AKHMANOV, S.A.; DMITRIYEV, V.G.

Parametric amplification of traveling waves with low-frequency pumping. Vest. Mosk. un. Ser. 3: Fiz., astron. 18 no.4:32-41 Jl-Ag '63. (MIRA 16:8)

1. Kafedra radiotekhniki Moskovskogo universiteta.
(Parametric amplifiers) (Traveling-wave tubes)

1.4752

S/057/63/033/001/011/017
B125/B186

9,2572

AUTHORS: Akhmanov, S. A., Gvozdover, S. D., Gorshkov, A. S., and Dmitriyev, V. G.

TITLE: The nonlinear effects and the parametric regeneration in the interaction of waves in wave guide systems with long electron currents

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 33, no. 1, 1963, 90 - 99

TEXT: Experiments were conducted in the centimeter and decimeter wave range of this wave guide system with freely drifting electron currents and an electron beam of a slow-down system. The effective parametric regeneration was studied over a wide range of signal-to-pump frequency ratios of traveling waves. Thereby, a great number of combination frequencies were observed, considerably influencing the non-linear and parametric processes. The accelerating potential of the drifting section has an important effect on the character of the space charge waves in the freely drifting electron current. The parametric regeneration is possible in a very wide frequency band and shows no qualitative difference for the

Card 1/2

The nonlinear effects ...

cases $f_{pump} > f_{sign}$ and $f_{pump} < f_{sign}$. Nonlinear effects such as parametric amplification for $f_{pump} > f_{sign}$ and $f_{pump} < f_{sign}$, suppression, cross modulation, clipping, etc., are possible in wave guide systems with long electron currents. A spectrum of Raman frequencies, particularly the sum and difference of f_{pump} and f_{sign}, occurs in spiral systems. The interaction of these two frequencies leads in the general case to the spectrum $f_{mn} = mf_{pump} + nf_{sign}$ of the Raman frequencies. Some of the nonlinear effects mentioned above follow from the dispersion properties of the system and the theory of interactions in nonlinear wave systems by taking into account numerous Raman frequencies. There are 9 figures.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet, Fizicheskiy fakul'tet (Moscow State University, Division of Physics)

SUBMITTED: December 3, 1961

Card 2/2

AKHMANOV, S.A.; KOVRIGIN, A.I.; KHOKHLOV, R.V.; CHUNAYEV, O.N.

Length of coherent interaction of light waves in a nonlinear medium. Zhur. eksp. i teor. fiz. 45 no.5:1336-1343 N '63. (MIRA 17:1)

1. Moskovskiy gosudarstvennyy universitet.

AKHMANOV, S.A.; KHOKHLOV, R.V.; KLIMONTOVICH, Yu.L., doktor fiz.-matem.nauk, otv. red.

[Problems in nonlinear optics; electromagnetic waves in nonlinear dispersive media, 1962-1963] Problemy nelineinoi optiki; elektromagnitnye volny v nelineinykh dispergiruiushchikh sredakh, 1962-1963. Moskva, In-t nauchn. informatsii, 1964. 294 p. (MIRA 17:11)

ACCESSION NR: AP4009991 S/0109/64/009/001/0174/0176

AUTHOR: Akmanov, A. G.; Akhmanov, S. A.; Yeshtokin, V. N.

TITLE: High-ratio microwave frequency divider

SOURCE: Radiotekhnika i elektronika, v. 9, no. 1, 1964, 174-176

TOPIC TAGS: frequency division, frequency divider, microwave frequency divider, high ratio frequency divider, parametric frequency divider

ABSTRACT: An experimental investigation of a two-circuit parametric frequency divider for the 3-cm wavelength band is reported. The divider operates as an oscillator that mutually synchronizes the oscillations. The coaxial 1,800-2,500-mc circuit is coupled to the 6,800-7,500 mc waveguide circuit by means of a nonlinear-capacitance germanium diode (see Enclosure 1). The 9,300-mc pumping power was fed to the 10x23-mm waveguide. At a power exceeding 10 or 15 mw, parametric oscillations were excited in the two circuits with frequencies

Card 1/2

ACCESSION NR: AP4009991

whose sum was equal to the pumping frequency. Division ratios of 4 and 5 were attained. The microwave divider differs from the same type of divider for lower frequencies in that the former employs a much stronger coupling between the two oscillatory circuits. "The authors are indebted to Yu. A. Kravtsov and V. N. Pary*gin for discussion." Orig. art. has: 2 figures and 2 formulas.

ASSOCIATION: none

SUBMITTED: 14Mar63 DATE ACQ: 10Feb64 ENCL: 01

SUB CODE: GE NO REF SOV: 009 OTHER: 001

Card 2/2

ACCESSION NR: AP4038640 S/0109/64/009/005/0814/0821

AUTHOR: Akhmanov, S. A.; Dmitriyev, V. G.; Modenov, V. P.

TITLE: Theory of frequency multiplication in nonlinear dispersive lines

SOURCE: Radiotekhnika i elektronika, v. 9, no. 5, 1964, 814-821

TOPIC TAGS: frequency multiplication, dispersive line, radio frequency multiplication, nonlinear optics

ABSTRACT: A theoretical investigation of the propagation of electromagnetic (radio and optical) waves in a nonlinear-reactance single-dimensional medium is reported; phase velocities of the fundamental wave and its second and third harmonics are regarded as nearly equal. The results may easily be extended over the case of a two-dimensional medium. The differential equations involved were numerically integrated on a "Strela" digital computer; the effects of the modulation factor, dispersion, and attenuation on the generation of harmonics

Card 1/2

ACCESSION NR: AP4038640

were explored. It is found that effective frequency doubling and tripling by a nonlinear dispersive line is practically possible; the tripling conversion factor may go as high as 65%. In nonlinear optics, the use of reflections is recommended to keep down the conversion-equipment size. Orig. art. has: 4 figures and 17 formulas.

ASSOCIATION: Moskovskiy gosudarstvenny*y universitet im. M. V. Lomonosova (Moscow State University)

SUBMITTED: 19Mar63 DATE ACQ: 05Jun64 ENCL: 00

SUB CODE: EC, DP NO REF SOV: 005 OTHER: 002

Card 2/2

L 13560-65 EEC-2/EWT(1)/EED-2/FCS(k) Pn-4 RAEM/a JM

ACCESSION NR: AP4048264 S/0141/64/007/004/0693/0700

AUTHORS: Akhmanov, S. A.; Komolov, V. P.; Chirkin, A. S.

SOURCE: IVUZ. Radiofizika, v. 7, no. 4, 1964, 693-700

TOPIC TAGS: quantizer, parametric oscillator, random phase spread, signal noise ratio

