with increasing L_m/λ, the distance between the "conditional end" of the line and the load must be as small as possible.
In conclusion the errors occurring on the occasion of the determination of the position of the node are analized by calculus of observations. Though this calculus of observations increases the accuracy of determining the position of the node by one order of magnitude, it makes measuring considerably more complicated. It should therefore be used only if the usual method of determining errors from the voltage minimum leads to no results.

INSTITUTION:

[illegible]

[illegible], ...

Experimental Examination of the Rules Concerning the Distribution of Fluctuation Peaks According to Duration.

Radiotechnika, 11, [illegible] 8, 71-[illegible] (1956)

Issued: [illegible] 1956 Reviewed: [illegible] 1956

On the occasion of the solution of many radiotechnical problems it is of importance to know the density of the distribution of the probable duration τ of the fluctuation peaks and of the intervals T between the peaks. A peak is a development which is characterised by the fact that the value of a chance function $\xi(t)$ (representing fluctuation) assumes a certain level a = const in the course of the time τ (duration of peak). In the same way the interval T between the peaks is defined. These rules are the necessary preliminary conditions for the analysis of the influence exercised by fluctuation disturbances in various relay devices in radiotechnology and automatics. We are interested in the mean value of the relay work slit in the time unit and in the function of distribution density for the voltage impulses and the intervals between them. The formulae mostly given are insufficient. They permit no classification of peaks. The value a recurring distribution density were found theoretically, but mathematical results are too complicated and cannot be used for technical computations. For this reason the following experimental method was tried out: The source of normal fluctuations was the noise of the diode [illegible]. A photometrical device controlled the output fluctuations. Exposure

[illegible], 11, [illegible] 8, [illegible] (1956) [illegible] 2 / 2 [illegible] - 1,63

fluctuation was photographed by means of the two-beam impulse oscillograph [illegible]. The drive velocity was arranged so that each oscillogram had about 5 peaks. Even though the results are not sufficient for the drawing of general conclusions, some preliminary conclusions are nevertheless possible. Results are shown in 2 tables.

[illegible]:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1344
AUTHOR KOHENBLIT, L.L., STEJNBERG, A.A.
TITLE A Graphical Method for the Determination of the Chemical Potential in Semiconductors.
PERIODICAL Zurn.techn.fis, 26, fasc. 5, 927-937 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

Here a simple, practical, and sufficiently general graphical method for the determination of the temperature dependence of the chemical potential in semiconductors is described.
Idea of the method: In various equations which describe the state of an atomic semiconductor with admixtures the right and the left side are functions of $\alpha^* = (\alpha/kT)$, which depend on various other quantities (energy intervals, concentration N_d and N_a of the atoms of the donor and acceptor admixture respectively, temperature, etc.). Here α is the chemical potential of the electrons. The quantity α^* can, if the temperature and the parameters of the problem are given, be determined as abscissa of the point of intersection of two functions depending on α^*. However, this method is rendered difficult by the fact that, on the occasion of the modification of some parameters, and even at different temperatures the form of this function changes. However, if the system of reference is selected accordingly, not more than t w o different "universal" diagrams need be drawn for the purpose of determining the chemical potential even in the case of arbitrary values of the parameters. As a first example the equation

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$n_e = N_d^p$ is studied. Here n_e is the density of the free electrons in the conductivity zone and N_d^p the concentration of the holes on the local levels of the donor admixture. The practical realization of the process with the help of a special "work table" is described in detail. Also if the transition of electrons from the valence zone is taken into account, the graphical determination of α^* is not made much more complicated. In this way it is possible to determine α^* in the case of hole-like admixture semiconductors, semiconductors of the NEIGHBOR type, and also in the case of some local donor- or acceptor levels. The method extends to all main types of semiconductors and is equally well suited for degenerated and not degenerated semiconductors. With some practice it is possible by this method to determine the curves $\alpha^*(T)$ within the temperature interval of up to $\sim 1000^0$ within about half an hour. Furthermore, also other parameters, as e.g. n_e are determined together with $\alpha^*(T)$.
As a first example the thermoelectromotoric force of semiconductors with mixed conductivity, and as a further example the electric conductivity of well conductive semiconductors is investigated by means of this method.
On this occasion it was found among other things that the semiconductor model with local admixture levels in the energy spectrum, which is usually used in the zone theory, is less satisfactory in the case of a considerable concentration of admixtures because the possible delocalization of the carriers of admixtures is not taken into account.
INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1345
AUTHOR KOZLOVSKIJ, V.CH.
TITLE The Dynamic Theory of Ion Lattices of the Seignette-Electric Crystals at Static Conditions.
PERIODICAL Zurn. techn. fis, 26, fasc. 5, 963-976 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

Here the onedimensional inharmonic oscillations of seignette-electric ions with or without an electric field are investigated. On this occasion the electrostatic energy of spontaneous polarization is not, as is done by other authors, neglected, nor is the number of degrees of freedom reduced for purposes of simplification. However, in order to avoid too complicated computations, only onedimensional oscillations of the ions of a seignette-active lattice are studied. The ions of the remaining translation lattices are assumed to be immovable. Inspite of these simplifications this theory, at least qualitatively, describes the seignette-electric phenomena in many crystals. For the determination of qualitative results it is necessary to have the parameters of the forces, which take account of the bindings of the ions in the crystal. However, these parameters can at present not be accurately determined in the case of homeopolar crystals, to which belong also seignette-electrica. The potential energy of the seignette- active lattice is developed in a series according to shifts. The forces acting upon the shifted ions are subdivided into three types: 1.) The forces of the interaction of seignette-active ions with the ions of the remaining lattices of the crystal. These forces are here called exterior forces. 2.) The forces of

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the interaction of seignette-active ions among themselves, which are here referred to as "interior forces". 3.) The forces which are due to the deformation of all ions of the grid, which are, above all polarization forces. The potential energies corresponding to these three types of forces and the LAGRANGIAN of the seignette-active lattice are given. From the LAGRANGIAN the principal equations of the problem are derived. Next, the thermal properties of a strongly correlated seignette-electricum are discussed. There follows a report concerning the consideration of the correlation coefficient, slightly correlated seignette-electrica, as well as the seignette-electric crystals in a static electric field.
Also the theory dealt with here is not able to explain a number of effects such as the existence of phase transitions at low temperatures with barium titanate and the existence of spontaneous polarization restricted to a certain temperature interval in a seignette-electric salt. In conclusion ways and means of overcoming these difficulties are mentioned.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1346
AUTHOR GORLOV, G.V., GOCHBERG, B.M., MOROZOV, V.M., SIGIN, V.A.
TITLE The Angular Distribution of the Neutrons Produced on the Occasion of the Reaction $T(p,n)He^3$.
PERIODICAL Zurn.techn.fis, 26, fasc. 5, 985-989 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

This angular distribution was measured for proton energies of 1200, 1400 and 1600 keV. The protons were produced by means of an electrostatic generator and after passing through a 55 degrees magnetic analyser they were directed upon a tritium target. The system for the voltage stabilization of the generator warrants a constancy of the proton energy which is accurate up to 2.10^{-2}%. A solid tritium target was used, and a long counter served as a detector. The proportionality counter had a firm covering of boron and was filled with a mixture of argon and methyl alcohol. Next, the problem of the sensitivity of the long counter with respect to neutrons with different energies is discussed in detail. With the help of the obtained characteristic of sensitivity it was possible to measure the angular distribution of neutrons with more than 25 keV with great accuracy, i.e. for all angles at proton energies of 1400 and 1600 keV and for angles below 152° (in the center of mass system) at 1200 keV. In the case of large angles and 1200 keV accuracy is considerably lower.
Angular distribution was measured inside a cabin of 7 x 5 x 2,5 m, the walls of which were coated with a mixture of paraffin and borax. In the center of the cabin was the tritium target. The long counter was located at the distance of

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1 m from the target and could be turned round the target within the angles of from 10 to 140°. The statistical error of all measurements was less than 1%.

The angular distribution of the neutrons produced on the occasion of reaction T(p,n) is illustrated by a drawing. The number of neutrons counted at different angles decreases considerably with increasing angle and is particularly small at a proton energy of 1200 keV below 90°. The curves for 1200, 1400 and 1600 keV differ only slightly, such difference as there is being due to different degrees of scattering in the target material. The aforementioned data refer to the total number of counted neutrons and comprise also the background. This background can, however, be taken into account with sufficient accuracy. The angular distribution of neutrons found herefor proton energies of 1400 and 1600 keV is similar to the data obtained by G.A.JARVIS et al., Phys.Rev. 79, 929 (1950), but it differs from the data of the aforementioned work at angles of more than 100°. The causes of this difference are explained. This work is of importance for the transport theory of the hydrogen bomb and thermonuclear reactions.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 Pa - 1347
AUTHOR SOCOL', JA.E., SKUPNIK, L.I., SEKUDINOV, V.A.
TITLE The Production of Negative Hydrogen Ions on the Occasion of the Passage of Positive Hydrogen Ions through a Supersonic-Like Jet of Mercury Vapor.
PERIODICAL Zurn.techn.fis, 26, fasc.6, 1208-1221 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

Apparatus: An ion accelerator consisting of a high frequent ion source, a focussing lens, and an acceleration tube produced a bundle of positive hydrogen ions. The direction of this bundle was directed by means of an electrostatic corrector. The corrector was located in a chamber which connected the entire apparatus with a pumping device. The bundle of hydrogen ions entered the vapor jet target through an input channel. The trace of the ion bundle impinging upon the input channel of the vapor jet target could be observed on a quartz screen. The chamber of the vapor jet target and its mode of operation are described in detail on the basis of a drawing.
Measuring method: The mercury vapor jet was formed by a LAVAL nozzle, the supersonic part of which had exactly the same profile as the subsonic part. On the occasion of the production of the vapor jet a corresponding equilibrium must be established in the circulation of the mercury. After circulation equilibrium had been established the chamber of the vapor jet target was arranged in a suitable position with respect to the ion bundle. The bundle of hydrogen ions is slightly scattered when passing through the vapor jet target, on which occasion the vapor

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jet emits flashes of light of considerable intensity at the place where scattering occurs.
Experimental results: The optimum conditions for the transformation $H_1^+ \rightarrow H_1^-$ of positive hydrogen ions into negative ones on the occasion of their passage through the vapor jet target prevail at an energy of 25 keV of the protons and a temperature of 160°(3,2.10^{15} atoms per cm^2) in the boiler. The highest value of the current of negative hydrogen ions impinging upon the Faraday cylinder of the analyzer amounted to about 0,3 microamperes at optimum conditions and at I_0^+ = 30 microamperes, which corresponds to a density of 0,2 microamperes. On the occasion of the production of the vapor jet target a certain "evaporation" of Hg atoms from the target as well as turbulence phenomena when leaving the jet occurs. The disturbing and damaging consequences of these phenomena are pointed out. The flow of mercury vapors through the channels of the jet chamber in the here investigated temperature interval does practically not depend on the mode of operation of the jet. On the other hand, the vapor current passing through the channels of the vapor chamber forms only a small part of the quantity of vapor transferred by the current.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1348
AUTHOR AEROV, E.L., ZHURIN, N.A.
TITLE The Heat- and Mass Transfer in a Granular Layer. I.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1233-1242 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

Here the heat- and mass transfer in a layer of geometrically regular grains with not too small linear dimensions is investigated. The apparatus used for measuring consists of a cylindrical tube of 1... mm diameter, and the gas is introduced from the bottom to the top. The coefficient of the mass transfer was determined from the reduction of the weight of the elements of the filling which were made of naphtalene. These elements, which, as regards form and dimensions, are quite similar to other grains of the filling which were not made of non-sublimating material, are arranged in one or two rows in the upper half of the filling. The production of the grains made of naphtalene and the order in which tests were carried out is described.
Next, the naphtalene content in the gases which corresponds to the equilibrium is measured. Apparatus and carrying out of the test are described on the basis of a drawing. The dependence of the logarithm of the partial pressure p * prevailing in the state of equilibrium on 1/T (T = absolute temperature) is characterized by straight lines having the same inclination. The sublimation heat of the naphtalene, which was computed from this inclination, amounts to ~ 129 kal/kg, which is 10% less than the sublimation heat in the vacuum.
The diffusion coefficient of the naphtalene vapors diffused into the gas was de-

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termined experimentally from the data concerning the evaporation of the naphtalene into a laminary flow in a short section of the tube. The measuring device is discussed in detail. The average values of the diffusion coefficient for air and hydrogen are shown in a table; for air they agree well with theoretical values, but in the case of hydrogen the experimental diffusion coefficient is 43% below the value computed by the equation of SHERWOOD and E.N.GILLILAND, Ind.Eng.Chem. 26, 681 (1934).
The critical numbers found on the occasion of the final treatment of experimental results by NUSSELT as well as by PRANDTL, SCHMIDT, and REYNOLD for the granular layer are explicitly given. In the interval Re = 0,2 - 2000, 31 tests undertaken with hydrogen and 99 with air overlap one another to a univocal dependence with an average scattering of ± 8% and 20% on the occasion of tests with air and hydrogen respectively. According to the character of the dependence of the ratio (Nusselt number / cubic root of the product of PRANDTL'S and SCHMIDT'S numbers) on the REYNOLD number three different kinds of mass transfer may be distinguished.

INSTITUTION:

SUBJECT HEAT / PHYSICS CARD 1 / 2 PA - 1349
AUTHOR AGROV, V.A., BORIK, N.N.
TITLE The Heat- and Mass Transfer in a Granular Layer. II.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1243-1250 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

At first the authors compare their results in detail with those obtained by foreign authors. Next, the heat transfer of a layer of grains is compared with the heat transfer in a chessboard-like arranged bundle of tubes with a flow passing vertically through them. Agreement is tolerably good. There follows a discussion of the heat- and mass transfer to a sphere and a cylinder in a granular layer and in a free flow. The NUSSELT number for a single sphere tends towards two if the REYNOLD number is reduced; on the occasion of the heat transfer of the sphere in the layer this boundary value is apparently much lower and the NUSSELT number in the interval Re_c = 12 to 4 Nu still depends considerably on Re. The NUSSELT number for a cylinder with a transversal flow round it tends towards the constant value $1/\pi$ if the REYNOLD number is reduced.

Discussion of results: The general assumptions made by S.F.GUSHANOV, Izv.Akad. Nauk, Otdel.techn.nauk, No 10, 1341 (1947) with respect to the thermal conditions in a granular layer are confirmed by the present investigation. Thus the motion of the gas, at least at $Re_c > 50$, is to be considered as an "exterior problem". However, the relations mentioned by GUSHANOV are not in agreement with the results obtained by many works published later, and various

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errors committed by GUSHANOV were pointed out. If the spheres are arranged in a layer with direct contacts between individual elements, the amount of Nu_{min} must be considerably below 2, which is confirmed by the measuring results obtained by the authors. A comparison between the results obtained by the authors with the experimental material of other authors shows that two of the equations given at the end of the first part give a good description of most of the experiments which were made at very varying conditions. A comparison of the transfer processes in a granular layer in a chessboard-like bundle of tubes as well as in individual tubes and cylinders shows the following result: The heat transfer in the layer is composed additively of the individual acts of heat transfer to the elements of the layer (in the case of an average velocity in a narrow cross section of the layer). Within the domain $Re_c < 50$ deviations between the heat transfer of the individual element round which a flow flows and the element in the layer begin. In the latter case transfer intensity diminishes more, for, if the velocity is reduced, full flow round the sphere is interrupted in the layer, and between the spherules secondary circulation flows are produced.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1350
AUTHOR SEKTOPALOV, L.N.
TITLE On the Computation of the Relaxation of Tensions in Metals.
PERIODICAL Zurn.techn.fis, 26, fasc. 5, 1021-1033 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

Here the connection of the relaxation of tension with creep and the usual deformations is demonstrated on the basis of conceptions formed concerning real crystals with microdisturbances due to vacancies and dislocated atoms. In a lattice under load (which is a system that is not in thermodynamic equilibrium) the kinetics of the re-arrangement depends on the mobility of the atoms in the lattice. Because of the thermal oscillations of the atoms in the lattice, the production and removal of distortions is closely connected with the irreversible modification of form of the body under load, i.e. with its deformation. The relaxation time of solids depends not only on their temperature but also on the tension applied in this case. Therefore, the relaxation equation is given for the case that, after the static test, a certain plastic deformation remains. The herefrom derived approximated expression for relaxation at high temperatures is not purely exponential but depends also on a certain parameter product $\beta \gamma \sigma_o$ which contains the material constants γ and U_1, as well as the temperature and the stress conditions. Here U_1 denotes the energy constant describing the character of the displacements of atoms in a real lattice, γ - a constant of the dimension of a reciprocal tension, $\beta = 1/kT$. The curve of the tension relaxation at high temperatures has the following special features: After de-

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formation ceases (at $t = t_o$) tension has a constant value ($\sigma = \sigma_o$). At $t > t_o$, $t - t_o \ll \tau^* = \tau_o$ the curve is described by a declining fractional linear function. Here it is true that $\tau^* = \tau_o e^{U_o/kT}$, τ - relaxation time. For $t - t_o \sim \tau^*$ it is true that $\sigma^*/\sigma = 1/(1 + 1{,}71\beta\gamma\sigma_o)$. Here τ^* denotes the relaxation time of the unstressed systems and σ^* is the tension prevailing at the end of the relaxation time. After very long periods of time tension tends towards zero.
For the investigation of the domain of lower temperatures the quadratic approximation in the exponential development
$e^{\beta\gamma\sigma}$ is then studied by means of a formula of approximation.
The results obtained may be formulated as follows: The relaxation of tensions in metals is caused by the interior re-arrangement of the lattice of a real crystal that is not in equilibrium. The mobility of the atoms in such a system decreases with an increase of the binding energy of the atoms and increases with increasing temperature.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1351
AUTHOR BOL'SOV, V.G.
TITLE The Investigation of Thermoelectronic Emission on the Occasion of the Transition from the Solid to the Liquid State.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1151-1162 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

Here previously carried out measurements of the thermoemission current of Cu, Ag and Ge in the solid as well as in the liquid state are repeated with better vacuum conditions and with more pure material.
The measuring device is described on the basis of a drawing. The principal components of the measuring device proper, which is fitted in a vacuum piston, are: a vat containing the material to be examined, a heating spiral made of tantalum sheets, screens for thermal insulation, a protective- and a measuring electrode, as well as a thermopile made of wolfram- and tantalum wire. The repeated examination of Cu and Ag permits comparison with previously obtained results. The Ge-samples were cut out from a monocrystal of the N-type, the admixtures of which were of the order $10^{14}/cm^3$. After the experiment the germanium changed its N-conductivity into a P-conductivity.
Measuring results: In the course of experiments undertaken with purer material and better vacuum conditions the thermoelectron current has no jump during transition from one state of aggregation to another. However, the curve of the temperature dependence of emission changes its steepness at melting point. The lack of a jump of the emission current at melting point means that the true work function

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$\varphi(T)$ does not change on the occasion of transition from the solid to the liquid state. The change of the steepness of temperature dependence at melting point in the case of a constant $\varphi(T)$ is due to a jump-like modification of the temperature coefficient of the work function.
Discussion of results: The lack of a jump-like change of the thermoemission current on the occasion of melting could be explained as follows: The increase of the temperature of the crystal gradually increases the degree of the re-arrangement of surface atoms. The degree of re-arrangement might become so great at temperatures near melting point that the structure of the surface layers and the arrangement of atoms in them is not changed on the occasion of the destruction of the distant arrangement in the volume of the crystal (i.e. when it melts). In that case also the work function is not changed. From this explanation there result two interesting conclusions: One of the causes for the changing of the work function of a given crystal surface on the occasion of a change of temperature is a structural change of the boundary surface of the crystal as a result of increased re-arrangement. 2.) The modification of the spatial structure of the crystal during melting does not change the work function.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1352
AUTHOR GYRKIN, L.N.
TITLE On the Problem of the Temperature Dependence of Thermal Ion Polarization.
PERIODICAL Zurn.techn.fis, 26, fasc.6, 1163-1169 (1956)
Issued: 7 / 1956 reviewed: 12 / 1956

The usual theory of thermal ion polarization is based upon the condition U >> kT. However, according to investigations made by V.A.FOCK, Zurn.techn. fis, 24, 611 (1954) concerning the conductivity and the losses in dielectrica with thermal ion polarization, the height U of the potential barriers to be overcome by the ions on the occasion of polarization is often of the same order of magnitude as kT. Therefore also the cases U $\gtrsim$ kT and U < kT must be investigated. Here the state with stable polarization is examined. The true potential relief of the ion is approximated by a onedimensional rectangular well. Such a model describes the polarization process with sufficient accuracy in some glasses and perhaps also in some seignette-electric crystals. On this occasion the ion (independently of the acting electric field) deviates only little from the fixed well on the occasion of oscillations and "displacements". In the electric field the potential well is distorted.
Furthermore, an expression for the electric moment of the volume unit is given for the case that the dielectricum is anisotropic and that the electric field E includes an equivalent angle (here put equal to zero) with the directions of slight polarization for all investigated ions of the dielectricum. This ex-

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pression is several times transformed. Furthermore, the formula for the moment I is specialized for the case that the condition $q\mathfrak{E}(a+b)/kT = z(1+\varkappa) \ll$ is satisfied. Here q denotes the charge, a - the interior radius of the annular potential well, b - the width of this ring, $\varkappa$ - b/a, z = $q\mathfrak{E}a/kT$.
This problem is investigated also shortly for a macroscopically isotopic dielectricum. In this case the directions of the slight polarization of the ions (or ion groups) are statistically distributed over the space. When computing I it is then necessary to average not only over all values of x, but also over all angles. The expression for I thus found is explicitly given and specialized also for the case $q\mathfrak{E}(a+b)/kT = z(1+\varkappa) \ll 1$. Only within the domain that is far from saturation (i.e. at $z \ll 1$) is the polarization process of an isotropic ion dielectricum described by the same expression that describes an anisotropic dielectricum.

