ZHILEYKIN, Ya.M.

Refining the evaluation of the spectral function of Laplace's operator. Dokl. AN SSSR 141 no.3:543-546 N '61. (MIRA 14:11)

1. Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova. Predstavleno akademikom I.G. Petrovskim.
(Eigenfunctions) (Operators (Mathematics))

L 5348-66 EWT(1)/EPA(w)-2/EWA(m)-2 IJP(c) AT
ACCESSION NR: AP5021115 UR/0056/65/049/002/0500/0514

AUTHOR: Dmitriyev, I. S.; Zhileykin, Ya. M.; Nikolayev, V. S.

TITLE: Calculation of the effective cross section for the loss of electrons by fast hydrogen-like ions during encounters with hydrogen and helium atoms

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 2, 1965, 500-514

TOPIC TAGS: helium, electron loss, ion interaction, electron interaction

ABSTRACT: Approximate formulas in a form convenient for practical calculations are derived for the cross sections of K-electron loss by any element in encounters with hydrogen or helium atoms. Earlier calculations by the authors (ZhETF v. 44, 660, 1963) in the free-collision approximation did not yield a sufficiently complete and correct picture of the effect of variation of the colliding-particle velocity or of charge on the cross sections. The nonrelativistic Born approximation is used in the present article, and the energy and velocity ranges in which this approximation is valid are determined. The relative contributions of elastic and inelastic interactions are compared. For low-charge ions the approximation yields cross sections identical with those calculated in the free-collision approximation. In other cases the calculated cross sections are somewhat higher than the experimental ones

Card 1/2

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ACCESSION NR: AP5021115

6

or those calculated in the adiabatic approximation. The results can be used also to estimate the cross sections for electron loss from other shells. "The authors thank O. B. Firsov for valuable advice and remarks." Orig. art. has: 4 figures and 15 formulas. 44,55

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of the Moscow State University) 44,55

SUBMITTED: 28Dec64 ENCL: 00 SUB CODE: NP

NR REF SOV: 006 OTHER: 016

Card 2/2

ZHILIN, P.N.

Some data on the microclimate of Druskininkai Health Resort (Lithuanian S.S.R.). Uch. zap. Mosk. nauch.-issl. inst. san. i gig. no.6:71-76 '60. (MIRA 14:11)
(DRUSKININKAI, LITHUANIA—CLIMATOLOGY, MEDICAL)

ZHILEVICHYUS, I. [Zilevicius, I.]

Technology of the near future. Sov.foto. 19 no.8:54-55 Ag '59. (MIRA 13:1)
(Photography--Research) (Xerography)

(

S/084/60/000/03/067/083
D047/D002

AUTHOR: Zhileyev, N., Engineer (Irkutsk)

TITLE: Replacing Brake Chambers

PERIODICAL: Grazhdanskaya aviatsiya, 1960, Nr 3, p 32 (USSR)

ABSTRACT: This describes a quick method of replacing the brake chambers of the Tu-104.

ASSOCIATION: LERM

Card 1/1

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S/020/61/141/003/002/021
C111/C444

AUTHOR: Zhileykin, Ya. M.

TITLE: On the refinement of the estimate of the spectral function of the Laplace operator

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 141, no. 3, 1961, 543 - 546

TEXT: Let g be an n-dimensional domain for which the eigenvalue problem for the Laplace operator with an arbitrary one of the three homogeneous boundary conditions is solvable; P be an arbitrary fixed point in g; Q be an arbitrary point of g; $u_i(x)$ be the i-th eigenfunction of the considered problem; λ_i be the i-th eigenvalue. The function $\theta(P, Q) = \sum_{\sqrt{\lambda_i} < \mu} u_i(P)\, u_i(Q)$ is called spectral function of the Laplace operator. As a special case of g a parallelepiped is considered.

Theorem 1: Let $\theta(P, Q)$ be the spectral function of the Laplace

Card 1/4

4

30715

On the refinement of the estimate... S/020/61/141/003/002/021 C111/C444

operator for the homogeneous boundary condition of 1-st or 2-d kind for a rectangular n-dimensional parallelepiped. Let be $P \neq Q$. Then there holds the asymptotic estimation

$$\theta(P, Q) - \sum_{\sqrt{\lambda_i} < \mu} u_i(P)\, u_i(Q) = O(\mu^{N-\nu}), \qquad (1)$$

where

$$\nu = \frac{2N}{N+1} \text{ for } N < 8; \qquad \nu = 2 \text{ for } N \geqslant 8. \qquad (2)$$

The estimation is uniform with respect to P and Q in the whole N-dimensional rectangular parallelepiped, out of which an arbitrarily small neighborhood of the point Q = P has been removed.
The estimation(1) is used in order to prove the following theorem:

Theorem 2: The function $v(P, Q)$ of N variables be given in an arbitrary N-dimensional rectangular parallelepiped. In the inner point P of this parallelepiped it is assumed to possess the singularity $1/r_{PQ}^{\alpha}$ $(0 < \alpha < \nu)$; after removal of the singularity this function is

Card 2/4

to satisfy the ordinary conditions for the expansibility (the author means the given conditions of the basic theorem in (Ref. 6: V. A. Il'in, UMN, 13, 1, 87(1958)). Then this function can be expanded into a Fourier series in terms of the eigenfunctions of the equation $\Delta u + \lambda u = 0$ in the above mentioned parallelepiped with homogeneous boundary conditions of 1-st or 2-d kind; by summation in the sequence of increasing eigenvalues the mentioned Fourier series converges uniformly in the whole N-dimensional parallelepiped, out of which an arbitrarily small neighborhood of the singular point has been removed.

As a conclusion among others the following representation of the Green function of the Laplace operator for the 1-st and 2-d boundary value problem in the 3-dimensional rectangle is obtained:

$$K_1(P, Q) = \sum_{i=1}^{\infty} \frac{u_i(P)\, u_i(Q)}{\lambda_i}. \qquad (10)$$

The author thanks professor V. A. Il'in for the subject and advices.

There are 5 Soviet-bloc and 2 non-Soviet-bloc references.

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R002064810010-9"

30715

On the refinement of the estimate... S/020/61/141/003/002/021
C111/C444

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University, im. M. V. Lomonosov)

PRESENTED: June 30, 1961, by I. G. Petrovskiy, Academician

SUBMITTED: June 15, 1961

Card 4/4

ZHILEYKO, G. I.

"Present Status of Microwave Generation Technique," by G. I. Zhileyko, Elektosvyaz' No 12, Dec 56, pp 27-37

The author makes a general review of microwave generating devices, such as magnetrons, klystrons, traveling-wave tubes, and backward-wave tubes and discusses their capabilities and limitations. The generation of microwaves with the aid of crystal frequency multipliers and the radiation of electromagnetic waves by fast-moving electrons in transverse electric and magnetic fields are discussed in detail. The author describes the principle of operation of a magnetic undulator for the generation of microwaves.

Sum 1274

ZHILEYKO, G.I.

AUTHOR MIRIMANOV, R.G., ZHILEYKO, G.I. PA - 2573

TITLE Analysis of diaphragmed wave-guides of certain types.
(Analiz nekotorykh tipov diafragmirovannykh volnovodov.Russian.)

PERIODICAL Radiotekhnika i Elektronika, 1957, Vol 2, Nr 2, pp 172 -183(USSR)
Received 4/1957 Reviewed 6/1957

ABSTRACT A survey of the work carried out is given. The results of this work are used for the determination of fundamental technical characteristics of the different wave conductor systems. On the basis of these characteristics the efficiency of the systems is estimated from the point of view of their application in modern technology, e.g. for the acceleration of elementary particles and for the amplification of electromagnetic high-frequency oscillations. The present work, at the same time, deals with a new coaxial waveconductor system as well as with its approximated theoretical investigation which is sufficient for the determination of the fundamental technical characteristics. The qualitative analysis of the diaphragmatized wave conductors makes it possible to draw the following conclusions:
1. In the case of low currents in the electron beam (up to 0,1A) and if it is necessary to obtain important phase velocities of the wave, it is advisable to use a well investigated cylindrical wave conductor with disks.
2. If, in the case of large phase velocities of the wave stronger currents (some ampéres) have to be used in the electron beam two systems, according to the required shape of the beam, may

Card 1/2

Analysis of diaphragmed wave-guides of certain types. PA -2573

be applied : the coaxial wave conductor with disks upon two conductors and a rectangular wave conductor with two cogs. The advantage of these types of wave conductors consists in a low non-uniformity of the field E_z. When selecting the type of the wave conductor also the influence excercised by the edge of the diaphragm of the wave conductor upon the possible increase of losses must be taken into consideration.

