eA

3

Theory of hydrogen bonds in dimeric organic acids. M. A. Kovner and V. A. Churenkov (Saratov Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 14, 435-41(1950). Theoretical. A 2-min. scheme of potential curves is introduced to explain the appearance of doublet lines in Raman spectra, discovered by Batuev. The distance between the lines depends on the height of the potential barrier between the min. This relationship is plotted for formic, acetic, and isovaleric acids.   S. Pakswer

1951

A 53

8A

539.133 : 535.343

7667. **Vibration spectrum and force constants of diacetylene.** M. A. Kovner and V. T. Salosin. Dokl. Akad. Nauk, SSSR, 75 (No. 5) 651-4 (1950) In Russian.

Frequencies are calculated from a valence force field which includes interactions of neighbouring bonds and of adjacent angles. A comparison with known frequencies yields the corresponding force constants. J. Jacobs.

CA

3

Theory of the diffuse spectrum of methane and similar molecules. M. A. Kuvner and Sh. K. Tsimring (Cherny-shevskii State Univ.; Saratov). *Zhur. Fiz. Khim.* 25, 434 (1951).—The secular equation for methane is obtained and factorized by the valence bond method (Eyring, *et al.*, *C.A.* 29, 694[1]). From group-theoretical considerations, the selection rules for electronic-vibrational transitions are found; it is concluded that the absence of vibrational structure found in the electronic spectrum of methane (cf. Duncan and Howe, *C.A.* 29, 680[2]) cannot be attributed to these selection rules. However, since the electronic levels for allowed transitions are degenerate, the excited CH_4 mol. must be unstable in the tetrahedral configuration (theorem of Jahn and Teller) and thus dissocn. into radicals is expected following light absorption (Groth, *C.A.* 32, 2800[3]). From this viewpoint, the absence of structure in the electronic spectrum of CH_4 becomes clear.   Michel Boudart

cA   3

Quantum mechanics of the degenerate vibrations of the methane molecule. M. A. Kovner and Sh. B. Tsimring (Chernyshevskii State Univ., Saratov). *Zhur. Fiz. Khim.* 25, 438-43(1951).—A comparison between the quantum-mech. expression for the energy W of CH_4, taking into account the refinements of Linnett and Wheatley on the one hand (*C.A.* 43, 5242f) and the expression of Stepanov (*C.A.* 36, 340², 6413⁴) giving W as a function of the normal coordinates and the dynamic coeffs. k_a, a, and l on the other hand, can be made conveniently only for the degenerate vibrations of the mol. From this comparison and the values given by Stepanov ($k_a = 0.7165 \times 10^{-4}$ per sq. cm., $l = 0.039 \times 10^{-4}$ per sq. cm.), it is possible to calc. the value of the exchange integrals; in at. units $N_{ed} = -0.48$ and $N_{ee} - N_{ee} = -3.96$. However, the value of a can also be calcd. directly from the quantum-mech. expressions; this value is 10 times that given by Stepanov. The discrepancy can be partially explained by noting that a is very sensitive to a small error in the exptl. data which served as the basis for Stepanov's calcns. The main source of error lies nevertheless in the assumption made in the present work that the exchange integrals are independent of the C—H distance. It is known that, in the case of water, an assumption of this kind is not permissible.   Michel Boudart

KOVNER, M..A.

M. A. Kovner an. V. A. Chuenkov.   Theory of the hydrogen bond in dimers of carbonic acids.
P. 662

The N. G. Chernyshevskii State University
Chair of Theoretic Physics, Saratov
March 31, 1950

SO: Journal of Physical Chemistry, Vol. XXV, No. 6, June 1951

SA

A 53
i

535.343

8430.   On the theory of the continuum spectrum of methane and related molecules. M. A. KOVNER AND Sit. I. TRIBERINO. Dokl. Akad. Nauk, SSSR, 78 (No. 2) 235-7 (1951) In Russian.
The absence of vibrational structure in the absorption spectrum is not due to forbidden electron-vibration transitions. The spectrum coincides with a continuum as dissociation into radicals belonging to a different symmetry group must take place in tetrahedral molecules.   J. JACOBS

METALLURGICAL LITERATURE CLASSIFICATION

S.A.

sect. A

Molecules

2891.   Quantum mechanics and force-constants of the methane molecule and of deuteromethanes. M. A. Kovner and Sh. E. Tsimring. Dokl. Akad. Nauk SSSR, 79, 949–52 (No. 6, 1951) In Russian.—For the C electrons forming the C–H bond, ortho-normal linear combinations of $2s$ and $2p$ atomic functions are constructed which are energetically most favourable. For these wave functions the deviation of their axis of symmetry from the C–H tetrahedral direction is characterised by 2 "coeffs. of deviation." All 5 force constants and their dependence on Coulomb and exchange integrals are established using symmetry co-ordinates. One coeff. of deviation, being constant for all deuterated methanes, may be used as index of deformation of the electron shells.   J. JACOBS

KOVNER, M.A.

Chemical Abstracts
May 25, 1954
Electronic Phenomena
and Spectra

(3)

The theory of splitting the vibration frequency of OH caused by the tunnel effect. M. A. Kovner and V. N. Kapshtal (N. G. Chernyshevskii State Univ., Saratov). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 17, 561–6(1953).— Theoretical. Seignettoelec. properties are now attributed to the presence of a H bond. The presence of 2 bands in the Raman spectrum of KH₂PO₄ is attributed to a tunnel effect. A soln. of the wave equation in which the potential energy U corresponding to an OH bond has been introduced is in good agreement with the expt. as far as the position of the doublet is concerned, but gives too high values for the sepn. of the 2 lines.   S. Paksz̄er

KOVNER, M. A.

USSR/Physics - Analysis

Card 1/1   Pub. 43 - 13/62

Authors   :   Kovner, M. A.

Title   :   Calculation and interpretation of oscillation spectra of certain mon-
               oalkyl and polymethylbenzenes

Periodical :   Izv. AN SSSR. Ser. fiz. 18/6, page 671, Nov-Dec 1954

Abstract :   The report under above title was published in Doklady Akademii Nauk
               SSSR (Reports of the Academy of Sciences USSR) No. 97/2, page 229 (1954)
               and in Zhurnal Eksperimental'noi i Teoreticheskoy Fiziki (Journal of

Experimental and Theoretical Physics), No. 26/6, page 704 (1954).

Institution :   .....

Submitted   :   .....

KALINER M.A.

KOVNER M.A.

K.-5

Category : USSR/Optics – Spectroscopy

Abs Jour : Ref Zhur – Fizika, No 2, 1957, No 5038

Author : Kovner, M.A., Irkhin, Yu.P.
Inst : Saratov State University, USSR
Title : Concerning the Theory of Ultraviolet Spectra of Absorption of Methane Halides.

Orig Pub : Zh. eksperim. i teor. fiziki, 1954, 26, No 3, 317-322

Abstract : The electron energy levels of the CH_3I, CHI_3, and CI_4 molecules are calculated from the solution using the method of the valent pairs of the eight-electron problem of quantum mechanics. For molecules with a symmetry C_{3v}, the classification of the electron levels with respect to the symmetry is of the form $4A + 2B + 4E$. These representations correspond to 14 linearly independent spin function. However, a total of 24 new spin functions occur when the operations of symmetry of the C_{3v} group are applied to the general spin functions of the eight-electron problem. These include ten linear relationships. To determine the 14 linearly independent basic spin functions one employs the analogy between the behavior of the spin functions and the oscillatory coordinates

Card : 1/3

Category : USSR/Optics - Spectroscopy   K-6

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 5038

in the symmetry operations. This makes it possible to employ the pro-
cedure where the supplementary relationships between the oscillatory
coordinates are taken into account, a procedure used to calculate the
oscillations of the molecules. The matrix perturbation elements are
calculated using the graphic method employed earlier by Sklar (Sklar, A.,
Journal of Chemical Physics, 1937, 5, 669). The resultant secular de-
terminants contain an unknown energy in each term. In order for the un-
known to be contained only in the diagonal elements, a transformation
was used analogous to the introduction of the kinematic-coefficient
matrix instead of the kinetic-energy matrix in the oscillatory problems.
The matrix elements of the secular equations contain the exchange inte-
grals of the paired and unpaired electrons of the C, H, and C-halide
atoms, namely α, β and α', δ' as well as the exchange integrals of
the electrons of the H, H and H, Hal atoms (β and β') and the intra-
atomic exchange integral of the C atom together with the exchange inte-
gral β'' of the Hal and Hal electrons. Based on the data by Parti
and Samuel (Parti, Y.P., Smauel, R., Proceedings of the Physical Society,
London, 1937, $\underline{49}$, 568) for the dissociation energy of CH_4, CH_3I, CHI_3,

Card   : 2/3

KOVNER MA.

Vibration spectra of aromatic compounds. I. Evaluation and interpretation of the vibration spectra of benzene and of the deuteriobenzenes (planar vibrations). M. A. Kovner (Saratov State Univ.). Zhur. Eksptl. i Teoret. Fiz. 20, 900-908(1954).—The secular equations for the planar vibrations of benzene and of the deuteriobenzenes are formulated and solved. A complete detn. of the 60 force consts. was not possible since only 30 of their combinations were available, but several of these consts. are shown to vanish, and for others estimates are given. Interaction coeffs. for the symmetry coordinates of each irreducible representation and for the internal coordinates are then evaluated and tabulated. Analysis of the results shows: (1) Each type of the interaction between the symmetry coordinates is characterized by a certain order of magnitude

KOUNER, M. A.
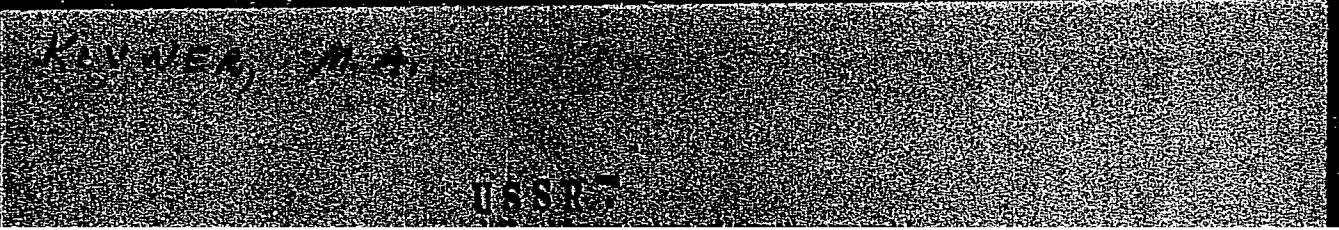
USSR/ Physics

Card 1/1   Pub. 147 - 26/27

Authors   : Kovner, M.A., and Irkhin, Yu. P.

Title   : "Metallic Model" of a molecule with Π - electrons and the method of
               molecular orbits. Letter to editor.

Periodical   : Zhur. fiz. khim. 28/2, 368-371, Feb 1954

Abstract   : The basic cause for the degeneration of energy levels in a metallic model
               is explained by using a benzene molecule as the model. The reason why this
               high symmetrical molecule was selected for the experiment is discussed. The
               greatest shortcoming of a conventional metallic model was found to be the
               lack of consideration regarding the periodic potential along the ring of the
               molecule. The effect of electron reaction and nuclear oscillations, on the
               elimination of the degeneration of energy levels, is explained. Nine re-
               ferences: 4-USSR; 3-USA; 1-Swiss and 1-Hungarian (1935-1952).