ABSTRACT: This is a continuation of earlier work by the authors

Card 1/4

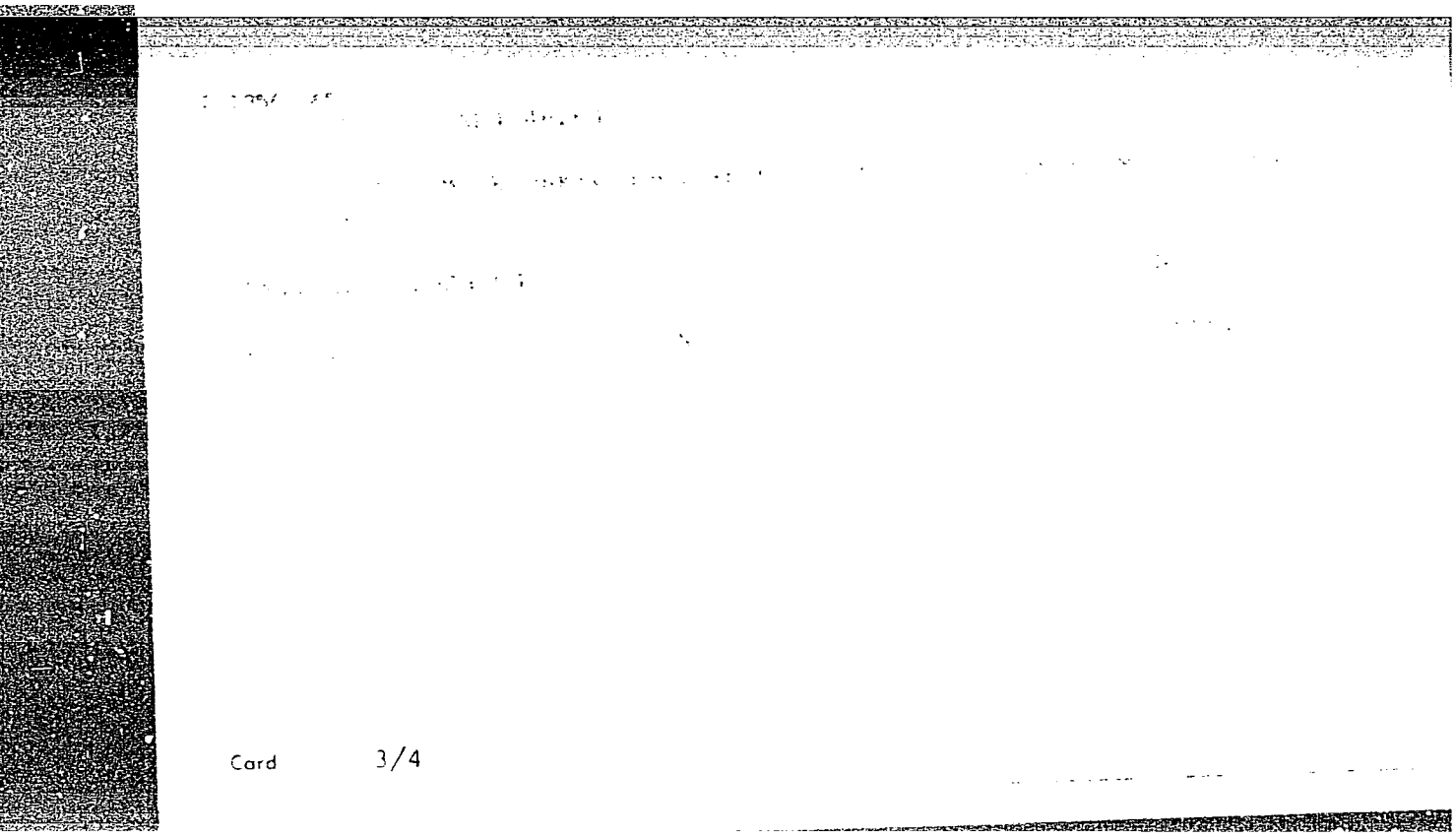
L 13560-65
ACCESSION NR: AP4049264

linearly on the

and a block diagram of the [illegible] the parametric oscillator

synchronous signal are described.

and negative pulses will be the same, the regular time dependence of the appearance of the bipolar pulses yields information concern-



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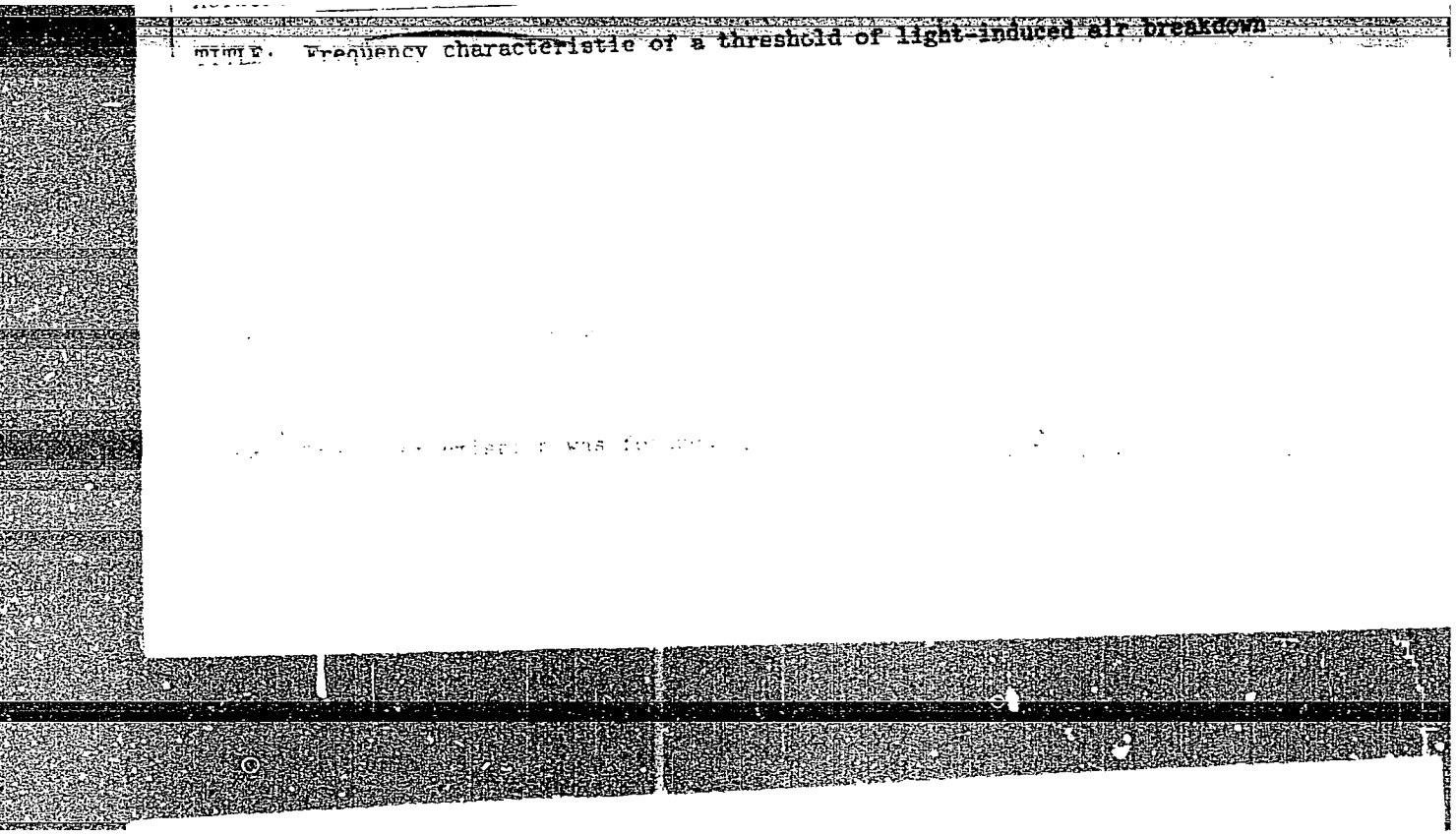
ACCESSION NR: AP4048264

ENCLOSURE: 01



L 53580-63 EWA(k)/FBD/EWG(j)/EWT(l)/EWT(m)/BDS/ES(w)-2 Pe-4/Pn-4/Po-4/Pf-4/Peb/P1-4/P1-4 S/195/

TITLE: Amplification of [illegible] Pis'ma v redaktsiyu.

[illegible] benzene. The cuvette was placed inside the [illegible] ruby laser. Resonator mirrors 1 and 2 were ~99% reflective at wavelengths from [illegible] beam reflected by mirror [illegible] contains the Stokes and Rayleigh [illegible]

Card 1/3

mirror 4 and the lower portion of A [through benzene], the [illegible]
[illegible] part of the spectrograph slit. Thus, the light beam is split into two

[illegible] increase in the pumping [illegible] experiment
[illegible] possibility of a coherent light [illegible]

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

Card 3/3

L 2123-66 EWT(1) IJP(c) WW/GG UR/0386/65/002/004/0171/0175

ACCESSION NR: AP5025255

AUTHOR: Akhmanov, S. A.; Klyshko, D. N.