3. In the case of low and average currents in the beam and at not too high phase velocities a rectangular wave conductor with a crest which is distinguished by a more simple construction but demands stronger magnetic fields for the purpose of focussing may be used.

(1 table, 2 ill. 7 citationes from Slav Publications).

ASSOCIATION
PRESENTED BY
SUBMITTED 9/1956
AVAILABLE Library of Congress
Card 2/2

AUTHOR: ZHILEYKO, G.I. 89-9-8/32

TITLE: On the Problem of Particle Groupings in a Travelling Wave Linear Accelerator. (K voprosu o gruppirovke chastits v lineynom uskoritele s begushchey volnoy)

PERIODICAL: Atomnaya Energiya, 1957, Vol 3, Nr 9, pp 245-247 (USSR)

ABSTRACT: A linear accelerator with "travelling" waves may be used for the production of especially short electron momenta. In many cases the grouping capacity of the accelerator is not sufficient. Theoretically only that case is derived in which grouping of the electrons takes place in the accelerator itself, i.e. to a sufficiently high extent. (With 3 Illustrations and 1 Slavic Reference).

SUBMITTED: 19 March 1957
AVAILABLE: Library of Congress

Card 1/1

9(3) PHASE I BOOK EXPLOITATION SOV/2596

Zhileyko, Georgiy Ivanovich

Radiotekhnika i elektronika v uskoritelyakh zaryazhennykh chastits (Radio Engineering and Electronics in Particle Accelerators) Moscow, Gosenergoizdat, 1958. 60 p. (Series: Massovaya radio-biblioteka, vyp. 317) 30,000 copies printed.

Ed.: P. O. Chechik, Deceased; Tech. Ed.: N. I. Borunov; Editorial Board: A. I. Berg, V. A. Burlyand, V. I. Vaneyev, Ye. N. Genishchta, I. S. Dzhigit, A. M. Kanayeva, E. T. Krenkel', A. A. Kulikovskiy, A. D. Smirnov, F. I. Tarasov, and V. I. Shamshur.

PURPOSE: This book is intended for the general reader.

COVERAGE: The author presents basic information on methods of accelerating charged particles and briefly discusses the construction, operation and application of various accelerators such as linear accelerators, cyclotrons, phasotrons, synchrotrons and synchrophasotrons. No personalities are mentioned. There are 5 references, all Soviet (including 1 translation).

Card 1/3

TABLE OF CONTENTS:

AVAILABLE: Library of Congress

Card 3/3

JP/jb
10-27-59

ZHILEYKO, G.I.; MELEKHIN, V.N.

Concentration of accelerated electrons in a field of a traveling electromagnetic wave. Nauch.dokl.vys.shkoly; radiotekh. i elektron.no.1:203-206 '58. (MIRA 12:1)

1. Institut radiotekhniki i elektroniki AN SSSR.
(Electrons) (Radio waves)

ZHILEYKO, G.I.

Energetic conditions in wave guides during the acceleration of electrons. Nauch.dokl.vys.shkoly; radiotekh. i elektron.no.1: 193-202 '58. (MIRA 12:1)

1. Institut radiotekhniki i elektroniki AN SSSR. (Wave guides)

ZHILEYKO, G.I.

Solution of the power-balance equation for a wave guide destined for electron acceleration. Nauch.dokl.vys.shkoly; radiotekh. i elektron. no.2: 63-65 '58. (MIRA 12:1)

1. Institut radiotekhniki i elektroniki AN SSSR.
(Wave guides)

AUTHOR: Zhileyko, G. I. SOV/120-58-2-30/37

TITLE: A Single-Wire Corrected Line for the Transmission of High Voltage Pulses (Odnoprovodnaya liniya s korrektsiyey dlya peredachi impul'sov vysokogo napryazheniya)

PERIODICAL: Pribory i Tekhnika Eksperimenta, 1958, Nr 2, p 107 (USSR)

ABSTRACT: In experiments employing pulse circuits it is often necessary to transmit high voltage pulses over some distance without change in waveform. The use of coaxial cables with matched output for pulses up to a few tens of kv is not possible. The most convenient method is to use a single wire suspended at a height of about 2.5-3 m above the ground. The line must be corrected to eliminate distortion of the waveform. The arrangement shown in Fig.1 gave very good results. In this figure L and R_1, R_2 are the correcting inductance and resistance respectively. The total capacitance of the line is 120 μμf. Using this arrangement it is possible to transmit pulses of up to a few kv over a distance

Card 1/2

SOV/120-58-2-30/37

A Single-Wire Corrected Line for the Transmission of High Voltage Pulses.

of 10 m. The waveform of the pulses is shown in Fig.2 and the values of the quantities indicated are given in the table. The repetition frequency was 200-300 c/s. There are 2 figures and 1 table.

ASSOCIATION: Institut radiotekhniki i elektroniki AN SSSR (Institute of Radio Engineering and Electronics of the Academy of Sciences of the USSR)

SUBMITTED: August 10, 1957.

Card 2/2

1. Waveguides--Materials 2. Pulses--Transmission 3. Electric wire--Applications

AUTHOR: Zhileyko, G.I. 89-4-4-21/28

TITLE: Rebatron - a Resonance Electron Accelerator With Improved Longitudinal Grouping (Rebatron - rezonatornyy uskoritel' dlya elektronov s uluchshennoy prodol'noy gruppirovkoy)

PERIODICAL: Atomnaya Energiya, 1958, Vol. 4, Nr 4, pp. 393-394 (USSR)

ABSTRACT: This is an abstract from the periodical J. Appl. Phys. 28, 9, 927 (1957). (Abstractor: G.I. Zhileyko). There is 1 figure and 1 reference.

1. Electron accelerators--Design

TITLE: Rebatron

Card 1/1

AUTHOR: Zhileyko, G.I. 89-4-4-22/28

TITLE: The Application of Linear Electron Accelerators for the Excitation of Millimeter-Radiowaves (Primeneniye lineynykh elektronnykh uskoriteley dlya generatsii millimetrovykh radiovoln)

PERIODICAL: Atomnaya Energiya, 1958, Vol. 4, Nr 4, pp. 394-394 (USSR)

ABSTRACT: This is an abstract in form of a short summary from the periodicals J. Appl. Phys. 22, 527 (1951), 24, 826 (1953) and IRE AP-4, Nr 3, 374 (1956). (Abstractor: G.I. Zhileyko). There are 5 references, 2 of which are Soviet.

1. Electron accelerators--Performance 2. Radio waves--Propagation

Card 1/1

AUTHOR: Zhileyko, G. I. SOV/108-13-8-4/12

TITLE: Some Characteristic Features of Septate Coaxial Wave Guides (Nekotoryye osobennosti koaksial'nykh diafragmirovannykh volnovodov)

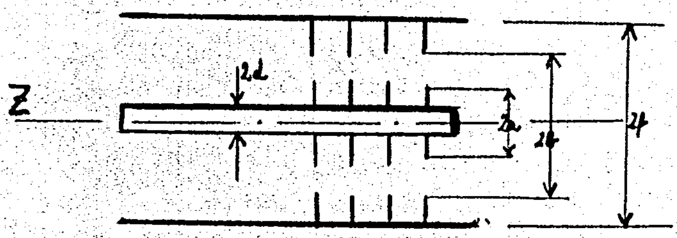
PERIODICAL: Radiotekhnika, 1958, Vol. 13, Nr 8, pp. 24-29(USSR)

ABSTRACT: The characteristic features of septate coaxial wave guides are investigated from the viewpoint of the quantity of flows of high-frequency power in the case of waves of the E-type. The power flux in any wave guide is determined by the formula(1): $P = \tau E_0^2 G$, where P denotes the power flux, τ the constant, E_0 the longitudinal component of the electric field, G a function dependent on the geometry of the wave guide and the phase velocity of the propagating wave. From (1) may be seen that in the case of constant E_0 the power flux P is proportional to the function G. Therefore the author only investigates the behaviour of the function G in the case of changing wave guide dimensions and phase velocities of the propagating wave. The equations (2) for the field component of the basic type of the E-wave in any wave guide of cylindrical symmetry are written down. (Formula (2) is derived in enclosure 2). It is assumed