If the potential well and the potential barrier have a comparable width, also the equivalent polarizability of the ions increases with increasing height of the potential barrier (activation energy) U_o. Naturally, the time necessary for the occurrence of polarization must increase on this occasion and the corresponding relaxation frequency must decrease.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1353
AUTHOR KOGAN, M.G.
TITLE The Nonstationary Heat Conduction in Solids which are Limited by Orthogonal Coordinate Surfaces.
1, Threedimensional Temperature Fields.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1185-1193 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

The present work investigates nonstationary threedimensional temperature fields in homogeneous and isotropic bodies, which are caused by nonstationary spatial and surfacelike distributed heat sources in the case of inhomogeneous boundary conditions of the first, second, and third kind. Bodies with 6 surfaces which are created by the section of three pairs of orthogonal coordinate surfaces, and, in addition, degenerated LAMÉ bodies with 6 surfaces are examined. The inhomogeneous partial differential equation for the nonstationary heat conduction process within the body, the boundary conditions valid for the boundary surfaces, and the initial temperature distribution are given. Because of the additivity of the solutions of this linear system the process of nonstationary heat conduction may, in the case of a piecewise continuous modification of the intensity of the sources with respect to time, be represented by a successive superposition of processes which correspond to its jump-like and continuous modification. It is advisable to investigate the two cases separately.
The temperature fields in the case of a discontinuous modification of the intensity of the sources: The most simple and most important case of such a modification is the sudden switching on of heating. For the determination of the non-

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stationary temperature field total systems of orthonormalized eigenfunctions and eigenvalues are introduced. The physical significance of the modified method by FOURIER-LAMÉ used here consists in treating the surface distribution of the source as a limit of a spatial distribution. In the case of a simultaneous effect of a space- and plane source, the temperature field may be considered to be a superposition of "partial fields", each of which is created only by one source. The short-lived effect produced by heat sources (e.g. in the case of a short-circuited electric cable) may often be looked upon as a thermal shock. On this occasion the density of the spatial distribution of the liberated energy may be considered as a limit with unlimited shortening of the duration of the impulse. Next, a formula for the influence function of a punctiform source is given for the threedimensional problem with mixed boundary conditions. There follow representations for the temperature fields in the case of a continuous modification of the intensity of the sources. In this case the solution can be found with the help of a DUHAMEL integral. As examples heat waves are studied.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1354
AUTHOR ZALESSKIJ, A.M.
TITLE The Determination of the Voltage of the Thermal Disruption of a Cylindrical Insulator.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1194-1201 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

The present work describes a new method for the computation of such a disruption while taking into account the heat liberated in a current-carrying vein. This problem is solved by the FOK method, i.e. at first the problem for a plane field is solved, after which one passes to a cylindrical field by conformal representation. The current in the vein changes the heat flux in the insulation considerably. This problem is at first solved for a dielectricum enclosed between plane electrodes. One of the electrodes is heated by a current, the other transfers the heat through another thin dielectricum, which is not under voltage, to the surrounding medium. The equations of heat conduction of the various layers are given and their solutions are determined step by step.

The thermal disruption in the dielectricum occurs on the occasion of the destruction of thermal equilibrium in the dielectricum, i.e. if in the entire device more heat is liberated than is led off into the surrounding medium. Next, a parameter is computed that corresponds to the disruptive voltage U_d, the corresponding family of curves is illustrated by a diagram. With the help of this diagram it is easy to compute the disruptive voltage. After this

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solution for the case of a plane field, the substitutions for transition to a cylindrical field are given.
By this method the disruptive voltage of an insulator for 220 kV was determined. For this purpose the equation of losses is specialized for a paper-oil insulator saturated with transformer oil. U_d = 211 kV is found, which exceeds the operation voltage of the insulator to a sufficient extent, namely by 66%.

The disruptive voltage of a cylindrical insulation depends essentially on the quantity p_o of the losses at an initial temperature ϑ_o of the multiplication constant a, and on the heat conduction coefficient λ_1 of the dielectricum. λ_1 changes rather little with different insulating materials, but a and p_o may change considerably according to the quality of the insulation. By reducing these parameters the disruptive voltage of insulators may be considerably increased. This method may be employed both for the computation of through-insulators as also for the computation of the insulators of cables and other insulator types.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1355
AUTHOR BARGAFTIK, N.B., SMIRNOVA, E.V.
TITLE On the Dependence of the Heat Conductivity of Steam on Temperature.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1251-1261 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

At first several works dealing with this topic are discussed and criticized. For the comparison of two different methods for the determination of the heat conductivity of steam and for the purpose of finding the corresponding sources of errors the authors undertook experiments concerning the determination of the heat conductivity of steam by means of two different devices. The one is based on the method of coaxial cylinders (method by F.KEYES and D.SANDELL, Trans. ASME, 72, 6, 767, 1950), the other on the method of a heated wire. The method of the heated wire is based on the determination of the heat conductivity of a gas located between coaxial cylinders. The inner cylinder consists of an electrically heated thin platinum wire and serves at the same time as a resistance thermometer. On the exterior surface of the second cylinder, which consists of a quartz- or glass tube, a platinum resistance thermometer is wound. The coefficient of heat conductivity is determined from the amount of heat transferred by the current in the measuring wire, from the temperature difference in the layer of the gas to be examined, and from the geometrical conditions of the device. The results obtained by the authors with the help of this method agree well with previously obtained measuring results. In the case of the method of coaxial cylinders, two coaxial cylinder (diameter = 25 mm) with

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a narrow gap between them containing the substance to be investigated are used. The heating system is in the inner cylinder. The coefficient of heat conductivity is determined from the heat flux through the substance to be examined and from the difference of temperature between the exterior surface of the inner cylinder and the interior surface of the outside cylinder. Next, the causes for the lack of agreement between the experimental results obtained by KEYES and SANDELL and those obtained by other authors are discussed. The main disadvantages of the apparatus developed by KEYES and SANDELL are the existence of 7 centering screws and the lack of a protective heating system in the lower part of the cylinder. Therefore the authors determined the heat conductivity of steam by means of a relative method. In this connection it is necessary to know the heat conductivity of a material of reference (in this case nitrogen) well. Because, when taring the apparatus, KEYES and SANDELL assumed the heat conductivity of nitrogen to be low, they also obtained too low values for the heat conductivity of steam.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1356
AUTHOR ALIMOV, P.Z.
TITLE The Heat Transfer on the Occasion of the Transversal Passing of a Two-Phase Flow Round a Heated Cylindrical Tube.
PERIODICAL Zurn.techn.fis, 26, fasc. 6, 1291-1305 (1956)
Issued: 7 / 1956 reviewed: 10 /1956

The present work deals with the heat transfer on the occasion of the transversal passing of air containing extremely small droplets of water round metal cylinders. Owing to the difficulties arising in connection with the aforementioned conditions the experiments were carried out with simplified conditions.
Order and method of the experiments are described on the basis of a drawing. A liquid (distilled water) was pumped from a pressure vessel through a purifying filter to a centrifugal strainer under a pressure of 2 - 10 atm. The drops of water leaving the centrifugal strainer drop under the influence of gravity, taking the air with them. Hereby a two-phase cylindrical flow with a diameter of up to 1 m is produced at distances of up to 0,5 m from the strainer; in this flow the metal cylinder to be investigated was located. The water was collected in a vessel, purified, and pumped back into the pressure vessel. The test cylinders were made of duraluminium rods of 12, 18, 22, 25 and 40 mm diameter, and were heated from within by an alternating current. The temperature of the surface of the compensators and test cylinders was measured by means of thermopiles. Considering heat transfer by radiation, there was good agreement among the results obtained at all surface temperatures, which indicates that the apparatus used is

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well suited for its purpose.
Conclusions: According to the temperature of the cylinder surface, there exist two different kinds of flow round the cylinders and of heat transfer: a film-like and a not wetted kind. Transition from the film-like to the not wetted kind takes place if the temperature of the cylinder surface is somewhat higher than the boiling temperature of the liquid, and by this transition the intensity of the heat transfer is considerably reduced. Experimental results are here represented in form of generalized quantitative dependences. However, because of the special character of the experimental method employed several quantities entering into these relations are indirectly determined by computation.

The process investigated is suited for a variety of technical applications. Above all the film-like flow may be most effective for the purpose of cooling highly heated surfaces. In the case of not too large REYNOLD numbers (of the order of from 300 to 5000) and in the case of a moderate consumption of liquid, it was possible to conserve a heat flux of up to 150.000 kcal/m^2. hour and a heat transfer coefficient of up to 1700 kcal/m^2.hour.^{o}C. This is 30 - 35 times as much as in the case of a flow with only air. This work is of great practical importance for the gas cooling of reactors.

INSTITUTION:

AUTHOR STEJN, B.B.
TITLE One-Band Modulation with the Help of Phase Systems.
PERIODICAL Radiotechnika, 11, fasc. 6, 13-26 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

Here the principle of the separation of a lateral frequency band by means of three-phase modulation is dealt with. With three-phase modulation equilibrium modulators and filters are unnecessary, but the phase shifts in the high- and low frequency parts must be exactly observed. At the present stage of radio-technology this is easily possible.

The principle of three-phase modulation: On the occasion of the modulation of a three-phase system of high frequency currents (or voltages) by a three-phase system of currents with sound frequency the following current system is obtained:

$$i_1 = I_{1n}(1 + m \sin \Omega t) \sin \omega_o t$$
$$i_2 = I_{1b}\left[1 + m \sin (\Omega t + 120^\circ)\right] \sin(\omega_o t + 120^\circ)$$
$$i_3 = I_{1n}\left[1 + m \sin (\Omega_2 + 240^\circ)\right] \sin(\omega_o t + 240^\circ)$$

Here I_{1n} denotes the value of the current for operation with carrier frequency, Ω - the sound-angular frequency, ω_o - high angular frequency, m - modulation coefficient. By superposition of the currents in a common circuit the voltage of the lower lateral band is obtained. In the case of another order of phases the above lateral band may be separated.

The block scheme of the device should be designed so that the three-phase modulating device need not be newly tuned in when switching over the transmitter from one wave to another. For this purpose a lateral band must be separated on a middle frequency. The block scheme of the cascadelike union of phase fourpoles is discussed on the basis of a drawing. This cascade scheme with crossed coupling of fourpoles theoretically permits the realization of an assumed constant phase shift within a certain frequency range. The accuracy of the summary phase characteristic depends exclusively on the accuracy of the characteristic of every individual phase shifter. The cascadelike wiring circuit of the phase shifters makes it possible to obtain a twophase voltage with a shift of 120° at the output of the device. This twophase voltage can be converted into a threephase voltage by means of the circuit illustrated. In real technical systems there is always a certain inaccuracy of phase shifts. Therefore the permitted deviations of phase shifts and the technical possibilities of the realization of these tolerances are here determined.

In conclusion the experimental realization of these deliberations is discussed in detail. Tests carried out with the device confirmed theoretical assumptions. The device is rather simple and has no complicated filter. It is ready for being used in practice.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1358
AUTHOR KALININ, A.I.
TITLE On the Computation of the Field Strength in the Zones of Shadow and Half-Shadow on the Occasion of the Propagation of Ultrashort Waves along the Smooth Spherical Surface of the Earth.
PERIODICAL Radiotechnika, 11, fasc. 6, 43-49 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

The present work describes an approximated method for the computation of field strength in these zones without graphical interpolation. The only method for such computations hitherto known is that by B.A.VVEDENSKIJ. In the case of ultrashort waves it is possible in many cases (with the exception of the propagation of waves with a wave length of more than 1 to 2 m with vertical polarization above the sea) to replace a corresponding expression by VVEDENSKIJ by the boundary value. In that case field strength does not depend on the electric parameters of the earth surface and also not on polarization, and a simple formula for the attenuation factor in the zone of the shadow is obtained: $V_{db} = U_1(x)_{db} + U_2(Y_1)_{db} + U_2(Y_2)_{db}$. Here x denotes the distance between the points of transmission and reception in dimensionless units, Y_1 and Y_2 - the heights of the transmitting- and receiving antenna respectively in dimensionless units, $x = R/R_o$, $R_o = (a_{ae}^2 \lambda/\pi)^{1/3}$, a_{ae} - equivalence radius of the earth, λ - wave length, $Y_1 = h_1/h_o$, $Y_2 = h_2/h_o$, h_1 and h_2 - height of the transmitting- and receiving antenna respectively above the surface of the

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earth, $h_o = (a_{ae} \lambda^2/8\pi^2)^{1/3}$. For ultrashort waves and not too low heights of the antennae the exponential dependence of the attenuation factor on distance holds good not only for the zone of shadow, but up to the distance of direct visibility and even beyond that distance. This permits a simple approximative computation of the attenuation factor in these zones. Computation of the attenuation factor in the zones of shadow and half-shadow is reduced to the computation of h_o and to the formula $V_{db} = V_{o\,db} - 17{,}1\sqrt{Y_1}(1+1/\sqrt{m})(\xi-1)$, where Y_1 denotes the smaller height of the antennae in dimensionless units, $m = Y_1/Y_2 = h_1/h_2 \leq 1$, $\xi = R/R_{np}$, $R_{np} = \sqrt{2a_{ae}}(\sqrt{h_1} + \sqrt{h_2})$, V_o - value of the attenuation factor with $x_{np} = R_{np}/R_o$.
Next, the limit ranges of application of the interference formulae and of the last formula but one is shown. These computations of field strength, according to this formula contain no inaccuracies greater than 2 db, and this is the case even with an antenna height of 10 m and a wave length of 7 m. With a permitted error of 2 db the formula derived here may be used if only $x_{np} = \sqrt{Y_1} + \sqrt{Y_2} \geq 0{,}5$. This condition is always satisfied within the range of ultrashort waves if the antennae are not too low. Thus it is possible to compute field strength in the zones of shadow and half-shadow without difficulty with an accuracy that is sufficient for practical purposes.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1359
AUTHOR GLAZMAN, M.S.
TITLE The Effective Output Circuit of a Television Radio Transmitter.
PERIODICAL Radiotechnika, 11, fasc. 7, 3-12 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The present work deals with the possibilities of suppressing part of the lower lateral band and with the determination of the selective frequency characteristic of a television transmitter. The realization of a steep lower section which at extremely high frequencies amounts to a fraction of a percent of the boundary frequency of the channel, necessitates special measures besides the suppression of the emitted radiation of low frequencies. This problem is solved in the following manner according to the demand made on the construction of the television transmitter: 1.) By using special ultrahigh frequency filters in the transmitter. 2.) By the utilization of the summary selective properties of the inter-cascade-circuits of the transmitter. The construction and the possibilities for the application of both methods are discussed in short. There follow deliberations concerning the construction of the electric circuit systems in the broad band cascades of the transmitter. Among other things a comparison of resonance curves shows that, in the case of a simultaneous decline of the characteristics on the edge of the band, e.g. by one db (conditions otherwise being the same) the transmission bands of a three-circuit- or of a one-circuit-filter are 2,38 or twice as wide respectively as in the case of a one-circuit-filter. By making the circuit systems of the pre-cascades of the broad band section more compli-

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cated the nominal power of the tubes in these cascades is only slightly diminished. The increase of selectivity of the inter-cascade-circuits in the input circuit of the transmitter means no essential improvement with respect to the resulting energy coefficients. The circuit system of the end cascade of the transmitter with increased selectivity is then discussed. The increase of selectivity of this circuit system by a simple increase of the number of intermediary tuned circuits in the anode circuit is not useful. It is of greater advantage to construct the circuit system in form of a band filter with the damping peaks at the transmission boundaries of the band. The wiring diagram of such a filter as well as its equivalence scheme are discussed on the basis of a drawing. Finally, the equivalent resistance of the tube which is caused by this circuit system, is determined. A further advantage offered by the scheme discussed here is the protection of the output of the television transmitter against the frequency of the sound emitter in the case of the operation on a common antenna. Experimental verification resulted in a sufficiently accurate agreement with theoretically computed relations. The selective circuit system warrants a noticeable broadening of the transmission band of the end cascade without any reduction of its power. The here discussed scheme was realized in many television stations of the Soviet Union.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1360
AUTHOR GAJLIT, T.A., LINAKOVA, I.I.
TITLE The Synchronization of a Tube Generator for Sinus Oscillations by a Fractured Multiple Quasi-Elastic Force.
PERIODICAL Radiotechnika, 11, fasc. 7, 50-56 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The frequency $\omega = p/n$ ($n = 2,3,\ldots k$) of the harmonic exterior force is near the frequency of one of the sub-harmonics of the eigenoscillations of the generator, but the eigenfrequency of the generator is $\omega_o \sim p$. The present investigation considers the soft and the hard mode of operation of the generator. If the system produces quasisinusoidal eigenoscillations in the case of a lacking exterior emf, periodic synchronous-like modes of operation of the generator are possible if an exterior emf (with $p \sim \omega_o$) exists. On this occasion oscillations enforced in the generator are produced with a frequency of the exterior force, and its own eigen oscillations are synchronized, i.e. its frequency then amounts to $\omega = p$. The amplitudes of the synchronized eigenoscillations depend in a very complicated manner on the amplitude of the exterior force, but each term of the corresponding formulae can be interpreted physically. The character of the modification of the amplitude and the phase in the case of synchronous-like operation depends essentially on the coefficients to be found in the equations with cos φ, sin φ, cos 2 , and sin 2 φ. In the general case investigation is carried out graphically. It was proved in theory that phase- and amplitude-jumps are possible. These jumps may occur according to the direction of the modification of the "detuning"