TITLE: Three-photon molecular scattering of light

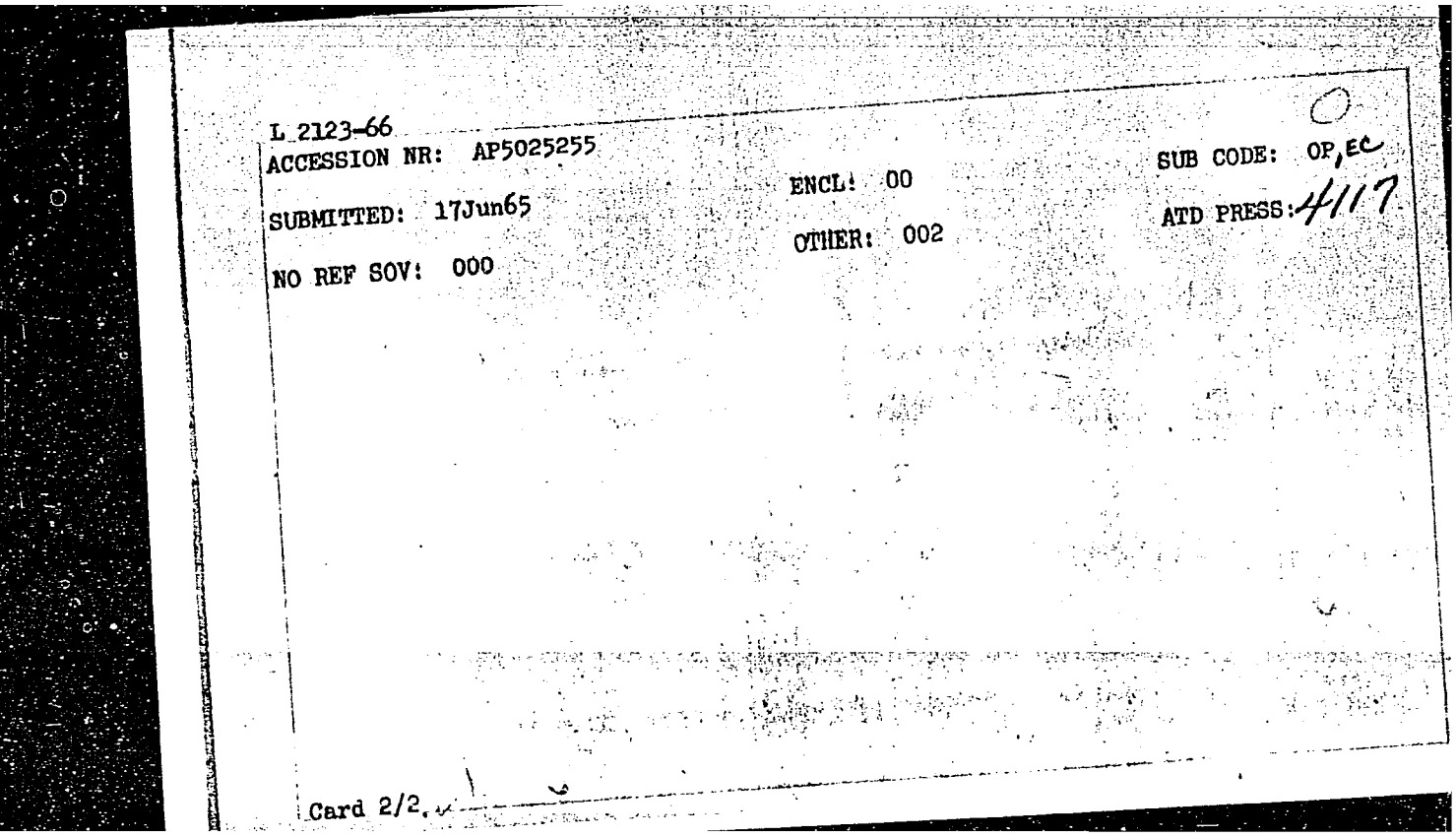
SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 2, no. 4, 1965, 171-175

TOPIC TAGS: Raman scattering, Rayleigh scattering, stimulated emission, nonlinear optics, multiphoton scattering, coherent light

ABSTRACT: The perturbation theory is used in calculating the three-photon Rayleigh and Raman scattering cross sections in gases and liquids. The analysis shows that three-photon scattering cross sections can be associated with two-photon cross sections, experimental data on which are available for many materials. According to numerical calculations, three-photon scattering can be observed in gases and liquids. It is established that three-photon Raman scattering can take place in molecules with a center of inversion. The active vibrations will be the same as those in infrared absorption. Orig. art. has: 2 figures and 3 formulas. [CS]

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

Card 1/2



L 2123-66
ACCESSION NR: AP5025255
SUBMITTED: 17Jun65
NO REF SOV: 000
ENCL: 00
OTHER: 002
SUB CODE: OP, EC
ATD PRESS: 4117
Card 2/2.

AKHMANOV, S.A.; CHIRKIN, A.S.

Detection of the phase fluctuations of multiple-mode generators in a nonlinear medium. Izv.vys.ucheb.zav.; radiofiz. 8 no.3:569-578 '65. (MIRA 18:8)

1. Moskovskiy gosudarstvennyy universitet.

L 41592-65 EWT(1)/EEC(k)-2 IJP(c)
ACCESSION NR: AP5010096 UR/0109/65/010/004/0649/0657

AUTHOR: Akhmanov, S. A.; Dmitriyev, V. G.; Kodenov, I. F.

TITLE: Theory of frequency multiplication in a resonator cavity filled with a nonlinear medium

SOURCE: Radiotekhnika i elektronika, v. 10, no. 4, 1965, 649-657

TOPIC TAGS: nonlinear optics, frequency multiplication, second harmonic, harmonic generation, Fabry Perot interferometer, nonlinear dispersive medium

ABSTRACT: A theoretical analysis is made of harmonic generation in a one-dimensional Fabry-Perot interferometer with a nonlinear dispersive material. If the duration of the intense pulse of nonlinear optics is of the order of the time required to establish steady-state operation, both stationary and transient regimes are considered. The analysis is based on the solution of a succession of boundary-value problems where the boundary conditions are taken according to the results of the previous boundary-value problem and the properties of the reflecting surfaces. The study of the dependence of the amplitudes of the propagated waves is thus replaced by the study of the spatial distribution along the axis of the cavity. It is shown that for a nonlinear cavity resonator the efficiency of second harmonic generation is determined mainly by the nonlinear-

Card 1/3

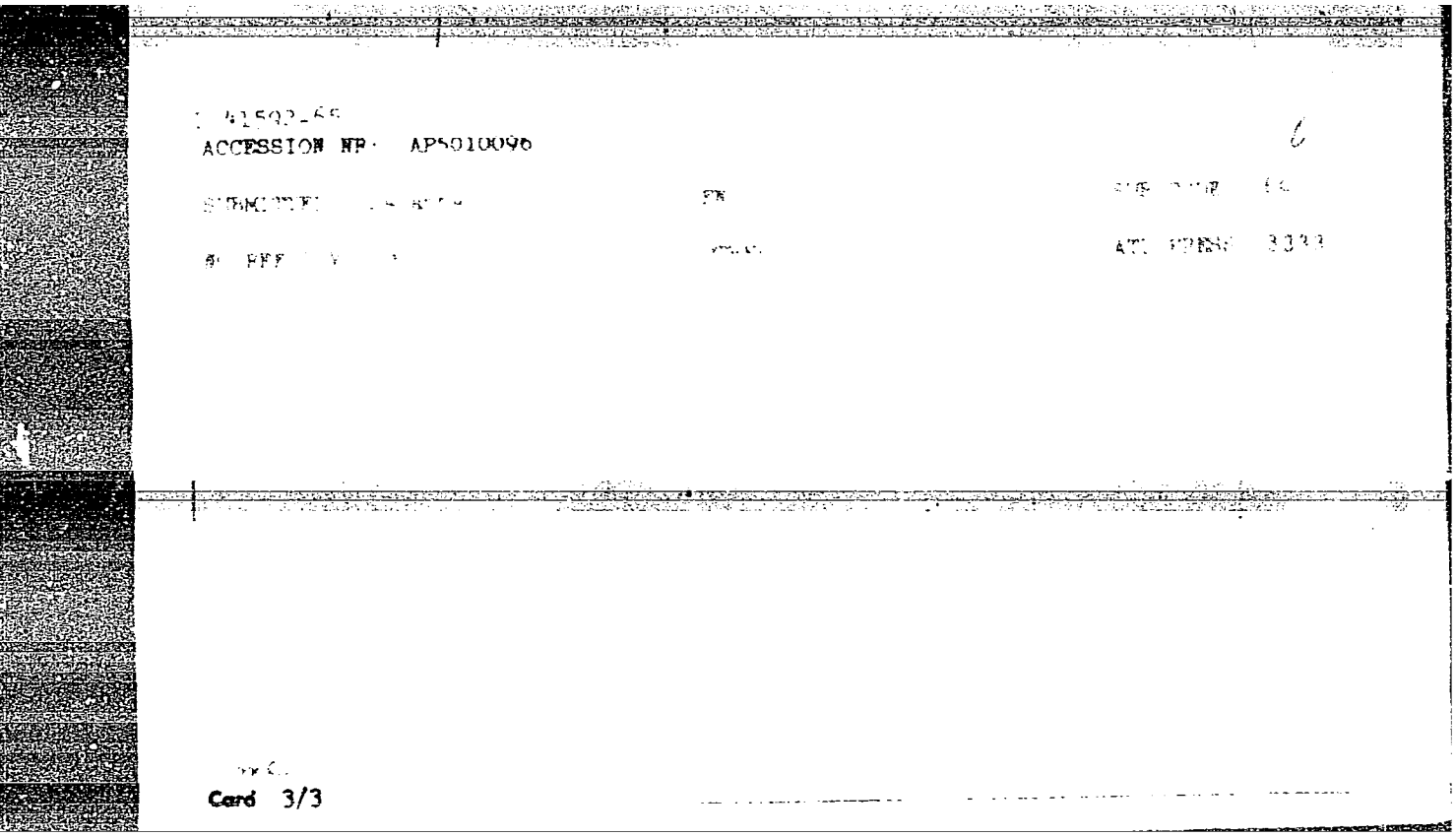
L 41592-65

ACCESSION NR: AP5010096

tion coefficient of the nonlinear medium. 2) the Q-factor, which depends on the number of reflections and the coupling between the [illegible] and the load, 3) losses in the medium, and 4) the amount of deviation from the direction of propagation from that of the matching indices. It is pointed out that use of a cavity resonator is justified when the coefficient of modulation and the losses are small (i.e., about 10^{-2}—10^{-1} and 1—3% per cm of length, respectively). When these values are larger the same effects can be obtained without a cavity resonator. In some cases, when the losses are of the order of 10% per cm the use of a resonator will actually lower the efficiency of second harmonic generation. When wave propagation is not in the direction of matching indices the steady state mode of operation is reached through a transient regime of the oscillatory type. In such a case the angular distribution of the second harmonic intensity [illegible] narrower than that which is attained from a traveling-wave frequency multiplier. It is noted that the results obtained can be extended to the case of a [illegible] cavity resonator. Orig. art. has: 24 formulas and 6 figures. [JS]