Card 1/4

that the wave guides are infinite, along the longitudinal axis Z that the diaphragms are infinitely thin and the distance between the diaphragms is considerably smaller than the wave length in the wave guide, and that there exists no change of the fields with respect to the azimuth. -In the solution of formulae (2) six cases can be distinguished: the coaxial line with diaphragms at both conductors. For these lines the following can be assumed in the equations (2): 1.) A = 0, 2.) B = 0, 3.) $E_r = 0$ at $r = \varrho (a < \varrho < b)$.- The coaxial line with diaphragms at one of the conductors, i.e. 4.) b = f or 5.) a = d and an ordinary wave guide with diaphragms (6) a = d = 0. The formulae for the exact value of the function G are derived for all these cases. The change of the function G in dependence on γ is given in a diagram for these cases. -A and B are constants which are determined by the boundary conditions and the excitation conditions. A and B occur in the equations (2), where 2 f denotes the diameter of the wave guide, 2d the diameter of the internal conductor, 2a the diameter of the internal diaphragms, 2b the inner diameter of the external diaphragms.
From the diagrams the following may be seen: 1.-Within the range of small γ(i.e.phase velocity $v_{Ph} \longrightarrow$ of the light velocity c)

the most useful retardation system is an ordinary cylindrical wave guide with diaphragms and a coaxial line with diaphragms at both conductors with the condition $E_r = 0$ at $r = \varrho$.
2.-Within the range of great γ(γ=3÷5 and more, i.e. $v_{Ph} \approx 0,1$ c) only a coaxial line with diaphragms at either conductor and the condition $E_r = 0$ at $r = \varrho$ has small G values.
3.-Coaxial lines with diaphragms at either conductor and B=0 and A=0 have greater G values than lines with $E_r = 0$ at $r = \varrho$.
4.- A coaxial line with diaphragms at the inner conductor only has a maximum value of the G function. Therefore this system is the most effective.



(Fig 1)

There are 2 figures and 3 references, 1 of which is Soviet.

SUBMITTED March 5, 1957 (initially), and November 4, 1957 (after revision)

1. Waveguides--Analysis 2. Electric fields 3. Waves--Propagation 4. Mathematics

ZHILEYKO, G. I., Cand Tech Sci -- (diss) "Waveguide electronic accelerators with increased beam currents and approximation theory for research into operating conditions." Moscow, 1960. 8 pp; (Ministry of Higher and Secondary Specialist Education RSFSR, Moscow Physics Engineering Inst); 140 copies; price not given; bibliography at end of text (20 entries); (KL, 25-60, 131)

ZHILEYKO, Georgiy Ivanovich, dots.; LEBEDEV, I.V., prof., retsenzent; MARKOV, G.T., prof., retsenzent; FEDOROV, N.N., dots., retsenzent; VZYATYSHEV, V.F., assisten, red.;

[Interaction between electrons and an electromagnetic field] Vzaimodeistvie elektronov s elektromagnitnym polem. Moskva, Energ. in-t, 1963. 55 p. (MIRA 18:1)

1. Kafedra teoreticheskikh osnov radiotekhniki Moskovskogo energeticheskogo instituta (for Zhileyko).

ACCESSION NR: AP4043671 S/0109/64/009/008/1374/1385

AUTHOR: Zhileyko, G. I.

TITLE: Parameters of an electron beam that radiates electromagnetic waves

SOURCE: Radiotekhnika i elektronika, v. 9, no. 8, 1964, 1374-1385

TOPIC TAGS: electron accelerator, electron acceleration, electron beam, electron beam formation

ABSTRACT: These characteristics of a cluster-forming accelerator and the parameters of its electron beam are theoretically considered: (1) Maximum beam current; (2) Power of beam harmonics; (3) Permissible energy straggling of electrons; (4) Maximum spacing with which the length of the electron cluster remains within a specified limit (effective range of radiation at a specified wavelength); (5) Modulating-voltage amplitude; (6) Permissible spread of spacing between the clusters (stability of the cluster repetition rate); (7) Requirements

ACCESSION NR: AP4043671

of accelerating and modulating devices. Formulas are also developed for the parameters of a beam having maximum harmonic content. It is shown that, in a short-wave band, a considerable radiation power can be obtained only if the radiator resistance is 1,000 ohms or higher and if the radiator length exceeds the wavelength by 1,000 times or more. To provide high-power shortwave radiation, the electron beam must have a very narrow energy spectrum. H. Motz' estimate (J. Appl. Phys., 1951, 22, 5, 527) cannot be materialized in practice. In the cases when no special radiator is used (bremsstrahlung, radiation by inhomogeneities, etc.), the beam-harmonic power will be 10^{2}—10^{4} times lower than the maximum power, mainly because the radiator length is smaller. Orig. art. has: 4 figures and 38 formulas.

ASSOCIATION: none

SUBMITTED: 27May63 ENCL: 00

SUB CODE: EC NO REF SOV: 014 OTHER: 004

Card 2/2

ACCESSION NR: AP4043671

of accelerating and modulating devices. Formulas are also developed for the parameters of a beam having maximum harmonic content. It is shown that, in a short-wave band, a considerable radiation power can be obtained only if the radiator resistance is 1,000 ohms or higher and if the radiator length exceeds the wavelength by 1,000 times or more. To provide high-power shortwave radiation, the electron beam must have a very narrow energy spectrum. H. Motz' estimate (J. Appl. Phys., 1951, 22, 5, 527) cannot be materialized in practice. In the cases when no special radiator is used (bremsstrahlung, radiation by inhomogeneities, etc.), the beam-harmonic power will be 10^2—10^4 times lower than the maximum power, mainly because the radiator length is smaller. Orig. art. has: 4 figures and 38 formulas.

ASSOCIATION: none

SUBMITTED: 27May63 ENCL: 00

SUB CODE: EC NO REF SOV: 014 OTHER: 004

Card 2/2

ZHILEYKO, G.I.; BASKAKOV, S.I.

Investigating a plasma with a relativistic electrom beam. Zhur. tekh. fiz. 35 no.6:1035-1038 Je '65. (MIRA 18:7)

ZHILEYKO, G.I.; SNEDKOV, V.A.

Wave-guide type accelerator-buncher intended for the production of a monoenergetic electron beam. Atom. energ. 18 no.6:627 Je '65.

ZHILEYKO, G.I.

Linear accelerator as an electron source in an electron microscope. Zhur.tekh.fiz. 34 no.12:2185-2187 D '64.

(MIRA 18:2)

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R002064810010-9"

... waveguide or resonator-type linear accelerator. Orig. art. has: 17 formulas

ZHILEYKO, G.I.

Parameters of an electron beam radiating electromagnetic waves. Radiotekh. i elektron. 9 no.8:1374-1385 Ag '64.

(MIRA 17:10)

ZHILEYKO, G.I.

Parameters of a buncher for a linear traveling wave electronic accelerator following a prescribed bunching law. Zhur. tekh. fiz. 33 no.12:1449-1455 D '63. (MIRA 16:12)

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R002064810010-9"

ACCESSION NR: AP4015562 S/0089/64/016/002/0138/0139

AUTHOR: Zhileyko, G. I.

TITLE: Power balance equation in a linear electron accelerator

SOURCE: Atomnaya energiya, v. 16, no. 2, 1964, 138-139

TOPIC TAGS: linear electron accelerator, power balance, waveguide, super high frequency, electron pocket radiation, electron accelerator

ABSTRACT: The input power of super high frequency oscillations in a waveguide is consumed by the accelerated particles, by losses on metallic walls, by the waveguide diaphragms, and by radiation of the electron pockets. The differential equation for the power balance has been obtained by the author in a previous paper ("Nauchny*ye doklady* Vy*sshey Shkoly*, Radiotekhnika i elektronika, no. 2, (1958) 63). For high energies ($\frac{u}{c} \approx 1$) the results of the work by E. L. Burshteyn and G. V. Voskresenskiy (Atomnaya energiya, v. 13, 446 (1962)) are used. It is deduced that, for this case, the influence

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R002064810010-9"

ACCESSION NR: AP4015562

of radiation on the accelerating process is negligible. Orig. art. has: no figures, 10 equations.

ASSOCIATION: none

SUBMITTED: 02Apr63 DATE ACQ: 12Mar64 ENCL: 00

SUB CODE: GE NO REF SOV: 003 OTHER: 000

Card 2/2

ZHILEYKO, G.I.

Equation of the balance of power for a linear electron accelerator. Atom. energ. 16 no.2:138-141 F '64.

(MIRA 17:3)

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R002064810010-9"

... processes occuring at electron ... is shown that the ma n effect ...

SUBMITTED: February 2?, 1962

ZHILEYKO, G.I.

Linear electron accelerator. Atom. energ. 12 no.2:147-149 F '62. (MIRA 15:1)
(Particle accelerators) (Electrons)

ZHILEYKO, G.I.