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at various points of the synchronization domain. If there are jumps, phases may change by more than π within the domain of synchronization. Furthermore, there exists a domain with stationary phase values. The theoretical investigation of a concrete generator scheme ($n = 2$ and $n = 3$) confirms the conclusions derived here. On the occasion of a thorough investigation of the case $n = 2$ the existence of a "threshold value" of a certain parameter was furthermore found, in the case of which further jumps are possible.
The block scheme of the experimental order is given; in the cathode repeater it contains a circuit which is tuned in to the frequency of the eigenoscillations of the generator to be synchronized. It is thereby possible, in the spectrum of the exterior force, to suppress the harmonics with a frequency that is near the eigenfrequency of the generator. Synchronization was carried out at frequencies of the exterior force $\omega_e = p/n$ ($n = 2,3,4,5$; $p \sim \omega_o$, ω_o - frequency of the generator, and showed that synchronization takes place on the subharmonic at arbitrarily small amplitudes of the exterior force. If the amplitude of the exterior force is increased, the breadth of the synchronization band increases non-linearly.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1361
AUTHOR PEROV, O.I.
TITLE On the Problem of the Computation of the Effective Reflecting Area of a Surface Target within the Range of Centimeter Waves.
PERIODICAL Radiotechnika, 11, fasc. 7, 57-58 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The present work remarks upon the faulty computations, such as are found in literature, of the effective reflecting area of surfaces which reflect radio waves diffusely. This relates to the impulselike irradiation of the surface of the earth, as e.g. by the panorama radiolocator of an aircraft.
The surface of the earth behaves with respect to centimeter waves like a diffusely reflecting surface. It is therefore possible, when investigating the field, to do so on the basis of LAMBERT'S law according to which the diagram of secondary radiation is a sphere that touches the reflecting surface.
If part of the surface of the earth with the area S_1 is uniformly irradiated, the density of the power flux of the reflecting wave through the surface of the hemisphere of the radius R around the point B (R - distance between the radiolocation station and the reflecting object) is $D_{2\Theta} = D_{2m} \sin \Theta$. Here D_{2M} is the density of the power current at zenith (point A), Θ - the angle above the horizon of the investigated point B. If D_{2M} is known the power P_{refl} which is reflected by the surface S_1 can be computed by integration of the density of the power current with respect to the surface of the hemisphere. On the other hand, it is true that

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$P_{refl} = \varrho P_1 \sin \Theta S_1$. Here ϱ denotes the reflection coefficient of the radio waves on the surface and D_1 - the density of the power current of the primary wave. For the effective reflecting area of the surface $S_{e\Theta}$ of the observed domain of the surface in the direction of the source of primary radiation $S_{e\Theta} = 4\pi R^2 D_{2\Theta}/D_1 = 4\varrho S_1 \sin^2\Theta$. This formula is e.g. derived by A.F.BOGOMOLOV, Bases of Radiolocation, published by "Soviet Radio", 1954, but the author is of the opinion that BOGOMOLOV committed errors when examining $S_{e\Theta}$. According to the author's opinion $S_{e\Theta} = 2c\varrho\ t_u aR \sin\Theta tg\Theta$ is true for the irradiation of the surface of the earth by the radiolocation station of an aircraft. Here c denotes the velocity of light, t_u - duration of the impulse, a - width of the diagram of the directivity of the antenna in a horizontal plane. R and Θ have the aforementioned significance. The lastnamed formula is opposed by allegedly erroneous formulae developed by foreign authors. Next, the weak arguments brought forward by several authors, as e.g. those of A.F.BOGOMOLOV, in favor of these allegedly wrong formulae is pointed out. This error committed in connection with the definition of $S_{e\Theta}$ causes a faulty determination of the most suitable form of the diagram of directivity in the vertical plane for the antenna of a panorama radiolocator for aircraft. According to the author's opinion these errors have hitherto not been corrected. This work is of great importance for radiolocation.
INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1362
AUTHOR KOČANOV, N.S.
TITLE A Resonance Phenomenon in Two Coupled Sections of a Line with Small Losses.
PERIODICAL Radiotechnika, 11, fasc. 7, 60-62 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

Also one, two, or three resonance sections of a line can be connected fourpole-like, on which occasion the transmission band of such a system can be made very small, which is of great practical importance.
Here a system consisting of two coupled fourpole-like sections of a line is investigated. A line of the length 2 l with low losses is investigated in the middle of which a resistance is connected between the two conductors. Thus, this line may be considered as a coupled system with the coupling resistance r. To the input terminals of this line a sinusoidal voltage of a generator with the electromotoric force E and with the interior resistance R is connected, and the output terminals of the line should be left open. The ratio between the voltage at the open output terminals and the emf of the generator for the frequency bordering upon the first resonance frequency f_o of the section with the length $l = \lambda_o/4$ is to be determined. Here it is true that $\lambda_o = 3.10^8/f_o$.

The transfer equations for such a case are given; from them the ratio between the voltage U_2 and the emf of the generator can be determined. It is transformed in consideration of the small losses of the line and is specialized for the fre-

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quencies near the resonance frequency. Herefrom the modulus of the ratio (voltage at the end of the line / emf of the generator) and its maximum value are derived.

The smallest relative transmission band is $4\beta l$ at $R \longrightarrow \infty$ and $r \rightarrow 0$. β is the real part of the propagation constant $\gamma = \beta + i\alpha$.
Therefore it is necessary, for the purpose of conserving the smallest possible transmission band, to increase the interior resistance of the generator (e.g. by means of an additional resistance) and to reduce the resistance r switched into the middle of the line. In the case of $r \sim 0$ (shortcircuited line) the coupling between the sections is realized by the magnetic interaction of both sections. It must, however, be taken into account that the absolute value of the maximum of U_2/E diminishes if the ratio R/r increases.

A diagram shows the resonance curve experimentally recorded on a section of a coaxial cable at $r = 0$.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1363
AUTHOR OCKUR, V.I., PETROV, JU.V.
TITLE The Computation of the Elastic Scattering of Slow Electrons by a Hydrogen Atom by the Method of Integral Equations.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc. 1, 146-148 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

Here the usefulness of the method of integral equations, which was suggested by V.F.BRUBAREV, is examined by basing upon the same approximated representation that was used by P.M.MORSE and W.P.ALLIS (Phys.Rev.44, 269 (1933)):
$\psi(r_1 r_2)=Y(r_1)F^{\pm}(r_2)\pm Y(r_2)F^{\pm}(r_1)$. Here $Y(r)$ denotes the function of the ground state of the hydrogen atom, $F^{\pm}(r)$ and $F^{-}(r)$ are considered to be spherical-symmetrical, i.e. only S-scattering is taken into account. On the occasion of the selection of $\psi(r_1 r_2)$, the functions $f^{\pm}(r) = rF^{\pm}(r)$ must here satisfy the equation: $\left(\frac{d^2}{dr^2} + k^2\right) f^{\pm}(r) = V(r) f^{\pm}(r) \pm 2u(r) \int_0^{\infty} u(r') f^{\pm}(r') \{ \gamma(rr') + \varepsilon - k^2/2 \}\, dr'$: and the corresponding boundary conditions. Here ε denotes the energy of the atom, k - the wave number of the inciding electron, and it is true that: $V(r) = 2\left\{ \int_0^{\infty} u^2(r') \gamma(rr') dr' - 1/r \right\}$, $u(r) = rY(r)$, $\gamma(rr') = 1/r$ (and $= 1/r'$ respectively for $r \geqslant r'$ (and $r \leqslant r'$) respectively). The equation mentioned can be clearly substantiated with the help of the variation principle defined for collision problems, and is here converted into the following two integral equations:

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$X(r) = \varphi_1 + \int_0^r K(rs) X(s)\, ds$, $Y(r) = \varphi_2 + \int_0^r K(rs) Y(s)\, ds$. Here $f^{\pm}(r) = a_1 X(r) + a_2 Y(r)$, $a_1 = f'(0)$, $\varphi_1 = (1/k)\sin kr$, $\varphi_2 = (1/k) \int_0^r \sin k(r-s) u(s)\, ds$, $a_2 = \int_0^{\infty} u(s)\, f(s)((1/s) + \varepsilon - (k^2/2))\, ds$, $K(rs) = (1/k)\sin k(r-s) V(s) \pm$ $\pm$ $(2/k)\, u(s) \int_s^r \sin k(r-t)\, u(t)\, ((1/t) - (1/s))\, dt$. Next, an equation for the connection between a_1 and a_2 is determined.
In the antisymmetrical case computations can be considerably simplified because of the invariance of the total wave function with respect to the transformation $f(r) \rightarrow f(r) + C\, u(r)$, which is shortly discussed. (C here denotes an arbitrary constant). - By means of the formulae mentioned here the functions $f^{+}(r)$ and $f^{-}(r)$ were computed in first approximation, and from them the phases of scattering were determined; results are shown by two diagrams into which also the results obtained by other authors were entered for reasons of comparison. In the antisymmetrical case the 3 curves (found by numerical integration by means of the variation method and by the method of integral equations) are in agreement. In the symmetrical case a somewhat higher phase value is obtained for $k > 0{,}5$. At lower energies the result fully agrees in first approximation with the result obtained by numerical integration.

INSTITUTION: Leningrad State University.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1364
AUTHOR ZABOJSKIJ, E.K., PANCHENKO, S.F.
TITLE The Physical Bases of Electron-Optical Chronography.
PERIODICAL Dokl.Akad.Nauk, 100, fasc. 2, 218-221 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

Electron-optical transformers can, because of their marked inertialess mode of operation be used for the study of processes of very short duration (10^{-9} to 10^{-14} sec) by developing the electronic image. This method may be called "electron-optical chronography"; its mode of operation is discussed on the basis of a drawing: An objective reproduces an image of the light source on the photocathode. The electrons emitted from the photocathode are accelerated and are then focussed by the electron-optical system (which here consists of two rings and an aperture). Before impinging on the fluorescing screen the electrons pass through a rapidly rotating electric or magnetic field, and therefore the image of the light source is developed on the screen according to time. Circular development is the most favorable. If, however, the duration of the process to be investigated is much longer than the period of rotation of the deflecting field, it is possible to make use of development in a spiral. The minimum still resolvable interval of time is $\Delta t_{res} = T/2\pi R\delta$. (T - period of rotation of the field, R - radius of the circuit of development on the fluorescence screen, δ - number of still resolvable strokes per 1 cm of the screen. The acuity with respect to time of development can, in principle, be made to assume any intensity by reducing T and increasing $R\delta$, but in practice

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it is limited by several causes: The first of them is electronic chromatic aberration. Here only the nonrelativistic motion of paraxial electrons in axial-symmetrical fields is discussed. The differences of time occurring on this occasion amount to $\Delta t_{chrom} = m \Delta v_{ox}/eE_o$ (E_o - field strength at the cathode, e,m,v_{ox},t - charge, mass, initial velocity, and duration of motion of the electron). Next, the deflection of electrons near the screen is discussed. The formula for Δt_{chrom} applies in the case of an electromagnetic focussing of the electrons in the electron-optical transformer. A further important cause of the limitation of acuity with respect to time is the finite thickness of the photocathode. The analysis of all these causes shows that the highest acuity of this method is $\sim 10^{-14}$ sec. For times of from 10^{-10} to 10^{-14} sec electron-optical chronography is at present the only existing method for the direct study of the development with respect to time of processes which in any way can cause the emission of slow electrons. Among others, the following processes have such a duration: excitation of nuclear states, ČERENKOV effect, initial stages of scintillations, some processes connected with spark discharges, decay of heavy mesons etc.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1365
AUTHOR ADIROVIC, E.I., GURO, G.M.
TITLE The Characteristic Timesof Electronic Processes in Semiconductors.
PERIODICAL Dokl.Akad.Nauk, 108, fasc.3, 417-420 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

First, the electron transition in a semiconductor containing recombination centers (traps) are given. The acceptors and donors are assumed to be totally ionized. By the subdivision of all concentrations into a part which is in equilibrium and a part which is not, as well as by the neglect of terms which are quadratic with respect to concentration, a further system of equations is obtained. This system is then solved for the damping of concentrations that are not in equilibrium at initial conditions which correspond to steady operation. The solution obtained contains 4 time-dependent parameters (which are explicitly given). Two of them are identical with the life of electrons. (W.SHOCKLEY, W.READ, Phys.Rev.87, 835 (1952)). These expressions are specialized for low concentrations of the recombination centers. Further, there is a characteristic time of damping which, at steady conditions, is identical with the life of the (real or unreal) carriers which are not in equilibrium. However, in the case of high concentrations of the "traps" the damping process is determined by two characteristic times. In a diagram these parameters are represented as functions of the position of the FERMI level. In the case of high concentrations of the "traps" the maximum of the life of the electrons is shifted towards the conductivity domains of the

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e-type. ($F > C$). According to the dependence of the life of the holes on the FERMI level F, another heat-dependent emission of holes from the "traps"into the valence zone occurs, and therefore a second maximum exists in the case of such a dependence. In the case of steady operation the recombination of electrons and holes in the "traps" is in equilibrium with the production of pairs. If this pair production is interrupted, uncompensated and approximately equall strong currents of electrons and holes from the zones to the "traps" are produced. The life of unreal charge carriers is introduced into the theory as a fundamental characteristic. In the case of high concentrations of the "traps" the results obtained by the authors agree with those obtained by SHOCKLEY and READ only within a certain interval. If the "traps" are in the lower half of the forbidden zone, the characteristic time of damping is equal to the life of the real current carriers. This is true for all positions of FERMI levels in electronic semiconductors as well as in sufficiently marked hole-semiconductors.
In conclusion the two main methods for the measuring of lives, the impulse method and the photoelectric method, are discussed.

INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1366
AUTHOR SAGARJACKIJ, JU.A., TJAPKIN, JU.D.
TITLE The Peculiarities of the Structure of Ni-Al-Alloys on the Occasion of the Separation Process of an Oversaturated Solid Solution of Aluminium in Nickel.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 3, 451-454 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The authors studied the aging of nickel-aluminium alloys containing a high percentage of nickel with the help of X-rays. On the occasion of the hardening of a quenched solution with 17 atom percent Al (= 8,5 weight percent) oscillations of the monocrystals of the satellite reflections occur besides the reflections of the primary solid solution at a certain stage of separation of the solid solution which is oversaturated after quenching. The change of the distance between the main reflections and additional reflections on the occasion of the transition from one radiation to another corresponds to the modulation of the lattice parameter of the type [001] in the crystal of the solid solution. The here observed case is only distinguished by great similarity of satellite reflection to the main reflection, which is the reason why the satellites can be observed only at large angles of reflection of the X-rays. No essential change of the distance between the satellites and the main reflections and thus also no change of the time of modulation with the time of hardening was found.
The modulation scheme resulting from the experiment is a go-between between the schemes of BRADLEY on the one hand and those of DANIEL and LIPSON on the other.

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The lattice parameter 3,556 kX found relates to the intermediate layers with increased aluminium concentration. However, the layers with reduced aluminium concentration have no distinctly marked lattice parameter along the direction of modulation. The layers which alternatingly contain a high and a low percentage of aluminium are probably of equal thickness. Additional information concerning the structure of nickel-aluminium alloys were obtained by observations concerning the change of superstructural reflections which characterize the compound Ni_3Al. In the case of alloys with 17 atom percent a very approximated estimate furnishes amounts of from 200 to 400 kX for the average measurements of domains with remote order. The amount of the lattice parameter within these domains is somewhat larger than the average amount of the parameter for the entire crystal. In the following stage of separation the washed-out state and the position of superstructural reflection change only little. In the course of further hardening superstructural reflections continue to become more distinct. This points to coagulation processes with increasing concentration of Al. If part of the aluminium in the Ni-Al-alloy is replaced by titanium, the character of the transformations does not change essentially. Also in the case of the triple alloy Ni-Al-Ti superstructural reflections occur after hardening which are indicative of the existence of domains with a remote order.

INSTITUTION: Institute for Metallurgy and Physics of Metals of the Central Scientific Institute of Research for Iron Metallurgy.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1367
AUTHOR AKULOV, N.S.
TITLE The Theory of Ferro-, Para- and Ferri-Magnetism.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 4, 603-606 (1956)
Issued: 6 / 1956 reviewed: 10 / 1956

On the basis of the formula for the atomic magnetic moment in the paramagnetic state $\mu_f = \mu_B \sqrt{2S_p(2+2S_p)}$ it is possible to construct a diagram for $S_p(n)$, the elements of which consist of sections of straight lines in the ferromagnetic and in the paramagnetic domain. Such a diagram, in contrast to the diagram by SLATER and PAULING, makes it possible to set up a general rule for the coupling of atomic moments above and below the CURIE point. The theory to be developed is based upon the capture of s-electrons by d-electrons at the expense of exchange energy. By an increase of accuracy on the occasion of the computation of capture probability it is possible to determine the magnetic moments of the atoms above and below the CURIE point. For the computation of the probability of the transition of the second s-electron into the d-shell, the numbers n''_d and n'_d of the"left" and"right"spins respectively must be ascertained, and from them ds-interaction is determined. For the Cr-atom it is true that $n'_d = 5$ and $n''_d = 0$, and for the transition probability of the second electron into the d-zone with $T < \Theta$ we find the relation $\Delta n''_d = a(n - 6)$. Here a is a proportionality coefficient. (T, Θ denote temperatures).