Institution : The N.G. Chernishevskiy State University, Saratov

Submitted   : May 26, 1953

Spectral Analysis

USSR/Physics

Card   : 1/1

Authors   : Kovner, M. A.

Title   : Calculation and interpretation of spectra of uneven oscillations of benzene, deutero-benzenes and toluene

Periodical   : Dokl. AN SSSR, 97, Ed. 1, 65 - 68, July 1954

Abstract   : A method for the calculation and interpretation of spectra of unsymmetrical oscillations of benzene, deutero-benzenes and toluene, is described. A "century" equation is given in which the non-diagonal elements are of the same order with the diagonal elements and a comparison between these two depends only upon the order of operation used in solving the equation by the method of "consequtive diagonalization". The changes in the oscillation forms during the transition from C_6H_6 into $C_6H_5CH_3$, are explained. Eleven references: 5 USSR, 4 USA, 1 French and 1 English. Tables.

Institution   : The N. G. Chernishevskiy State University, Saratov

Presented by : Academician, G. S. Landsberg, April 1, 1954

KOVNER, M. A.

USSR/Physics

Card 1/1

Author   : Kovner, M. A.

Title   : Calculation and interpretation of oscillatory paraxylene spectra

Periodical   : Dokl. AN SSSR, 97, Ed. 2, 229 - 231, July 1954

Abstract   : An attempt was made to calculate and interpret all fundamental oscillations of paraxylene. The calculations were made on the basis of the system of power constants characterizing the benzene ring, which had been determined in previous work, and the system of power constants of the methyl group, which was also determined previously. Twelve references. Table.

Institution   : The N. G. Chernishevskiy State University, Saratov

Presented by   : Academician G. S. Landsberg, Jan. 15, 1954

KOVNER, M.A.

Computation and interpretation of the vibration spectra of some
monoalkyl- and polymethylbenzenes. Izv.AN SSSR.Ser.Fiz.19 no.2:
218-219 Mr-Ap '55.

(MLRA 9:1)

1.Saratovskiy gosudarstvennyy universitet imeni N.G.Chernychev-
skogo.
(Tartu--Spectrum analysis--Congresses)

Kovner, M.A.

USSR/ Physical Chemistry - Molecule. Chemical Bond.   B-4

Abs Jour   :   Referat Zhur - Khimiya, No 3, 1957, 7200

Author   :   Kovner, M.A.
Title   :   Vibrational Spectra of Aromatic Compounds. III. Calcula-
                tion and Interpretation of the Vibrational Spectra of
                Mesitylene and Durene

Orig Pub   :   Optika i spektroskopiya, 1956, Vol 1, No 3, 348-363

Abstract   :   Geometrical models with C_{3h} and C_{2h} symmetry are used
                for mesitylene and durene, respectively. The force cons-
                tants of benzene and ethane are used in the calculation
                of the frequencies. The calculated frequencies are com-
                pared with frequencies observed in Raman spectra, fluores-
                cence spectra, and IR spectra. The full interpretation
                of the spectra is proposed on the basis of the calcula-
                tions and selection rules. A classification of the fun-
                damental and component frequencies is given, based on the
                symmetry of the point groups C_{3h} and C_{2h}.

Card 1/2   - 25 -

Kovner, M.A.

USSR/Optics

K

Abs Jour: Referat Zhur-Fizika, 1957, No 4, 10451

Author : Kovner, M.A., Bogomolov, M.A.
Inst   : Saratov University, USSR
Title   : General Theory of Oscillation Spectra of Normal Mono-Alkylbenzols.

Orig Pub: Optika i spektroskopiya, 1956, 1, No 3, 364-373

Abstract: The secular equations for the 46 oscillation frequencies of the molecule of ethyl benzol were setup and solved. An interpretation is given for its oscillation spectra, and also for the vibration spectra of the higher mon-alkylbenzols up to $C_6H_5(CH_2)_{15}CH_3$. The frequencies of the mono-alkylbenzols are compared with the frequencies of the benzol itself. The frequencies that do not change upon substitution, and also those that change and are independent or dependent on the length of the alkyl chain are determined. The frequencies of the valent vibrations $C = C$ are calculated with the aid of a simplified model of one dimensional zig-zag chain with

Card   : 1/2

Kovner, M. A.

USSR/Physical Chemistry - Molecule, Chemical Bond.

B-4

Abs Jour: Referat. Zhurnal Khimiya, No 2, 1958, 3538.

Author : M.A. Kovner.
Inst   : Saratov State U.
Title   : Vibration Spectra of Aromatic Compounds. IV. Computation
          and Interpretation of Vibration Spectra of Diphenyl and
          Decadeuterodiphenyl.

Orig Pub: Optika i spektroskopiya, 1956, 1, No 6, 742-751.

Abstract: A computation of basic frequencies of Raman and infrared spectra
          of diphenyl and decadeuterophenyl was carried out and their com-
          plete interpretation was offered. Following approximations were
          admitted: the interaction amidst rings was assumed to be zero,
          all the force constants of diphenyl were expressed by the ben-
          zene force constants determined previously with the exception
          of the interaction constants of angles produced by the inter-
          ring links with benzene rings n_ρ and n_ρ, which were accepted

Card   : 1/3

-20-

KOVNER, M. A., Doc of Phys-Math Sci -- (diss) "Calculation and interpreta-
tion of an oscilating spectra of benzol and its derivatives." Minsk, 1957

23 pp (Belorussian State University im V. I. Lenin), 260 conios

(KL, 36-57, 103)

KOVNER, M.A.

PRIKHOT'KO, A.F.

24(7)   p 3   PHASE I BOOK EXPLOITATION   SOV/1365

L'vov. Universytet

Materialy X Vsesoyuznogo soveshchaniya po spektroskopii. t. 1:
Molekulyarnaya spektroskopiya (Papers of the 10th All-Union
Conference on Spectroscopy. Vol. 1: Molecular Spectroscopy)
[L'vov] Izd-vo L'vovskogo univ-ta, 1957. 499 p. 4,000 copies
printed. (Series: Its: Fizychnyy zbirnyk, vyp. 3/8/)

Additional Sponsoring Agency: Akademiya nauk SSSR. Komisiya po
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Kornitskiy, V.G., Candidate of Technical Sciences, Rayskiy, S.M.,
Candidate of Physical and Mathematical Sciences, Klimovskiy, L.K.,
Candidate of Physical and Mathematical Sciences, Miliyanchuk, V.S.,
Candidate of Physical and Mathematical Sciences, and Olauberman,
A. Ye., Candidate of Physical and Mathematical Sciences.

Card 1/30

Tumeran, L.A. New Optical Method in Mass-spec-
   troscopy   81

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   Vibrational Spectra of Some Aromatic Hydrocarbons   84

Kamenetskiy, V.D., and B.M. Yavorskiy. Method for the
   Calculation of Absorption Spectra of Organic Molecules.   88

Iogansen, A.V. Normal-vibration Frequencies and the
   Anharmonicity Constants of Acetylene and Deutero-
   acetylene Molecules   93

Motulevich, G.P., and A.A. Shubin. Polarization
   Method for the Measuring of Optical Constants of
   Metals in the Infrared Range   95

Kislovskiy, L.D. Use of a Resonator Model With
   Viscous Friction for the Representation of Optical
   Characteristics of Absorbing Media in the Infrared
   Range   96

Card 7/30

KOVNER, M.A.; BOGOMOLOV, A.M.

Structure and vibration spectra of various aromatic hydrocarbons.
Fiz. sbor. no.3:84-88 '57.   (MIRA 11:8)

1. Saratovskiy gosudarstvennyy universitet im. N.G. Chernyshevskogo.
(Hydrocarbons—Spectra)

51-3-4/24

AUTHOR: Kovner, M.A.

TITLE: Metallic model and π- electron polarizability of the benzene molecule. (Metallicheskaya model' i π-elektronnaya polyarizuyemost' molekuly benzola).

PERIODICAL:"Optika i Spektroskopiya" (Optics and Spectroscopy), 1957, Vol.2, No.3, pp.304-309 (U.S.S.R.)

ABSTRACT: This theoretical paper deals with quantum-mechanical calculations of the π-electron polarizability in the plane of the ring of the benzene molecule. Three models were considered: (1) free electrons in a undimensional well with infinitely high walls, (2) electrons moving in a cosinusoidal field, and (3) electrons in a rectilinear periodical potential field.

(1) Free electron model.
The electrons were assumed to be moving on a circle of radius R = L/2π, where L = 6a and a = the length of the C-C bond. The energy levels of electrons are given by

$$W_n = \frac{n^2 h^2}{72ma^2} \quad (n = 0, \pm 1, \pm 2, \ldots)$$

The first four electrons occupy level W_0 and the other four W$_{\pm 1}$. Only the transition to the nearest free level was

Card 1/3

Metallic model and π-electron polarizability of the 51-3-4/24
benzene molecule. (Cont.)

considered, i.e. $\pm I1 \rightarrow +2$, since the $0 \rightarrow +2$ transition was forbidden. The polarizability for $\lambda = 4358$ Å was found to be $\alpha_\pi(\nu) = 9.40$ Å^3, and the static value $\alpha_\pi(0) = 7.63$ Å^3. The experimental value, for the C-C bond in the plane of the ring, is 8.16 Å^3 and it includes the effect of the σ-electrons. Thus, the values calculated are of the right order but too high.

(2) <u>Cosinusoidal potential model</u>. Introduction of a periodic potential makes the energy level gaps smaller and the frequency ν_1 of the first electronic transition lower. Since α_π is inversely proportional to ν_1 it follows that α_π is larger. This was confirmed by rough calculations. Since a lower value of α_π than that obtained in (1) above is required, it is clear that the cosinusoidal potential is not a sufficiently accurate approximation of the molecular field.

(3) <u>Rectilinear potential model.</u>

Card 2/3   The potential along the circle of circumference L is given by $V = V_0$; $(\ell - 1) \frac{L}{12} \leqslant r \leqslant \ell \frac{L}{12}$; $(\ell = 1,3,5,7,9,11)$

Metallic model and π-electron polarizability of the
benzene molecule. (Cont.)   51-3-4/24

$$V = 0; \quad (j - 1)\frac{L}{12} \leqslant r \leqslant j\frac{L}{12} \; ; \quad (j = 2,4,6,8,10,12)$$

where r = the coordinate along the circumference L.
Simple calculations gave, for V_0 = 17 eV (or about eight
times W_{+1} = 2.16 eV), values of $\alpha_\pi(\nu)$ = 9.12 $Å^3$
and $\alpha_\pi(0)$ = 6.97 $Å^3$ respectively.
In contrast to the cosinusoidal potential the α_π values are
now lower but not low enough. Further improvement should be
sought by taking into account the finite height of the
potential walls, the three-dimensional motion of electrons,
the Coulomb and exchange interactions of the π-electrons
themselves and the interaction of the π- and σ-electrons.
Card 3/3 B. N. Snegirev also took part in this work. There are
1 figure, 1 table and 11 references, 9 of which are Slavic.

SUBMITTED: To Zhurn. Eksper.Teor. Fiziki (and passed on to Optika
i Spektroskopiya) on November 23, 1955.