Effect of spatial charge on electron bunching in a traveling-wave linear accelerator. Zhur. tekh. fiz. 31 no.4:506-507 Ap '61. (MIRA 14:8)

1. Moskovskiy energeticheskiy institut.
(Particle accelerators) (Electrons) (Electric fields)

ZHILEYKO, G.I.; YAKOVLEV, D.A.

Experimental study of a linear accelerator with an electron prebuncher. Atom.energ. 11 no.5:447-449 N '61. (MIRA 14:10)
(Particle accelerators)

ZHILEYKO, G.I.

Load characteristics of a traveling-wave linear electronic accelerator. Zhur. tekh. fiz. 31 no.4:502-505 Ap '61.
(MIRA 14:8)

1. Moskovskiy energeticheskiy institut.
(Particle accelerators)

ZHILEYKO, G.I.

Effect of spatial charge on the bunching within a freely moving cluster of electrons. Zhur. tekh. fiz. 31 no.4:508-510 Ap '61. (MIRA 14:8)

1. Moskovskiy energeticheskiy institut.
(Electrons) (Electric fields)

33235

S/089/62/012/002/007/013
B102/B138

24.6731

AUTHOR: Zhileyko, G. I.

TITLE: A linear electron accelerator

PERIODICAL: Atomnaya energiya, v. 12, no. 2, 1962, 147 - 149

TEXT: A linear travelling-wave electron accelerator is described which has the following parameters: electron energy 0.5 - 5.4 Mev; beam current up to 150 - 250 ma; mean current 50 μa; spectral width of accelerated particles 5 - 15%; beam parameter at a distance of 800 mm, 3 - 6 mm; pulse duration 0.1 - 2 μsec. The final energy of the electrons is varied by varying the frequency of the accelerating field. The duration of the h-f pulses and the injection voltage can be varied and the pulses can be shifted relative to each other. The 2 m waveguide of the accelerator has constant tube diameter; the phase velocity is varied by adjusting the aperture in the range 0.11 - 0.16 λ (λ - wavelength of the accelerating field in free space). The h-f power can be supplied at different frequencies. It is supplied to the input waveguide via a transformer with a special stepped cone and four apertures in the first four irises for band broadening. As

Card 1/3

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S/089/62/012/002/007/013
A linear electron ... B102/B138

a result working the frequency band is 3 - 4.5 Mc, despite the small a/λ ratio (a is the aperture width). The electron gun of the accelerator has an oxide cathode. The main characteristics of the accelerator are given in Fig. 1 for different conditions of operation and are partly compared with calculations. The spectral width ΔU was also measured in dependence on electron energy U, h-f power P, beam current I, and injection voltage U_{inj}. The experimental curves were in satisfactory agreement with the calculated ones, using the equations $\Delta U(U) = (U/U_0+1)^{3/4}(1-U^2/U^2_{max})^{1/8}$; $\Delta U(P) = (P/P_{min}-1)^{1/8}$ and $\Delta U(I) = (1 - IU/P)^{1/8}$, deviation was only observed where the equilibrium phase φ_s was close to 90^o. From the I(P) and $I(U_{inj})$ curves it can be seen that I changes near $P \simeq P_{min}$ and drops suddenly where $P < P_{min}$. When U_{inj} is decreased by 15%, I decreases by 20%. The input-to-output ratio of particle number is between 50 - 80% for 0.5 - 3.5 Mev and 30 - 50% at higher energies. At 0.5 Mev the angular length of the electron cluster was 80 - 90^o, at 3-5.5 Mev it was 15 - 28.5^o. The efficiency of

Card 2/ 3

33235

A linear electron ... S/089/62/012/002/007/013
B102/B138

the accelerator waveguide rose to 30 - 50% at 3 - 4 Mev, at 5 - 5.4 Mev it was 15 - 20%. There are 3 figures and 7 Soviet references.

SUBMITTED: July 14, 1961

Fig. 1. Main energy characteristics. a) U in Mev as a function of f in Mc; —— experiment, --- theory; б) U in Mev versus P in relative units; for several frequencies; the A_i denote the points where $P = P_{min}$ and $\varphi_s = 90^\circ$. b) U in Mev versus I in ma for P = 2 - 3 (1), P = 4 (2), P = 5 (3) and P = 6.5 rel. units (4).

Card 3/3

29544
S/089/61/011/005/009/017
B102/B104

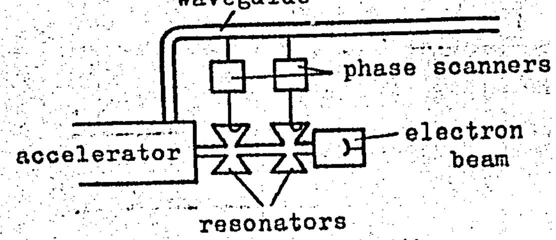
24,6731

AUTHORS: Zhileyko, G. I., Yakovlev, D. A.

TITLE: Experimental investigation of a linear accelerator with an electron prebuncher

PERIODICAL: Atomnaya energiya, v. 11, no. 5, 1961, 447 - 449

TEXT: The authors investigated the dependence of the width of the spectrum and of the beam current on the main parameters of the experimental arrangement:



The double-resonator prebuncher was fed with h-f current via cables including phase shifters. The experiments were made with two, as well as with one, resonator. For both, the width ΔU of the spectrum of the accelerated electrons as well as the current I of the electron beam were measured as functions of the h-f phases in the

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B102/B104

Experimental investigation of a...

resonator(s), of the injection voltage and of the h-f power supplied to the resonator(s). Results: The prebuncher exerts a considerable effect on the operation of the accelerator. The experimental results agree with the theory. With $\varphi = 20 - 40^{\circ}$, the electron bunches emerging from the prebuncher coincide in the accelerator at the equilibrium phase: this yields minimum width of spectrum and maximum current. At a phase of the phase scanner of $\varphi = -(80 - 120^{\circ})$, the beam enters the accelerator in the phase range of electromagnetic traveling waves rendering bad bunching conditions. A prebuncher, even with one resonator, raises I to 3I, and reduces ΔU to $\Delta U/3 - \Delta U/4$. Use of two resonators raises the current by several times, but operation conditions become more sensitive and their proper choice is complicated. There are 6 figures.

SUBMITTED: May 27, 1961

Card 2/2

26371
S/089/61/011/002/008/015
B102/B201

24,6731

AUTHOR: Zhileyko, G. I.

TITLE: Current load of the buncher in a linear accelerator

PERIODICAL: Atomnaya energiya, v. 11, no. 2, 1961, 181-182

TEXT: It is shown in the present "Letter to the Editor" how the effect a high current upon the diminution of the traveling-wave amplitude is to be taken into account when calculating the waveguide buncher in a linear accelerator, especially when determining the geometry of the waveguide diaphragm as a function of its length. In terms of the problem: $F(\gamma,a) = f(\omega,a)$ (1) (where a is the radius of the opening of the waveguide diaphragm, v_{ph} is the phase velocity of TM waves, ω is their frequency, $\gamma = \sqrt{(\omega/v_{ph})^2 - (\omega/c)^2}$ is the eigenvalue of the problem of propagation of TM waves in the waveguide) this statement means that γ and a become functions of the load of the waveguide due to the particle-beam current. The attempt is made to express γ as an approximate function of z (z being the longitudinal coordinate) for a waveguide with variable phase velocity,

Card 1/3

taking account of the load due to the current and of power losses on the walls. If γ is known as a function of z, it will be easy to calculate the other parameters of the waveguide. The equation of the h-f power flux balance in any cross section of the accelerator waveguide reads $dP/dz = -IE_z \sin\varphi - 2\alpha P$, where P denotes the h-f power flux, I is the particle-beam current, φ is the equilibrium phase of the particles, and α is the attenuation in the waveguide due to the losses on the walls. The solution of this equation is to be sought in the form

$$P = (P_o - I\int e^{2\alpha z}\, dU)e^{-2\alpha z},$$

where $dU = E_z \sin\varphi\, dz$; $P = P_o$ if $z = 0$; U is the kinetic energy of the particles. In order to solve the integral, U(z) must be known.

$$P = [P_o - IU(1 + \varrho)]e^{-2\alpha z}$$

is now obtained, where $\varrho = \frac{1}{U}\int(2\alpha z + 2\alpha^2 z^2)dU$. If αz is sufficiently small, this will be an approximate solution of (1). An approximate expression is then also sought for ϱ, and is eventually found in the form $\varrho = \alpha z_1 + \alpha^2 z_1^2$, where z_1 is the length of the accelerator waveguide. The current load is negligible if the drop of the h-f power flux along the waveguide does not exceed 15-20%. This entails a drop of the

26371

Current load of the buncher in ...