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The relations mentioned are at low temperatures in quantitative agreement with the experiment in the case of the metals from Cr to Ni and in the case of their alloys. At high temperatures the second s-electron is practically subjected to the same conditions as is the first s-electron at low temperatures.
If the parameter n_0 (that electron concentration at which the moment of the atom is equal to zero), is known, it is possible to determine the values of μ_f (moment in the ferromagnetic state) with great accuracy. In this way a diagram is obtained which agrees quantitatively with respect to its principal components with the experiment and which, besides, makes it possible to predict the magnetic moments above CURIE point for a number of alloys.
It is possible already now to set up some rules for ferro- and ferrimagnetic alloys, e.g. that the elements with an unstable group of 5 d'-electrons are inclined to form ferrimagnetic branches. Such branches are those of FeCr, CoCr and NiCr. The slightest instability of the d'-group is found with Fe, followed by Mn and Cr. With an increasing content of Mn the inclination to form ferrimagnetic branches grows. In the model discussed the ferrimagnetic elements are not on the main lines but on the lateral branches. These deliberations agree with the data of neutronographic analysis.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1368
AUTHOR PODGORNYJ, I.M.
TITLE On the X-Ray Radiation on the Occasion of the Initiation of a Gas Discharge.
PERIODICAL Dokl.Akad.Nauk, fasc. 5, 820-822 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The start X-ray radiation occurring on the occasion of the discharge of condenser batteries by hydrogen at low pressure was investigated. The hydrogen was in a ceramic chamber of [illegible] mm height and 175 mm diameter. Immediately behind the holes which were covered with aluminium foil and served as an outlet for the radiation from the tube a luminescent crystal was fixed. The quanta produced on the electrode and on the walls of the chamber impinged upon one of the crystals behind the hole in the electrode. Into a second crystal behind the other hole in the wall of the Farfor tube there impinged only the quanta produced by scattered electrons inciding upon a small portion of the wall opposite the hole. After amplification the impulses were conveyed to the input of a two-beam impulse oscillograph. According to an attached diagram the start distinctly takes place later than the connecting of the voltage to the electrodes. At initial pressures of the hydrogen of from 10^{-2} to 10^{-1} torr delay amounts to some microseconds, after which the voltage between the electrodes diminishes considerably. The impulse of X-ray radiation occurs at the moment of the voltage drop at the electrodes. The duration of X-ray impulses and of the steep voltage drop at the

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electrodes amounts to ~ 1 μ sec in the case of conditions such as those investigated.
The intensity of start-X-ray radiation diminishes with growing pressure and becomes infinitely low at pressures of about 1 mm torr. At this pressure the energy increase of the electrons on the occasion of their motion in the electric field can no longer equalize the ionization losses. According to BATHER'S formula energy losses are at the most equal to the energy absorbed by the electron from the field per path unit (of free path) at the initial density $n = (1/\pi) \sqrt{e/2}\, \pi I/\varepsilon^3$. Here E denotes the field strength of the electric field, I - the ionization potential of the hydrogen atom and ε the charge of the electron. According to the above formula X-ray radiation should cease at a hydrogen pressure of 1,3 torr. However, if the diffusion of the electrons in a constant electric field is taken into account, the acceleration of electrons would have to cease at somewhat lower pressures. Also the existence of molecular instead of atomic hydrogen reduces the above pressure limit of X-ray radiation. Practically, however, X-ray radiation ceases already at some tenths torr. In the case of growing pressure electrons are able to absorb their energy only in the domain near the anode. Therefore the X-ray radiation, on the occasion of registration through the hole in the electrode, is recorded also if recording by the recorder fitted to the center of the tube is lacking.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1369
AUTHOR KITAJGORODSKIJ, I.I., INDENBOM, V.L.
TITLE The Solidification of Glass by Quenching.
PERIODICAL Dokl.Akad.Nauk, 108, fasc.5, 843-845 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

After the progress made in prewar years development within this field was only slow. The degree of hardening characterized by tensions in the central plane of a glass plate could not be increased beyond 0,2 and 0,7 with a glass thickness of 6 and 20 mm respectively in spite of complicated blowing devices. According to V.L.INDENBOM, Zurn.techn.fis, 24, 925 (1954) there is no difference between the theoretical and the technical boundary value of the degree of hardening. An exact computation for the dependence of the degree of hardening γ on the intensity of heat transfer characterized by the criterion of Biot (Bi = beta l - relative coefficient of the emission of heat on the surface, a - half thickness of the plate) is possible by a formula $\gamma(\delta)$. Here δ denotes the first root on the equation $\delta \operatorname{tg} \delta = Bi$. Accordingly, the limit value of hardening at $Bi = \infty$ is 0,617 and it is true that $\gamma_{max} = 1 - 2/\pi \sim 0,3634$. The above formula is illustrated by a diagram with dimensionless coordinates $\gamma = \gamma(Bi)$ and is compared with more recent experimental data. The degrees of hardening attained at present correspond to the value Bi ~ 5,7, and for a further increase of the degree of hardening by 15% the intensity of the heat transfer must be doubled. However, the possibilities for the solidification of glass need herewith not yet

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be exhausted. The above data refer to tensions in the central plane of the plate, whereas the solidity of the hardened glass is determined by tensions on its surface. Unfortunately the authors only quite recently succeeded in developing a method for the direct determination of the surface tension of hardened glass from the modification of the degree of hardening on the occasion of a successive grinding of the surface layers. According to various experimental data the ratio $\mathcal{H}$ = (tension on the surface of the plate / tension in its central plane) may change within very wide limits (about from $\mathcal{H} = -1$ to $\mathcal{H} = -3$). The surface tension of hardened glass can be determined indirectly from its solidification with respect to annealed glass. By means of INDENBOM'S theory of hardening it is possible to determine the theoretical dependence between the tensions on the surface and in the middle layers of regularly heated glass. The corresponding formula is given, and the curve obtained agrees satisfactorily with experimental data.
Thus, the present experimental data confirm V.L.INDENBOM'S theory, according to which the possibilities for the solidification of glass are by no means exhausted, in a convincing manner.

INSTITUTION: Moscow Chemical-Technological Institute "D.I.MENDELEEV"

SUBJECT USSR / PHYSICS CARD 1 / 4 PA - 1370
AUTHOR OGIEVECKIJ, V.I.
TITLE On a Possibility for the Interpretation of the Series of the Perturbation Theory in the Quantum Theory of the Field.
PERIODICAL Dokl.Akad.Nauk, 109, fasc.5, 919-922 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

According to the opinion of various authors the aforementioned series can be divergent also if the infinities are excluded from individual terms. Here it is shown that a certain value may be ascribed to a perturbational series if it is interpreted in the spirit of the summation methods (G.HARDY, "Divergent Series", Publishing House for Foreign Literature, Moscow 1951) and not in the narrow classical sense of CAUCHY. By means of the theory of generalizing functions a method of summation is developed here, with the help of which a representation of the S-matrix is found that is more acceptable than the usual one and which, in principle, permits analysis according to negative powers of coupling constants.
The author begins with an interesting example by B.L.IOFFE (Dokl.Akad.Nauk, 94, 437 (1954), J.SCHWINGER (Phys.Rev. 82, 664 (1951)). IOFFE, without using the perturbation theory, obtained

$L' = -(1/8\pi^2)\int_0^\infty (ds/s^3)e^{-m^2 s}\{esH\,\mathrm{cth}(esH) - 1 - (esH)^2/3\}$ for the additional

term which is due to the polarization of the vacuum by a constant exterior

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magnetic field. Here m denotes the mass of the electron. The perturbation theory furnishes for L' the series

$L' = -(1/8\pi^2)\sum_{n=2}^{\infty} ((2n-3)!/(2n)!)2^{2n} B_{2n} H^{2n} m^{-4n+4} e^{2n}$. Here B_{2n} denotes the BERNOULLI numbers. With $n \gg 1$ it is true that $B_{2n} \sim (-1)^{n-1}((2n)!/2^{2n-1}\pi^{2n})$, and therefore the above series diverges in the case of all e with the exception of e = 0, and is asymptotic. Herefrom IOFFE concludes that the perturbational method leading to a diverging series is useless in spite of the fact that the first-named expression for L' exists.
Here it is now shown that the summation of the mentioned development in series for L' by BOREL'S method furnishes the corresponding formula for L'. These deliberations do not indicate the uselessness of the formula given for L' but the fact that summation must be understood in a more general than the classical sense.
For the scattering matrix it is true in the representation of the interaction that $i\partial S/\partial t = \{-ig\int d^3x\, N(\bar{\psi}(x)\gamma_\mu\psi(x))\varphi(x) + \text{"renormalization terms"}\}S$.
It is usually written down as a series according to powers of the coupling constant g:

$$S = \sum_{0}^{\infty} ((-1)^n/n!)g^n \, T\left\{ \int d^4x \, N(\bar{\psi}(x) \, / \, T(x))\varphi(x) \right\}^n. \qquad (1)$$

In this expression the infinities must now be eliminated by using the just mentioned "renormalization terms". The matrix elements for the various physical processes computed by the aforementioned formula can be represented by diverging series according to the powers of g.
In this connection a representation for the S-matrix acceptable from the point of view of convergence is determined, which satisfies the last but one equation ($i\partial S/\partial t = \ldots$). The derivation given here is in a certain sense analogous to the application of BOREL'S method to the theory of generalizing functions. Also a direct application of BOREL'S method would be possible, but this would necessitate making stricter demands on the existence of a certain integral which is mentioned here. With it the following representation for the S-matrix is found:

$$S = \int_{-\infty}^{+\infty} ds . \exp\left[-\frac{is}{g}\right] T\left\{ \delta(s) + \frac{\zeta(s)}{2} \sum_{n=1}^{\infty} \frac{(-1)^n s^{n-1}}{(n-1)!\, n!} a^n \right\} \qquad (2)$$

or in symbolic form:

$$S = \int_{-\infty}^{+\infty} ds . \exp\left[-\frac{is}{g}\right] T\left\{ \delta(s) - \frac{\zeta(s)}{2} \sqrt{\frac{a}{s}} \, J_1\left(2\sqrt{as}\right) \right\} \qquad (3)$$

Here $a = i \int d^4x N(\bar{\psi}(x) \, / \, T(x))\varphi(x)$, and $J_1(y)$ denotes a BESSEL function.

In the expression (2) S is a generalized function of $1/g$. In just this expression, the infinities, by the use of the terms of renormalization, must be eliminated for S just like in the case of the formula (1). The series in (2) can converge also if the series in (1) diverges. Thus the development in series according to the powers of the coupling constant satisfies the corresponding physical quantity at very general conditions.
As the series in the representation (2) is most probably convergent it follows from the present deliberations that the application of potential developments as intermediate stage is allowed for renormalizations, for the derivation of equations, etc.

The series according to powers of the coupling constant must, by the way, not be broken off. The success of the perturbation theory in quantum electrodynamics is apparently based only upon the fact that the series (1) is asymptotic and that the coupling constant is very small.

The representation (3) permits a development according to inverse powers of the coupling constant g by the development of $e^{-is/g}$ according to the powers of the argument, for from (3) there follows $S = \sum_{n=0}^{\infty} \frac{(-i)^n}{n!} \left(\frac{1}{g}\right)^n \int_{-\infty}^{+\infty} s^n \, T\left\{ \delta(s) - \frac{\zeta(s)}{2} \sqrt{\frac{a}{s}} \, J_1(2\sqrt{as}) \right\} ds$ if the development according to $1/g$ exists.

INSTITUTION: Electrophysical Laboratory of the Academy of Sciencs in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1371
AUTHOR SLJAGIN, K.N.
TITLE The Electron Spectra of Pu^{239}, Pu^{240} and Pu^{241}.
PERIODICAL Žurn.eksp.i teor.fis, 30, fasc.5, 817-823 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

At first the pertinent works on the decay of these plutonium isotopes are discussed in short.
Technique of the experiment: The electron spectra are recorded by means of an ordinary β-spectrometer with focussing of electrons at 180° (radius of the average orbit 15 cm). A Geiger-Mueller-counter was used as electron indicator. The Pu^{239} was as usual obtained by irradiation of U^{238} by neutrons; by a further irradiation of Pu^{239} with neutrons Pu^{240} and Pu^{241} accumulate. Two samples containing Pu^{239}, Pu^{240} and Pu^{241} were investigated, of which one contained more Pu^{240} and Pu^{241} than the others. The radioactive source was produced by deposits from an aqueous solution of plutonium nitrate on a celluloid film.
Measuring results: In the interval of electron energies a β-spectrum and a series of conversion lines are found; 7 of them are conversion lines of U^{235}, 3 are conversion lines of U^{236}. Furthermore, the electron spectra of the same plutonium samples were recorded by means of a spectrometer with increased acuity (~1%). On this occasion a number of weak lines is added to the already previously known intense conversion lines. At electron energies of from 0,05

Žurn.eksp.i teor.fis, fasc.5, 30, 817-823 (1956) CARD 2 / 2 PA - 1371

to 2 MeV neither electron lines not β-spectra are found in Pu^{239}, Pu^{240} and Pu^{241} with an intensity that is more than double the background. The most intense electron line has no connection with the nearest conversion lines, and its high intensity can hardly be explained by the combined intensity of K-conversion lines. This line is perhaps producted by the electrons torn away from the N,O-shells, in which case the energy of the γ-transition must be ~ 3keV. In this case one of the excited levels of U^{235} might be concerned and also the ionization of the atom on the occasion of the α-decay might possibly make an important contribution. However, these assumptions must yet be thoroughly examined.
The conversion lines observed are due to γ-transitions with 3(?); 12,5; 30,3; 50,8; 117(?) keV of the U^{235} nuclei (product of α-decay if from Pu^{239}) and with 44,6 keV of U^{236} nuclei (product of α-decay if from Pu^{240}). A scheme for the α-decay of Pu^{239} is suggested. The analysis of the β-spectrum of Pu^{241} with the help of a CURIE diagram showed that it has the form of this permitted spectrum. In this interval it is found that, in the energy interval of from 3 to 19 keV the experimental points fit quite accurately on to a straight line. The upper limit of the β-spectrum was 20,8 ± 0,2 keV.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1372
AUTHOR GRIGOR'EV, V.I.
TITLE A Generalized Method for the Purpose of Taking Account of Damping in the Relativistic Quantum Theory.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 873-880 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

A system of an infinite number of connected equations is constructed each of which describes a process with the production and absorption of a certain number of particles. The here discussed solution contains the normalization, and from it, as approximations, the results of the theory of damping and, as zero-th approximation, the results of the perturbation theory are obtained. The usual equation for the scattering matrix serves as a basis: $i\frac{\delta}{\delta\sigma}\left[\frac{\delta}{\delta\sigma}\right]S\sigma(x) = \mathcal{H}(x)U(\sigma)$. The operator function $\mathcal{H}$ of the interaction and the therein contained operators of the free fields are given. The solution must take the following physical facts into account: The probability of the initial state decreases in the course of time because of the interaction among the particles, and at the same time the probabilities to new states, which compete among one another, increase: The transitions themselves prove to be absorption- and emission processes of free particles with different energies and momenta. The scattering matrix is here set up as a sum of the operators of all sorts of types of transitions. However, this "splitting up" of the matrix U alone is not sufficient, but it is necessary to find equations that connect all part-matrices, and these equations must be solved with a certain degree of accuracy.

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The corresponding system of equations is written down and discussed. However, the right sides are not explicitly mentioned because of their complicated nature (128 terms), but only the method of constructing these terms is demonstrated, after which the terms that correspond to the following processes are written down as typical examples and discussed in short: Absorption of a photon and absorption of an electron in a state and their emission into another state, emission of a photon on the occasion of the transition of an electron from one state into another, absorption of a previously emitted photon with simultaneous creation of an electron-positron pair, emission of a previously absorbed photon and absopption of a previously emitted electron-positron pair, transition of a positron from one state into another with emission of a photon. Next, the solution of the equations by means of a solution ansatz is discussed. As the theory is formulated in explicitly covariant form, divergences can be removed by the same methods as in the usual theory. The computation method is suited for several simultaneously occurring fields and for different kinds of generalizations (higher derivations, nonlinear interactions, nonlocal problems, steady problems).

INSTITUTION: Moscow State University

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1373
AUTHOR SAPIRO, I.S.
TITLE The Peculiarities of the Levels of Nonspherical Even-Even Nuclei.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 975-977 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

Here the properties of the levels with $\Omega = 0$ are investigated. (Ω - sum of the projections ω_i of the angular momenta of nucleons on the axis of the nucleus). Like in the case of the Σ-terms of a two-atom molecule a quantum number $\eta = \pm 1$ occurs in addition in the case $\Omega = 0$, which characterizes the behavior of the wave function on the occasion of a reflection of the space with respect to a plane passing through the symmetry axis of the nucleus. On the occasion of this transformation the wave function $\Psi_{\Omega P}$ is converted into $\hat{I}_{\phi\gamma\Omega P} = \Psi_{-\Omega P}$. Because of the invariance of the HAMILTONIAN of the system with respect to the transformation investigated, every term is twice degenerated with respect to Ω. Here $P = \pm 1$ denotes the parity of the state. in the case of $\Omega = 0$ it is true that $I_{\phi\gamma o P\eta} = \eta \Psi_{o P}$, $\eta = \pm 1$, and therefore it is possible that, instead of degeneration, two levels with different values of η exist. States with $\Omega = 0$ can occur in nuclei with even A and obviously especially in even-even nuclei. Among them are e.g. the ground state (J=0, P= +1) and the first excited state (J=2, P=+1). These two states of even-even nuclei have the same η. With η the following selection rule for the radiation transitions is connected: The transitions between levels with the same η (or with a change of sign for η) can be only of

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an electric multipole-like (or magnetic) type. For the quantum numbers η_i in the initial state and η_f in the final state it is true for electric (+) and magnetic (-) transitions $\eta_i = \pm \eta_f$. If there are two levels with $\Omega = 0$ and $|\Delta J| \leq l - 1$, $P_i = (-1)^l P_f$ (be it that $J_i \neq 0, J_f \neq 0$), then by the selection rules for the parity and for the angular momentum simultaneously 2^l-pole and magnetic 2^{l-1}-pole transitions are allowed, but there is no special forbidding rule, the magnetic transitions must prevail. There now follow several other details.
These deliberations are now compared with the experimental data concerning even-even nuclei. As the deviation of the nuclei from the spherical shape increases with the number of nucleons outside the closed shells, also the probability of the radiation E 2 on the occasion of the transition $2^+ \rightarrow 2^+$ in the case of even-even nuclei increases with increasing deviation from the spherical shape. The first excited rotation level, however, diminishes with increasing deviation. The following is required: a) a comparison of the deviations of the investigated nuclei from the spherical shape by investigation of COULOMB'S excitation, b) precise data concerning the multipole transition $2^+ \rightarrow 2^+$ of the Os^{186} nucleus, investigation and study of the level scheme of rare earths and heavy elements.

INSTITUTION: Moscow State University

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1374
AUTHOR LEVINTOV, I.I.
TITLE On the Amount of Nuclear Spin-Orbit Interaction.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 987-989 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The author names all relative quantities of the moduli V_2/V_1 of the central and of the spin-orbit potential on the basis of all data known to him.
V_2/V_1 can be determined from the data on polarization at high energies (100 to 300 MeV) without determining the density distribution $\varrho(r)$ of the nucleons in the nucleus, on the assumption that the spin-orbit correction makes only a small contribution towards the phase. One finds $V_1/V_2 = k^2\vartheta_m$, where ϑ_m is the angle under which the maximum polarization P_m is observed. The average value of V_2/V_1 is $3,5.10^{-27}$ cm^2.
The estimation of V_2/V_1 from the data on scattering at low energies and from those on levels and shells requires certain conditions concerning the form of $\varrho(r)$, but it can in some cases be carried out correctly. The levels of Be^5 and Li^5: The experimentally well determined course of the phases $P_{1/2}$ and $P_{3/2}$ in the case of scattering of nucleons by He^4 within the energy range of from 1 - 15 MeV can be computed with great exactitude by putting $\varrho(r) \sim \exp(-r^2/a^2)$. The potential which agrees best with the experiment is given, so that $V_2/V_1 = 3,3.10^{-27}$cm^2 is obtained. The one-particle doublet levels of O^{17} and Pb^{209} : By solving the

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Schroedinger equation for the potential with plane bottom and smeared out edge the author alleges to have obtained a more exact result than R.J.BLIN-STOYLE, Phil.Mag.96, 977 (1955) and for V_2/V_1 and V_2/V_1 the first perturbational approximation is explicitly given. A table shows the values of V_2/V_1 for smeared out $\delta=0,57(O^{17})$, $\delta=0,29(Pb^{209})$ and V_1 = 50 MeV. The order of filling the levels in the shells computed with the help of a potential between the oscillator potential and the rectangular well furnishes $V_2/V_1 = 4.10^{-27}$ cm^2.

The relative amount of the spin orbit potential remains constant within wide limits if the energy of nucleons and the dimensions of the nucleus change, and amounts approximatively to $3,5.10^{-27}$ cm^2. This may be explained by interpreting the effective nuclear potential as the average potential of the nucleon forming the nucleus. In the case of such an averaging over the closed shells the forces (e.g. tensor forces) which depend on the product of the spin of the outer nucleon and the nucleons in the nucleus make no contribution in first approximation. The existence of a strong spin orbit interaction is an argument in favor of the existence of forces of the kind $V(\vec{r})\{\vec{l}(\vec{\sigma}_i + \vec{\sigma}_j)\}$.