ASSOCIATION: Theoretical Physics Department, Saratov State University
(Saratovskiy Gos. Universitet Kafedra Teoreticheskoy Fiziki).

AVAILABLE:

KOVNER, M.A.; BOGOMOLOV, A.M.

Method of calculating the oscillation frequency of systems having a
periodical structure. Uch.zap. Sar.un. Vyp.fiz. 56:100-112 '57.

(MIRA 12:11)

(Benzene)

AUTHOR   KOVNER, M.A., SHEGIREV, B.N.   PA - 2248
TITLE   Depolarisation and Intensities in the Raman Spectra of Benzene and
            Hexadeuterobenzene (Depolarisataii i intensivnosti v spektrakh kom-
            binatsionnogo rasseyaniya benzola i geksadeyterobenzola).
PERIODICAL Doklady Akademii Nauk SSSR, 1957,Vol 112,Nr 5,pp835-838 (U.S.S.R.)
            Received 4/1957   Reviewed 4/1957

ABSTRACT   The present paper uses the method for the calculation of depolari-
            zations and intensities developed by M.V.VOL'KENSHTEYN et al.(kole-
            baniya molekul - "The oscillations of molecules",1949) and detailed
            by S.M.FERIGLE, A.WEBER (Canad.J.Phys., 32, 799, 1954).
            Fully symmetrical oscillations (A_{1g}): The CH-bindings in benzene are
            produced by carbon-atoms with trigonal hybridization and cannot have
            a cylindrical symmetry. The expressions for the derivations of the
            tensor of the polarizability of the molecule in a certain direction
            are given. The coefficients occurring therein and the normalizing
            factors are known from the solution of a mechanical problem. Only
            certain relations are here determined on the basis of experimental
            values of certain quantities. By this method ϱ_3, ϱ_4 and S_3/S_2 can
            be determined. The corresponding quantities are determined here
            more precisely than before and satisfy a certain sum rule.
            Non-plane degenerated oscillations (E_g): First the formulae are
            written down which are obtained by computation of the projection of
            the angular momentum M in JACOBI's coordinates. Also the expressions
            resulting from the geometric image of the non-plane oscillations,

Card 1/2

KOVNER, M). A

51-4 -3-4/30

AUTHORS: Kovner, M.A. and Bogomolov, A.M.

TITLE: Vibrational Spectra of Aromatic Compounds.
             V. Calculation and Interpretation of Vibrational
             Spectra of Metaxylene. (Kolebatel'nyye spektry
             aromaticheskikh soyedineniy. V. Raschet i
             interpretatsiya kolebatel'nykh spektrov metaksilola.)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol.IV, Nr.3,
             pp.301-308 (USSR).

ABSTRACT: The authors calculate frequencies of vibrations and
             give a full interpretation of vibrational spectra of
             metaxylene. Their calculations are based on two
             variants of the force constants. The variant No.1
             is based on the following values of non-active
             frequencies B_{2u} of C_6H_6: 1110.1648 cm^{-1}, and for
             C_6D_6: 825.1577 cm^{-1}. In this variant the force
             constant for the CCC angles external to the molecular
             ring (K_γ) is taken to be 0.71, and the force constants
             of interaction of these angles with CCH angles of
             methyl groups ($m_\beta; n_\beta$) are taken to be 0.12 and

Card 1/3   - 0.02 respectively. In the variant No.2 the B_{2u}

51- 4 3-4/30

Vibrational Spectra of Aromatic Compounds. V.

frequencies for C_6H_6 and C_6D_6 are taken to be 1152.1310 and 838.1287 cm^{-1} respectively, with $K_\gamma = 1.10$ and $m_\beta = n_\beta = 0$.   Table 1 gives the force constants in A_1 symmetry coordinates, and Table 2 gives the force constants in B_1 symmetry coordinates.   The force constants of interaction of coordinates of methyl groups were taken from Ref.13. Other force constants are equal to zero.   Table 3 collects all known experimental data on Raman, infra-red and phosphorescence spectra of metaxylene.   The same table gives the results of calculations obtained on the basis of the two variants given above.   Both these variants do not apply to A_2 and B_2 vibrations.

Some calculations were made using a third variant, which differed from variant No.2 in values of m_β (0.12) and n_β (- 0.02).   The results of calculations based on the third variant did not differ greatly from those of the variant No.2 and are not given in the paper.

Card 2/3

Vibrational Spectra of Aromatic Compounds. V.   51- 4 .3-4/30

The calculations carried out by the present authors
give better agreement between experimental and
calculated vibrational frequencies of metaxylene if
the variant No.2 is used (with values for the non-active
B$_{2u}$ frequencies taken from Refs.11-12).   A note
added in proof says that the results of the present
paper agree with those published by Wilmhurst and
Bernstein in Canad. J. Chem., Vol. 35,911 (1957).
There are 3 tables, 1 figure and 30 references, 12 of
which are Soviet, 6 English, 5 American, 4 French,
1 German, 1 Indian and 1 Danish.

ASSOCIATION: Saratov State University. (Saratovskiy
             gosudarstvennyy universitet.)
SUBMITTED: May 21, 1957.

         1. Cyclic compounds--Spectra

Card 3/3

AUTHORS: Kovner, M.A. and Peregudov, G.V.   SOV/51-5-2-6/26

TITLE: Vibrational Spectra of Octadeuterotoluene (Kolebatel'nyye spektry
              oktadeytorotoluola)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 2, pp 134-140 (USSR)

ABSTRACT: Preparation of octadeuterotoluene ($C_6D_5CD_3$) and the preliminary
              results on its spectrum were published in Ref 13. The present
              paper reports more accurate results on the Raman spectrum of
              $C_6D_5CD_3$. A "Isot" B II spectrograph was used to measure the Raman
              spectra. A low-pressure mercury lamp was used as the light source.
              The excitation lines at 4358 and 4047 Å were separated out by glass
              filters. A qualitative estimate of depolarization of lines was made
              following the method of Ref 14. Infrared absorption spectrum in
              the 2.5-15 μ region was also obtained. Table 1 gives the Raman and
              infrared frequencies measured to within 1-2 cm^{-1} for sharp lines and
              2-4 cm^{-1} for broad lines. Table 1 shows also the intensities of the
              lines relative to the 761 cm^{-1} line, whose intensity is taken to
              be 100. The 975, 1554 and 1584 cm^{-1} lines are due to partly deuterated
              toluene present as an impurity. The authors also calculate vibrational
Card 1/2   frequencies of the octadeuterotoluene molecule. They compare two

Vibrational Spectra of Octadeuterotoluene   SOV/51-5-2-6/26

variants of force constants of the B_{2u} representation of benzene and
two variants of force constants of interaction of the methyl group
with the ring.   Table 2 gives the fundamental frequencies of
C_6H_6, C_6D_6, $C_6H_5CH_3$ and $C_6D_5CD_3$ (both experimental and calculated
values).   Complete interpretation of the octadeuterotoluene spectrum
is given. G.V. Peregudov carried out the experiments, while
calculations were made by M.A. Kovner. The authors thank
P.A. Bazhulin for advice and A.M. Bogomolov, S.D. Osecinskiy and
L.A. Novikova for help in experiments and calculations.   There are
2 tables and 15 references, 10 of which are Soviet, 2 American,
1 Danish, 1 English and 1 French.

ASSOCIATION: Fizicheskiy institut im. P.N. Lebedeva, AN SSSR; Saratovskiy
            gosudarstvennyy universitet (Physics Institute imeni P.N. Lebedev,
            Academy of Sciences of the U.S.S.R.; Saratov State University)

SUBMITTED: October 3, 1957
Card 2/2   1. Toluene-d--Preparation   2. Toluene-d--Spectrographic analysis
            3. Raman Spectroscopy--Applications   4. Infrared Spectroscopy
            --Applications

AUTHORS: Kovner, M.A. and Snegirev, B.N.   SOV/51-5-3-3/21

TITLE: Calculation of the Raman Spectrum Intensity of Benzene and Certain
             Deuterobenzenes in the Zeroth and First Approximations of the
             Valence-Optical Theory (Raschet intensivnostey v spektrakh
             kombinatsionnogo rasseyaniya benzola i nekotorykh deyterobenzolov v
             nulevom i pervom priblizhenii valentno-optichoskoy teorii)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 3, pp 239-250 (USSR)

ABSTRACT: The authors calculated the intensities and depolarizations of the
             Raman spectra of benzene and two deuterobenzenes: C_6D_6 and $C_6H_3D_3$.
             The method of calculation used was that of Ferigle and Weber (Ref 2),
             generalized to molecules not possessing the axial symmetry. The
             method is semi-empirical and some of the required data were taken from
             the experimental results of Ref 3. To allow for the dependence of the
             bond polarizability on the changes in the bond lengths and valence
             angles, the calculations were carried out in two stages: in the
             usual zeroth and in the first approximations of the valence-optical
             theory (Ref 1). Table 1 gives the forms of vibrations. Table 2 gives
Card 1/2   the experimental and calculated intensities and depolarizations of the

AUTHORS: Kovner, M. A., Snegirev, B. N.   SOV/48-22-9-5/40

TITLE: Intensities and Depolarization in the Spectra of
                Combination Dispersion of C_6H_6, C_6D_6, and of the
                Symmetrical $C_6H_3D_3$ (Intensivnosti i depolyarizatsii v
                spektrakh kombinatsionnogo rasseyaniya C_6H_6, C_6D_6 i simm.
                $C_6H_3D_3$)

ABSTRACT: New information gained (Ref 1) on the spectra of
                combination dispersion of C_6H_6, C_6D_6 and $C_6H_3D_3$ made

                it possible to determine the electro-optical parameters
                of the benzene ring. This is necessary for the investigation
                of its electron shell and for the computation of the
                intensities of the spectra of substituted benzenes with
                a complicated structure. In order to calculate the tensors
                of the polarizability derivatives for all frequencies
                of the spectra of combination dispersion the authors
                employed the formulae of the optical valence theory
Card 1/3   (Ref 2) as well as formulae in which the momentum is

Intensities and Depolarization in the Spectra of   SOV/48-22-9-5/40
Combination Dispersion of C_6H_6, C_6D_6, and of the Symmetrical $C_6H_3D_3$

       There are 2 tables and 7 references, 4 of which are
       Soviet.

ASSOCIATION: Saratovskiy gos. universitet im. N. G. Chernyshevskogo
       (Saratov State University imeni N. G.Chernyshevskiy)

Card 3/3

05303
SOV/170-59-8-14/18

24(8)

AUTHOR: Kovner, M.A.

TITLE: Calculation of Thermodynamic Functions of Benzene, Benzene-d$_6$, Toluene, and Toluene-d$_8$ from Spectroscopic Data

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Nr 8, pp 108 - 111 (USSR)

ABSTRACT: Calculations of thermodynamic functions of benzene and toluene, which were performed previously, were based on the old interpretation of vibrational spectra studied insufficiently. In the present investigation the author made use of the theoretical calculations of vibrational frequencies given in References 1 - 5 and new experimental data /Refs 5-11/ with some improvements. The theoretical calculations mentioned were recently confirmed by A.M. Bogomolov who checked them on an electronic computer. The author calculated thermodynamic functions of the above named compounds for the ideal gaseous state at a pressure of 1 atm and at temperatures ranging from 298.16 to 1,000°K and tabulated the data in Tables 1 - 4. N.I.Davydova and V.D. Konakova took part in carrying out these calculations. The author

Card 1/2

AUTHORS: Kovner, M.A. and Snegirev, B.N.