S/089/61/011/002/008/015
B102/B201

accelerating voltage by 7-10%, which, as a rule, has no effect upon the work of the accelerator. There are 4 references: 2 Soviet-bloc and 2 non-Soviet-bloc. The two references to English-language publications read as follows: G. Saxon. Proc. Phys. Soc., 67, no. 417B, 705 (1954); R. Neal. J. Appl. Phys., 29, No. 7, 1019 (1958).

SUBMITTED: December 7, 1960

Card 3/3

MARTYNOV, Yevgeniy Mikhaylovich; ZHILEYKO, G.I., red.; BORUNOV, N.I., tekhn.red.

[Electronic devices of discrete action] Elektronnye ustroistva diskretnogo deistviia. Moskva, Gos.energ.izd-vo, 1960. 127 p. (Massovaia radiobiblioteka, no.381) (MIRA 14:7)
(Automatic control--Equipment and supplies)
(Electronic apparatus and appliances)

21550

9.4230
26.2340

S/057/61/031/004/016/018
B125/B202

AUTHOR: Zhileyko, G. I.

TITLE: Load characteristics of an electron linear accelerator with traveling wave

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 4, 1961, 502-505

TEXT: The author attempted to determine the approximated load characteristics of the accelerator mentioned in the title. (The exact consideration of the shift of the equilibrium phase was made by numerical integration of the equation of motion of the electrons which is very difficult). The exact solution, however, is not necessary in most cases; the approximations are made as follows: According to G. I. Zhileyko (Rad. i elektr., 2, 63, 1958) the field strength E_z of the accelerating field is the following in any point of the accelerating waveguide:

$$E_z = e^{-\alpha z}\sqrt{\frac{P - IU(1 + \alpha z + \alpha^2 z^2)}{r}}$$ (1) where α denotes the damping

Card 1/8

coefficient of the wave, z - the longitudinal coordinate of the accelerating waveguide, P - the high-frequency power flux with z = 0; I - the amperage of the beam, U - the energy of the electrons at a given value of z. The function $\Gamma = \frac{1}{2E_z^2}\int_s E_r H_\theta ds$ depends on the geometrical conditions of the waveguide and on the phase velocity of the wave; s is the area of the cross section of the interaction volume. By taking account of $E_{accel} = dU/dz = E_z \sin\varphi_s$ Eq. (1) can be written in the differential form:

$$\sin\varphi_s e^{-\alpha z} dz = \sqrt{\frac{\Gamma}{P - IU(1 + \alpha z + \alpha^2 z^2)}}\, dU.$$

With φ_s = const, Γ = const, it can also be written in the form

$$U = \frac{\sin\varphi_s(1 - e^{-\alpha L})}{2\alpha\sqrt{\Gamma}}\left[2\sqrt{P} - I'\frac{\sin\varphi_s(1 - e^{-\alpha L})}{2\alpha\sqrt{\Gamma}}\right]$$

if $1 + \alpha z + \alpha^2 z^2 = 1 + \alpha L + \alpha^2 L^2$ where L is the length of the accelerator. Since

$1 - e^{-\alpha L} \sim \alpha L$ it follows that $U = E_{zo} L \sin \varphi_s \left[1 - I' \frac{E_{zo} L \sin \varphi_s}{4P}\right]$ (2), where $I' = I(1+\alpha L+\alpha^2 L^2)$. E_{zo} is the field strength with $z = 0$ and $E_{zo} = \sqrt{P/\Gamma}$. Eq. (2) does not take account of the change of the equilibrium phase which can be expressed by $\varphi_s + \Delta\varphi$, where $\Delta\varphi$ is the change of the equilibrium phase as a result of the disturbance of synchronism. For $\varphi_s = \pi/2$,

$$U = U_0\left(1 - \frac{I'U_0}{4P}\right) - \frac{\Delta\varphi^2}{2} U_0\left(1 - \frac{I'U_0}{2P}\right), \qquad (3) \quad (3)$$

holds, and for $\varphi_s < \pi/2$ and $\Delta\varphi < \pi/4$,

$$U = U_0\left(1 - \frac{I'U_0}{4P}\right) + \Delta\varphi U_0 \operatorname{ctg} \varphi_s\left(1 - \frac{I'U_0}{2P}\right), \qquad (4) \quad (4)$$

holds, where $U_s = E_{zo}L$ is the equilibrium value of the energy. Fig. 1 illustrates the dependences of U on I expressed by (3) and (4). These curves are in good agreement with the experiment. The energy U of the particles is not only reduced by the reduction of the amplitude of the field but also by the disturbance of the synchronism: with reduced energy (i.e., with reduced velocity) the electron cluster is no longer on the wave crest. With $\varphi_s < \pi/2$ the electron energy decreases more slowly due to the disturbance of the synchronism. Equations (3) and (4) are solved by an ansatz: with given U and, hence, also with given $\Delta\varphi$ the corresponding value of the amperage I can be determined. In (3) and (4) with $I = 0$ also $\Delta\varphi = 0$ must hold. The change of the equilibrium phase is in general $\Delta\varphi = k\int_0^z\left(\frac{1}{\beta} - \frac{1}{\beta_w}\right)dz$, where $k = 2\pi/\lambda$. λ denotes the wavelength of the accelerating field; β and β_w are the relative velocities of the electron and the phase of the wave. With

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$\beta \sim \beta_w$ and with β being sufficiently close to 1, $\Delta\varphi \sim \frac{1}{2}k\Delta z\left(\frac{\beta_w - \beta}{\beta\beta_w}\right)$ holds. The coefficient 1/2 occurs when at the beginning of the acceleration the synchronism is not disturbed. Then

$$\Delta\varphi = 4\Delta z\left[\frac{1}{(U + U_o)^2} - \frac{1}{(U_s + U_o)^2}\right] \quad (5)$$

holds where $\Delta\varphi$ is measured in radians and the energy in Mev. With (3), (4), and (5) the load characteristics of the accelerator can be determined from its data. The figures show the load characteristics of some accelerators which are described in publications. According to these characteristics the calculations are in good agreement with experiment. There are 5 figures and 7 references: 1 Soviet-bloc and 6 non-Soviet-bloc. The two most recent references to English-language publications read as follows: G. Saxon, Proc. Phys. Soc., 67, 417B, 705; C. W. Miller, PIEE, 101, p. I, 130, 207, 1954.

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S/057/61/031/004/016/018
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Load characteristics of ...

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute)

SUBMITTED: May 19, 1960

Legend to Fig. 1: qualitative course of the curves determined from Eqs. (3) (curve 1), and (4) (curve 2). The straight lines denote the first terms of these equations.

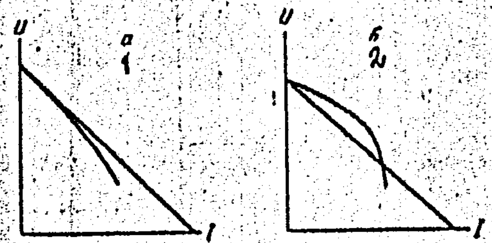

Fig 1

Card 6/8

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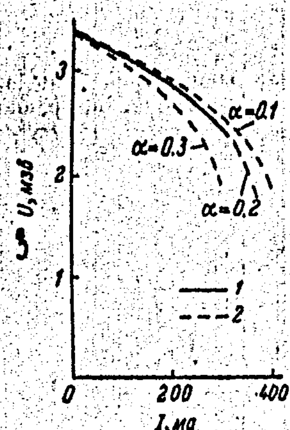
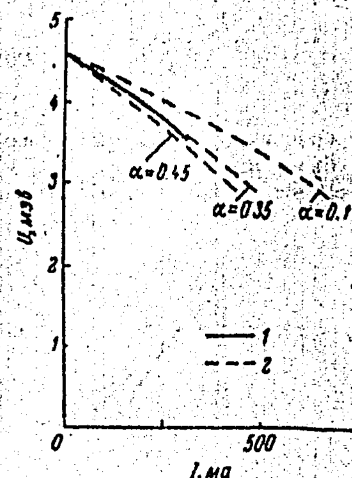
Load characteristics of ...

Legend to Fig. 2: experimental (1) and theoretical (2) load characteristics of the accelerator by D. W. Fray. 3 - U in Mev, U = 3.4 Mev, P = 1.34 milliwatts, φ_s = 55°, L = 2m.
Legend to Fig. 3: as in Fig. 2; U = 4.6 Mev, P = 2.14 milliwatts, φ_s = 45°, L = 1m.





Card 7/8

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Load characteristics of ...