ASSOCIATION: Vysshcheskiy fakul'tet Moskovskogo ordena Lenina gosudarstvennogo universiteta im. M. V. Lomonosova (Physics Faculty, Moscow State University)

Card 2/3



ACCESSION NR: AP5010096

Card 3/3

[illegible] A. [illegible] Kovrigin, A. I. [illegible] Yelakova, N. K. [illegible] Romanyuk, [illegible] M. [illegible] Yher [illegible]

oscillation of molecules of the scattering [illegible] is proportional to $\beta_{ci} E_0^2 \geq \delta_{ci}$, where E_0 is the field intensity of the incident wave, (frequency ω_0), β_{ci} is a value determined by the polarization of the [illegible] of the scattering medium at frequency $\omega_i = \Omega = \omega_{ci}$ (Ω is the

value of the [illegible]. The second [illegible]
of ruby laser ($\lambda_0 \approx 0.69\mu$). The investigations showed
laser ($\lambda_0 = 0.53\ \mu$) was used to excite SRS. The investigations showed
a substantial decrease in SRS threshold in comparison to corresponding
[illegible] decrease in SRS threshold was approximately half that at
[illegible] 0.7μ. In benzene [illegible] conditions, [illegible]
$\lambda_0 \approx 0,7\mu$ under the same [illegible] relations [illegible]
the result of the fact that 1) with the [illegible] of the focal spot of
[illegible] increases or 2) the diameter of the focal spot [illegible] smaller than

and 2 tables.

L 4212-66 EWT(1)

ACCESSION NR: AP5025161 UR/0188/65/000/005/0078/0088
621.371

AUTHOR: Akhmanov, S. A.; Chirkin, A. S.

TITLE: Line spectrum transformation in media with quadratic nonlinearity

SOURCE: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 5, 1965, 78-88

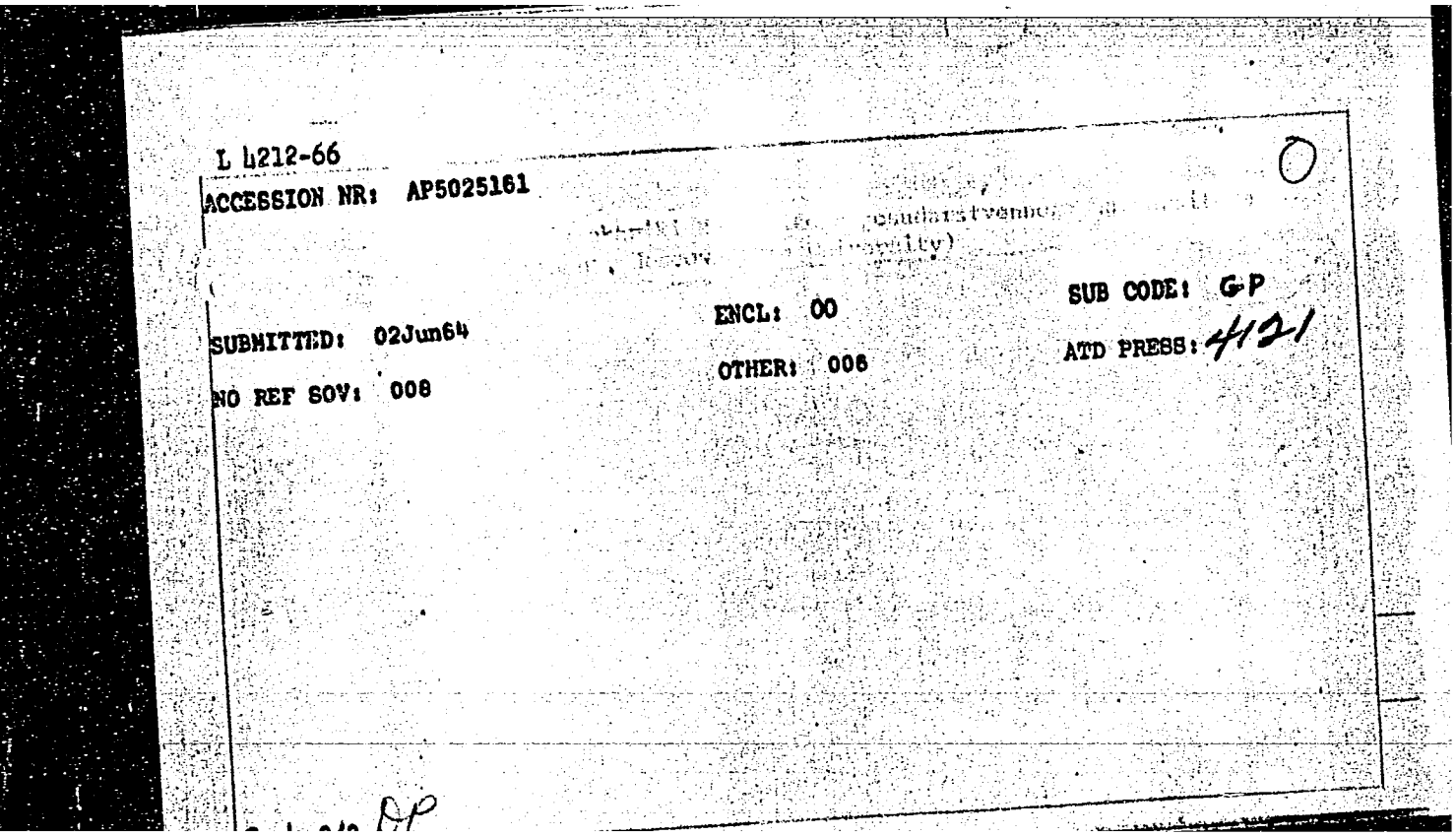
TOPIC TAGS: electromagnetic wave phenomenon, electromagnetic wave scattering, harmonic oscillation, anisotropic medium, line spectrum, frequency conversion

ABSTRACT: The paper gives the results of a theoretical analysis of frequency conversion in a line spectrum with width $\Omega\Delta = N \cdot \Delta\omega$ which is grouped close to the frequency $\omega_0 (\Delta\omega/\omega_0 << 1)$ in a medium with quadratic polarizability. Particular attention is given to the effect which phase distribution in the fundamental grouped near the frequency $2\omega_0$ has on the radiative power of the second harmonic. Calculations are made both for regions of low conversion efficiency and for conditions in which the power of the fundamental radiation and the second harmonic are comparable. A system of equations is derived for the amplitudes and phases of electromagnetic waves propagated in a weakly nonlinear anisotropic nondissipative dispersing medium. All the

Card 1/2

equations in this system are interdependent. Numerical integration must be used for solving even the simplest case where there are only two modes. However, some simplifying assumptions make it possible to obtain approximate solutions which can be used for analyzing fluctuations in the harmonic wave and for a qualitative evaluation of these fluctuations as a function of distance from the boundary in a nonlinear medium. Expressions are derived for the average power and dispersion of the harmonic. The most important result of the calculations is an analysis of nonhomogeneous dispersion of power fluctuations in the second harmonic which are caused by fluctuation phase scattering in the fundamental radiation. The results are true for any number of modes of the fundamental radiation. The behavior of nonhomogeneous dispersion in nonlinear processes of higher order should be similar: as the distance from the boundary of the medium $l \to \infty$, the fluctuations in boundary conditions disappear and a statistical relationship is established between the phases of the interacting waves. The calculations in the paper are limited to the quasi-static approximation which is most important for practical purposes. This approximation is true only when the difference in group lags for the interacting waves in the $N\Delta\omega$ band can be disregarded. Otherwise an individual analysis is generally required. The results may also be used for analyzing time (spectral) characteristics of fluctuations in the power of the harmonic. Orig. art. has: 3 figures and 46 formulas. [14]

ASSOCIATION: Kafedra radiotekhniki Moskovskogo gosudarstvennogo universiteta (Radio Engineering Department, Moscow State University)



L 4212-66

ACCESSION NR: AP5025161

SUBMITTED: 02Jun64 ENCL: 00 SUB CODE: GP

NO REF SOV: 008 OTHER: 006 ATD PRESS: 4121

ACCESSION NR: AP5016544

AUTHOR: Akhmanov, S. A.; Kovrigin, A. I.; [illegible]

TITLE: Effect of the finite aperture [illegible]

SOURCE: Zhurnal eksperimental'noy [illegible]

1545-1553

[illegible] nonlinear optics, harmonic [illegible]

Card [illegible]

L 31998-65
ACCESSION NR: AP5016544

of crystal anisotropy can be used for modulation of harmonic emission; 2) aperture effects play a decisive role in the process of second harmonic generation near [illegible] direction; 3) the number of dark and [illegible]

Card 2/2

EWT(1)/EWA(h)

ACC NR: AP5026099

SOURCE CODE: UR/0386/65/002/005/0223/0227

AUTHOR: Akhmanov, S. A.; Kovrigin, A. I.; Piskarskas, A. S.; Khokhlov, R. V.