TITLE: Intensities and Depolarization in the Raman Spectra of Polymethylbenzenes.
           I. General Theory. Toluene.

ABSTRACT: In an earlier paper (Ref 1) the authors determined the polarizabilities
           of bonds in benzene and their derivatives with respect to the bond length.
           The results of that paper can be used as the basis of a systematic
           discussion of intensities in the spectra of substituted benzenes. This
           is started by the present paper which reports calculations of elements
           of tensors T of the derivatives of polarizability with respect to the
           normal coordinates for all 38 vibrations of the toluene molecule. The
           elements of T are expressed in terms of atomic masses, bond lengths,
           bond polarizabilities and their derivatives, elements of matrices L
           of normalized coefficients of vibration forms and elements of matrices
           L^{-1}. The formulae for T are very complex and are, therefore, given
           in Tables 2-8. As in the earlier paper (Ref 1) calculations were based
           on the valence-optical theory suggested by Vol'kenshteyn and later

Card 1/2

SOV/51-7-4-9/32

Intensities and Depolarization in the Raman Spectra of Polymethylbenzenes. I.
General Theory. Toluene.

worked out in greater detail by Vol'kenshteyn and Yel'yashevich
(Refs 2, 3). A figure on p 487 shows the geometrical model of the
toluene molecule assumed by the authors, and its vibrational coordinates.
The paper is entirely theoretical. There are 1 figure, 8 tables and
6 references, 3 of which are Soviet and 3 English.

SUBMITTED: January 10, 1959

Card 2/2

67153
SOV/51-7-6-7/38

5.3100

AUTHORS: Kovner, M.A. and Bogomolov, A.M.

TITLE: Vibrational Spectra of Aromatic Compounds. VI. Calculation and Interpretation of the Vibrational Spectra of Orthoxylene

PERIODICAL: Optika i spektroskopiya, 1959, Vol 7, No 6, pp 751-755 (USSR)

ABSTRACT: By interpretation of the vibrational spectra of orthoxylene (alkylbenzene) the authors mean carrying out of the following four tasks. (1) Division of the observed frequencies into fundamental and composite; calculation of those fundamental frequencies which are not observed for various reasons so that a complete system of $3N-6$ fundamental frequencies is obtained (here N is the number of atoms); correlation of the fundamental frequencies with irreducible representations (symmetry types) of the symmetry group to which the molecule belongs. (2) Attribution of the fundamental frequencies of a given type of symmetry to vibrations of bonds or variations of valence angles, in particular attribution of the fundamental frequencies to vibrations of the ring and the alkyl groups. (3) Correlation of vibrations (frequencies) of the ring in alkyl benzene with those of benzene. (4) Representation of the composite frequencies as linear combinations of the fundamental frequencies. In the earlier papers only the tasks Nos 1 and 4 were

Card 1/3

67153

$50J/5:-7-b-7/38$

Vibrational Spectra of Aromatic Compounds. VI. Calculation and Interpretation
of the Vibrational Spectra of Orthoxylene

carried out completely. The tasks 2 and 3 were only partially fulfilled
since the vibration-form coefficients were not known. The present
paper reports a complete interpretation including tasks 2 and 3, because
the authors could now use the values of the vibration-form coefficients
calculated by A.M. Bogomolov for all frequencies of the orthoxylene
molecule. These coefficients were determined using a technique
developed by Mayants (Ref 1) for obtaining accurate values of the roots
of secular equations and a consequent determination of the vibration-
form coefficients which are the eigen-vectors of the secular-equation
matrices. To fulfil tasks 2 and 3, calculations were carried out using
two systems of ring vibrational symmetry coordinates: (1) a system of
coordinates of the approximate symmetry D_{6h} (Ref 4) and (2) a system
of coordinates of the exact symmetry C_{2v}, which are sums and differences
of pairs of equivalent coordinates shown in a figure on p 752 and pairs
of coordinates of the type ρ (displacement of the C--H and C--C bonds from
the plane of the ring) and of the type χ (non-planar vibrations of the
carbon skeleton of the ring). The results are shown in a table on
p 753 which lists the observed and calculated fundamental frequencies of
orthoxylene. Cols 2, 5 and 7 give the values of the observed

Card 2/3

67153

SOV/51-7-6-7/36

Vibrational Spectra of Aromatic Compounds. VI. Calculation and Interpretation of the Vibrational Spectra of Orthoxylene

Raman (Refs 13, 16-19), infrared absorption (Refs 20-23) and luminescence (Refs 11, 14) frequencies, respectively. The calculated frequencies are listed in col 8, in the majority of cases the calculated and empirical frequencies agree satisfactorily. The symmetries are given in col 9 and the bonds or valence angles responsible for the particular frequencies are listed in col 10. Col 11 gives the frequencies of benzene corresponding to the appropriate frequencies of orthoxylene. There are 1 figure, 1 table and 25 references, 11 of which are Soviet, 9 English, 1 Danish, 1 German, 1 Indian, 1 translation and 1 from an international journal. The authors also give a correction to an earlier paper (Ref 7).

SUBMITTED: April 10, 1959

Card 3/3

68326

SOV/51-8-1-32/40

24.3410

AUTHORS: Kovner, M.A., Karyakin, A.V. and Yefimov, A.P.

TITLE: Characteristic Frequencies of the Hydroperoxide Group C--O--O--H

PERIODICAL:Optika i spektroskopiya, 1960, Vol 8, Nr 1, pp 128-130 (USSR)

ABSTRACT: The authors discuss vibrational frequencies of the hydroperoxide group C--O--O--H. Studies of the infrared spectra of hydroperoxides showed that the C--O--O--H vibrations have the following frequencies: 840, 880, 1155, 1325, 3450 cm^{-1}. These frequencies were tentatively assigned to δ(COOH), ν(O--O), ν(C--O), δ(O--H), ν(O--H), respectively. The corresponding frequencies of C--O--O--D were found at 800, 855, 995, 1155, 2550 cm^{-1} in the spectrum of isopropylbenzene peroxide (Ref 2). Analysis of the two sets of frequencies shows that they are incomplete. Firstly a non-linear chain consisting of four atoms should have six vibrational frequencies and secondly the reported data suggest that the frequencies of vibrations of the angle XYZ (X, Y and Z are the heavy atoms) lie below 600 cm^{-1}, i.e. in the two sets of values (given above) the frequency δ(COO) is absent. This was confirmed experimentally by the discovery of a very intense line at 585 cm^{-1} in the spectrum of isopropylbenzene hydroperoxide (cf. curve 1 in a figure on p 128). This line was interpretted as δ(COO) of the COOH group. The corresponding frequency in the COOD group is unfortunately not known. The 840 cm^{-1}

Card 1/3

68326

SOV/51-8-1-32/40

Characteristic Frequencies of the Hydroperoxide Group C--O--O--H

frequency, previously denoted by δ(COOH) can now be assigned to vibrations of a dihedral angle χ between the plane COO and OOH. Since the geometry of the hydroperoxide group in isopropylbenzene was not known the authors used geometrical parameters of the same group in performic acid: C--O = 1.35 Å, O--O = 1.49 Å, O--H = 1.02 Å, $\angle$COO = 105°, $\angle$OOH = 100° (Ref 3). The dihedral angle χ was taken to be 90°. Assuming the bond lengths and angles just listed and using "spectroscopic masses" of H and D, the authors calculated kinematic coefficients which are given in Table 1 (cols 2 and 4). Six of the eleven non-zero force constants were found by various methods and the remainder were deduced from the constants of CH_3OH (Ref 5) and methyl alcohol; all 21 force constants are given in cols 3 and 6 of Table 1. The calculated and observed vibrational frequencies of COOH and COOD are given below;

Card 2/3

80562

S/051/60/008/06/023/024
B201/E691

5,4130

AUTHORS: Snegirev, B.N. and Kovner, M.A.

TITLE: The Formulae Used for Calculation of Intensities in the Infrared Molecular Spectra

PERIODICAL:Optika i spektroskopiya, 1960, Vol 8, Nr 6, pp 880-881 (USSR)

ABSTRACT: Ferigle and Weber (Ref 1) gave a formula for calculation of the components of the tensor of the derivatives of molecular polarizability along normal coordinates and this formula can easily be applied to the case of calculation of components of the dipole moment vector μ along the normal coordinates Q:

$$\left(\frac{\partial \mu_u}{\partial Q^m}\right)_0 = \sum_{nr} \left(\frac{\partial r_n}{\partial q_n}\right)_0 \cos(nu) T^{n}_{r}{}^{r}_{m} + \sum_{n\ell} \mu_n S_n^{-1} \left[e_u - e_{ji}\cos(nu)\right] \times$$

$$\times \left(\frac{S_i}{m_i} - \frac{S_j}{m_j}\right)(L^{-1})^m_\ell , \qquad (1)$$

where $u = x, y, z$; e_u are the unit vectors along the axes x, y and z; n are the numbers of the bonds; μ_n and S_n are the dipole moments and the equilibrium lengths of the bonds; m_i and m_j are the masses of atoms forming the bond ji; r and ℓ are the numbers of the

Card 1/2

Q

KOVNER, M.A.; SNEGIREV, B.N.

Intensities and depolarizations in the Raman spectra of polymethyl-
benzenes. Part 2: Numerical calculation for toluene. Opt. i spektr.
9 no.2:170-175 Ag '60.   (MIRA 13:8)
                        (Toluene—Spectra)

32982

S/641/61/000/000/009/033
B104/B102

26.2242

AUTHORS: Kovner, M. A., Kolerov, G. I.

TITLE: Calculation of the elastic scattering cross section of slow
             neutrons from protons bound in a benzene molecule

SOURCE: Krupchitskiy P. A., ed. Neytronnaya fizika; sbornik statey.
             Moscow, 1961, 100 - 104

TEXT: A. M. L. Messiah (Phys. Rev., 84, 204 (1951)) formulated the
general theory of neutron scattering from protons bound in polyatomic
molecules. At neutron energies lower than the excitation energy of the
first vibrational level of the fundamental frequencies in the molecule,
this theory leads to formula

$$(\bar{\sigma}_0)_T/\sigma_F = Q + (R/y)\theta + (S/y)\theta^2,$$ (1),

where E_o is the neutron energy prior to collision and

Card 1/3

Calculation of the elastic ...

$$\theta = kT/2\hbar\omega; \quad y = E_0/2\hbar\omega;$$

$$Q = (2\pi y)^{-1} \int_0^1 \int_0^{2\pi} t^{-1}[1 - \exp(-s^2 ty)]\, du\, d\varphi; \qquad (2)$$

$$R = (2\pi)^{-1} \int_0^1 \int_0^{2\pi} s(2-s)\,(\tfrac{1}{2} - s^2 ty)\exp(-s^2 ty)\, du\, d\varphi;$$

$$S = (2\pi)^{-1} \int_0^1 \int_0^{2\pi} ts^2(2-s^2)^2 \left[-\tfrac{3}{8} + (\tfrac{3}{2}).s^2 ty - \right. \qquad (3)$$

$$\left. - (\tfrac{1}{2})\, s^4 t^2 y^2\right]\exp(-s^2 ty)\, du\, d\varphi. \qquad (4)$$

$$s = 2\left[v_2^{-1} - (v_2^{-1} - v_1^{-1})\, u^2\right]^{-1}; \qquad (5)$$

$$t = (c_1 - c_2)\cos^2\varphi + c_2 + u^2[c_3 - c_2 - (c_1 - c_2)\cos^2\varphi]. \qquad (6)$$

where ν, ψ are the polar coordinates of the momentum transferred to the molecule and $u = \cos\nu$, hold for benzene. $\langle \bar{U}_0/\bar{T}\rangle_F$ is calculated (Table).
The authors thank Docent A. S. Shekhter for advice and Docent S. I. Drozdov
Card 2/3

32982
S/641/61/000/000/009/03*
B104/B102

Calculation of the elastic ...

for his interest and comment. There are 1 figure, 2 tables, and 11 refer-
ences: 8 Soviet and 3 non-Soviet. The three references to English-langu-
age publications read as follows: Messiah A. M. L., Phys. Rev., 84, 204
(1951); Sachs R. G., Teller E., Phys. Rev., 60, 18 (1941); Feri?l? 3. M.,
Waber A., Canad. Phys., 32, 799 (1954).