Legend to Fig. 5: the same for the accelerator by C. F. Bareford and M. G. Kelliher; designations as in Fig. 2. U = 14.8 Mev, P = 1.5 milliwatts, ψ_B = 55°, L = 6 m.

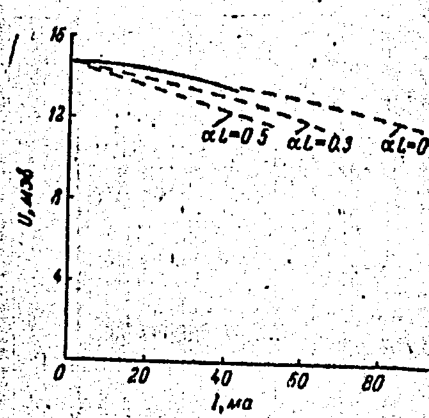

Fig 5

Card 8/8

21551

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26.2340

AUTHOR: Zhileyko, G. I.

TITLE: Effect of space charge on the grouping of electrons in a linear traveling-wave accelerator

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 4, 1961, 506-507

TEXT: The force of space charge acting upon the grouping electrons in a linear accelerator with traveling wave can be determined by comparing the electric field produced by the space charge of the electron cluster and the electric field of the accelerating wave. An electron cluster of the angular length 2ϕ is assumed to move along the z-axis synchronously with the wave. The field strength $\mathcal{E}$ of the field of space charge along the z-axis is assumed to be $\mathcal{E} = \frac{Q}{4\pi\varepsilon_0} F(r,l)$ (1), where r and l are the radius and the length of the cluster, F(r,l) the factor characterizing the form of the cluster, Q - the charge of the cluster, ε_0 - the dielectric constant. The total field strength at the ends of the cluster then is

Card 1/4

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21551

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B125/B202

Effect of space charge on the ...

$E_z \sin(\varphi_s + \psi) - \mathcal{E}$ and $E_z \sin(\varphi_s - \psi) + \mathcal{E}$ where φ_s denotes the equilibrium phase. If $\mathcal{E}$ is so large that with $\psi \ll 1$, $E_z \sin(\varphi_s + \psi) - \mathcal{E} = E_z \sin\varphi_s$, $E_z \sin(\varphi_s - \psi) + \mathcal{E} = E_z \sin\varphi_s$ (2), then the grouping effect of the accelerating field is compensated and the limit of $\mathcal{E}$ is $\mathcal{E}_{lim} = E_z \psi \cos\varphi_s$ (3). If the cluster is grouped without losses of the beam current I, equation $\frac{30\lambda^2\beta}{\pi}\sqrt{1-\beta^2} \cdot \frac{I}{l} F(r,l) = E_z \cos\varphi_s$ (4) is obtained from (3) if $\psi = l\frac{\pi}{\beta\lambda}$. Eq. (4) permits the determination of the admissible beam current I for a given length and form of the cluster as well as with given amplitude of the field and the equilibrium phase. If the cluster (radius r) is spherical, $F(r,l) = 1/r^2$, and (4) takes on the form $\frac{30\lambda^2\beta\sqrt{1-\beta^2}}{\pi}\frac{I}{l}\frac{4}{l^2} = E_z \cos\varphi_s$ (5). In this case $l = 2r$ and the factor $\sqrt{1-\beta^2}$ is obtained as the result of relativistic corrections. This Eq. (5) is reduced to

Card 2/4

21551

S/057/61/031/004/017/018
B125/B202

Effect of space charge on the ...

$\frac{I\,(a)}{l^3(m)} \simeq 6\,E_z(v/m)\cos\varphi_s$ (6) with λ = 10 cm and β = 0.5. Very important conclusions can be drawn from (6): With E_z = 30 kv/cm, φ_s = 45° and l = 1 mm the maximum admissible amperage is 12.7 ma and with l = 0.5 mm, it is 1.5 ma. With an increase in the field amplitude until the practical limit of 150 kv/cm and a decrease of the equilibrium phase to 10° the amperage of the beam increases only to 10 ma with a diameter of 0.5 mm of the spherical cluster. Actually, Eqs. (3) to (6) must be written in the form of the inequalities $\mathcal{E} < E_z\psi\cos\varphi_s$. The amperages of the beam determined above are then reduced. These examples indicate a strong effect of space charge on the acceleration of the electron cluster. The practical applicability of this method is obvious, since the production of a field strength of 150 kv/cm requires the feeding of an 8 to 10 mw high-frequency power into the accelerating waveguide. A similar but simpler method for taking account of the forces of space charge has been described by H. Leboutet (Ann. Radioél., 13, 52, 107, 1958). There is 1 non-Soviet-bloc reference.

Card 3/4

21551

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B125/B202

Effect of space charge on the ...

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute)

SUBMITTED: May 19, 1960

Card 4/4

21552

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B125/B202

9.4230
26.2340

AUTHOR: Zhileyko, G. I.

TITLE: Effect of space charge on the grouping of a freely moving electron cluster

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 4, 1961, 508-510

TEXT: The author studies the process of grouping of electrons in a cluster under the effect of a grouping electric field. A cylindrical electron cluster with a length l and an invariable radius r is assumed to move freely with the velocity v_o. The grouping sinusoidal voltage U ($v_{group} \sim \sqrt{U} < v_o$) acting during a short period accelerates the front electrons and the back electrons, but not the central electrons. For reasons of simplicity, the electron distribution is assumed to be even, and the form of the electron cluster to be invariable. The field strength $\mathcal{E}$ of the space charge at the front face of the cylindrical cluster with r = 0 (i.e., on the axis of the cylinder) is

Card 1/5

21552

Effect of space charge on the

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B125/B202

$$\mathcal{E} = \frac{Q}{2\pi\varepsilon_0 r^2}\left[1 + \frac{r}{l} - \sqrt{1 + \frac{r^2}{l^2}}\right] \quad (1),$$

where Q is the total charge of the cluster. This field is assumed to act upon all electrons on the front face of the cylinder and to prevent the compression (grouping) of the cluster. The degree of grouping of the cluster is then determined by comparing the voltage U and the integral $\int_{l/2}^{l_{min}/2} \mathcal{E}\, dl$, where l_{min} is the minimum length of the cluster resulting from the grouping. The velocity excess of the back electrons and/or the lacking velocity of the front electrons (which are both due to the action of the voltage U) are compensated by the field of the space charge at the ends of the cluster. In addition, the usual Coulomb repulsion of the electrons occurs and the length of the cluster gradually increases. The integral is calculated elementary and

Card 2/5

$$\int_{l/2}^{l_{min}/2} \mathcal{E} dl = \frac{Q}{2\pi\varepsilon_0 r^2}\left\{\frac{1}{2}l - \frac{1}{2}l_{min} - \sqrt{\frac{1}{4}l^2 - r^2} + \sqrt{\frac{1}{4}l_{min}^2 + r^2} + r\ln\frac{r + \sqrt{\frac{1}{4}l^2 + r^2}}{r + \sqrt{\frac{1}{4}l_{min}^2 + r^2}}\right\} \quad (3)$$

is obtained. With $l_{min} = 0$, the cylindrical cluster is transformed into a disc-shaped cluster and (3) is reduced to $\int_{l/2}^{0} \mathcal{E}\, dl = \frac{Q}{2\pi\varepsilon_0 r}\left(1 + \ln\frac{l}{4r}\right)$.

If the wavelength of the variable grouping voltage U is λ and if the electron cluster is formed from a continuous electron beam with the amperage I, the last equation may definitely take on the form

$U = 30\frac{I\lambda}{r}\left(1 + \ln\frac{l}{4r}\right)$ (4). In this case the initial length l of the cluster is $l = v_0\frac{T}{2} = \frac{v_0}{c}\frac{\lambda}{2}$; T is the period of oscillations of the grouping voltage. (U - in volts, I in amperes, λ and r in meters). Eqs. (1) to (4) permit the estimation of the effect of space charge on the grouping of a freely moving cylindrical electron cluster, if the dimensions, amperage, and grouping voltage are given. The inequality $U > \int_{l/2}^{0} \mathcal{E}\, dl$ speaks in favor of a regrouping of the electrons in the cluster. The energy increase of the back electrons caused by the voltage U was so high that the space charge could not compensate the velocities of the electrons in the cluster. After some calculations the following value is obtained for the total distance in which the length of the cluster does not exceed a given length l_1: $d = 2s = 4r\sqrt{\frac{U_{accel}\cdot l_1}{30/\lambda}}$ (5), where

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Effect of space charge on the ... S/057/61/031/004/018/018
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U_{accel} is the voltage with which the electron current was accelerated. Using Eq. (5) that distance at which the length of the cluster does not exceed the given length l_1 can be determined with given dimensions of the cluster, with given amperage and accelerating voltage of the beam on the trajectory of the electron cluster. Hence, with r = 10 mm, l_1 = 0.5 mm, U_{accel} = 80 kv, I = 1 a, λ = 10 cm, d = 14.6 cm. By conserving certain ratios between amperage and velocity of the beam, between the dimensions of the cluster and the modulating voltage, extremely short electron clusters can be produced, the length of which remains unchanged on a sufficiently long path.