INSTITUTION: Institute for Chemical Physics of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1375
AUTHOR JAKOVLEV, L.C.
TITLE On the Theory of the Plural Production of Mesons.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc.1, 142-144 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

In view of the fact that computation to be carried out in consideration of all conservation theorems is very difficult, various methods of approximation are used. On this occasion the value $\varepsilon_n = \mathcal{E} - \sum_{i=1}^{n-1} m_i$ is assumed as the maximum limiting value for the energy of a particle. ($\mathcal{E}$ - total energy of the colliding particles, $\sum m_i$ - sum of the rest masses of all particle products with the exception of those given). Here it is shown that these values must diminish in the manner that follows from the conservation theorems of momenta and of energy. The computation of the maximum energy and the maximum momentum of each product leads to the determination of a hereby caused maximum. Computations are here carried out in the center of mass system. If it is assumed that, on the occasion of a collision, a total of n particles is created, then $\varepsilon_n + \sum_1^{n-1} \varepsilon_i = \mathcal{E}, \vec{k}_n + \sum_1^{n-1} \vec{k}_i = 0$. Here ε_i, k_i and v_i denote the total energy, momenta, and velocity of the i-th particle product. The corresponding quantities of the investigated particle product have the index n.
In the case of a maximum k_n the momenta of all (n-1) particles must be opposed

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to the direction of the momentum $\vec{k}_n$, and in this case it is true that $k_n = -\sum_1^{n-1} k_i$. and $v_n = k_n / \varepsilon_n = \sum_1^{n-1} k_i / (\mathcal{E} - \sum_1^{n-1} \varepsilon_i)$. Next, the secondary condition resulting from $\varepsilon_i^2 = m_i^2 + k_i^2$ for the determination of the maximum of the function $v_n(k_1, \ldots, k_{n-1})$ is given. Finally, $v_1 = v_2 = \ldots = v_{n-1} = v$ is found. It is then possible to consider the (n-1) particles as one single particle with the mass $M = \sum_1^{n-1} m_i$ and the velocity v. We further find:

$k_{n\,max} = \left[(\mathcal{E}^2 - M^2 + m_n^2)^2 - 4m_n^2 \mathcal{E}^2\right]^{1/2} / 2\mathcal{E}$, $\varepsilon_{n\,max} = \left[\mathcal{E} - (M^2 - m_n^2)/\mathcal{E}\right] / 2$

$v_{n\,max} = \left[(\mathcal{E}^2 - M^2 - m_n^2)^2 - 4m_n^2 \mathcal{E}^2\right]^{1/2} / (\mathcal{E}^2 - M^2 + m_n^2)$. R.M.Sternheimer computed the maximum recoil angle of the nucleon after collision: $tg\Theta_{max} = (1-v_c^2)^{1/2}(v_c^2/v_{max}^2 - 1)^{-1/2}$

Here Θ_{max} denotes the angle in the laboratory system of the coordinates, v_c - the velocity of the center of mass system in the laboratory system. The author considers Θ_{max} as a criterion for the identification of the particles. Apparently the existence of a maximum recoil angle of the nucleons on the occasion of integration of the angle Θ must be taken into account. - Three diagrams show the maximum energies of the pions produced on the occasion of π-N-collisions, N-N-collisions, and nucleon-antinucleon annihilation processes. This maximum energy diminishes with a growing number of produced pions.

INSTITUTION: Moscow State University.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1376
AUTHOR KLEPIKOV, N.P.
TITLE Solution of a System of Equations for the Vacuum Functional.
PERIODICAL Dokl.Akad.Nauk, 100, fasc.6, 1057-1059 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

At first the equation system with the variation derivations for the functional G_o, which describes the vacuum of the electron-positron fields and electromagnetic fields which are in interaction, is given. Each equation of this system is varied according to the corresponding equation, and the limiting values of the half-sums of the third mixed approximations are put equal to one another.

Next, the possibility of a decomposition of G_o according to the negative powers of e was investigated. The zero-th approximation of such a decomposition must cause the right sides of the aforementioned system of equations to disappear, and apparently the system of equations thus created has no "non-zero-th" solution. However, it is possible to attempt to solve the aforementioned system of equation also by means of the apparatus of functional equations: The solution in form of a functional integral of the LAPLACE type with linear dependence of the coefficient on all three sources is elementary; it is given here. Integration is carried out in such a manner that the function under the integral sign vanishes on the limits. The functionals $G(x,x')$ and $\langle A_\mu(x) \rangle$ are explicitly given; they solve SCHWINGER'S equations.

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Besides, the aforementioned system of equations has a solution in form of a simple functional integral if certain functionals $F(z,t;A)$ and $\Phi[A]$ exist. The functional $F(x,y)$ occurring in the pertinent equations is GREEN'S function for an electron in an assumed exterior electromagnetic field. For this GREEN'S function and for the functional Φ it is easy to determine solutions in form of series according to the powers of e. This, however, is opposed to the principle that series be avoided, and the decomposition of Φ contains a divergent term. The possibilities of representing the solution of the system of equations for the above mentioned simplified functional in a closed and finite form are further investigated.

After the present work had been completed, D.S.FRADKIN, Dokl.Akad.Nauk, 98, 47 (1954) published a similar computation for the case of mesodynamics.

INSTITUTION: Moscow State University "M.V.LOMONOSOV"

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1377
AUTHOR VASILOV, V.S., SMIRNOV, L.S., GALKIN, G.N., SPIRYN, A.V., PAZHEWIC, L.M.
TITLE The Formation of Defects on the Crystalline Lattice in Germanium on the Occasion of a Bombardment by Fast Electrons.
PERIODICAL Žurn.techn.Fis, 26, fasc. 9, 1865-1869 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

The purpose of the present work was to clear up the dependence of the cross sections of formations of defects of the FRENKEL type on the electron energies W and to find out how many energetic levels, that are connected with the aforementioned structural defects of the crystal, influence conductivity. Experiments were carried out in the course of which the monocrystals of germanium with an electron conductivity were bombarded with monoenergetic electrons ($\frac{\Delta W}{W_o} < 6\%$) of an energy of from 400 to 1000 keV. Electron irradiation and the following measurements were carried out at room temperature. Thin (50 μ) monocrystalline plates were used. The energy loss in them amounted to not more than 60 keV. Three different methods were employed for measuring the specific resistance ϱ of the irradiated crystals: 1.) A homogeneous crystal with a known initial specific resistance ϱ_o was bombarded with electrons that impinged upon a surface of the greatest area. The resistance of the sample was measures, whereupon a layer having a thickness of 50 μ was ground together with the bombarded

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surface and the resistance of the remaining part of the crystal was measured. From the distance between resistances the resistance of the part which was ground together was determined. Herefrom its specific conductivity ϱ after bombardment was computed.
2.) A homogeneous crystal was bombarded as described under 1.) and then its bombarded surface was pasted on to a glass by means of Canada balsam where it was ground together to a thickness of 50 μ. The resistance of the thin remaining plate was then measured.
3.) The resistance of monocrystalline plates with a thickness of 50 μ, which were pasted on to glass, was measured, whereupon they were bombarded with electrons. The resistance was then newly measured.

When measuring the resistance of thin crystals of germanium it is always necessary to reckon with the possibility of the formation of surface layers with increased resistance. The experiment showed that the threshold value of the energy W_{min}, from which onwards the conductivity of germanium crystals diminishes by irradiation, is equal to 500 $\pm$ 20 keV. The results obtained by the present work are not in contradiction to the hypothesis of JAMES and LARK - HOROVITZ if it is assumed that a donor level of the defect and an acceptor are near the corresponding zones. (The hypothesis says that to an atom in the

intermediate node of the germanium lattice there must correspond two levels in the forbidden zones which correspond to the first and second ionization. In the forbidden zone also 2 levels correspond to the empty node).
The second acceptor level is higher than the first. In N-germanium the second acceptot thus removes an electron from the conductivity zone. However, before attempts are made to irradiate P-germanium, the existence of 4 levels that would correspond to the pair: atom in the intermediate node - empty node - remains unconfirmed. It was discovered that the energy limit of electrons which cause the forming of recombination centers within the crystal is also 500 keV.

INSTITUTION: FIAN (Physical Institute of the Academy of Science)

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1378
AUTHOR SCHUBALOW, JU.N.
TITLE The Connection between the Changes of Conductivity and the New Distribution of electron Density in a Sulphur-Cadmium Crystal.
PERIODICAL Žurn.techn.fis, 26, fasc. 9, 1870-1879 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

The question is dealt with as to whether change of conductivity is connected with a change of the distribution of electron density in the lattice and whether this may be found with the help of X-rays. Hexagonal monocrystals of sulphur cadmium were used for this purpose. Investigations were carried out by taking X-ray pictures by means of molybdenum irradiation, which were developed by the Weissenberg method and then subjected to photometric recording. A certain method of photometric recording was employed in that the intensities of the blackening of the film were measured transversally to the spot every 0,1 mm. As a comparative basis the intensity conditions of neighboring reflexes were taken. A unilateral modification of the intensity of the most important reflexes was found to exist on the occasion of transition to samples with a higher electroconductivity or in the case of an increase of the conductivity of the sample under the influence of light or heating. The modifications of the intensity of reflexes may be interpretated as being a new distribution of electron density in the crystal. This distribution by the intensity of reflexes was computed by means of the synthesis of the FOURIER series. Two-dimensional projections of electron density in the crystal were built up

for different samples and the new distribution of electron density on the occasion of transition from samples of low conductivity to such of high conductivity was observed. This new distribution consists in an increase of electron density along the straight lines which connect the adjoining atom projections. This may be explained by the creation of lines of increased electron density between the neighboring atoms of opposite signs.

INSTITUTION: LGU (Leningrad State University)

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1379
AUTHOR KUSMIN, D.W.
TITLE The Dipole Moments of Dielectric and Semiconductor Particles.
PERIODICAL Žurn.techn.fis, 26, fasc. 9, 1880-1883 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

The well-known formula of the electric moment of a sphere in the homogeneous field is used for the evaluation of the ponderomotoric forces of the electric field. On the basis of the continuity of the total amperage SKANAWI investigated the processes of the distribution of an electric field in the dielectricum of the layer of a conductive flat condenser. A similar method can be applied for the computation of the dipole moments of dielectric and semiconductor particles. It is assumed that a sphere with the radius R is introduced in a homogeneous field between parallel flat electrodes which are under the voltage U. In comparison with the distance d between the electrodes U is not high. The dielectric constants and the conductivities of the medium and the sphere are ε_1, ε_2 and γ_1, γ_2. The sphere is in the middle between the electrodes. It is homogeneously polarized and the moment of the dipole of the sphere is equal to p. The voltage of the exterior field E is equal to the sum of the voltage $E_o = \frac{U}{d}$ and the voltage of the field of the dipole system in flat metal electrodes. The following assumptions are taken into account:
1.) Neglect of the time necessary for adjusting dielectric polarization.
2.) Because of different current densities of conductivity in the medium and

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in the sphere a free charge collects on the boundary of separation, which has a field. The amount of the electric moment of the sphere changes and is a function of time p = p(t).
3.) It is assumed that the field between the plates changes according to the law $E_0 = E_{m0} e^{i\omega t}$ and that the electric moment of the sphere is $p(t)=p_m e^{i\omega t}$, where p_m is a complex quantity which depends on time. In order to compute the function p(t) a continuity of the total current through a closed surface is assumed. On the basis of these assumptions the following formulae are obtained after several transformations: for the dependence of the electric moment of the sphere on time in steady state ($t = \infty$) in the periodic field; for the amplitude value of the electric moment of the sphere in the steady state; the time constant for the process of new distribution of the field and for adjustment of the steady moment which is the same for parallel- and alternating fields. If a sphere with sufficient conductivity is introduced into the insulating layer, one obtains

$$p_{max} = \frac{\varepsilon_1}{\beta_1} R^3 E_o$$

where

$$\beta_1 = 1 - \frac{2R^3}{d^3} \sum_{n=1}^{\infty} \frac{2}{n^3}$$

With d $>>$ R (β_1 = 1) the above formula coincides with the well-known formula for the dipole moment.
In the steady state a certain phase shift occurs between the dipole moment of the particle and the voltage of the exterior field, which is equal to zero for dielectric particles and for particles of good conductors. For particles of semiconductors it can, however, attain a considerable amount.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1380
AUTHOR BOGORODISKIJ, N.P., FRIEDBERG, I.D.
TITLE On the Character of the Temperature Dependence of Dielectric Losses on the Occasion of Polarizations of Ion Compounds.
PERIODICAL Zurn.techn.fis, 26, fasc. 9, 1884-1889 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

The dielectric losses of a numbef of simple borate- and silicate glasses as well as of the qualitatively superior types of high frequency ceramics were recently investigated. Among them were pure boron anhydride, boron sodium glasses at different conditions of B_2O_3 and Na_2O, boron-barium glasses, silicate-lead glasses, and ceramic substances such as radio porcelain, steatite, ultraporcelain, and spinell ceramics. Silver and ground silver disks were used as electrodes. The dielectric losses at radio frequences were measured by the method of the modification of reactance.
The curve of tgδ plotted in dependence of the temperature for the boron glass has a considerably lower value than is stated in literature. These curves for boron-barium and boron alcaline glasses are marked by a visible increase of losses within that range of temperature in which previously this dependence was by mistake not noticed. Also in the case of silicate glasses it was not possible to prove that tgδ is independent of temperature. On the occasion of the investigation of ceramic substances no temperature domain in which losses do not depend on temperature was found to exist. It may be said in a general way that within a

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wide temperature- and frequency range on the occasion of the polarization of ion compounds dielectric losses are due to one and the same phenomenon, namely to the disturbance of the heat motion of ions under the influence of the electric field, which is all the more marked the more the period of the electric field and the relaxation time of the particles are in agreement.

Dielectric losses may essentially be said to be caused by the following physical processes:
1.) Relaxation during polarization, a phenomenon which is connected with the heat motion of the particles and which occurs at low frequences, radiofrequences, and ultrahigh frequences.
2.) Relaxation in connection with electroconductivity, which is also due to the heat motion of particles.
3.) The phenomenon of the ionization of substances, which manifests itself in electric fields of higher voltages.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1381
AUTHOR BOGORODIZKIJ, N.P., FRIEDBERG, I.D., ZWETKOW, N.M.
TITLE On the Problem of Anomalous Polarization in the Polycrystalline Peroxide of Titanium.
PERIODICAL Zurn.techn.fis, 26, fasc. 9, 1890-1901 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

In connection with contradictions found in literature the authors investigated the influence exercised by admixtures of oxides of the metal groups II., III., and V. on the electric properties of polycrystalline peroxide of titanium. Chemically pure reagents were used as additions of foreign oxides. The samples were mixed in an agate mortar with distilled water, after which they were dried and pressed. The thickness was 1,0 to 1,5 mm. Burning was carried out in electric silican carbide ovens at 1200 to 1450° C in platinum vats. Burnt-in silver layers served as electrodes. The degree of purity was controlled by spectral analysis and structure was controlled by X-ray analysis. One of the basic problems is that of the characteristic of the spectrally pure peroxide of titanium with a permitted low content of admixtures. A table contains the data on the dielectric constant and the tgδ for various frequencies at room temperature as well as for a specific space resistance at 100° C of the titanium peroxide of various brands. A curve represents the dependence of and tgδ on temperature. The same was done by further curves for titanium peroxide with various admixtures. These curves show that titanium peroxide with admixtures of Nb_2O_5 and CaO has anomalous electric properties. Additions of Al_2O_3, Fe_2O_3 and ZrO_2 remove these anomalies.

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Summary:
1.) Specially purified (spectrally pure) titanium peroxide is characterized by important electric properties within a wide temperature- and frequency range, and possesses no anomalous electric properties.
2.) An anomalous polarization in TiO_2 is found in the cases of additions of CaO and Nb_2O_5, which is connected with the process of partly recomposing the TiO_2 in the presence of these oxides.
3.) An anomalous polarization occurs also in pure titanium peroxide which has no foreign admixtures, namely if it is treated thermally until it attains a light blue color in a reducing atmosphere.
4.) The additions of Al_2O_3 and Fe_2O_3 to titanium peroxide, providing the latter contains Nb_2O_5 or CaO, lead to a considerably lower restoration of TiO_2 because of the compensating effect of the trivalent oxides. In this case no anomalous polarization is observed.
5.) An anomaly of the electric properties of titanium peroxide with admixtures is observed in the case of technical and accoustic frequences. Within the range of radio frequences the tgδ does not increase but is reduced in the case of all compounds.
6.) A carefully carried out X-ray structural analysis of titanium peroxide with admixtures of foreign oxides (CaO, BaO) produced no loosening of the crystalline rutile lattice.

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7.) It has been proved by experiment that within the range of sufficiently large concentrations of Fe_2O_3, Nb_2O_5 and Al_2O_3 additions the presence of a phase - that of rutile - becomes noticeable. The solid solution occurs distinctly in addition of Nb_2O_5.

8.) If the low frequences, at which the anomalous processes of polarization in titanium peroxide with admixtures have been observed, are taken into account together with the conductivity of the anomalous TiO_2, it may be assumed that the most probable mechanism of dielectric losses is the electron-relaxation mechanism.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1382
AUTHOR BOKOW, W.A.
TITLE The Behavior of Seignette-Electric Solid Solutions in Strong Electric Fields.
PERIODICAL Zurn. techn. fis, 26, fasc 9, 1902-1911 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

It is the purpose of this work to augment already existing knowledge concerning the behavior of solid solutions with seignette-electric properties in strong electric fields. For the characterization of these solutions the notions of the differential dielectric constant ε_d, the normal constant ε_n, and the "reversive" dielectric constant were introduced. They can be determined by the inclining and by the declining branch of the hysteresis curve. As the capacity of a condenser with a seignette-electric solution depends on voltage, the current will not be sinusoidal. Therefore, "full" compensation of the bridge is not possible and may only be attained for the first harmonic. We obtain a value for the linear capacity through which a current flows, the basic frequency of which is equal to that flowing through the nonlinear capacity with the same voltage. This capacity and the corresponding dielectric constant are called C_1 and ε_1. In view of the fact, however, that C_1 does not determine the full resistance, the conception of effective capacity C_{eff} is introduced, which is:

$$\frac{I_{eff}}{\omega U_{eff}}.$$

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The corresponding dielectric constant, which is of the greatest importance, is ε_{eff}. In the case of the application of seignette-electric solid solutions also ε_1 and the nonlinearity: $N = \frac{1}{\varepsilon_1} \frac{d\varepsilon_1}{dE}$

as well as the coefficient of the nonlinear current distortions and the spectral composition of the latter are of great importance. In the case of the present work a method was employed which permitted the determination of all these quantities.
The sample was provided with a sinusoidal voltage with the frequency 70 c, and with the help of a wave analyzer of the type 455 D, made by MARCONI, the effective values of all those harmonics of the current were determined, the values of which amounted to more than 5% of that of the first harmonic. The samples were first burnt in the usual manner at 1350° C and finally burnt at from 1420°C to 1480°C. As initial products corresponding carbonates and oxides were used. The surface of the electrodes was 6 to 9 mm^2. The temperature was measured by means of a thermocouple copper-constantan with an accuracy of up to one degree. Examination extended to:
$Ba(Ti_{0,95}, Sn_{0,05})O_3$; $Ba(Ti_{0,9}, Sn_{0,1})O_3$; $Ba(Ti_{0,9}, Zr_{0,1})O_3$;
$(Ba_{0,9}, Sr_{0,1})TiO_3$; $(Ba_{0,8}, Sr_{0,2})TiO_3$ and $Ba(Ti_{0,8}, Zr_{0,2})O_3$.