Table 2: Results of measurements of $\langle \bar{u}_0 \rangle_T / $ F

E_0, эв	D	Q	R	S	$R\theta/\nu$	$S\theta^2/\nu$	$\langle \bar{a}_0 \rangle$ T/σ_P
0,005	0,050	3,476	0,061	—0,004	0,313	—0,005	3,783
0,010	0,100	3,313	0,040	0	0,103	0	3,416
0,015	0,150	3,161	0,023	0,001	0,039	0	3,201
0,020	0,200	3,018	0,009	0,003	0,012	0,001	3,031
0,025	0,250	2,885	—0,002	0,004	0,002	0,001	2,884
0,030	0,300	2,760	—0,011	0,004	—0,010	0,001	2,751
0,035	0,350	2,643	—0,019	0,005	—0,014	0,001	2,630
0,040	0,400	2,533	—0,024	0,005	—0,016	0,001	2,518
0,045	0,448	2,430	—0,028	0,005	—0,016	0,001	2,414
0,050	0,498	2,333	—0,032	0,004	—0,016	0,001	2,317

Card 3/3

Opt.i spektr. 10 no.3:328-334
(Aromatic compounds--Spectra) (Benzene--Spectra)   (MIRA 14:8)
(Infrared rays)

KOVNER, M.A.; KOROSTELEV, Yu. S.; BEREZIN, V.I.

Vibrational spectra of aromatic compounds. Part 10: Calculations and interpertation of the vibrational spectra of pyridine and deuteropyridines. Opt. i spektr, 10 no.4:457-465 Ap '61.

(Pyridine—Spectra)

(MIRA 14:3)

KOVNER, M.A.; CHAPLIK, A.V.

Vibration-rotation interaction in the benzene molecule and the line
width of its Raman spectrum. Opt.i spektr. 13 no.1:56-62 Jl '62.
(Benzene--Molecular rotation)   (Raman effect)   (MIRA 15:7)

KOVNER, M.A.; KRAYNOV, Ye.P.

Vibrational analysis of the fluorescence spectra of a frozen
solution of naphthalene in pentane and naphthalene vapors.
Opt. i spektr. 15 no.4:565-568   O '63.   (MIRA 16:11)

KOVNER, M.A.; DAVYDOVA, N.I.; ZHIGUNOVA, I.A.

Interpretation of the vibrational spectra and force constants of phenol and D-phenol. Opt. i spektr. 18 no.1:152-153 Ja '65.
(MIRA 18:4)

DAVYDOVA, N.I.; ZHIGUNOVA, I.A.; IGNAT'YEVA, L.A.; KOVNER, M.A.

Calculation and interpretation of the spectra of nonplanar
vibrations in m-cresol, n-cresol, o-cresol and their
deuterosubstituted. Opt. i spektr. 18 no.6:1077-1079 Je '65.

(MIRA 18:12)

L 31134-66   EWP(j)/EWT(l)/EWT(m)/EWP(e)   RM/WH

ACC NR: AP6012859

SOURCE CODE: UR/0368/66/004/0351/0353

AUTHOR: Berezin, V. I.; Zubov, V. A.; Kats, M. L.; Kovner, M. A.; Sidorov, N. K.; Stal'makhova, L. S.; Sushchinskiy, M. M.; Turbin, Yu. P.; Shubalov, I. K.

ORG: none

54
52
B

TITLE: Intensities and line thresholds of stimulated Raman scattering

SOURCE: Zhurnal prikladnoy spektroskopii, v. 4, no. 4, 1966, 351-353

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

ABSTRACT: The relative values for the threshold I for the intensity of the exciting light necessary to attain stimulated Raman scattering in toluene, chlorobenzene, and pyridene have been measured. Using a theory of SRS developed by P. A. Apanasevich and B. I. Stepanov (Zhurnal prikladnoy spektroskopii, v. 1, 1964, p. 202), the authors derived the following formula

$$I_B/I = (I_\infty/\delta)/(I_\infty/\delta)_B \; \nu^3_{\beta B}/\nu^3_\beta \; n^3_B/n^3, \qquad (1)$$

where I_∞ is the integral intensity of the SRS line, δ is the line width, ν_β is the frequency of the scattered light, n is the index of refraction, and the subscript B identifies these quantities for benzene. The experimental values of

Card   1/2

UDC: 535.22/36

Card   2/2   AU

Kovner, M. L.

AUTHORS: Sopov, N. P., and Kovner, M. L.

79-11-6/56

TITLE: Condensation of the Diene Compounds (C_nH_{2n-2}) with Methyl Metacry= late. - Synthesis of Hydroaromatic Alcohols and Hydrocarbons (Konden= satsiya dienovykh soyedineniy s metilmetakrilatom. - Sintez gidroaro= maticheskikh spirtov i uglevodorodov).

PERIODICAL: Zhurnal Obshchey Khimii, 1957, Vol. 27, Nr 11, pp. 2936-2941 (USSR).

ABSTRACT: In earlier published papers in which one of the authors of this ar= ticle participated it was investigated whether it is possible to ob= tain trivalent hydroaromatic alcohols and hydrocarbons [1,2] from products of the condensation of 1,3-diene hydrocarbons with methyl metacrylate with the aid of organic magnesium compounds. In this con= nection it was shown that mixtures with extensive boiling temperature are obtained on the action of magnesium methyl iodide upon the methyl esters of alkylcyclohexene carboxylic acids. In the present work the authors made it their object to determine the composition of the mix= tures forming in this connection. The tests showed that mixtures of alcohols and ketones develop in reactions of the esters of 1-methyl- cyclohexene-2-carboxylic acid and its homologues with RMgJ, reaction velocity and relative yield of the alcohols and ketones being depen= dent on the position and the number of the methyl groups in the ring

Card 1/2

Condensation of the Diene Compounds ($Cn H_{2n-2}$) With Methyl Metacrylate. 79-11-6/56
Synthesis of Hydroaromatic Alcohols and Hydrocarbons.

(see table 1).

Thus quite a number of trivalent alcohols and ketones was produced
from products of the condensation of methylmetacrylate with divinyl-,
piperylene-, isoprene-, dipropenyl-, diisopropenyl-, cyclopentadiene
-1,3 and cyclohexadiene-1,3 with the aid of magnesium-methyl iodide
and magnesium ethyl iodide. By dehydration of five alcohols the cor-
responding hydroaromatic hydrocarbons were obtained. Hydrocarbons of
the type 1,4-dimethyl-1-isopropenylcyclohexene-3 could not be dehydra-
ted with platinum.

There are 4 tables, and 5 references.

ASSOCIATION: Leningrad Institute of Aircraft Equipment Construction   (Leningrads-
kiy institut aviatsionnogo priborostroyeniya).

SUBMITTED: November 1, 1956.

AVAILABLE: Library of Congress.

Card 2/2

1. Diene compounds-Condensation reactions   2. Hydroaromatic
   alcohols-Synthesis   3. Hydrocarbons-Synthesis
4. Methylmetacrylate-Condensation reactions

SOV/79-28-8-32/66

AUTHORS: Sonov, N. P., Kovner

TITLE: Condensation of Diene-Hydrocarbons with Cinnamaldehyde. Synthesis of Hydro-Aromatic Alcohols, Acetates and Hydrocarbons (Kondensatsiya diyenovykh uglevodorodov s korichnym al'degidom. Sintez gidroaromaticheskikh spirtov, atsetatov i uglevodorodov)

ABSTRACT: Continuing their previous investigations (Refs 1-6), the authors investigated the condensation of divinyl, piperylene, isoprene, diisoprenyl, cyclopentadiene, and cyclohexadiene with cinnamaldehyde. From the aldehydes thus obtained, secondary alcohols, their acetates, and, by pyrolysis of the latter, hydro-aromatic hydrocarbons were synthesized. The constants, analysis data, and yields of 2-phenyltetrahydrobenzaldehyde and its homologues are shown in table 1. The condensation of cyclopentadiene-1,3 with cinnamic acid could not be effected. The phenyltetrahydrobenzaldehydes are viscous, odorless, water-insoluble liquids which are easily soluble in ether, benzene, and alcohol. For all aldehydes,

Card 1/2

Instruments & Equipment

SOPOV, N.P.; KOVNER, M.L.

Preparation of the derivatives of 1,3-butadiene by pyrolysis of
secondary alcohol acetates obtained on the basis of the condensation
products of bivinyl with unsaturated aldehydes. Zhur.ob.khim. 33
no.6:1827-1830 Je '63.   (MIRA 16:7)
                    (Butadiene) (Acetic acid)

SOPOV, N.P.; KOVNER, M.L.

Preparation of hydroaromatic hydrocarbons by the pyrolysis of acetates of secondary alcohols obtained on the basis of the condensation product of isoprene with crotonaldehyde. Zhur.ob.khim. 33 no.4:1142-1145 Ap '63.   (MIRA 16:5)

1. Leningradskiy institut aviatsionnogo priborostroyeniya.
   (Hydrocarbons)   (Isoprene)   (Crotonaldehyde)

SOPOV, N.P.; KOVNER, M.L.

Preparation of 1,3-butadiene derivatives by pyrolysis
of secondary alcohol acetates obtained on the basis of
the condensation products of ioprene and piperylene with
unsaturated aldehydes. Zhur. ob. khim. 34 no. 5:1492-1496
My '64.

Dic   condensati   c   substituted butadiene . Ibid.:1496-
1499   (MIRA 17:7)

1. Leningradskiy institut aviatsionnogo priborostroyeniya.

KOVNER, M.S.

Case of wave excitation in a nonequilibrium magnetoactive plasma.
Izv.vys. ucheb. zav.; radiofiz. 4 no.6:1035-1044 '61.
(MIRA 14:12)

1. Nauchno-issledovatel'skiy radiofizicheskiy institut pri
Gor'kovskom universitete.
(Plasma oscillations)

GERSHMAN, B.N.; KOVNER, M.S.

Special features of quasi-lateral propagation of magnetohydrodynamic waves in the plasma. Izv.vys.ucheb.zav.; radiofiz. 1 no.3:19-24
' 58.
(MIRA 12:1)

1. Issledovatel'skiy radiofizicheskiy institut pri Gor'kovskom universitete.
(Magnetohydrodynamics)

GERSHMAN, B.N.; KOVNER, M.S.