ASSOCIATION: Moskovskiy energeticheskiy institut
(Moscow Power Engineering Institute)

SUBMITTED: May 19, 1960

Card 5/5

ZHILEYKO, G.I.; SNEDKOV, B.A.

Equations describing the motion of electrons in a traveling wave field allowing for nonlinearity of the second order.
Zhur. tekh. fiz. 35 no.3:486-488 Mr '65. (MIRA 18:6)

1. Moskovskiy energeticheskiy institut.

L 13441-66 EWT(d)/EWT(m)/EWA(h) IJP(c)

ACC NR: AP6002452 SOURCE CODE: UR/0057/65/035/012/2239/2242

AUTHOR: Zhileyko, G. I.

ORG: Moscow Power Engineering Institute (Moskovskiy energeticheskiy institut)

48 B

TITLE: Solving the equations of motion for traveling wave electron accelerators

SOURCE: Zhurnal tekhnicheskoy fiziki, v.35, no. 12, 1965, 2239-2242

TOPIC TAGS: linear accelerator, electron accelerator, motion equation, ~~mathematic method~~ electron motion, traveling wave, space charge

ABSTRACT: In accord with a previous suggestion of the author (ZhTF, 33, 1449, 1963; 34, 2185, 1964), the equations of motion of electrons in a traveling wave accelerator are written with the ratio $u_s = U_s/U_0$ of the equilibrium kinetic energy U_s to the rest energy U_0 as independent variable in place of the longitudinal coordinate z. These equations include the effects of space charge and radiation of the bunched electrons. Advantages of writing the equations in this form are pointed out. These include ease of calculating the acceptance angle, the simple manner in which the coordinate z can be introduced after the equations have been solved, and the fact that the space charge and radiation fields are explicit functions of u_s rather than of z. Certain approximations that are suggested by the form of the equations and certain

Card 1/2

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ACC NR: AP6002452

limiting cases, including that of negligible beam current, are discussed briefly. Orig. art. has: 13 formulas.

SUB CODE: 20 SUBM DATE: 12Mar65 ORIG. REF: 003 OTH REF: 000

Card 2/2

L 14206-66 EWT(1) IJP(c) WW
ACC NR: AP6003612 SOURCE CODE: UR/0054/65/000/003/0026/0035

AUTHOR: Zhilich, A. G.; Monozon, B. S. 62

ORG: Leningrad State University (Leningradskiy gosudarstvennyy universitet) B

TITLE: Behavior of a hydrogen type system in a strong magnetic field 21, 44, 55

SOURCE: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 3, 1965, 26-35

TOPIC TAGS: strong magnetic field, atomic spectrum, continuous spectrum, exciton, copper compound, absorption edge

ABSTRACT: The article proposes a method for an effective description of states of a hydrogen type system which border on the Landau levels on the side of both the discrete and the continuous spectrum in a sufficiently strong homogeneous magnetic field. Eigenfunctions and eigenvalues of the energies are found by using the self-consistent method of solving the Schroedinger equation. A qualitative comparison is made with an experiment in which the absorption spectrum of the yellow exciton series of Cu_2O was studied in a homogeneous magnetic field of 29000 Oe. The spec-

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Card 1/2

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trum consisted of a set of lines adjacent to the edge of the continuum, whose edge is displaced toward the violet portion as compared to the spectrum in the absence of the magnetic field. Although not enough data were available to permit a quantitative check of the theory, a qualitative agreement was obtained. Orig. art. has: 2 figures, 43 formulas.

SUB CODE: 07/ SUBM DATE: 03Jul64/ ORIG REF: 000/ OTH REF: 005

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Card 2/2

ACC NR: AP7005842 SOURCE CODE: UR/0181/66/008/012/3559/3566

AUTHOR: Zhilich, A. G.; Monozon, B. S.

ORG: Leningrad State University im. A. A. Zhdanov (Leningradskiy gosudarstvennyy universitet)

TITLE: Quasiclassical analysis of the spectrum of a hydrogenlike system in a strong magnetic field

SOURCE: Fizika tverdogo tela, v. 8, no. 12, 1966, 3559-3566

TOPIC TAGS: magnetooptic effect, spectral analysis, adiabatic approximation, strong magnetic field, exciton, semiconductor theory

ABSTRACT: This is a continuation of an earlier attempt (Vestnik LGU v. 16, 26, 1965) to use the spectrum of a hydrogenlike system in a strong magnetic field for a study of magnetooptic effects in semiconductors near the absorption edge and in other spectral regions in which Mott excitons participate. In the present paper the authors propose an adiabatic method for analyzing a hydrogenlike system in a strong magnetic field. The method consists of an investigation of the eigenvalues of the Schrodinger equation for a particle moving in a Coulomb field in a homogeneous magnetic field and deriving from this analysis an equation for the energy spectrum. The present results are compared with the earlier ones and with results by others. A criterion for the applicability of the adiabatic approximation is established. Results are compared qualitatively with an experiment on the magnetooptic absorption in the region of the

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yellow exciton series in Cu_2O crystals. It is concluded that the experimental data are not sufficiently detailed to provide a check on the derived formulas, but that the adiabatic approach is suitable for magnetooptic effects in semiconductors in strong magnetic fields. Orig. art. has: 1 figure and 20 formulas.

SUB CODE: 20/ SUBM DATE: 04May66/ ORIG REF: 003/ OTH REF: 006

Card 2/2

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ACC NR: AP6002346 SOURCE CODE: UR/0054/65/000/004/0029/0037

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AUTHOR: Zhilich, A. G.

ORG: none

TITLE: Dielectric constant and magnetic-field-caused inversion in the exciton absorption region in CdS crystals

SOURCE: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 4, 1965, 29-37

TOPIC TAGS: cadmium sulfide crystal, exciton absorption

ABSTRACT: Connected with the D. G. Thomas and J. J. Hopfield works (Phys. Rev., 122, 35, 1961; 124, 657, 1961; and Phys. Rev. Lett., 4, 357; 5, 505, 1960), this article develops formulas for the tensor of the dielectric constant in magnetic field and considers the effect of magnetic-field-caused inversion in hexagonal CdS-type crystals; the large (Mott's) exciton model is used. The physical origin and relative

Card 1/2

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values of various constants that characterize the inversion effect are clarified. The effect of magnetic field on the frequencies of real excitons, i.e., Mott's excitons interacting with the radiation field, is considered. For this purpose, the Fourier

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components of the dielectric-constant tensor are found and then — by using a Fresnel equation — the frequencies of normal electromagnetic waves in the crystal are determined; these frequencies in the accepted approximation are also the frequencies of real excitons. It has also been theoretically verified that, with H‖Oz magnetic field, the inversion effect is zero. Orig. art. has: 35 formulas.

SUB CODE: 20 / SUBM DATE: 02Nov64 / ORIG REF: 009 / OTH REF: 005

Card 2/2

GROSS, Ye.F.; ZHILICH, A.G.; ZAKHARCHENYA, B.P.; VARFALOMEYEV, A.V.

Magneto-optical studies of quadrupole exciton transitions in Cu_2O crystals. Fiz.tver.tela 3 no.5:1445-1452 My '61. (MIRA 14:6)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Excitons) (Cuprous oxide—Magnetic properties) (Crystal lattices)

ZHILEYKO, G.V.

Maximum efficiency and limit flow of an electron beam in a high-current wave-guide type accelerator. Atom. energ. 18 no.6:628 Je '65.
(MIRA 18:7)

24,7700(1137,1138,1160,1462) 24924 S/181/61/003/006/021/031
B102/B214

AUTHORS: Zhilich, A. G., Cherepanov, V. I., and Kargapolov, Yu. A.