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Summary of results obtained:
1.) The coefficient of the nonlinear distortions of the current flowing through the seignette-electric condenser may even exceed 100% in a sufficiently strong field.
2.) In strong electric fields the temperature dependence of the dielectric constant decreases in the case of all investigated solid solutions.
3.) The shift of the maxima on the curves of the temperature dependence of the dielectric constant occurring in strong electric alternating fields is not the image of the point shifts of phase transitions.
4.) The greatest nonlinearity among the investigated solid solutions at room temperature was found in the case of the samples $Ba(Ti_{0,9}, Sn_{0,1})O_3$ and $Ba(Ti_{0,9}, Zr_{0,1})O_3$.

INSTITUTION: Institute for Silicate Chemistry of the Academy of Science in the USSR, Leningrad.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1383
AUTHOR BALYCIN, I.E., OBRASZOW, A.I.
TITLE The Dependence of Dielectric Losses in Ceramic Substances on the Voltage of the Electric Field.
PERIODICAL Zurn.techn.fis, 26, fasc. 9, 1917-1923 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

In order to obtain additional data for the dependence of dielectric losses on the voltage of the electric fields (50 c), the authors investigated samples of ultra porcelain, radio porcelain, radio steatite, thermokond T-20, tikond T-20 and tikond T-150. These investigations showed that the dependence $tg\delta = f(E)$ differs in the case of each substance and is determined by the physical and chemical properties and by the structure of the ceramic. All samples were thoroughly examined before experiments began with respect to baking them together by measuring dielectric losses on the Q-meter before and after boiling in distilled water for one hour. The thickness of the samples was 1 to 3 mm. With these thicknesses it was possible to compare $tg\delta$ values for one and the same voltage of the bridge but for different voltages of the field of the dielectricum to be examined. From the curves of the ultra porcelain it may be seen that a slight increase of $tg\delta$ was found to occur only within the temperature rahge of from 28 to 100° C. For the temperature range of from 28 to 120° C the increase of $tg\delta$ with an increase of E may be represented by an empiric formula $tg\delta = A + B\,(1-e^{-0.02E})$, in which E is expressed in kilovolt per centimeter. A table contains the values of the coefficients A and B at various temperatures.

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From them it is seen that B hardly changes at all within the temperature range mentioned. As already theoretically assumed, it was found in the course of tests that with increasing E ionization processes take place also in finer pores and that, consequently, also $tg\delta$ increases. From the curves for steatite it may be concluded that it possesses a whole set of heights of potential barriers. The dielectric losses in the case of the ceramic substances investigated change only little or not at all if the electric field increases.
Within the range of relatively not very high temperatures $tg\delta$ increases somewhat in the case of an increase of the field voltage in ultra porcelain and radio steatite because of ionization in the pores. At much higher temperatures the share of these losses is reduced and increase usually ceases. With radio porcelain and tikon T-150 the contrary is the case: at first $tg\delta$ is found to diminish slightly, and in the case of tikond T-20 and thermokond T-20 the dielectric losses are independent of E within a wide range of temperature.
In samples of a T-150 mass and at a temperature of something more than 200° C the maximum values for $tg\delta$ are found, which is apparently connected with the relaxation character of the dielectric losses. Empiric formulae for the dependence $tg\delta = f($ were set up also in the case of other investigated materials and these formulae can be used in some cases for the theoretical computation of the thermal disruption of the ceramics.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1384
AUTHOR GUBANOW, A.I., MAKOWSKIJ, L.L.
TITLE On the Article by K.B.TOLPYGO and I.G.SASLAWSKAJA on "Bipolar Diffusion in Semiconductors in the Case of Strong Currents".
PERIODICAL Zurn.techn.fis, 26, fasc. 9, 2126-2127 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

On the occasion of the solution of the system of differential equations in the work by K.B.TOLPYGO and I.G.SASLAWSKAJA (Zurn.techn.fis, 25, 955 (1955) the method of successive approximation was incorrectly used. The authors investigated the system of equations (11a), (11b), (11w') and (11g'). They attempt to find the solution of (16) by exploiting the smallness of the parameter A which takes the recombination of the electrons and holes into account. The function $\xi(\theta)$, however, must necessarily appear in the following form according to the equation (11g'):

$$\xi(\theta) = \frac{\xi_{-1}(\theta)}{A} + \xi_0(\theta) + A\,\xi_1(\theta) + \dots \qquad (a)$$

Let us now investigate the equation (11a). By inserting the unknown functions which are expressed in series according to A-powers, we obtain:

$$\frac{1}{\lambda}\left[\frac{dN_0(\xi)}{d\xi} + A\,\frac{dN_1(\xi)}{d\xi} + \dots\right] = \theta + N_0 y_0 + A(N_0 y_1 + y_0 N_1) + \dots$$

It should be noted that on the occasion of approximation towards zero, the

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equation obtained in the special case coincides with the initial equation. By dividing the equation (11a) by the equation (11g'), as was done by the authors (the parameter b is neglected in this equation), we obtain the equation (15a).
In order to prove that such an operation contributes absolutely nothing towards solving the task we represent both parts of the equation (11g') in form of a series with respect to the powers A:

$$\frac{1}{A}\,\frac{d\xi_{-1}}{d\theta} + \frac{d\xi_0}{d\theta} + A\,\frac{d\xi}{d\theta} + \dots = \frac{\lambda}{A}\left[\frac{1}{N_0 z_0} + A(\dots) + \dots\right], \qquad (b)$$

where $\frac{d\xi_{-1}}{d\theta} = \frac{\lambda}{N_0 z_0}$ etc.

It is clear that, by multiplying both parts of the equation (11a) by one and the same series, the equation (11a) is again obtained by approximation towards zero. The error committed by the authors consists in having failed to consider the fact that the quantity on the left side of the equation (15a) is proportional to the parameter A as follows from the equation (11g'), and from physical deliberations. Actually, θ is the relative densitypf the electron current which, in the flat case and with lacking recombination (with A=0) is constant.- Therefore θ is proportinal to A in first approximation. In view of the fact that the results obtained by K.B.TOLPYGO and I.G.SASLAWSKAJA are based upon an incorrect solution of equations they are of doubtful value.
INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1385
AUTHOR
TITLE Remarks Concerning the Letter written by CUBANOW and MAKOWSKIJ about the Work by TOLPYGO and SASLAWSKAJA on "Bipolar Diffusion in Semiconductors in the Case of Strong Currents".
PERIODICAL Zurn.techn.fis, 26, fasc. 9, 2127-2128 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

The authors of the letter (Žurn.techn.fis, 26, fasc.9, 2126-2127 (1956) (see review 1384) say with perfect justification that, as may be seen from (11g') of the work (Žurn.techn.fis, 25, 955 (1955)), $\lambda \frac{d\Theta}{d\xi} = A(Nz-b)$, the coordinate $\xi(\Theta)$ on tending towards zero has the ordinal number $\frac{1}{A}$ (see equation (a) of the letter). Besides, this is seen from the solution for ξ (see formula (20) of the paper Žurn.techn.fis, 25, 955 (1955). This is, however, contradictory to what is said in the last paragraph, i.e. that $d\Theta$ is proportional to A. If we put: $\xi = \frac{\xi_{-1}(\Theta)}{A} + \xi_0(\Theta) + \Theta A$, where ξ_1, ξ_0 .... are of the order of one, the (11g') results in $\lambda \frac{d\Theta}{d\xi} = Nz - b$, and $d\Theta$ does not contain A as a factor. This is also impossible because of a complete change of Θ in the sample is of the order one. Therefore the equation (15a) of the paper $\frac{A}{\lambda 2} \frac{dN}{d\Theta} = \frac{\Theta + Ny}{Nz - b}$, which is obtained after diving (11a) by (11g'), actu-

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ally contains the small parameter $\frac{A}{\lambda 2}$ on the left side, according to the power of which extension is carried out.
Furthermore, the authors of the letter come to the wrong conclusion that the fact that the second equation written down by them
$\frac{1}{\lambda} \frac{dN_o(\xi)}{d\xi} = \Theta + N_o y_o$ tending towards zero coincides with the initial equation (11a). If, beginning from $\frac{\xi_{-1}}{A}$, we aim at finding $\xi(\Theta)$ in form of an extension according to the powers of A, the $\frac{A}{\lambda} \frac{dN_o}{d\xi_{-1}} = \Theta + N_o y_o$ in reality forms the tendency towards zero which, in turn, contains the small parameter $\frac{A}{\lambda}$. Just because $\xi(\Theta)$ is of the order $\frac{1}{A}$, all initial equations (11), except (11g') contain on their left parts: $\frac{dN}{d\xi}$, $\frac{dz}{d\xi}$, $\frac{dy}{d\xi}$ the small parameter A, and their exists a s p e c i a l solution (which is just what we need) which is obtained by means of extension according to powers. The correctness of this special solution (which satisfies the boundary conditions for ∞) can be verified, independent of the errors committed by the authors, without referring to the method of finding the solution. If the solutions (16), (18), (19) are inserted into the equations (15) of the paper, the terms of the order of zero as also of the first order according to A will coincide. It is only necessary

to satisfy the criterion

$$\frac{A}{A_2} \ll \left[\left(1 + \frac{q}{K}\right) \theta - \frac{q}{K} \right] 5$$

In the following work (Zurn.techn.fis, 26, fasc.2, 1956) solutions for the same system (11) of the first work were found in a more general case, namely if the criterion mentioned is exceeded and the diffusion currents cannot be neglected. At a distance from p - n transition they pass over to the solutions of the first work.
Finally, in paper Zurn.techn.fis. 1956 (in print), the solutions of the first work were used by RASCHBA and TOLPYGO for the purposes of finding the volt-ampère characteristic of the direction of the transmission of the rectifier. The tests made by KOSENKO (Zurn.techn.fis. 1956) (in print) with specially prepared thick samples agree with the theory.
On the basis of what has just been shown the pessimistic conclusion drawn by the authors of the letter as regards the results obtained appear as unjustified.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1386
AUTHOR DERJAGIN, B.V., ABRIKOSOVA, I.I.
TITLE Direct Measuring of the Molecular Attraction among Solids in the Vacuum.
PERIODICAL Dokl.Akad.Nauk, 108, fasc.2, 214-217 (1956)
Issued: 7 / 1956 reviewed: 10 / 1956

Previous measuring of molecular attraction occurring between two solid bodies (plate and spherical lens) in air as a function of the interspace H between them was made very difficult by the viscosity of the air in the space between them. The cause of this is discussed on the basis of the equation of motion of the scale balance.
In spite of these difficulties a number of measurements was successfully carried out with a sufficient degree of reproducibility. The influence exercised by concussions was successfully reduced to a minimum by the erection of a device on an amortization platform which, in turn, was placed upon a cement base. In order to attain better stabilization of the interspace H, a two-mirror system was used. For the radical simplification of measuring and increasing its accuracy, a device for the carrying out of measurements in the vacuum was constructed. At from 10^{-1} to 1-3 mm Hg it was possible to reduce the time constant to fractions of a second in spite of the fact that the damping necessary for the prevention of self-oscillations was conserved.
Measuring results are entered into a diagram (abscissa - lg H, ordinate - lg F). The reproducibility of measurings separated from one another by long periods

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(years) and carried out with different samples of quartz glass is satisfactory. By means of the theory of the molecular interaction of convex surfaces it is possible, from the measured values of F(H), to compute the energy u(H) of the attraction of the parallel surfaces separated by the interspace H according to the formula $u(H) = F(H)/2\pi R$. Here R denotes the radius of the spherical surface. The values of u determined in this manner are entered into a diagram as functions of H. The values of u(H), which were found with the help of various considerably curved lenses, are in good agreement, which confirms the molecular nature of the effect under investigation. The values obtained for F and u are about 20 times lower than those computed with the formula of LONDON, and they also agree better with the theory developed by H.B.CASIMIR and D.POLDER (Phys. Rev. 73, 760 (1948)). However, an accurate comparison on the basis of this theory is still not possible.
E.M. LIFSIC, Dokl.Akad.Nauk, 97, 643 (1954); ibid. 100, 879 (1954), Žurn.eksp. i teor.fis, 29, 94 (1955) developed a strict theory on the molecular interaction of macroscopic bodies. However, an exact comparison with this theory necessitates full knowledge of the optic properties of the material in its absorption domains. However, the character of the absorption of quarts permits an approximated theoretical estimation of the forces of attraction. The values of F(H) and u(H) computed by the LIFŠIC method agree sufficiently well with measuring results.

INSTITUTION: Institute for Physical Chemistry of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1387
AUTHOR MATVEEV, A.N.
TITLE On the Influence Exercised by Radiation on the Synchrotron Oscillations of Electrons in the Case of Hard Focussing.
PERIODICAL Dokl. Akad. Nauk, 108, fasc.3, 432-435 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

Hard focussing reduces the amplitude of betatron oscillations considerably, and therefore transition to hard focussing is probably unavoidable from the point of view of betatron oscillations at energies of several BeV. For the exact solution of this problem it is necessary to take also synchrotron oscillations into account. For information concerning synchrotron oscillations induced in the case of soft focussing by radiation see M.SANDS, Phys.Rev.97, 470 (1955). Here the domain of high energies is investigated. On these conditions the effects connected with modifications of velocity (accompanied by only slight modifications of the energy of particles) can be neglected and the equation $d(E-E_s)/d\mu = eV_0(\cos\varphi-\cos\varphi_s)-(I-I_s)$ may be used. Here E denotes the energy of the particle, φ - the phase of the passage through the high frequent field, I - the energy radiated per revolution, μ - the number of passages through the accelerated interval, eV_0 - the amplitude of the accelerating field. The quantities denoted by the index s refer to the state of equilibrium. One finds:
$\delta I = I-I_s = (I_s/2\pi R_s)\left\{4\pi R_s(\delta E/E_s) + \int_0^{2\pi}\left[1-2n(\vartheta)\right]\delta R(\vartheta)\,d\vartheta\right\}$ and herefrom a further expression for δI which is explicitly given. Next, the modification δS

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of the orbit in the case of a modification of energy by the amount $\delta E=E-E_s$ is computed. If acceleration occurs on the k-th harmonic of the high frequent field, there results: $\Psi = k\omega(\alpha/\lambda)(\delta E/E)$, $\lambda = 1 + (L/2\pi R_s)$, and herefrom further the required equation of motion $\ddot{\Psi} + \gamma\dot{\Psi} + \Omega^2\Psi = 0$. Here L denotes the length of all rectilinear stretches on the synchrotron, $\Psi = \varphi - \varphi_s$ is the deviation from the phase of equilibrium.
The last-named equation was derived while the quantum-like character of radiation was neglected. The quantum-like character can be taken into account either by the addition of a term to the equation of motion or by direct deliberation. Both ways furnish the same expression for the average quadratic deviation.
After some transformations there results herefrom further the expression:
$\overline{\Psi}^2 = (55\sqrt{3}/64)(k\alpha/\lambda\sigma)\operatorname{ctg}\varphi_s(hc/e^2)(mc^2/E_s)$ which is suitable for application.
Next, an expression for the average deviation for the synchrotron oscillations of the average radius, which is in connection with these phase oscillations, is given.
From the point of view of synchrotron oscillations, hard focussing is, in any case, not disadvantageous if compared with soft focussing, and in some respects it even offers advantages.

INSTITUTION: Moscow State University "M.V.LOMONOSOV"

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1388
AUTHOR MOROZ, E.M.
TITLE A Cyclotron with a Magnet which is Cut Apart.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 3, 436-439 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

This work describes the principle for the construction of such a magnet and investigates the stability of the motion of particles and the resonances. At first an expression for the duration of the revolution of a particle with the energy E is given: $T = (2\pi E/ceH) + (Hl/v)$. Here l denotes the length of the interval between the magnet sectors, v - velocity of the particle, c - velocity of light, e - charge of the electron, $E_o = m_o c^2$ - rest energy of the particle. The modification of the time needed by a particle for passing through the magnet sector (first segment) can be compensated by a corresponding modification of the duration of the passage through the interspace of the sectors (second segment). The corresponding energy dependence of l is computed. With increasing energy l at first increases and later diminishes. The maximum is at about

$(E/E_o)^3 = TceH/2\pi E_o$.

The vertical focussing of the particles is brought about by a declining magnetic field on the boundaries of the magnetic sectors. The limits of vertical focussing may be extended considerably by the use of unsymmetrical sectors. The inclinations of the sector boundaries can be chosen in such a manner that one of the angles between the particle orbit and the normal to the sector boundary is

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positive so that thereby the motion of the particles becomes steady. In the case of symmetrical sectors it is true for the two angles of inclination that $tg\gamma_1 = tg\gamma_2 = (1/2)dl/dy$. (y - distance from the center of the rectilinear section of the orbit to the center of the accelerator). In the case of an unsymmetrical shape of the sectors it applies that $\gamma_1 = \gamma_2$ and the geometric locus of the centers of the rectilinear sections of the orbits forms a spiral.

Next, the radial stability of the particles is discussed. The maximum energy values at which a vertical as well as a radial stability still exists are given for various conditions.
The range of stability existing at $N \geqslant 3$ (N - number of uniform sectors) is intersected by resonance lines between the frequency of the vertical oscillations and the frequency of revolution, between the frequency of radial oscillations and the revolution frequency, and finally between the frequencies of the radial and the vertical oscillations. By confining oneself to terms of the second order in the equations of motion of the particles, 5 and 9 detrimental resonances respectively are found for N = 3 and N = 4 respectively.
From wedge-shaped sectors also a magnetic system for a microtron may be established which avoids the difficulties connected with vertical focussing.

INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1389
AUTHOR STRASKEVIC, A.M.
TITLE New Physical-Engineering Methods for the Modelling and Computation of the Motion of Relativistic Charged Particles in Electrostatic Fields.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 3, 440-443 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

The conservation theorem of energy for a particle with the algebraic value of the charge e: $m_0c^2(\alpha-1) + e\varphi = h$ and the equations of the trajectory of a relativistic particle in the electrostatic field are:

$$x'' = -eA(1 + x'^2 + y'^2)(\partial\varphi/\partial x - x'\partial\varphi/\partial z)/2(h - e\varphi)$$

$$y'' = -eA(1 + x'^2 + y'^2)(\partial\varphi/\partial y - y'\partial\varphi/\partial z)/2(h - e\varphi)$$

Here h denotes a certain constant, $\alpha = (1-v^2/c^2)^{-1/2}$, $A = 2\alpha/(\alpha + 1)$, and the strokes denote differentiation with respect to z. In the nonrelativistic case ($v \ll$) it is true that $A = 1$, and with increasing v, A increases and approaches the value 2.
Next, the above equations of motion are written down for a nonrelativistic charged particle in a field with the potential distribution: $\varphi^* = \varphi - m_0c^2(\alpha-1)^2/2e$. By inserting φ^* into these equations they are transformed into the trajectory equations of a relativistic particle. Consequently, the trajectories of a particle with variable mass can be modelled in the field φ by modelling the trajectories of a

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particle with constant mass in the field φ^*. The relief is to be produced according to the function φ^* which may easily be computed. By inserting φ^* into the conservation theorem of energy it may be seen that there is a difference in the extent of modification of the velocities of the relativistic and of the nonrelativistic trajectories in spite of the equality of these trajectories.