Special features of wave propagation connected with collisions
in a magnetically active plasma. Izv.vys.ucheb.zav.; radiofiz.
2. no.1:28-36 '59.   (MIRA 12:10)

1. Issledovatel'skiy radiofizicheskiy institut pri Gor'kovskom
universitete.
        (Electromagnetic waves) (Plasma (Ionized gases))

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26,1410   10.8000(2307, 2407, 2207)   85982
S/141/60/003/004/007/019
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AUTHOR: Kovner, M.S.

TITLE: Kinetic Approach to the Interaction of a Stream of
          Charged Particles with a Stationary Plasma in the
          Magnetic Field. I.

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy,
              Radiofizika, 1960, Vol. 3, No. 4, pp. 631 - 644

TEXT: As discussion is given (based on the kinetic-equation
method) of the instability of a stream of charged particles
passing through a stationary magneto-active plasma, and
conditions are determined under which the waves produced in
the plasma are amplified. It is assumed that the plasma
and the stream are not bounded and that the ordered stream
velocity v_o is in the direction of the external magnetic
field H_o . The direction of propagation of the waves is
taken to be arbitrary and is determined by a wave vector k
which makes an angle α with the direction of the external
field H_o (Fig. 1). In the absence of this stream three
types of waves can be propagated, namely, extraordinary,
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ordinary and plasma. In the presence of a   stream having a
sufficiently low intensity, the refractive index for the above
waves is changed only very slightly. However, in distinction
to the case $v_c = 0$, it is possible for the waves to be
amplified. Moreover, the order of the dispersion equation for
the interaction of a stream with the plasma is increased and
hence new types of waves can be propagated. In some cases,
the instability may be associated with the amplification of
this type of waves. In the first section of the present
paper, a general dispersion equation is derived which deter-
mines the propagation of high-frequency waves in a magneto-
active plasma. In section 2, this equation is used in a
discussion of the stability of plasma waves. Section 3 is
concerned with the stability and the amplification (damping)
coefficients for the extraordinary and ordinary waves. The
discussion given in Sections 2 and 3 takes into account thermal

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motion of particles in the stream. The results obtained by the
kinetic-equation method for the instability of a stream of
charged particles in a plasma and the amplification of electro-
magnetic waves is interpreted in terms of the radiation emitted by
electrons in a plasma. When charged particles move through
a magneto-active plasma having a refractive index greater than
unity, coherent bremsstrahlung and Cherenkov radiations are
produced. The kinetic energy associated with the translational
motion of the particles is thus partly converted into radiational
energy and the density of this energy may increase. The part
played by the plasma in this process is as follows. On the
one hand, it ensures that the refractive index is in fact
greater than unity, i.e. it retards the waves and, on the
other hand, even in the absence of collisions, the amplification
is prevented by the Landau effect (Ref. 12). If the
concentration of the particles in the stream is sufficiently
high, the Landau damping cannot prevent the amplification of
the field and the system becomes unstable (on the linear
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Kinetic Approach to the Interaction of a Stream of Charged
Particles with a Stationary Plasma in the Magnetic Field.   I

approximation). Acknowledgments are made to B.N. Gershman
for valuable advice and assistance and to V.V. Zheleznyakov for
reading the manuscript and a discussion of the results.
There are 1 figure and 19 references: 16 Soviet, 1 Italian
and 2 English.

ASSOCIATION: Nauchno-issledovatel'skiy radiofizicheskiy
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               Gor'kiy University)

SUBMITTED: January 29, 1960

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9.9300

AUTHOR: Kovner, M.S.

TITLE: Kinetic Analysis of the Interaction of a Beam
          of Charged Particles with Stationary Plasma in
          a Magnetic Field. II.

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy,
          Radiofizika, 1960, Vol. 3, No. 5, pp. 746 - 757

TEXT: The work is a continuation of the author's earlier
article (Ref. 1). On the basis of the linearised kinetic
equations and electrodynamic equations, a scattering
equation (Eq. 1.15) was derived in the previous article.
This is valid provided the conditions of Eqs. (1.1) and (1.2)
are fulfilled, where $n = kc/\omega$, $\beta^2 = \varkappa T/mc^2 \equiv v_T^2/c^2$,

and $u = \omega_H^2/\omega^2$. In the derivation of the dispersion equation,
it was also assumed that the plasma and the beam are
uniform and unlimited; the velocity $\underline{v}_0$ of the beam is
directed along the magnetic field $\underline{H}_0$ and the electromagnetic

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perturbation has the form of a plane wave whose wave vector
$\underline{k}$ forms an angle α with the direction of the magnetic field
$\underline{H}_o$. The plasma and the beam were regarded as non-

relativistic. The scattering equation is now written

differently as Eq. (1.3), where n_1^2, n_2^2 and n_3^2 are roots

of Eq. (1.4). The quantities A, B, C, D, $\mathcal{E}$ and R are
given by Eqs. (1.5); the other parameters in these formulae
are defined by Eqs. (1.6). The quantities A_{ik} are defined

by Eqs. (17.). The scattering equation (1.3) is investigated

for the case when $\left| b_{0,\pm}^s \right| \gg 1$ and the exponential terms

can be neglected. From Eqs. (1.3) and (1.7) it follows that
the scattering equation can now be expressed as:

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$$v\beta^2 R(n^2 - n_1^2)(n^2 - n_2^2)(n^2 - n_3^2) - B \, \frac{\omega_{0s}^2}{(\omega - \underline{kv}_o)^2} -$$

$$- v_s \, \frac{(\omega - \underline{kv}_o)^2}{(\omega - \underline{kv}_o)^2 - \omega_H^2} \left[A - \frac{\omega_H}{\omega - \underline{kv}_o} \, C \right] = 0$$

(1.8) .

In analysing the stability of the system it is possible to
use the perturbation method. It is assumed that the
frequency of the plane wave for the zero approximation
satisfies the Vavilov-Cherenkov condition for the average
velocity of the beam:

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$$\omega^{(0)} - \underline{kv}_o = 0$$

(1.9)

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where $\omega^{(0)}$ and k are related by Eq. (1.3). The second approximation is assumed to be in the form:

$$\omega^{(1)} = \frac{kv}{}_o + \mu \qquad (1.10) .$$

Assuming then that the inequality:

$$|\mu| \ll \omega^{(0)} \qquad (1.11)$$

is fulfilled and considering only the main terms of Eq. (1.8) which do not contain μ, the following expression is obtained:

$$\mu_k = -\sqrt[3]{1} \; \omega_{os}^{2/3} \left\{ \frac{\omega^2 B}{v\beta^2 R(n_k^2 - n_j^2)(n_k^2-n_i^2)\left[(\partial/\partial\omega)(n_k^2\omega^2)\right]} \right\}_{\omega=\frac{kv}{}_o}^{1/3} \qquad (1.12)$$

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where   i, j, k - 1, 2, 3   and   i $\neq$ j $\neq$ k .   The subscripts
1, 2 and 3 relate to the extraordinary, ordinary and plasma
waves, respectively.   Eq. (1.12) can be used for analysing
various types of waves.   In the case of a plasma wave

$n_3^2 \gg 1$, it can be expressed by Eq. (1.14).   Consequently,

the increment factor μ is given by Eq. (1.15), where Φ
is defined by Eq. (1.16).   In considering the ordinary and the
extraordinary waves outside the transition region the
expression for the increment factor is in the form of
Eq. (1.21).   For the region which fulfils conditions expressed
by Eqs. (1.23) and (1.24), the increment factor is given by
Eq. (1.27).   This formula coincides with the results obtained
by Rapoport (Ref. 8).   In the transition region which fulfils
the conditions expressed by Eq. (1.30) the increment factor
is given by Eq. (1.31).   The instability due to the magnetic
deceleration radiation can be investigated by considering the
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growth (or attenuation) of the waves at the frequency
corresponding to the normal and the anomalous Doppler effect.
The condition of radiation in the region of the anomalous
Doppler effect is expressed by:

$$n(v_o/c) \cos \alpha = 1 + \omega_H/\omega \qquad (2.1)$$

while for the normal Doppler effect it is given by:

$$n(v_o/c) \cos \alpha = 1 - \omega_H/\omega . \qquad (2.2)$$

Provided the conditions of Eqs. (2.4) are fulfilled, Eq. (1.8)
can now be written as Eq. (2.5), where μ_ϕ is defined by

Eq. (2.3). By using the perturbation method, the expression

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for determining $\mu_{\pm}$ is in the form of Eq. (2.6). Consequently,
$\mu_{\overline{k}}^{\pm}$ are given by Eqs. (2.7) and (2.8). From the above it
follows that the plasma wave in the region of the anomalous
Doppler effect is described by Eq. (2.9). The wave in the
region of the normal Doppler effect is characterised by
Eq. (2.19). The extraordinary and the ordinary waves in the
region of the anomalous Doppler effect are characterised by
Eqs. (2.21) and (2.22), respectively, where A and C are
determined by Eqs. (1.5). In the transition region which
fulfils the conditions of Eqs. (1.2) and (1.5), the increment
factors for the ordinary and the extraordinary waves are
represented by Eqs. (2.27) and (2.28); these are derived from
Eqs. (2.21) and (2.22). From Eq. (2.27), it is seen that the
instability occurs for $u < 1$. On the other hand, $u > 1$.
Eq. (2.28) shows that the instability is observed for

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Particles with Stationary Plasma in a Magnetic Field.   II.

The author expresses his gratitude to V.V. Zheleznyakov and
V.O. Rapoport for reading the manuscript and discussing the
results and also to B.N. Gershman for his interest in this
work.   There are 15 references: 2 English and 13 Soviet.

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SUBMITTED: March 25, 1960

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24.6714

AUTHOR: Kovner, M.S.