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosudarstvennyy universitet)

TITLE: Generation of ultraviolet radiation by using cascade frequency conversion

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 2, no. 5, 1965, 223-227

TOPIC TAGS: nonlinear optics, laser, frequency conversion, harmonic generation, second harmonic, UV radiation, crystal, Raman scattering

ABSTRACT: Experiments are described in which coherent monochromatic radiation was generated in the frequency range between 0.53 and 0.26 μ. The power output of the ultraviolet radiation attained by cascade frequency conversion of the unfocused radiation in two successive KDP or ADP crystals was not less than 3 Mw. The experimental arrangement used is shown in Fig. 1. A beam from a Q-switched neodymium laser ($\lambda_1 = 1.06$ μ) with a power output P_1 was incident on a 3-cm-long KDP crystal. The power of the second harmonic ($\lambda_2 = 0.53$ μ) P_2 from the first KDP crystal was sufficient to produce the fourth harmonic ($\lambda_4 = 0.26$ μ) by doubling the frequency of the second harmonic, or the third harmonic ($\lambda_3 = 0.35$ μ) by mixing the fundamental and the second harmonic in the second KDP crystal. A whole series of discrete spec-

Card 1/3

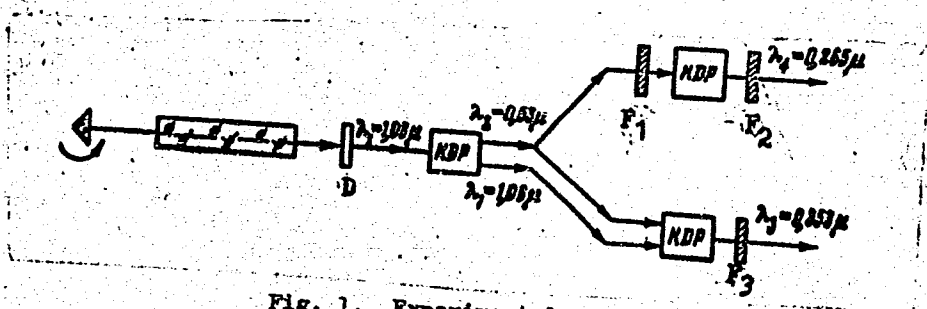


Fig. 1. Experimental setup

D - Discriminator; F_1, F_2, F_3 - filters.

tral lines was also generated by stimulated Raman scattering of the fundamental or the second harmonic. The line intensity of stimulated Raman scattering was 5—10% of the intensity of the fundamental radiation. The efficiency of the frequency

Table 1.

	P_1	P_3	P_4	θ_0*	Interaction employed
Fourth harmonic generation	150 MW/cm²	-	3 MW/cm²	77°	$\gamma_o(2\omega) + \gamma_o(2\omega) \rightarrow \gamma_e(4\omega)$
Third harmonic generation	150 MW/cm²	8 MW/cm²	-	49°	$\gamma_o(\omega) + \gamma_o(2\omega) \rightarrow \gamma_e(3\omega)$
				58°	$\gamma_e(\omega) + \gamma_o(2\omega) \rightarrow \gamma_e(3\omega)$

*θ_0 is the angle between the optical axis and the index matching direction for the interactions listed in the last column.

doubling P_2/P_1 was about 30—35% and that of the P_4/P_2, 10%. Some of the important results are summarized in Table 1. Orig. art. has: 1 figure and 1 table. [CS]

SUB CODE: 20/ SUBM DATE: 08Jul65/ ORIG REF: 004/ OTH REF: 004/ ATD PRESS: 4449

Card 3/3

L 7690-66 EWA(k)/FBD/EWT(1)/EEC(k)-2/T/EWP(k)/EWA(m)-2/EWA(h) SCTB/IJP(c) WG

ACC NR: AP5027987 SOURCE CODE: UR/0386/65/002/007/0300/0305

AUTHOR: Akhmanov, S. A.; Kovrigin, A. I.; Piskarskas, A. S.; Fadeyev, V. V.; Khokhlov, R. V.

ORG: Physics Faculty of the Moscow State University (Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta)

TITLE: Observation of parametric amplification in the optical range

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. (Prilozheniye), v. 2, no. 7, 1965, 300-305

TOPIC TAGS: parametric amplifier, laser, laser amplifier, optical pumping

ABSTRACT: The authors report the results of an experiment in which they observed parametric amplification of an optical signal with wavelength $\lambda_s = 1.06\ \mu$ by its second harmonic at $\lambda_p = 0.53\ \mu$. The feasibility of such an effect in the optical band and its theory were detailed earlier (ZhETF v. 43, 351, 1962). The experimental setup is shown in Fig. 1. A beam from a neodymium-glass laser was fed into a KDP frequency modulator producing the second harmonic (KDP-I crystal $\ell = 3$ cm long), and served simultaneously as the signal beam. At the output of the frequency modulator, the power ratio of the second harmonic (P_2) to the radiation at the fundamental frequency (P_1) was $P_2/P_1 = 0.2$--0.3. After passing through the filter system F_1, this ratio became equal to $P_2/P_1 = 10^4$--10^5. Thus, the second, amplifying KDP crystal was

Card 1/3

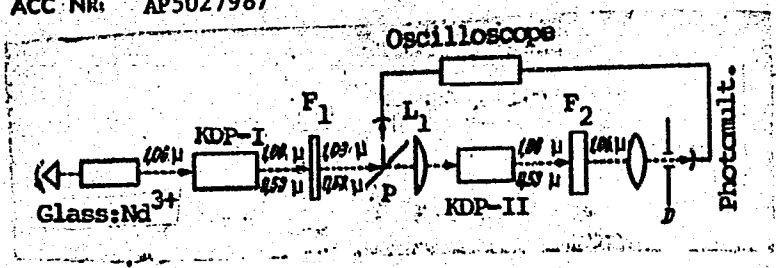


Fig. 1. Block diagram of experimental setup; F_1 - filter, F_2 - infrared filter, D - diaphragm, L_1 - cylindrical lens, P - plane-parallel plate.

fed a weak signal beam (λ_s = 1.06 μ) and a powerful pump wave (λ_p = 0.53 μ). The pump was focused on crystal KDP-II (ℓ = 3 cm) with the aid of a cylindrical lens L_1 (focal distance 13 cm) so that the pump power density in the second crystal reached $S_2 \approx 100$ MW/cm^2. A two-channel photoelectric circuit or photographic film was used to register the change in the signal intensity in the KDP-II crystal. The curves show that appreciable parametric amplification takes place only in a relatively narrow angle between the amplified signal and the index matching direction, Q ≈ 10'. The maximum gain corresponded to the index matching direction, but fluctuated from flash to flash; the average experimental gain was ≈2.5, compared with a theoretical value of 14. The appreciable fluctuations of the parametric amplification from pulse to pulse and the small average gain (compared with the theoretical) may be due to singularities of the parametric interaction in the degenerate mode. The authors deem the gain attained by them sufficient for the realization of a parametric light

L 7690-66

ACC NR: AP5027987

generator in which continuous tuning of the frequency of coherent optical oscillations is possible. The authors are grateful to V. G. Dmitriyev for useful discussions. [02]
Orig. art. has: 2 figures and 2 formulas.

SUB CODE: OP, EC/ SUBM DATE: 23Jul65/ ORIG REF: 002/ OTH REF: 004/ ATD PRESS: 4143

Card 3/3

L 12816-66 FBD/EWT(1)/EWP(e)/EEC(k)-2/T/EWP(k)/EWA(m)-2/EWA(h) SCTB/IJP(c)

ACC NR: AP6001771 WG/WW/GG/WH SOURCE CODE: UR/0386/65/002/010/0458/0463

AUTHOR: Akhmanov, S. A; Yershov, A. G.; Fadeyev, V. V.; Khokhlov, R. V.; Chunayev, O. N.; Shvom, Ye. M.