TITLE: Possible existence of magnetic dipole lines in the exciton absorption spectrum

PERIODICAL: Fizika tverdogo tela, v. 3, no. 6, 1961, 1812 - 1814

TEXT: The present paper gives a theoretical investigation of the possibility of magnetic dipole exciton transitions in cubic crystals. It can be shown that such transitions may appear on excitation of exciton levels by light if these levels show a pseudovectorial symmetry. An investigation is also made of the dependence of the intensity of absorption on the direction of propagation, on the polarization of light in magnetic dipole transitions in deformed crystals in the presence of an external magnetic field. V. I. Cherepanov and V. S. Galishev (Ref. 1: FTT, III, 4, 1961) have shown before that by using the equation of motion $\hat{p}_j = \frac{m}{i\hbar}[\vec{r}_j, \hat{H}]$ the equation for the matrix element of the exciton quadrupole transition:

$$\langle \eta, S | \hat{W} | 0 \rangle = \frac{ie}{m} \left\langle 0, S \left| \sum_{j=1}^{N} (\eta r_j)(\xi \hat{p}_j) \right| 0 \right\rangle, \qquad (1)$$

Card 1/6

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B102/B214

can be brought in the form

$$\langle \eta, S | W | 0 \rangle = -\frac{e\omega^2}{2c} \left\langle 0, S \left| \sum_{\alpha,\beta} q_\alpha \xi_\beta T_{\alpha\beta} \right| 0 \right\rangle + \frac{ie\omega}{2mc} \langle 0, S | ([q\xi] \hat{M}) | 0 \rangle. \quad (2)$$

Here $\vec{\eta}$ is the propagation vector of the exciton (same as that of light), S is a set of discrete quantum numbers characterizing the exciton state, $\vec{\xi}$ is a unit vector in the direction of the polarization of light, $\vec{r}_j$ and $\vec{p}_j$ radius vector and momentum operator of the j-th electron, $\hat{H}$ the Hamiltonian operator for a system consisting of n interacting electrons in the crystal, $\vec{q}$ the unit vector in the direction of propagation of the light, $T_{\alpha\beta}$ a symmetric quadrupole tensor, and $\hat{M}$ the operator of the total angular momentum of the electron system. The first term of (2) can be considered to represent the electric quadrupole and the second the magnetic dipole. The selection rules for the first term for a cubic crystal (symmetry group O_h) are established in Ref. 1 where it is shown that two types of electric quadrupole exciton absorption lines may exist: $A(\Gamma_1 \rightarrow \Gamma'_{25})$ and $B(\Gamma_1 \rightarrow \Gamma_{12})$. To the type A belongs, for example, the 6125-A line in the yellow series of the exciton absorption spectrum of Cu_2O.

Possible existence of... 24924 S/181/61/003/006/021/031
B102/B214

The second term of (2) was not dealt with in Ref. 1. This term signifies, however, that one more type of weak exciton absorption lines - the magnetic dipole lines can exist. This term is different from zero only for transitions of the type $(\Gamma_1 \to \Gamma'_{15})$, where Γ'_{15} is an irreducible representation of the O_h group according to which the components of the pseudovector $\hat{M}$ are transformed. Both terms of (2) can not vanish simultaneously. Analogously to Ref. 1 one obtains

$$|\langle \eta, \Gamma'_{15} | W^s | 0 \rangle|^2 = |\langle \eta \Gamma'_{15} | W^p | 0 \rangle|^2 = g' |M|^2, \quad (3)$$

for the square matrix element where $g' = e^2\omega^2/4m^2c^2$; M the matrix element of the components of $\hat{M}$; s and p are indices describing the state of polarization of the light wave. According to this, there is complete isotropy for this line in a cubic crystal with respect to the direction of propagation as well as to the state of polarization. From this point of view the magnetic dipole lines are analogous to the electric ones, but their intensity is smaller than that of the latter by a factor $(a/\lambda)^2 \sim 10^{-6}$. The effect of uniform directed compression on the magnetic dipole lines is now studied.

Card 3/6

1) Compression along a symmetry axis of 4th order: the line splits into two components $\Gamma'_{15} = E + A$.

$$\left.\begin{array}{ll} |\langle\eta, E|W^{s}|0\rangle|^2 = g'|\Delta|^2\cos^2\theta, & |\langle\eta, A|W^{s}|0\rangle|^2 = g'|\Delta|^2\sin^2\theta, \\ |\langle\eta, E|W^{p}|0\rangle|^2 = g'|\Delta|^2, & |\langle\eta, A|W^{p}|0\rangle|^2 = 0. \end{array}\right\} \quad (4)$$

2) Compression along a symmetry axis of 2nd order ($\Gamma'_{15} = B_1 + B_2 + B_3$):

$$\left.\begin{array}{l} |\langle\eta, B_1|W^{s}|0\rangle|^2 = g'|\Delta|^2\sin^2\theta, \quad |\langle\eta, B_2|W^{s}|0\rangle|^2 = \\ \qquad = g'|\Delta|^2\sin^2\left(\varphi - \frac{\pi}{4}\right)\cos^2\theta, \\ |\langle\eta, B_1|W^{p}|0\rangle|^2 = 0, \quad |\langle\eta, B_2|W^{p}|0\rangle|^2 = g'|\Delta|^2\cos^2\left(\varphi - \frac{\pi}{4}\right), \end{array}\right\} \quad (5)$$

$$\left.\begin{array}{l} |\langle\eta, B_3|W^{s}|0\rangle|^2 = g'|\Delta|^2\cos^2\left(\varphi - \frac{\pi}{4}\right)\cos^2\theta, \\ |\langle\eta, B_3|W^{p}|0\rangle|^2 = g'|\Delta|^2\sin^2\left(\varphi - \frac{\pi}{4}\right). \end{array}\right\} \quad (6)$$

In a magnetic field, the exciton level of Γ'_{15} is split into three levels which are displaced from the field-free level by $\Delta\varepsilon_1 = 0$ and $\Delta\varepsilon_{2,3} = \pm\gamma' H$, where

$$i\gamma' = \frac{e}{2mc}\langle 1|M_y|3\rangle = \frac{e}{2mc}\langle 2|M_x|3\rangle = \frac{e}{2mc}\langle 1|M_z|2\rangle. \quad A$$

The intensity of the magnetic dipole transitions from the ground state of Γ'_{15} in the magnetic field are described by

$$|\langle\eta, 1|W^t|0\rangle|^2 = g'|\Delta|^2|\cos\theta\cos\varphi H_x + H_y\cos\theta\sin\varphi - H_z\sin\theta|^2,$$

$$|\langle\eta, 1|W^p|0\rangle|^2 = g'|\Delta|^2|H_x\sin\varphi - H_y\cos\varphi|^2,$$

$$|\langle\eta, 2|W^t|0\rangle|^2 = |\langle\eta, 3|W^t|0\rangle|^2 = g'|\Delta|^2\frac{H^2 - H_z}{2H^2}\Big|-\sin\theta +$$

$$+\frac{H_xH_z + iHH_y}{H^2 - H_z^2}\cos\theta\sin\varphi + \frac{H_yH_z - iHH_x}{H^2 - H_z^2}\cos\theta\cos\varphi\Big|^2, \quad B$$

$$|\langle\eta, 2|W^p|0\rangle|^2 = |\langle\eta, 3|W^p|0\rangle|^2 =$$

$$= g'|\Delta|^2\frac{1}{2H^2}\left|\frac{H_xH_z + iHH_y}{\sqrt{H^2 - H_z^2}}\cos\varphi - \frac{H_yH_z - iHH_x}{\sqrt{H^2 - H_z^2}}\sin\varphi\right|^2.$$

$$\Delta \equiv \langle 1\hat{M}_x|0\rangle.$$

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There are 5 Soviet-bloc references.

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova (Leningrad State University imeni A. A. Zhdanov), Ural'skiy gosudarstvennyy universitet im. A. M. Gor'kogo Sverdlovsk (Ural State University imeni A. M. Gor'kiy, Sverdlovsk)

SUBMITTED: December 7, 1960 (initially),
January 20, 1961 (after revision)

Card 6/6

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24,6200

AUTHORS: Gross, Ye. F., Zhilich, A. G., Zakharchenya, B. P., Makarov, V. P., and Sibilev, A. I.

TITLE: Zeeman effect of the yellow exciton series in strong magnetic fields

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 327-338

TEXT: The Zeeman effect of the members of the yellow exciton series of Cu_2O crystals was examined in magnetic fields of up to 140 koe directed in the direction perpendicular to the magnetic field. The crystals were cooled in liquid helium. With increasing field strength the line splitting grows more complex with rising main quantum number n (Paschen-Bak effect). The experiments with single crystals showed clear dependence between the splitting and the orientation of the crystal in the magnetic field. The Zeeman splitting of the principal members of the yellow series with $n \geqslant 2$ is distorted by the action of forbidden lines. Conclusions: In Cu_2O there is a Γ_{25}^+ zone at the top of the valency band an a Γ_1^+ zone at the bottom

Card 1/2