TITLE: Instability of low-frequency electromagnetic waves
in a plasma with a beam of charged particles passing
through it (propagation at an arbitrary angle with
respect to the direction of the magnetic field)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika,
v. 4, no. 3, 1961, 444 - 454

TEXT: The stability of a system consisting of a beam of
charged particles and plasma has been investigated only as
regards the high-frequency waves but it appears that little work
has been done as regards low-frequency waves (Ref. 9 -
V.P. Dokuchayev - ZhETF, 39, 413, 1960; Ref. 10 - G.V. Gordeyev,
ZhETF, 27, 19, 1954 and Ref. 11 - the present author, ZhETF,
40, 517, 1961). In the following, therefore, a kinetic approach
to the problem of the stability of a beam of charged particles
in plasma, with respect to low-frequency waves, is presented.
It is assumed that the waves propagate in the direction k,
which forms an arbitrary angle α with the direction of the
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constant magnetic field $\underline{H}_o$. The plasma and the beam are unlimited, quasi-neutral and singly ionized. The beam of the particles moves along the external magnetic field $\underline{H}_o$. The basic equations for the system are the linearized kinetic equations and the equations of electrodynamics. By following the approach adopted in Ref. 12 (L.D. Landau, ZhETF, 16, 571, 1946) and Ref. 14 (B.N. Gershman, ZhETF, 24, 659, 1953) and assuming that all the physical quantities can be represented as plane waves, the scattering equation for the system is in the form:

$$
\begin{vmatrix}
\varepsilon_{xx} & \varepsilon_{xy} & \varepsilon_{xz} \\
\varepsilon_{yx} & \varepsilon_{yy} & \varepsilon_{yz} \\
\varepsilon_{zx} & \varepsilon_{zy} & \varepsilon_{zz}
\end{vmatrix} = 0
\qquad (1.1)
$$

where

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$$\varepsilon_{xx} = a_{xx} + \omega^2 - k^2 c^2 \cos^3 \alpha; \qquad \varepsilon_{xy} = a_{xy} \; ;$$

$$\varepsilon_{xz} = a_{xz} + k^2 c^2 \sin \alpha \cos \alpha \; ; \qquad \varepsilon_{yx} = a_{yx} \; ;$$

$$\varepsilon_{yy} = a_{yy} + \omega^2 - k^2 c^2 \; ; \qquad \varepsilon_{yz} = a_{yz} \; ; \qquad\qquad (1.2)$$

$$\varepsilon_{zx} = a_{zx} + k^2 c^2 \sin \alpha \cos \alpha ; \qquad \varepsilon_{zy} = a_{zy} \; ;$$

$$\varepsilon_{zz} = a_{zz} + \omega^2 - k^2 c^2 \sin^2 \alpha$$

where:

$$a_{jp} = - i 4 \pi \omega \sum_{\gamma = 1}^{4} \int e_{\gamma} v_{j\gamma} C_{p\gamma} dv_{\gamma} \qquad (1.3),$$

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in which
$$dv_\gamma \equiv v_p \, dv_p \, dv_z d\varphi \, ;$$

$$C_{xy} = a(\varphi) K_\gamma \left(1 - \frac{k v_{0\gamma}}{\omega}\right) v_{\gamma p} \left\{ \frac{\exp(2\pi \varepsilon_\gamma)}{1 - \exp(2\pi \varepsilon_\gamma)} \int_0^{2\pi} \frac{\cos \varphi'}{a(\varphi')} d\varphi' + \int_0^\varphi \frac{\cos \varphi'}{a(\varphi')} d\varphi' \right\}.$$

$$C_{xz} = a(\varphi) K_\gamma \left\{ \frac{\exp(2\pi \varepsilon_\gamma)}{1 - \exp(2\pi \varepsilon_\gamma)} \int_0^{2\pi} \left(v_{z\gamma} - v_{0\gamma} + \frac{v_{0\gamma}}{\omega} v_{p\gamma} k \sin\alpha \cos\varphi' \right) \frac{d\varphi'}{a(\varphi')} \right. $$

$$\left. + \int_0^\varphi \left(v_{z\gamma} - v_{0\gamma} + \frac{v_{0\gamma}}{\omega} v_{p\gamma} k \sin\alpha \cos\varphi' \right) \frac{d\varphi'}{a(\varphi')} \right\} ; \qquad (1.4)$$

$$K_\gamma = - \frac{e}{\omega_{H\gamma}} \frac{N_\gamma}{T_\gamma} \left(\frac{m_\gamma}{2\pi T_\gamma}\right)^{3/2} \exp\left\{ -\frac{m_\gamma (v_\gamma - v_{0\gamma})^2}{2 T_\gamma} \right\} ;$$

$$a(\varphi) = \exp(\varepsilon_\gamma \varphi + \chi_\gamma \sin\varphi) ;$$

$$\varepsilon_\gamma = - \frac{i k v_{z\gamma} - i\omega}{\omega_{H\gamma}} ; \qquad \chi_\gamma = - \frac{k v_{p\gamma} \sin\alpha}{\omega_{H\gamma}} . \qquad (1.5)$$

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The quantity $C_{y\gamma}$ is obtained from the expression for $C_{x\gamma}$ by replacing $\cos\varphi$ by $\sin\varphi$. In the above formulae the quantities with indices $\gamma = 1, 2, 3, 4$ refer to the ions of the plasma, electrons of the plasma, ions and electrons of the beam, respectively. The following symbols are also introduced: $\omega_{H1} = \omega_{H3} = -\Omega_H = -eH_o/Mc$, where ε and M are the charge and the mass of an ion; $\omega_{H2} = \omega_{H4} = \omega_H = eH_o/mc$, where e and m are the charge and the mass of an electron; N_γ and T_γ are the concentration and temperature of the corresponding particles, the temperature being measured in energy units; $\underline{k}$ is the wave perturbation vector lying in the plane x, z ; the direction of the magnetic field $\underline{H}_o$ and that of the average velocity $v_{o\gamma}$ of the particles of the beam is assumed to be the axis z . First, the instability is investigated for the case when the thermal agitation of the particles can be neglected. It is shown that in this case the scattering equation is in the form:
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$$\left[k^2 c^2 - \frac{\omega_{01}^2 \omega^2}{\Omega_H^2} - \frac{\omega_{03}^2 (\omega - k v_0)^2}{\Omega_H^2} \right] \left\{ \frac{\omega_{01}^2 \omega^2}{\Omega_H^2} - k^2 c^2 \cos^2 \alpha + \right.$$

(2.5)   (2.5) .

$$\left. + \frac{\omega_{04}^2 \omega^2}{(\omega - k v_0)^2 \omega_{02}^2} \left(\frac{\omega_{01}^2 \omega^2}{\Omega_H^2} - k^2 c^2 \cos^2 \alpha \right) + \frac{\omega_{03}^2}{\Omega_H^2} \left[(\omega - k v_0)^2 + \frac{\omega_{04}^2 \omega^2}{\omega_{02}^2} \right] \right\} = 0.$$

From this, it follows that the instability occurs at:

$$v_0 > \frac{H_0}{\sqrt{4\pi M N_{\text{эфф}}} \cos \alpha},$$

(2.9)

where:

$$N_{\text{эфф}} = \frac{N N_s}{N + N_s}.$$

(2.10).

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Further investigation of Eq.(2.5) shows that the extraordinary
wave is stable and that it obeys the following relationship
(Ref. 19 - Ya.L. Al'pert, V.L. Ginzburg and Ye.L. Feynberg
- Propagation of Radio Waves, Gostekhizdat, Moscow, 1953):

$$\frac{\omega}{k} = \frac{H_0}{\sqrt{4\pi NM}\cos\alpha} \qquad (2.14).$$

If the region of anomalous Doppler effect is considered, the
instability of the low-frequency waves can be described by the
following scattering equation:

$$(\omega - kv_0 + \Omega_H)\left[k^4c^4\cos^2\alpha + k^2c^2\frac{\omega_{01}^2\omega^2}{\omega^2-\Omega_H^2}(1+\cos^2\alpha) - \frac{\omega_{01}^4\omega^4}{\Omega_H^2(\omega^2-\Omega_H^2)}\right] = \omega_{03}^2\Omega_H\left[\frac{\omega_{01}^2\omega^2}{\Omega_H(\omega-\Omega_H)} - \frac{k^2c^2(1+\cos^2\alpha)}{2}\right],$$

(2.19)

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which is valid when the following conditions are met:

$$\frac{\omega^3}{\omega^2 - \Omega_H^2} \, tg^2\alpha(1 + \cos^2\alpha) \ll \frac{M}{m}; \qquad \frac{\omega^2}{\Omega_H^2} \ll \frac{c^2}{v_{M}^2}, \qquad (2.20)$$

where $v_{M}^2 = H_o^2/4\pi NM$. It is of interest to take into account
the thermal agitation of the particles since their influence
substantially change the nature of the stability of the system.
This problem is investigated under the assumption that the
thermal agitation in the beam is significant and that the
stationary plasma can be considered as being "cold". For the
case when the phase-velocity of the wave is near to the
velocity v_o , and the thermal agitation is intense, the
scattering equation for the system becomes:

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$$\left[\omega_{02}^2 - \frac{\omega_{03}^2\,\omega^2}{k^2 v_{T3}^2 \cos^2\alpha}\left(1 + \frac{T_3}{T_4}\right) - i\sqrt{\frac{\pi}{2}\frac{\omega_{03}^2\,\omega^2\,(\omega - kv_0)}{(kv_{T3}\cos\alpha)^3}}\right] \times$$

$$\times \left[k^4 c^4 \cos^2\alpha + k^2 c^2 \frac{\omega_{01}^2\,\omega^2}{\omega^2 - \Omega_H^2}(1+\cos^2\alpha) - \frac{\omega_{04}^2\,\omega^4}{\Omega_H^2(\omega^2 - \Omega_H^2)}\right] = 0. \qquad (5.5) .$$

From this, it is found that instability occurs when
$\omega^{(0)} - \underline{kv}_0 < 0$. Now, the instability in the region of the
anomalous Doppler effect (under the conditions of thermal
agitation) is described by the following scattering equation:

$$k^4 c^4 \cos^2\alpha + k^2 c^2 \frac{\omega_{01}^2\,\omega^2}{\omega^2 - \Omega_H^2} - \frac{\omega_{01}^4\,\omega^4}{\Omega_H^2(\omega^2 - \Omega_H^2)} +$$

$$+ i\sqrt{\frac{\pi}{8}}\frac{\omega_{03}^2\,\Omega_H}{kv_{T3}\cos\alpha}\left\{ k^2 c^2(1+\cos^2\alpha) + \frac{2\omega_{01}^2\,\omega^2}{\Omega_H(\omega - \Omega_H)}\right\} = 0. \qquad (5.10) .$$

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From this, it is possible to find the correction factor for
the frequency $\omega^{(0)}$.

There are 20 references: 18 Soviet-bloc and 2 non-Soviet-bloc.
The two English-language references mentioned are:
Ref. 2 - R.Q. Twiss, Phys. Rev., 84, 448, 1951 and
Ref. 15 - I. Bernstein, Phys. Rev., 109, 10, 1958.

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SUBMITTED: October 21, 1960

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$2\,4,2/20\;(1538)$

AUTHOR: Kovner, M.S.

TITLE: On One Case of Cherenkov Instability in Non-equilibrium Plasma

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy,
        Radiofizika, 1961, Vol. 4, No. 4, pp. 765 - 766

TEXT: Published work concerned with the instability of
a beam of charged particles in a non-equilibrium plasma
located in a magnetic field, is based on the assumption that
the phase velocity of the wave is much greater than the
velocity dispersion due to thermal motion of the particles.
The present author considers the excitation of waves in a
plasma by a beam of charged particles, whose phase velocity
satisfies the relation

$$v_{T1}\, \cos\, \alpha \ll v_\phi \ll v_{12}\, \cos\, \alpha \tag{1}$$

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where α is the angle between the wave vector k and the
        external magnetic field $\underline{H}_o$, and

        $v_{T\gamma}$ is the average thermal velocity of particles of
               type γ .