ORG: Physics Department of the Moscow State University (Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta)

TITLE: Observation of two-dimensional parametric interaction of light waves

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 2, no. 10, 1965, 458-463

TOPIC TAGS: ruby laser, laser modulation, parametric amplifier, laser emission coherence

ABSTRACT: The authors report the results of an experiment in which two-dimensional parametric interaction was realized in the optical band, using a ADP nonlinear crystal. The pump was the second harmonic of ruby laser emission ($\lambda_p = 0.3471\ \mu$), and the signal was the laser emission itself ($\lambda_s = 0.6943\ \mu$). A degenerate interaction mode was thus realized ($\omega_s = \omega_1 = \omega_2 = \omega_p/2$). The two-dimensional interaction of the signal wave with the pump in the ADP crystal gave rise to still another wave at frequency ω_{sup} (the supplementary wave), the wave vector of which $\vec{k}_{sup}$ had a direction determined by the relation $\vec{k}_1 + \vec{k}_2 = \vec{k}_p$ and by the dispersion characteristics of the crystal. The tuning curves of the parametric amplifier are presented and expressions for the signal and supplementary power are derived. It is noted that whereas the process of degenerate parametric amplification in one-dimensional interaction is de-

Card 1/2

ACC NR: AP6001771

termined essentially by the phase shift between the pump and the signal, the phase dependence disappears for the two-dimensional degenerate interaction. A block diagram of the experimental setup is shown in Fig. 1. The Q-switched ruby laser excites an optical frequency doubler (with a KDP crystal 2 cm long) and is simultaneously the generator of the amplified signal. The unfocused pump and signal waves interact in the ADP crystal (3 cm long); the way the two-dimensional interaction is realized is clear from the figure. The experiment yielded $P_{sup}/P_s(0) = 0.02$ and $P_s/P_s(0) = 0.8$, as against the theoretical $P_{sup}/P_s(0) = 0.2$ and $P_s/P_s(0) = 1.0$. The angular aperture of the two-dimensional parametric interaction exceeds the corresponding value for the one-dimensional amplification, and is equal to the angular aperture of the pump beam. In the experiment the divergence of the pump was 2', equal to the divergence of the supplementary wave. The theoretical value of the capture angle calculated for the conditions of the experiment is 10". Authors thank V. G. Dmitriyev, with whom the theoretical research was carried out, G. V. Venkin for help in the experiment, and V. V. Yurlov for the KDP and ADP crystals. Orig. art. has: 3 figures and 4 formulas. [02]

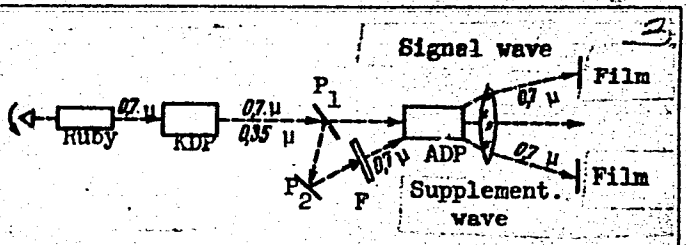


Fig. 1. Block diagram of experimental setup. P_1 and P_2 - plane-parallel plates, F - filter absorbing the pump radiation ($\lambda_p = 0.3471$ μ).

SUB CODE: 20/ SUBM DATE: 23Jul65/ ORIG REF: 002/ OTH REF: 007/ ATD PRESS 4183

L 6354-66 EWT(1)/EWA(h)

ACC NR: AP5020370 SOURCE CODE: UR/0141/65/008/003/0569/0578

AUTHOR: Akhmanov, S. A.; Chirkin, A. S.

ORG: Moscow State University (Moskovskiy gocydarstvennyy universitet)

TITLE: On detecting phase fluctuations in multiple mode generators operating in a nonlinear medium

SOURCE: IVUZ. Radiofizika, v. 8, no. 3, 1965, 569-578

TOPIC TAGS: phase measurement, phase shift analysis, harmonic oscillation, frequency discriminator

ABSTRACT: Fluctuation phenomena in multiple mode generators are discussed. The analysis covers the spectrum of second harmonic power fluctuations and the difference frequencies of the power fluctuation spectrum. The results show that nonlinear transformations can be used to discriminate between the uncorrelated phase fluctuations of different modes. In this case the envelope of the spectrum associated with phase fluctuations has a form which corresponds to the component of the mode spectral line. It is shown that the discrimination coefficient is inversely proportional to the width of the line so the proposed method is most convenient for narrow lines. It is also convenient for recording the phase fluctuations of continuous gas and semiconductor generators. The power values achieved for optical harmonics may be increas-

UDC: 53 : 519.25

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L 6354-66

ACC NR: AP5020370

ed substantially due to the large choerent lengths and the high power of basic radiation. A slightly modified form of the method may be used to investigate phase fluctuations in an integrated solid state generator. In this case when the pulse duration is greater than the correlation time for the phase fluctuations, the pulse shape of the second harmonic or of the difference frequency will be determined not only by the amplitudes, but also by the phases of the principal mode. The equations which have been derived may be useful in cases when the spectrum of the multiple mode generator is investigated by measuring the width of the beat spectrum between modes. "The authors thank I. L. Bershteyn who became thoroughly familiar with the manuscript and whose remarks were considered in the preparation of the final draft." Orig. art. has: 34 formulas, 2 figures.

SUB CODE: OP,EC/ SUBM DATE: 06Jul64/ ORIG REF: 009/ OTH REF: 011

Card 2/2 fds

L 10240-66 EWT(1)/EWA(h)

ACC NR: AP6000560 SOURCE CODE: UR/0109/65/010/012/2157/2166

21
26
B

AUTHOR: Akhmanov, S. A.; Dmitriyev, V. G.; Modenov, V. P.; Fadeyev, V. V.

ORG: none

TITLE: Theory of parametric oscillation in a resonator filled with nonlinear medium

SOURCE: Radiotekhnika i elektronika, v. 10, no. 12, 1965, 2157-2166

TOPIC TAGS: cavity resonator, parametric oscillator 25

ABSTRACT: The process of parametric excitation of a single-dimensional Fabry-Perot resonator filled with nonmagnetic nonlinear dispersing medium is considered; the wavelength is a small fraction of the resonator linear dimensions. The excitation, transient, and stationary conditions are analyzed as well as the generation of subharmonics in a semi-infinite nonlinear medium. These resonator variants are considered: (a) the pumping wave passes the resonator freely while the subharmonic wave undergoes multiple reflections; (b) the reflected subharmonic wave passes outside the nonlinear medium; (c) a standing pumping wave is set up in the resonator. It is found that the oscillation threshold, the transient time, and the subharmonic-oscillator efficiency essentially depend on the following factors: (a)modulation factor of the medium parameters; (b) resonator Q-factor (loss in the medium and radiation from the mirrors); (c) difference in phase velocities of the interacting waves; (d) form of boundary conditions imposed on the mirrors. The resonator with a

UDC: 621.373.93:534.414.014.6

L 10240-66

ACC NR: AP6000560

standing pumping wave is better than other variants thanks to its shorter transient time. All variants have practically the same efficiency. The stationary-oscillation amplitude decreases with the increasing coupling factor which enhances self-excitation and cuts down transient time. When the pumping-wave phase velocity differs from that of the subharmonic, the self-excitation becomes difficult and oscillatory. The latter characteristic persists in the standing-pumping-wave resonator even under exact synchronous conditions. "The authors wish to thank R. V. Khokhlov for a useful discussion of the results." Orig. art. has: 6 figures and 28 formulas. [03]

SUB CODE: 09 / SUBM DATE: 18Jul64 / ORIG REF: 007 / OTH REF: 001 / ATD PRESS: 4/61

Card 2/2

AKANAYEV, B.A.; AKHMANOV, S.A.; KHOKHLOV, R.V.

Intensification of coherent radiation making use of the effect of induced Raman scattering. Pis'. v red. Zhur. eksper. i teoret. fiz. 1 no.4:4-9 My '65. (MIRA 18:11)

1. Moskovskiy gosudarstvennyy universitet imeni Lomonosova.
Submitted April 6, 1965.

L 35876-66 EWT(1)/EWP(e)/EWT(m)/T/EWP(j) IJP(c) RM/WH/WG

ACC NR: AP6023636 SOURCE CODE: UR/0386/66/004/001/0022/0026

AUTHOR: Akhmanov, S. A.; Venkin, G. V.; Zubov, B. V.; Khokhlov, R. V.