Some older methods are then discussed, but it is not possible to transfer all physical engineering methods to the relativistic domain by means of the transformation $\varphi \to \varphi^*$. This is true above all for the method of the rubber model, the automatic and the semiautomatic method. However, the formulae of the graphoanalytical method (A.M.STRASKEVIC, Zurn.techn.fis, 23, 1796 (1953)) can, after suitable corrections, also be generalized for the relativistic case. Next, formulae for the application of the semiautomatic method, which is developed for nonrelativistic particles, to relativistic particles are given. A graphoanalytical method is then suggested for the construction of the plane trajectories of relativistic particles. This method is based upon the successive construction of momentum vectors.
There follows a rather detailed discussion of the method on the basis of a drawing. According to a comparative table the here described methods of approximation are of sufficient accuracy for the computation of relativistic trajectories.

INSTITUTION: Kiev Polytechnic Institute.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1390
AUTHOR TOLMACEV, V.V., TJABLIKOV, S.V.
TITLE A Method for the Computation of the Statistical Sums for Ferromagnetica in Consideration of the Restrictions Imposed upon the Filling Numbers of the Spin Waves.
PERIODICAL Dokl.Akad.Nauk, 108, fasc. 6, 1029-1031 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The present representation of this method takes into account that the projection of the spin of every atom (in $\hbar/2$ units) assumes only the two values + 1 if one electron corresponds to each atom.
At first the HAMILTONIAN of the ferromagneticum is written down, after which one passes from spin operators to BOSE operators. Also on this occasion one electron is supposed to correspond to each atom. The HAMILTONIAN in this new variable is written down as a sum of three summands $\mathcal{H} = \mathcal{H}_0 + \mathcal{H}_1 + \mathcal{H}_2$, and each summand is explicitly given. The equations $\mathcal{H}\varphi = E\varphi$ for the determination of eigenfunctions and eigenvalues are to be investigated only within the space of the filling-up numbers $n_f = 0,1$. However, in order to simplify further computations, this equation is examined in all spaces of all possible filling-up numbers; the restriction to $n_f = 0,1$ is taken into account by the introduction of an operator $P = \prod_{(f)} \{ \Delta(n_f) + \Delta(n_f - 1) \}$. Here $\Delta(n) = 1$ and $\Delta_n = 0$ is true for $n=0$ and $n \neq 0$ respectively. This operator P projects

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the functions applying within the space of all possible filling-up functions on to the functions in the space with $n_f = 0,1$.
In zero-th approximation $Z_0 = Sp(e^{-\mathcal{H}_0/\Theta})$ is true for the sum of states, on which occasion the trace is extended to the space of the numbers $n_f = 0,1$. $Z_0 = Sp(P \exp[-\mathcal{H}_0/\Theta])$ is true in the space of all possible filling-up numbers. The computation of Z_0 is simplified considerably by making use of an orthonormalizing system; the rather complicated expression found is explicitly given. There follows herefrom at low temperatures

$$Z_0 \sim 1 + \sum_{(\nu)} e^{-E(\nu)/\Theta}.$$

According to information received from N.N.BOGOLJEBOV similar ideas were already developed by DYSON in manuscripts meanwhile received while the present work was being printed.

INSTITUTION: Mathematical Institute V.A.STEKLOV of the Academy of Science in the USSR

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1391
AUTHOR STEPANOV, B.M.
TITLE The Nonrelativistic Regularization of the S-Matrix.
PERIODICAL Dokl.Akad.Nauk, 108, fasc.6, 1045-1047 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

All regularization methods hitherto employed were relativistically covariant, and in some cases, when dealing with divergent expressions, covariance was even considered to be necessary. However, in the case of regularization the integrals can be broken off also nonrelativistically. On this occasion counterterms must be defined in such a manner that, after the cancelling of regularization, the properties of relativistic covariance are restored. Here the possibility of such a definition is pointed out, on which occasion the effective HAMILTONIAN proves to be hermitian.
For reasons of correctness the fundamental idea is illustrated on the basis of quantum electrodynamics, but its applicability to every renormalizable theory is obvious. At first a regularizing LAGRANGIAN is given instead of the usual LAGRANGIAN of interaction, and the regularization factors occurring therein are chosen in such a manner that the effective HAMILTONIAN is hermitian. This may be attained by doing without the relativistic invariance of these factors, i.e. by admitting the dependence of these factors on some spacelike unit vectors. Ansatzes for these regularization factors are given which establish agreement among all diagrams. Regularization is thereby attained. The formulation of the R-operation with respect to the suggested regularization method is best demon-

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strated on the basis of the results and denotations of the basic work by N.N.BOGOLJUBOV and D.V.SIRKOV, Usp.fis.nauk, 57, 3 (1955).
The FOURIER representation of the coefficient function from the T-product then has the form of a convergent integral. On the occasion of the cancelling of regularization the covariant properties are restored, but the integral expression loses its sense because of the divergence of integrals.
Now the structure of the counterterms of spinorial electrodynamics resulting in connection with this regularization method is explained. Because of the special part played by time the time-dependent, spatial, and mixed components must be investigated separately in vectors and tensors. The effective LAGRANGIAN of interaction thereby computed is explicitly given. The constants occurring therein are real and finite in every perturbational approximation and are chosen in such a manner that the S-matrix is relativistically invariant. This demand and the further demand concerning the equality of mass and charge with its experimental values fully determines all constants. In conclusion the possibility of a certain paradoxial result is pointed out.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1392
AUTHOR TITC, T.
TITLE On the Selection of the Physically Applicable Solutions of the SCHRODINGER equation for the Hydrogen Atom.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 948-949 (1956)
Issued: 9 / 1956 reviewed: 10 / 1956

The wave function $\psi(r, \vartheta, \varphi) = R(r)P_l^m(\cos\vartheta)e^{\pm im\varphi}$ leads (in atomic units) to the following differential equation for R:

$d^2R/dr^2 + (2/r)dR/dr + (2E+(2Z/r)-l(l+1)/r^2)R = 0$ (with $E < 0$). According to A.SOMMERFELD, Atomic Structure and Spectral Lines, vol.2; H.A.KRAMERS, Quantum Theory of the Electron and Radiation, Leipzig (1938), and F.RELLICH, Math.ZS. 49,719(1943/44) the second particular solution is not to be omitted in the case of l=0, because all particular solutions are normalizable. According to the author's opinion this is not correct.
It is intended to show here that, with l=0, there exists only one normalizable solution, and that at the point r=0 a certain boundary condition must be imposed in order to obtain the correct spectrum of eigen values. For l=0 there are the following independent particular solutions: $R_1 = e^{-\varrho/2}\,{}_1F_1(1-2Z/\mathcal{H},2,\varrho)$; $R_2 = e^{-\varrho/2}\,\Phi(1-2Z/\mathcal{H},2,\varrho)$. The following abbreviations were used on this occasion: $2E = -\mathcal{H}^2/4$; $\mathcal{H}\,r = \varrho > 0$. ${}_1F_1$ is the confluent hypergeometrical progression and Φ is the second independent solution of the confluent hypergeometric differential

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equation. An integral equation is then given for Φ, and the asymptotic form of this function for $\varrho \to +\infty$ is $\Phi(a,b,x) = x^{-a}\left[1+O(1/x)\right]$. Therefore the here investigated second solution R_2 with $\varrho = +\infty$ is $R_2 = e^{-\varrho/2}\varrho^{-\left[1-(2Z/\mathcal{H})\right]}\left[1+O(1/\varrho)\right]$. This formula shows that the second particular solution can be normalized. For small r it applies that $\lim_{\varrho \to +0} R_2 = \left(e^{-\varrho/2}/\Gamma\left[1-(2Z/\mathcal{H})\right]\right)(1/\varrho)$. R_2 is therefore normalizable for all eigenvalues $E < 0$, and there always exists a normalizable solution. However, normalization conditions are insufficient for the determination of the correct spectrum of the eigenvalues. This deficiency can be removed by imposing a second boundary condition which expresses the steadiness of the solution at zero. If we demand $1-(2Z/\mathcal{H}) = -n, n = 0,1,2,\ldots$, the Φ is, as we know, reduced to LAGUERRE polynomials, and therefore R_2 is steady in the case of r=0. With $1-(2Z/\mathcal{H}) = -n$ the functions of R_1 and R_2 are linearly dependent but with $1-(2Z/\mathcal{H}) = n-n$ (or "-n" ?) they are linearly independent. With l=0, also WEYL'S theory requires an additional boundary condition. In the present case the demand for steadiness corresponds to the selection of a certain fully determined WEYL boundary condition for r=0. Thus, the demand for steadiness warrants a physically correct spectrum of the eigenvalues. Also the boundary condition in the case of r=0 may be explained quite simply by using the demand for self-adjointness.

INSTITUTION: University of Torun, Poland.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1393
AUTHOR KLIMONTOVIC, JU.L.
TITLE On the Correlation Function for Quantumlike Systems.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc. 5, 977-979 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

Here the correlation function of a quantumlike system of particles which are in interaction, is determined by the BOGOLJUBOV method. The quantumlike distribution function f_2 is approximated without considering the exchange effects by a binary quantumlike distribution function, and for the correlation function $g(|q'|)=g_{id}+(2\pi)^{-3}\int (\Psi(k)F(k)/(1\mp\Psi(k)F(k))e^{ikq}dk$ is obtained, where $g_{id}=1\pm\int f_o(p')f_o(p'')e^{iq(p'-p'')}dp'\,dp''$ is the quantumlike correlation function of the perfect gas. $f_o=1/(2\pi\hbar)^3\, n_o\,[A\exp(p^2/2mkT\mp 1)]$ denotes the function of the distribution according to momenta in the case of a homogeneous spatial distribution. The minus sign corresponds to the BOSE statistics, the plus sign to the FERMI statistics. The second term in the formula for $g(|q'|)$ is due to the interaction of particles. At $\hbar = 0$ the expression for $g(|q'|)$ is identical with the correlation function of a classical system. Furthermore, the correlation function by DEBYE is obtained for a fully ionized gas at $\hbar = 0$.
Now the correlation functions for some special cases are given, namely for a totally degenerated BOSE gas (also in the case of small momenta), for a totally degenerated system subjected to the FERMI statistics, and for a plasma.

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In the case of the approximation investigated here it is not necessary to use the equation system for the quantized distribution function when dealing with a totally ionized gas, but it is possible to be content with solving the kinetic equation with self-consisting field for the quantumlike distribution function. For the computation of the thermodynamic functions of a totally ionized gas it is necessary to know the additional energy (with respect to the energy of a perfect gas). This additional energy is determined by the distribution of the potential U round any ion.
Now the equation for the potential of a quantumlike system is determined in linear approximation for the case $\partial f/\partial t$:
$\triangle U = -4\pi e^2 \int F(k)\, e^{ik(q-q')}U(q')dk\,dq'$. In the case $\hbar = 0$ this equation passes over to the equation of the DEBYE theory. At $\hbar k \ll p_o$, an equation agreeing with the equation of DEBYE'S theory is also obtained in the quantumlike case, namely $\triangle U = r_d^{-2}U$, but this equation has a different correlation radius. In the case of total degeneration of the FERMI gas the correlation radius is $r_d=(p_o^2/12\pi e^2 n_o)^{1/2}$.
Thus the expression for the correlation function holds good in the case of a weak interaction for classical and for quantumlike systems of particles with central interaction at any temperature.

INSTITUTION: Moscow State University.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1394
AUTHOR BOGDANOV, G.F., VLASOV, N.A., KALININ, S.P., RYBAKOV, B.V., SIDOROV, V.A.
TITLE The Spectra of Neutrons produced on the occasion of the Bombardment of Light Nuclei by 14 MeV Deuterons.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 981-983 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

In order to become fully acquainted with the production mechanism of neutrons on the occasion of the bombardment of tritium and deuterium by 14 MeV deuterons previous measurements (G.F.BOGDANOV et al, Zurn.eksp.i teor.fis,30, 185 (1956)) were continued with targets of other light elements (gaseous elements of H, He^3, He^4 as well as solid elements of Li,Be,B,C and Cu). The neutrons were analyzed on the basis of the time of passage through the stretch between target and counter (2,85 m). The construction of the gaseous and liquid targets is described. The data obtained by averaging over a number of series of measurements are shown in diagrams. The acuity of the device makes it possible to discover individual levels of the nucleus created by reaction only on the occasion of the bombardment of the isotopes of hydrogen and helium; in all other cases spectra must be continuous. The spectrum of the neutrons and their production cross section do not change steadily with the number of the nucleons in the nucleus.
In the case of a high positive thermal effect Q of the reaction the upper limits of the spectra are higher than the maximum energy of the neutron which is produced on the occasion of the fission of the deuteron without modification of the

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bombarded nucleus. Consequently, the state of the nucleus produced by the reaction exercises essential influence upon the neutron spectrum under investigation. A comparison between the production cross sections and spectra of neutrons corresponding to the reactions T+d and He^3+d confirms the existence of an excited state of He^4 with the excitation energy ~ 22 MeV, and is indicative of the fact that no similar state exists in the case of the Li^4 nucleus. H^4 and Li^4 probably do not exist in a state that is similar to the excited state of He^4. This confirms the assumption that the isotopic spin of the excited He^4-state with 22 MeV is equal to zero. Next, the neutron spectrum produced on the occasion of the bombardment of He^4 is discussed in short. On the occasion of this (d,n)-reaction an Li^5 nucleus is produced, for which, apart from the ground state, a second state with an energy surpassing that of the ground state by 2,5 MeV was hitherto assumed to exist. However, in the neutron spectrum of the reaction He^4+d no excited state of Li^5 could be found.
Furthermore, the production cross sections of the neutrons emitted in the direction of 0° towards the deuteron bundle were estimated for various targets. In the case of all investigated light elements with the exception of tritium this cross section is 50 mb/sterad per nucleon of the nucleus, which means that it is approximately proportional to the number of nucleons A. On the occasion of transition to heavy nuclei the cross section decreases and in the case of Cu, for instance, it is 200 mb/sterad.
INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1395
AUTHOR BELEN'KIJ, S.Z.
TITLE On the Diffraction Scattering of Pions of High Energy by Nucleons.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 983-985 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

Here diffraction scattering is investigated on the basis of the general theory which is not connected with any concrete nucleon model. Investigation bases on the relations: $\sigma_c = \pi\lambda\!\!\!^{-2} \sum_{l=0}^{\infty} (2l+1)(1-|\beta_l|^2)$, $\sigma_s = \pi\lambda\!\!\!^{-2} \sum_{l=0}^{\infty} (2l+1)|\beta_l - 1|^2$. The dependence of the nuclear forces on the spins and the "re-charging" of pions by protons is here neglected. Denotations: σ_c - absorption cross section of the particles, σ_s - cross section of elastic scattering, $\lambda\!\!\!^{-}$ - wave length of the inciding particle, $\hbar l$ - orbital angular momentum, $\beta_l = \exp\{2i\eta_l\}$, η_l - phase of scattering.
In the case of high energies the imaginary part of the scattering amplitude is much larger than the real part and consequently β_l is a real quantity, which makes phase analysis much easier. The present accuracy of tests warrants no univocal determination of the phase, but nevertheless the results obtained by accelerators at high energies can be used for an approximated phase analysis. The most complete test results concerning the scattering of negative pions with 1,4 BeV by nucleons were obtained by L.M.EISBERG et al.Phys.Rev.97, 797 (1955). When estimating cross sections, they ascribed part of the observed elastic scattering to processes standing in direct connection with the absorption of a pion. Actually,

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it is necessary that, on the occasion of the capture of a pion and after the following "decay" of the compound system, an incoherent and nearly isotropic elastic scattering takes place, which, in contrast to diffraction scattering, must be classed among the nonelastic collisions. EISBERG et al. found the following cross sections for nonelastic and elastic scattering respectively: $\sigma_c = 26,7 \pm 1,3$ mb and $\sigma_s = 7,3 \pm 1,0$ mb. The ratio σ_s/σ_c changes in the interval 0,33-0,23. In the case of sufficiently high energies the sums of the formulae mentioned above can be replaced by integrals: $\sigma_c = \pi\lambda\!\!\!^{-2} \int_0^{\infty} 2la_l(2-a_l)dl$; $\sigma_s = \pi\lambda\!\!\!^{-2} \int_0^{\infty} 2la_l^2 dl$. Here $a_l = 1-\beta_l$. By basing on the simple assumption $a_l = \alpha \exp(-\lambda\!\!\!^{-2}l^2/R^2)$ (where α and R are experimentally determined) one obtains: $\sigma_c = (\pi\alpha^2R^4/2)((4/\alpha-1)$; $\sigma_s = \pi\alpha^2R^2/2$. The values of α and R which correspond to the experimental data, are between the following limits: $0,86.10^{-13}$ cm $> R >$ $0,74.10^{-13}$ cm; $0,74 < \alpha < 0,99$. The curve computed for the corresponding average values is shown in a diagram; it corresponds to the cross sections $\sigma_c = 28$ mb and $\sigma_s = \sigma,1$ mb. The theoretical curve agrees sufficiently well with experimental data. In conclusion the quantity $Z_1 = 1-|\beta_l|^2$ is discussed which has the physical significance of a "sticking-on probability" of a particle.
INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1396
AUTHOR GITERMAN, M.S.
TITLE The "Smoothing" of Charge Density in the Theory of Polarons.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 991-992 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

In the theory of polarons (I.S.PEKAR, Investigations concerning the Electronic Theory of Crystals, Gostechizdat, Moscow 1951) an "auxiliary equation" for the "smoothed" wave function $\varphi(r)$ is to be solved:
$(-(\hbar^2/2\mu)\Delta + W)\varphi = E\varphi$; $\varphi = \sum_{\vec{k}} a_{\vec{k}} e^{i\vec{k}\vec{r}}$. Here μ denotes the effective mass of the electron and the polarization potential $W(\vec{r})$ is not computed from the true function $\Psi(\vec{r}) = \sum a_{\vec{k}} \Psi_{\vec{k}}(\vec{r})$ of the polaron ($\Psi_{\vec{k}}$ = BLOCH functions), but from the smoothed function $\varphi(\vec{r})$. This smoothing, however, causes a certain error committed as regards the amount of energy. This error is here estimated for the case that the limit of applicability of the method of the effective mass $r_p >> a$ is reached. (r_p - polarization radius, a - distance between the nearest ions). The error, which is computed by the perturbational theory, is at first explicitly given. The dispersion of the crystal and the dependence of its polarization on the wave length are here neglected. On the basis of the approximation of strongly coupled electrons it was found to apply that: $\Psi_{\vec{k}} = \sum_{n} e^{ikn} \Psi_a(|\vec{r} - \vec{n}|)$. Here $\vec{n}$ denotes the center of the cell which is identical with the core of the positive ion.