The particle beam is assumed to be unbounded, uniform and
moving in the direction of the external magnetic field with
the velocity $\underline{v}_o$. The case α = 0 was considered in

Ref. 4 (M.S. Kovner, ZhETF, 40, 527, 1961). Assuming that
in the absence of the beam

$$\omega \ll \omega_{II} , \omega_{vi}; \quad |\omega - \omega_{H\tau}| \gg k v_{T\tau} \cos\alpha;$$

$$\frac{k^2 v_{T\tau}^2}{\omega_{H\tau}^2} \sin^2\alpha \ll 1 \qquad (2)$$

where $\omega_{H\gamma} = e_\gamma H_o / m_\gamma c$ and γ = 1, 2, 3, 4 refers to pl⸱
ions and electrons and beam ions and electrons, respectiv⸱
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and using the dielectric constant tensor given in Refs. 5
(M.S. Kovner - this journal, 4, 444, 1961) and 3 (K.N. Stepanov -
this jorunal - 3, 631, 746, 1960) the dispersion equation is
of the form:

$$k^6 c^6 + \frac{1}{\omega^2 - \Omega_H^2 \cos^2\alpha} \left\{ k^4 c^4 \frac{\omega^2}{\omega_{01}^2} \left[2\omega_{01}^4 - \omega_{02}^2 \left(\omega^2 - \Omega_{//}^2 \right) \frac{c^2}{v_{T2}^2} \right] - \right.$$

$$\left. - k^2 c^2 \frac{\omega^4}{\Omega_H^2 \cos^2\alpha} \left[\omega_{01}^4 + \Omega_H^2 \frac{\omega_{02}^2 c^2}{v_{T2}^2} (1 + \cos^2\alpha) \right] + \frac{\omega_{01}^2 \omega^6 \omega_{02}^2}{\Omega_H^2 \cos^2\alpha} \frac{c^2}{v_{T2}^2} \right\} = 0. \qquad (3) .$$

This relation includes a parameter describing the thermal
motion of the electrons but the thermal motion of plasma ions
is neglected in view of Eq. (1) and the first inequality of
Eq. (2). In the above expressions,
$\omega_{0\gamma}^2 = 4\pi N_\gamma e^2 / m_\gamma$. In the limiting case

$$v_{M\tau}^2 \gg v_{JB}^2 \qquad\qquad (4)$$

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where $v_{M\Gamma}^2 \simeq H_o^2/4\pi\rho N$, $v_{26}^2 \simeq (m/M)v_{T1}^2$, ρ is the plasma density and the angle α does not approach $\pi/2$, the solutions of Eq. (5) are

$$c^2 k_1^2 = \frac{\omega^2 - \Omega_H^2}{\omega^2 - \Omega_H^2 \cos^2\alpha} \cdot \frac{M}{m} \frac{c^2}{v_{T2}^2} \omega^2;$$

$$c^2 k_{2,3}^2 = \frac{\omega_{01}^2 \omega^2}{\Omega_H^2 - \omega^2} \frac{\Omega_H (1 + \cos^2\alpha) \pm \sqrt{\Omega_H^2 \sin^4\alpha + 4\omega^2\cos^2\alpha}}{2\Omega_H \cos^2\alpha}.$$

(5) .

If the opposite inequality to Eq. (4) applies, then:

$$c^2 k_1^2 = \frac{M}{m} \frac{c^2}{v_{T2}^2} \omega^2; \qquad c^2 k_{2,3}^2 = \frac{\omega_{01}^2 \omega^2}{\Omega_H(\Omega_H \cos\alpha \pm \omega)\cos\alpha}.$$

(6) .

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In the presence of the charged-particle beam, and when the
beam particle-density is much smaller than the plasma density,
one can use the wave increments (decrements) given by the
present author in Ref. 6 (ZhTF). In the case of instability
associated with Cherenkov radiation, the increment (decrement)
of the j-th wave is given by

$$\mu_j = \text{Im} \sqrt[3]{-1} \left\{ \frac{\omega^2 \omega_{04}^2 c^2 k_j^2 E}{a_1 \frac{\partial}{\partial \omega} (c^2 k_j^2) \prod_{1 < q+l < 3} (c^2 k_j^2 - c^2 k_q^2)} \right\}^{1/3}_{\omega - k v_0} \tag{8}$$

where, subject to Eq. (1),

$$E = k^4 c^4 \cos^2 \alpha + \frac{\omega_{01}^2 \omega^2}{\omega^2 - \Omega_{II}^2} k^2 c^2 (1 + \cos^2 \alpha) - \frac{\omega_{01}^4 \omega^4}{\Omega_{II}^2 (\omega^2 - \Omega_{II}^2)} ; \tag{9}$$

$$a_1 = - \frac{\omega_{01}^2 (\omega^2 - \Omega_{II}^2 \cos^2 \alpha)}{\omega^2 - \Omega_{II}^2} ,$$

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and $c^2 k_j^2$ are given by Eqs. (5) and (6). Eq. (8) applies when the effect of thermal motion in the plasma on the attenuation and the thermal motion in the beam can be neglected. If, however, thermal motion in the beam has a large effect on the stability, and the absorption in the plasma is appreciable, then the expression for the increment (decrement) is:

$$
\mu_j = - i c^2 k_j^2 \left[a_1 \frac{\partial \left(c^2 k_j^2 \right)}{\partial \omega} \prod_{1 \leqslant q \neq j \leqslant 3} \left(c^2 k_j^2 - c^2 k_q^2 \right) \right]^{-1} \left\{ F(\delta) + \sqrt{\frac{\pi}{2}} \left(\omega - k v_0 \right) P \right\}.
$$

(10)

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· where

$$P = \sum_{\tau=3}^{4} \frac{\omega_{0\tau}^2}{k v_{\tau\tau} \cos \alpha} \left[E \frac{\omega^2}{k^2 v_{\tau\tau}^2 \cos^2 \alpha} - D \frac{\omega}{\omega_{H\tau}} \operatorname{tg}\alpha + 2A \frac{k^2 v_{\tau\tau}^2}{\omega_{H\tau}^2} \sin^2 \alpha \right];$$

$$F(\ell) = \sqrt{\frac{\pi}{2}} \frac{\omega_{02}^2 \omega}{k v_{\tau2} \cos \alpha} \left\{ E \frac{\omega^2}{k^2 v_{\tau2}^2 \cos^2\alpha} \left[\left(\frac{MT_2^3}{mT_1^3}\right)^{1/2} e^{-\frac{1}{2}\left(\frac{\omega}{k v_{\tau1} \cos \alpha}\right)^2} + 1 \right] + \right.$$

$$\left. + D \frac{\omega}{\omega_{H\tau}} \operatorname{tg}\alpha \left[\left(\frac{M}{m} \frac{T_2}{T_1}\right)^{1/2} e^{-\frac{1}{2}\left(\frac{\omega}{k v_{\tau1} \cos \alpha}\right)^2} - 1 \right] \right\};$$

$$D = \omega_{01}^2 \frac{\omega}{\Omega_H} \frac{\sin 2\alpha}{\omega^2 - \Omega_H^2} \left(k^2 c^2 \Omega_H^2 - \frac{\omega^2 \omega_{01}^2}{\cos^2 \alpha} \right);$$

$$A = k^2 c^2 \left(\omega_{01}^2 \frac{\omega^2 - \Omega_H^2 \cos^2 \alpha}{\omega^2 - \Omega_H^2} - \frac{\omega_{02}^2 \omega^2}{k^2 v_{\tau2}^2} \right) + \frac{\omega_{01}^2 \omega^2}{\omega^2 - \Omega_H^2} \left(\omega_{01}^2 - \frac{\omega_{02}^2 \omega^2}{k^2 v_{\tau2}^2 \cos^2 \alpha} \right).$$

(11) .

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Acknowledgments are expressed to B.N. Gershman.
[Abstracter's note - this is a slightly abridged translation.]

There are 6 Soviet references.

ASSOCIATION: Nauchno-issledovatel'skiy radiofizicheskiy
               institut pri Gor'kovskom universitete
               (Scientific Research Radiophysics Institute of
               Gor'kiy University)

SUBMITTED: March 9, 1961

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E032/E114

24.6730

AUTHOR: Kovner, M.S.

TITLE: On one case of excitation of waves in a non-
            equilibrium magnetoactive plasma

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy,
            Radiofizika, v.4, no.6, 1961, 1035-1044

TEXT: The author derives the conditions under which waves
can be excited in an infinite uniform and magnetoactive plasma by
streams of charged particles when

$$v_{T1} \cos \alpha \ll \omega/k \ll v_{T2} \cos \alpha$$

where ω/k is the phase velocity of the waves, $v_{T\gamma}$ is the
average thermal velocity of the plasma particles $(\gamma = 1,2$
refers to ions and electrons respectively) and α is the angle
between the wave vector k and the constant external magnetic
field H_0. A discussion is also given of the instability
associated with the synchrotron radiation from a corpuscular
stream which is assumed to be uniform, unbounded and quasi neutral. X
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The stream density is assumed to be small and its average velocity v_c parallel to the magnetic field H_0. In the first part of the paper the author derives the dispersion relation using the results given in Ref.11 (M.S. Kovner, ZhTF, in press). Only non-relativistic streams are considered and therefore the analysis is confined to the case

$$n^2 \gg 1 \qquad (1.11)$$

The second section is concerned with the excitation of waves by a 'cold' stream (thermal motion of plasma ions and stream particles neglected). Using the results of Ref.11, expressions are derived for the increments (decrements) of the waves. The final section deals with the excitation of coherent synchrotron radiation in a plasma by a 'hot' stream, for which

$$\left| \omega - \underline{k}\underline{v}_0 + \left| \omega_{H\gamma} \right| \right| \ll kv_{T\gamma} \cos \alpha \qquad (3.1)$$

The paper is entirely theoretical. Acknowledgments are expressed to B.N. Gershman and V.V. Zheleznyakov for reading the manuscript and discussing the results.

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On one case of excitation of waves...

There are 1 figure and 12 Soviet-bloc references.

ASSOCIATION: Nauchno-issledovatel'skiy radiofizicheskiy institut
pri Gor'kovskom universitete
(Scientific Research Radiophysics Institute at
Gor'kiy University)

SUBMITTED: April 1, 1961

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S/056/61/040/002/024/047
B102/B201

/0. 7000

AUTHOR: Kovner, M. S.

TITLE: Instability of low-frequency electromagnetic waves in a
              plasma penetrated by a current of charged particles

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki,
              v. 40, no. 2, 1961, 527-536

TEXT: The interaction between charged-particle beam and plasma has been
often studied in the past, but mostly in the case of high-frequency
disturbances. The author restricts himself to low-frequency disturbances,
i.e., frequencies that are very small compared with the electron
gyrofrequency and comparable or small with respect to the gyrofrequency
or the plasma frequency of ions. Longitudinal and transverse low-
frequency waves may propagate in the direction of the constant magnetic
field H_0. The stability of low-frequency magnetohydrodynamic waves in

the presence of a quasineutral particle current has been studied by
V. P. Dokuchayev (Ref. 14: ZhETF, $\underline{39}$, 413, 1960) without taking thermal

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motion into account. The propagation of longitudinal waves is not affect-
ed by the magnetic field; their stability in a non-equilibrium plasma
has likewise been already studied. The present paper offers a kinetic
consideration of the stability of a charged particle beam and of plasma
with respect to low-frequency transverse disturbances. In addition,
some results are given concerning the stability of longitudinal waves,
that are not contained in Refs. 5 (ZhETF, $\underline{38}$, 850, 1960) and 12 (G. V.
Gordeyev, ZhETF, $\underline{27}$, 24, 1954). Plasma and particle beam are supposed
to be homogeneous, unbounded, and singly ionized. The particle current
is assumed to have its course along the field direction ($\vec{H}_o$), the
disturbances to be plane waves which likewise propagate along $\vec{H}_o$.

Section I gives a derivation of the general dispersion equations which
determine the propagation of the transverse and longitudinal waves;
the start is made from a system of linearized kinetic equations for the
plasma and the particle flux as well as from the electrodynamic self-
consistent field equations. From

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