ORG: Physics Department of the Moscow State University im. M. V. Lomonosov (Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta)

TITLE: Generation of coherent radiation in the infrared band by nonlinear-optics methods

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 4, no. 1, 1966, 22-26

TOPIC TAGS: coherent light, ir radiation, ir source, laser application, electromagnetic mixing, semiconductor crystal, nonlinear effect

ABSTRACT: The authors report experimental results offering evidence that sufficiently intense sources of coherent infrared radiation, at least in the 2 - 5 μ range, can be produced by using the effect of optical mixing in nonlinear media. Radiation from a Q-switched ruby laser (6943 Å) was mixed with radiation of the first Stokes component of stimulated Raman scattering in cyclohexane (8657 Å) and n-heptane (8677 Å) in an $LiNbO_3$ crystal (Fig. 1). This produced at the output of the crystal radiation pulses with wavelengths 4.5 and 3.47 μ respectively, with power not less than 1 - 10 W. The use of the $LiNbO_3$ crystal as the mixer eliminated some of the difficulties hitherto encountered in this field. The conditions for synchronized mixing in a nonlinear crystal are derived and the angles between the beam direction and the crystal axis,

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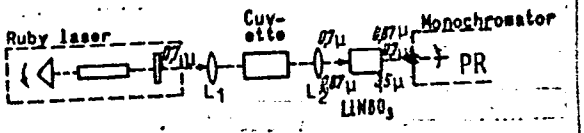

Fig. 1. Block diagram of experimental setup. L_1, L_2 - lenses (7 and 10 cm focal length), PR - photoresistor

required for the synchronization, are calculated. It is estimated that the potential output of such a setup is not less than 500 W once the adverse effect of the multi-domain structure of the $LiNbO_3$ crystal used in the experiment is eliminated. Better results can be expected by using for the mixed oscillations spectral lines obtained from a tunable parametric light generator, which would permit operation in the 100 - 150 cm^{-1} range. The authors thank A. S. Bebchuk and Yu. I. Solov'yeva for supplying the crystals, V. I. Pchelkin for help with the experiment, and A. G. Yershov and V. V. Fadeyev for a discussion. Orig. art. has: 3 figures and 4 formulas. [02]

SUB CODE: 20/ SUBM DATE: 03May66/ ORIG REF: 001/ OTH REF: 004/
ATD PRESS: 5037

L 38194-66 EWT(1)

ACC NR: AP6024890 SOURCE CODE: UR/0056/66/051/001/0296/0300

AUTHOR: Akhmanov, S. A.; Sukhorukov, A. P.; Khokhlov, R. V.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Development of an optical waveguide during propagation of light in a nonlinear medium

SOURCE: Zhurnal eksperimental'noy teoreticheskoy fiziki, v. 51, no. 1, 1966, 296-300

TOPIC TAGS: nonlinear optics, laser theory, self focusing, self trapping, electrostriction, Kerr effect, refractive index

ABSTRACT: The self-trapping of a laser pulse in a nonlinear medium was studied theoretically as a nonstationary problem. The effects associated with the finite duration of the laser pulse were analyzed in detail. The spatial and temporal development of an optical waveguide was considered as the quasi-optic approximation by taking the inertia of the nonlinear properties of the medium into account. The equations for the self-focusing rate, length, and efficiency were derived and discussed in terms of two possible mechanisms of self-trapping: quadratic Kerr effect and electrostriction. Orig. art. has: 12 formulas. [YK]

SUB CODE: 20/ SUBM DATE: 09Feb66/ ORIG REF: 007/ OTH REF: 003/ ATD PRESS: 5144

L 20731-66 EWA(h)/EEC(k)-2/EWP(k)/EWT(1)/FBD/T IJP(c) WG
ACC NR: AP6007230 SOURCE CODE: UR/0056/66/050/002/0474/0486

AUTHOR: Akhmanov, S. A.; Sukhorukov, A. P.; Khokhlov, R. V.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

49

B

TITLE: Theory of optical harmonic generation in converging beams

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 2, 1966, 474-486

TOPIC TAGS: laser, nonlinear optics, harmonic generation, second harmonic

ABSTRACT: A theory of nonlinear optical effects at the focus of a converging laser beam is developed by analyzing the evolution of the nonlinear effect in the whole region of the beam rather than the region near the focal plane. The analysis is based on the method of parabolic equations extended to the nonlinear problem, which makes it possible to take into account the diffraction effects. The parabolic equation, which is a solution of the equation for the wave propagation in a nonlinear medium, is then used for a detailed analysis of the second-harmonic generation by a weakly converging cylindrical wave in a medium with a quadratic dependence of polarization on the field intensity of the laser beam. The theoretical data on the intensity and spatial structure of the second harmonics are in good agreement with the available experimental data. It was established that from the energy point of view the optimal focusing is such that one of the semi-axes of the elliptical focal

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L 20731-66
ACC NR: AP6007230

spots of the beam is about equal to the length of the nonlinear sample. The method used can be extended to the analysis of other nonlinear effects, such as parametric amplification and stimulated scattering with the diffraction effects taken into account. Orig. art. has: 44 formulas and 3 figures. [CS]

SUB CODE: 20/ SUBM DATE: 25Aug65/ ORIG REF: 006/ OTH REF: 005/ ATD PRESS: 4223

Card 2/2

L 24203-66 FBD/EWT(1)/EEC(k)-2/T/EWP(k)/EWA(h) IJP(c) WG

ACC NR: AP6014614 SOURCE CODE: UR/0386/66/003/009/0372/0378

AUTHOR: Akhmanov, S. A.; Kovrigin, A. I.; Kolosov, V. A.; Piskarskas, A. S.; Fadeyev, V. V.; Khokhlov, R. V.

ORG: Physics Department of the Moscow State University (Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta)

TITLE: Tunable parametric light generator with KDP crystal

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 3, no. 9, 1966, 372-378

TOPIC TAGS: laser r and d, parametric converter, parametric amplifier, frequency controal

ABSTRACT: The authors present in this communication the results of an experimental investigation that has led to the construction of a continuously tunable parametric generator of coherent light waves in the region of $\lambda \approx 1\ \mu$, using a KDP crystal. Continuous tuning of the wavelength was effected mechanically in a band from 9575 to 11775 Å, and the oscillation power reached several kilowatts. The frequency is tuned by rotating a nonlinear crystal in an optical resonator (Fig. 1). Such a scheme has made it possible not only to construct a generator with larger bandwidth than hitherto, but also to attain better reproducibility of the generated frequencies. The pump produced coherent oscillations at 0.53 λ (second harmonic of laser with Nd^{3+}), the maximum pump power in the unfocused beam reached 30--35 Mw/cm^2, the pump pulse duration was 25 ± 10^{-9} sec, and the beam divergence was ~7'--8', with the

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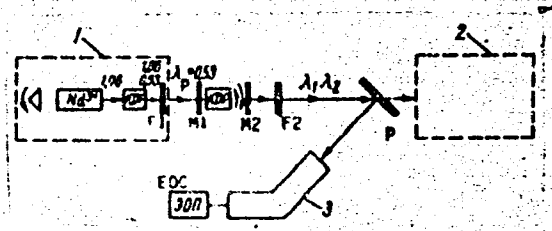

Fig. 1. Block diagram of the experimental setup: M_1, M_2 -- mirrors of parametric generator, F_1, F_2 -- filters, P -- plane-parallel plate, 1 -- pump generator, 2 -- meter, 3 -- spectrograph.

length of the KDP crystal 3 cm. The theory of the parametric generator is discussed in detail. Tests have shown the degenerate parametric oscillations ($\lambda_1 = \lambda_2 = 1.06$ μ) to occur at a pump power $P_p \geq 8$--10 Mw/cm^2 (inside the resonator). With increasing deviation from the degenerate mode, the threshold pump power increased. Self-escitation was manifested by the appearance of an intense signal which exceeded the indicator background by a factor of at least 10^5; the produced radiation had good directivity and its divergence angle did not exceed 1.5'. At $P_p \approx 30$--35 Mw/cm^2 the power of the parametric oscillations reached 5 kw. Tuning curves of the parametric light generator are presented and agree essentially with the presently accepted theory. The limiting tuning range is found to be determined only by the position of the absorption bands; estimates show that it should be not smaller than 4000 Å. The authors thank N. K. Podsot-skaya for help with the measurements and I. V. Nizhegorodova for help with the data reduction. Orig. art. has: 3 figures and 3 formulas. [02]

SUB CODE: 20/ SUBM DATE: 17Mar66/ ORIG REF: 006/ OTH REF: 006/ ATD PRESS: 4245

L 26244-66 EEC(k)-2/EWA(h)/EWP(k)/EWT(1)/EWT(m)/FBD/T/EWP(e) IJP(c) WG/WH

ACC NR: AP6014020 SOURCE CODE: UR/0056/66/050/004/0829/0843

55
52
B

AUTHOR: Akhmanov, S. A.; Kovrigin, A. I.; Chirkin, A. S.; Chunayev, O. N.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Statistical effects associated with the generation of optical harmonics

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 4, 1966, 829-843

TOPIC TAGS: laser, nonlinear optics, second harmonic, ruby laser

ABSTRACT: Results of an experimental and theoretical investigation of statistical effects appearing during generation of the second harmonic in optically transparent crystals are presented. It is established experimentally that under real conditions the correlation coefficient between the power of the second harmonic P_2 and the square of the power of the fundamental radiation emitted by a solid state laser, P_1, differs from unity and that the proportionality factor K in the equation, $P_2 = KP_1^2$, is a random quantity. In order to explain these effects in the approximation of the field of fundamental radiation, a theory of generation of optical harmonics in the field of randomly modulated waves is developed which takes into account spatial as well as temporal incoherence of the fundamental radiation. The spatial dimensions characterizing the generation of optical harmonics by a bound, randomly modulated beam in an anisotropic medium are determined. It was found that the main