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As an approximating function $\varphi(r) = (\alpha^{3/2}/\sqrt{55\pi})(1+\alpha r+(\alpha r)^2/2!+(\alpha r)^3/3!)e^{-\alpha r}$ is then used. On this occasion α is determined by minimizing the corresponding function ls as being $\alpha = 0{,}821(\mu/m)c/a_B$, where a_B is the BOHR radius. Next, the terms of the expression for the error are discussed. Numerical computation was carried out for sodium salts and the function Ψ_a was approximated with sufficient accuracy according to data obtained by V.A. FOK and M.PETRASEN', Phys.Zs. of the Soviet Union, 6, 369 (1934):
$\Psi_a(r) = 0{,}727(4\pi a_B^3)^{-1/2}(r/a_B - 1)e^{-0{,}71r/a_B}$. $E_1 = (0{,}01873 \cdot 10^{-16}\alpha^2 + 0{,}07221 \cdot 10^{-32}\alpha^4 + +\ldots)e^2 c\alpha$ was obtained.
In the case of NaCl crystal $\alpha = 1{,}109 \cdot 10^8$ and the smoothing of the potential produced a value for energy which is about 15% too low. By using the approximation of strongly coupled electrons the estimate of the error is somewhat increased so that in the case of NaCl this error amounts to about 10 to 12%. K.B.TOLPYGO, Zurn.eksp.i teor.fis, 21, 443 (1951) took the higher approximations of the method of the effective mass into account, and according to the results he obtained the values for energy determined by this method are too high, particularly those for NaCl which are too high by about 12-13%. Thus these errors are about equal and inversely directioned. This confirms the applicability of the method of effective mass to the computation of energy even if r_p is about 2 or 3 times the amount of a.

INSTITUTION: Mordwinian State Pedagogical Institute, Saransk.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1397
AUTHOR KARPMAN, V.I.
TITLE On the Correlation between the Planes of the Production and of the Decay of Λ^0-Particles.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.5, 963-964 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

At first several pertinent previous works are mentioned. The z-axis is assumed to be vertical to the plane of production of the Λ^0-particles, and these particles are assumed to move along the y-axis. The angle between the plane of production and the plane of decay is then equal to the azimuthal angle φ. We then pass over to a system of reference in which the Λ^0-particles are at rest, and on this occasion φ does not change. The density matrix $\varrho(x',x)$ of the Λ^0-particle can be developed according to the wave functions $\Lambda_m(x)$ of the Λ^0-particle:
$\varrho(x',x) = \sum_{m_1 m_2} \varrho_{m_1 m_2} \Lambda^*_{m_1}(x') \Lambda_{m_2}(x)$.
Next, the distribution of the angle φ between the plane of production and that of decay is computed. For the probability density of the angle φ the expression
$W(\varphi) = \sum_{k=0}^{2j-1)/2} (a_k e^{2ik\varphi} + a_k^* e^{-2ik\varphi})$, is found. Here the coefficients a_k for $a \neq 0$ are linear combinations of the initial elements of the density matrix $(\varrho_{m_1 m_2})$.
The angle is, by the way, always measured experimentally in such a manner that $\varphi < 90^0$ applies. The probability density $\omega(\varphi)$ of the thus determined angle is:

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$\omega(\varphi)=W(\varphi)+W(\pi+\varphi)+W(\pi+\varphi)+W(2\pi-\varphi)$ or $\omega(\varphi) \sum_{k=0}^{(2j-1)/2} b_k \cos 2k\varphi$ with $b_k = 8|a_k| \cos$ (arg a_k). If the non-diagonal elements of the density matrix tend towards zero the distribution of the angle φ becomes isotropic, and consequently there can be no correlation between the plane of production and the plane of decay, also not if $j \geq 3/2$. From the normalization condition $\int_0^{\pi/2} \omega(\varphi) d\varphi = 1$ follows $b_0 = 2/\pi = 0{,}637$.
There follows an exact study of the correlation effects on the assumption that the spin of the Λ^0-particle is $j=3/2$, in which case it is true that $\omega(\varphi) = 2/\pi + b_1 \cos 2\varphi$. In the case of $j=3/2$, the probability for $\varphi > 45^0$ is at least 18%, and the probability for $22{,}5^0 \leq \varphi \leq 67{,}5^0$ is 50%. If these conditions are not satisfied in the case of existing correlation, it is true for the spin of the Λ^0-particle that $j > 3/2$.
By considering all data in conjunction, a share of 26% is obtained for the number of cases with $\varphi > 45^0$, and for the cases with $22{,}5^0 \leq \varphi \leq 67.5^0$ a share of 42% is obtained, which approaches 50%. In view of the fact that hitherto statistical data have been incomplete, it must be said that the spin of the Λ^0-particle is 3/2. However, these data do not exclude the possibility $j > 3/2$.
From all these deliberations it follows quite simply that the spin of the θ^0-particle is different from zero.

INSTITUTION: Pedagogical Institute, Minsk

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1398
AUTHOR SOKOLOV, JU.L., SULKOVSKAJA, M.M., KARPUSKINA, E.I., AL'BICKAJA, E.A.
TITLE The Levels of the Li^6 Nucleus.
PERIODICAL Zurn.techn.fis, 30, fasc.6, 1007-1012 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

By the photographic method the present work studies the reactions taking place to the accompaniment of the emission of several particles on the occasion of the interaction of fast deuterons (energy 13,8 MeV) with Li^6- and Li^7-nuclei. The Li was introduced into the photoplates by saturating these plates with the salt acetate of a natural mixture of Li-isotopes and of a mixture which was enriched with Li^6. Then the plates saturated with Li were irradiated by deuterons (13,8 $\pm$ 0,2 MeV) in such a manner that their ranges remained fully in the emulsion. Nuclear fissions could be caused because of the continuous decrease of deuteron energy as a result of slowing down by deuterons of different energies. On equal planes of the plates saturated with the different mixtures an approximately equal number of stars of various types was found, which consist of 2, 3 or 4 beams. The energetically possible reactions with $Q \geq -5$ MeV are enumerated. The identification of the stars found is discussed.
Most of the 3-beam stars consisting of 2 traces of simply charged particles and of a trace of an α-particle belong to the following reactions:
$Li^6(d;2d)He^4$, $Li^6(d;d',p,n)He^4$, $Li^7(d;t,d')He^4$. The most frequent reaction which, according to the author, has hitherto not been observed, is $Li^6(d,2d)He^4$, in the

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case of which a deuteron, which is comparatively weakly bound with one α-particle in its core, is torn away by the impinging deuteron. This reaction probably develops in two stages; the impinging deuteron is scattered nonelastically and excites the Li^6-nucleus to a certain level, starting from which the nucleus decays into a deuteron and into an α-particle. The following denotations are used for the energy of the excited level: $E^* = \varepsilon_d + \varepsilon_\alpha + |Q|$ and $E^* = (2/3)\left[E - 2E' + \sqrt{EE'}\cos\vartheta\right]$. Here E denotes the energy of the impinging deuteron, E' the energy of the scattered deuteron, and ϑ the scattering angle. (All in the laboratory system).
For the reaction $Li^6(d,d',p,n)He^4$ it applies that Q=-3,7 MeV. All stars observed and belonging to this reaction belong to a hitherto unknown level with the energy 7,6 $\pm$ 0,3 MeV.
The reaction $Li^7(d;t,d')He^4$ may apparently develop in two ways:

$$Li^7 + d \rightarrow t + Li^{6*} \rightarrow \begin{cases} \alpha + d \\ d + Li^{7*} \rightarrow \begin{cases} \alpha + t \end{cases} \end{cases} \quad \text{and} \quad Li^7 + d \rightarrow t + Li^{6*} \rightarrow \alpha + d$$

While dealing with the stars belonging to this reaction, levels of about 2,2 ; 4,5 and 7,5 MeV were found. There exist also other stars which do not belong to these levels but to other and possibly unknown levels of the Li^6-nucleus.

INSTITUTION:

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1399
AUTHOR GURZI, R.N.
TITLE On the Scattering of Photons by Nucleons.
PERIODICAL Zurn.eksp.i teor.fis, 30, fasc.6, 1079-1083 (1956)
Issued: 8 / 1956 reviewed: 10 / 1956

This cross section is here computed by the semiphenomenological theory in consideration of damping. Because of the meson field which surrounds the nucleon, the scattering cross section of photons by nucleons must be distinguished from the well-known formula by KLEIN-NISHINA; the cross section probably depends resonance-like on energy. Computations carried out in this connection meet with the basic difficulties of the present meson theory. This is why the semiphenomenological theory is employed in this case.
At first the LAGRANGIAN of the interaction of a nucleon with light is written down. The inciding photon is characterized by the polarization vector $\vec{e}$ and the four-momentum $k(\vec{k},i\omega)$, but the four-momentum of the nucleon in the initial state is denoted by $p(\vec{p},iE)$. Next, the ansatzes for U and A ($F_{\mu\nu} = \partial A/\partial x_\mu - \partial A_\mu/\partial x_\nu$) are written down. The quantities occurring in these expressions are developed according to polynomials and the corresponding coefficients of development are given. The scattering cross section in consideration of damping is determined by the method of integral equations by HEITLER. The equations for the matrix element $U(n^+, p\gamma)$ and for the amplitude $F(n^+)$ of the photo production $\gamma + p \rightarrow n + \pi^+$ are solved by decomposition of the quantities U and F according to a system of orthogonal polynomials. The results

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following therefrom as well as the differential and integral cross section are given in the center of mass system. For the integral cross section of the scattering of light by protons the following values are obtained:

ω (in MeV)	280	340	400
$\sigma.10^{-31}$	11,6	21,3	20,3

In the center of mass system the maximum, as expected, is about $\epsilon \sim \mathcal{H}$, which corresponds to an energy of $\omega \sim 340$ MeV in the laboratory system. At the same time, but independently, a similar computation was carried out by V.L.RITUS. However, the course taken differs in the case of these two forms of computation. There is also a difference in numerical results, which appears to be connected with the selection of the constants.

INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR

SUBJECT USSR / PHYSICS CARD 1 / 3 PA - 1400
AUTHOR FEDORENKO, N.W., AFROSIMOW, W.W., KAMINKER, D.M.
TITLE The Capture of Electrons and Ionization on the Occasion of Interaction between Positive Ions having a Charge and Gas Atoms.
PERIODICAL Zurn.techn.fis, 26, fasc.9, 1929-1940 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

There are two schemes, which differ in principle, for the realization of the simple processes of ionization of atoms by ions: 1.) As a result, a slow ion with a charge e.n is produced, and n free atoms are liberated. 2.) The production of the slow ion with the charge n.e is accompanied by the liberation of n-1 electrons and the capture of an electron by the fast ion.
The occurrence of free electrons during the passage of the ion bundle through a gas may also be the consequence of the removal of the electrons from the shell of the fast ion. It may be assumed that, on the occasion of one and the same collision between ion and atom, both the ionization process of the atom as also the stripping process of the ion may take place. For this reason considerable experimental difficulties are encountered on the occasion of the determination of the cross section of each individual process.
The total cross sections in one and the same gas (argon) for different ions (He^+, Ne^+, A^+) and total cross sections for different gases (He, Ne, A, Kr) and one and the same ion (He^+) were compared. The apparatus used consisted of a mass spectrometer, a receiver F_1 in the first chamber (for measuring by the potential method), and a receiver F' in the second chamber. Behind the latter

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there is a magnetic analyzer. If the magnetic field is lacking in the analyzer chamber, the primary bundle is caught by the receiver F_2 after passing through the second chamber, whilst the receiver F_2 catches only fast atoms.

Working pressure in both collision chambers amounts to $1.5 \cdot 10^{-4}$ torr. For filling them spectrally pure gases were used: helium, neon, argon, and krypton. The potential method was described in detail in Zurn.techn.fis, 24, 2113 (1954) by N.W.FEDORENKO. The total cross section of the formation of slow ions δ_+ was determined according to the formula

$$\delta_+ = \frac{i_+}{i_1 Nb}$$

The total cross section of the formation of free electrons δ_- was determined according to the formula

$$\delta_- = \frac{i_-}{i_1 Nb}$$

In these formulae i_+ and i_- are the positive and negative currents of the saturated slow particles. N is the number of atoms in 1 cbcm gas, with which the first chamber is filled, b is the length of the measuring electrons. The total cross section of the capture (δ_o) was determined according to the formula

$$\delta_o = \frac{i_3}{i_1' NI \gamma k}$$

Here N is the number of atoms in 1 cbcm gas filling the second chamber, i_1 is the current of the primary bundle measured by the receiver F_1, i_3 is the current of electrons of the secondary emission ejected by the fast atoms, l is the length of the second collision chamber, γ is the coefficient of the secondary emission for the ions of the primary bundle, measured for each individual experiment according to the determination of δ_o, k is the transmission capacity of the analyzer, which varied in individual cases between 0.6 and 0.9. The dependence $\delta_o(T_o)$ for the pair He^+ - He and the pair A^+ - A, which is illustrated by curves, shows that the total capturing cross section decreases continuously with an increase of energy. For the pairs He^+-Ne, He^+-A, He^+-Kr, and A^+-Kr dependence has flat maxima. The cross section in the maximum is of the order $\sim 1.10^{-15}$ cm^2. The tables show that, as regards the order of the maxima, the behavior is not, as might have been expected, in accordance with the formula by MASSEY. For argon and Kr the cross sections are δ_+ and δ_- within the investigated energy range of from 1 to 2.10^{-15} cm^2.

INSTITUTION: LFTJ

Russian Physical Literature

Report No 20 - September 1956

(Finished 25th of September 1956)

Covering 100 Selected Reviews of Papers published in

Doklady Akad. Nauk SSSR

Uspechi Fis. Nauk

Zhurnal Exper. i. Teor. Fisiki

Zhurnal Technicěskoj Fisiki

Radiotechnika

Atomnaja Energija

Continously reported from

1. 9. 1954

This report covers 100 papers published in these journals later than 15th of February 1956 and earlier than 21st of August. These Reviews are

No 1201 - 1300

The report contains 3 papers published in February 1956
16 papers published in March 1956
23 papers published in April 1956
3 papers published in May 1956
19 papers published in June 1956
18 papers published in July 1956
18 papers published in August 1956

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Carbons of Single Reviews only in the Normal Carbon Copy of this Report; for Original and Reproducible Copy: see the enclosed 100 Matrices.

1. List of Reviewed Journals

The Papers were selected from:

	volume	fascicule	published	received
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	108	No 2	(11.5.56)	
	108	No 4	(1.6.56)	
	108	No 5	(11.6.56)	
	108	No 6	(21.6.56)	
	109	No 1	(1.7.56)	
	109	No 2	(11.7.56)	
Z Žurnal exper. teor. fis.				
	30	No 4	(15.4.56)	
	30	No 5	(15.5.56)	
	30	No 6	(15.6.56)	
	31	No 1(7)	(15.7.56)	21.9.1956
T Žurnal techn. fis.				
	26	No 4	(15.4.56)	
	26	No 7	(15.7.56)	
	26	No 8	(15.8.56)	
U Uspechi fis. nauk				
	58	No 4	(15.4.56)	
	59	No 3	(15.7.56)	

R Radiotechnika

11	No 2	(15.2.56)	
11	No 3	(15.3.56)	10.5.1956
11	No 4	(15.4.56)	
11	No 5	(15.5.56)	
11	No 7	(15.7.56)	

E Atomnaja Energija

1	No 3	(15.3.56?)

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Doklady

109, No 1, published 1.7.1956, received 8.9.1956

yes (8): 49, 53, 61, 64, 68, 72, 77, 85

no (2) : 57, 80

109, No 2, published 11.7.1956, received 8.9.1956

yes (6): 271, 279, 283, 285, 289, 303

no (4) : 275, 292, 295, 299

109, No 3, published 21.7.1956, received 20.9.1956

yes (8): 473, 477, 481, 489, 495, 499, 507, 519

no (6) : 485, 493, 503, 511, 521, 515

Radiotechnika

11, No 8, published 15.8.1956, received 15.9.1956 (K)

yes (9): 3, 25, 31, 36, 52, 64, 71, 74, 79

no (2) : 14, 78

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31, No 1(7), published 15.7.1956, received 21.9.1956

yes (24): 14, 18, 25, 31, 37, 40, 45, 55, 80, 105, 113, 121, 138, 136, 140, 142, 144, 146, 154, 157, 162, 164, 166, 167

no (10) : 3, 63, 86, 132, 134, 148, 150, 152, 156, 159

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26, No 8, published 15.8.1956, received 4.9.1956

(K finished)

yes (18): 1634, 1646, 1651, 1665, 1681, 1689, 1696, 1704, 1714, 1723, 1730, 1741, 1769, 1802, 1815, 1823, 1836, 1857

no (13) : 1625, 1657, 1669, 1671, 1738, 1744, 1782, 1790, 1799, 1841, 1849, 1862, 1863

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59, No 3, published 15.7.1956, received 8.9.1956

yes (3) : 377, 459, 553

no (2) : 399, 543

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D Total of material dealt with since September 1954 and volumes 100, 101, 102, 103, 104, 105 (1955)
106, 107,
108, No 1 (published 1.5.56, received 20.6.56)
in preparation: 108, No 2-6, 109, No 1-3 (No 3 published 21.7.56, received 24.9.56)

Z 27 (1954) since September 1954; 28, 29 (1955)
30, No 1, 2, 3, 4 (1956)
in preparation No 5, 6; 31, No 1(7) (published 15.7.56, received 21.9.56)

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U 54 (1954) since September 1954, 55, 56, 57 (1955)
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E 1 (1956) No 3 finished

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R: 11, No 6, 7 (No 8 finished!)

T: 25, (1955) No 8, 9;
26, (1956) No 5, 6 (No 7, 8 finished)

U: 59, (1956), No 1 (No 2 finished)

Z: 30, (1956) No 5, 6

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1211 Utilization of the Gas-Hydraulic Analogy for Purposes of Gas Dynamics

1213 On the Theory of the Deflectron

1219 The Elastic Scattering of Protons by Protons at Energies of 460, 560 and 660 MeV within the Range of Small Angles

1220 On the Emission of Neutrons by the Short-Lived Active Precipitation of the Radon

1228 The Theory on Cyclotron Resonance in Metals

1229 The Isotopic Invariance and the "Strange Particles"

1233 On the Applicability of the Entropy Theorem of Thermodynamics to Large Volumes of a Gravitating Gas

1249 Measuring the Slowing Down of Neutrons in Water in the Energy Interval 1,46 - 0,025 eV

1250 The Slowing Down of Fission Neutrons in Uranium-Water Media

1251 Sun Piles (On the Direct Transformation of Radiation Energy into Electric Energy with the Help of Photoelements)

1252 On the Part Played by Radiation Losses in Cyclic Accelerators

1253 The Problem of the Strong Punctiform Explosion in a Gas with Vanishing Temperature Gradient

1255 The Sublimation of a Crystal Lattice under the Effect of a Strong Shock Wave

1258 The Application of the Method of Curvilinear Coordinates on the Computation of a Π-Shaped Resonator

1259 On the Removal of the Critical Energy in a Synchrophasotron with Strong Focussing

1277 The Wave Motion on the Interface of a Flow in Horizontal Tubes

1280 The Determination of the Average Number ν_{eff} of Neutrons Emitted per Act of Decay in the Isotopes U^{233}, U^{235} and Pu^{239} in the Epithermal Energy Region of Neutrons

1283 The Determination of the Relative Reproduction Coefficient of Pu^{239} in Lattices of Natural Uranium and Ordinary Water

1284 The Determination of the Ratio of Average Fission Cross Sections of Pu^{239} and U^{235} in the Slugs of Uranium-Water-Lattices

1285 On the Mechanism of the Compression of a Current on the Occasion of a Rapid and Powerful Gas Discharge

1286 The Hard Radiation of Impulse Discharges

1287 Spectroscopic Examination of a Strong Impulse Discharge in Hydrogen

1290 On the Singularity of the Electromagnetic Potential in Higher Approximation of the Perturbation Theory

1292 The Investigation of Impulse Discharges of High Amperage

1295 On the Problem of the Renormalizability of the Pseudoscalar Meson Theory with Pseudovectorial Coupling

1296 The Selection Rules on the Occasion of the Annihilation of Antiprotons into Pions

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