2

Card 1/2

sources of excess fluctuations of the second harmonic power are fluctuations of mode phases, mode number, and angular divergence of the fundamental radiation, generation of the optical harmonics being attained by means of ruby or neodymium glass lasers. Experiments on the generation of optical harmonics and mixing of frequencies by means of non-laser light sources are briefly discussed. It is noted that in this case spatial incoherence effects are important. Orig. art. has: 2 figures, 3 tables, and 47 formulas. [CS]

SUB CODE: 20/ SUBM DATE: 15May65/ ORIG REF: 015/ OTH REF: 010/ ATD PRESS: 4244

L 30081-66 FBD/EWT(1)/EEC(k)-2/T/EWP(k) IJP(c) WG

ACC NR: AP6011485 SOURCE CODE: UR/0053/66/088/003/0 9/0460

AUTHOR: Akhmanov, S. A.; Khokhlov, R. V. 59 B

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosudarstvennyy universitet)

TITLE: Parametric amplifiers and generators of light

SOURCE: Uspekhi fizicheskikh nauk, v. 88, no. 3, 1966, 439-460

TOPIC TAGS: laser r and d, parametric amplifier, parametric converter, nonlinear effect, laser emission

ABSTRACT: This is a review article dealing with latest efforts at tending the tunable range of lasers and thereby exploit more fully the hitherto unrealized research opportunities afforded by the development of high-power coherent optic emission and its interaction with matter. The various research problems in which tunable lasers can be useful are briefly described and it is shown that an effective method for producing continuously tunable lasers is the use of parametric interaction between light waves in an optically transparent medium. The principles of the parametric amplifiers and optical generators developed to date are presented in detail, along with computer methods of determining the stationary

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L 30081-66
ACC NR: AP6011485

parametric light generator, and features of parametric amplification and generation of real beams. Parametric interaction and induced scattering are also briefly discussed. It is concluded from a review of the present state of the art that the principle of parametric amplification and generation in the optical band is perfectly feasible, and its further progress depends on the development of suitable nonlinear materials, resonator systems, and pump sources. Orig. art. has: 7 figures, 38 formulas, and 1 table.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 024/ OTH REF: 024

Card 2/2

L 31961-66 EWT(l) IJP(c) WW/GG

ACC NR: AP6020209 SOURCE CODE: UR/0056/66/050/006/1537/1549

AUTHOR: Akhmanov, S. A.; Sukhorukov, A. P.; Khokhlov, R. V.

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosudarstvennyy universitet)

TITLE: Self-focusing and self-trapping of intense beams of light in a nonlinear medium

SOURCE: Zh eksper i teor fiz, v. 50, no. 6, 1966, 1537-1549

TOPIC TAGS: nonlinear optics, self focusing, high power laser

ABSTRACT: A stationary theory of the self-trapping of finite beams in a nonlinear medium is developed in the quasi-optical approximation. The calculations are performed in the geometrical-optics approximation as well as in the approximation in which diffraction effects are taken into account. The conditions under which the medium exerts a focusing effect on the beam are elucidated. It is found that, generally speaking, the self-focusing takes place with aberration. It is shown that the saturation of the nonlinear refraction index plays an essential role in self-trapping. Conditions for self-trapping of two- and three-dimensional beams in a nonlinear medium are determined. The size of

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ACC NR: AP6020209

the focal spot is calculated for a beam self-trapped in a nonlinear medium. The significant effect of nonlinearity on the structure of the focal region is noted, especially for a cylindrical Gaussian beam. Self-focusing mechanisms achievable under experimental conditions are discussed. Orig. art. has: 4 figures and 54 formulas. [CS]

SUB CODE: 20/ SUBM DATE: 14Dec65/ ORIG REF: 015/ OTH REF: 004/
ATD PRESS: 5022

Card 2/2 LC

ACC NR: AP6036166 SOURCE CODE: UR/0188/66/000/005/0096/0105

AUTHOR: Akhmanov, S. A.; Komolov, V. P.

ORG: Department of Radio Engineering (Kafedra radiotekhniki)

TITLE: Statistical effects in the measurement of phases with the aid of systems with variable parameters

SOURCE: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 5, 1966, 96-105

TOPIC TAGS: signal detection, signal to noise ratio, digital system, parametric converter, phase modulation

ABSTRACT: A method is described for measuring the amplitude and phase of weak signals with known frequency at a signal/noise ratio $\ll 1$. A feature of the method is the use of digital techniques to accumulate the data and determining the signal parameters with a specified degree of reliability. A receiving unit effecting both amplification and binary quantization of the signal, built around a parametron connected in a balanced circuit, was used (Fig. 1). The presence of a signal was determined after a series of triggerings of the parametron by processing digital information whose complete accumulation cycle consisted of a number of triggering series. Results are presented in which signals of power as low as 10^{-16} watt were reliably registered after a time of ten seconds. At a signal/noise ratio $\sim 10^{-2}$, the phase of the signal was determined accurate to 0.5° (confidence level 0.99) after ten seconds. The method

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ACC NR: AP6036166

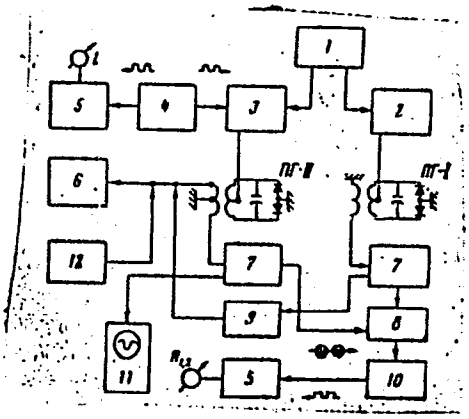

Fig. 1. Block diagram of setup (without power supply): 1 - Pump generator, 2 - pump amplifier, 3 - pump amplifier-modulator, 4 - triggering pulse generator, 5 - pulse counter, 6 - microvolt meter, 7 - buffer stage, 8 - phase detector, 9 - phase shifter, 10 - amplifier-limiter, 11 - oscilloscope, 12 - Gaussian-noise generator, PG - parametric generator.

can also be used to observe slight phase modulation of a signal. The results are compared with those obtained by other methods. It is concluded that the phase measurement method is more suitable at high frequencies, especially at radio and microwave frequencies. Orig. art. has: 7 figures and 11 formulas.

SUB CODE: 09/ SUBM DATE: 27May65/ ORIG REF: 010/ OTH REF: 001

Card 2/2

L 8202-66 JXT(C2)

ACC NR: AT5022299 SOURCE CODE: UR/3136/64/000/620/0001/0011

AUTHOR: Gurevich, I. I.; Makar'ina, L. A.; Nikol'skiy, B. A.; Sokolov, B. V.; Surkova, L. V.; Khakimov, S. Kh.; Shestakov, V. D.; Dobretsov, Yu. P.; Akhmanov, V. V.

ORG: [Gurevich, Makar'ina, Nikol'skiy, Sokolov, Surkova, Khakimov, Shestakov] IAE; [Dobretsov] MIFI; [Akhmanov] LYaP OIYaI

TITLE: Asymmetry of the angular distribution of electrons in the decay $\pi^+ \to \mu^+ \to e^+$ in a magnetic field of 140,000 gauss

SOURCE: Moscow. Institut atomnoy energii. Doklady, IAE-620, 1964. Asimmetriya uglovogo raspredeleniya elektronov pi plus → mu plus → e plus raspada v magnitnom pole napryazhennost'yu 140 000 gauss, 1-11

TOPIC TAGS: mu meson, pi meson, positron, bubble chamber, radioactive decay

ABSTRACT: The universal V-A coupling theory applied to the determination of the angular distribution of electrons in the reaction $\pi^+ \to \mu^+ \to e^+$ is given by

$$\frac{dN}{d\theta} \sim 1 - a \cos \theta_e$$

in terms of the parameter a. In order to obtain a value of a which depends on the polarization state of the meson, an experiment was performed showing the effect countering the depolarization of the dense medium through which the meson is moving.

Card 1/2

L 8202-66
ACC NR: AT5022299

Critical magnetic fields needed to oppose the depolarizing effect, which in turn allows more accurate determination of the parameter α, were found. Only 8800 gauss were required in the hydrogen bubble chamber to counter the effect of hydrogen depolarization. However, the scatter in the value is quite large. The photographic emulsion yielded much smaller scatter but required an application of a very large magnetic field of 140,000 gauss. The value of α found in the experiment is 0.325 ± .010 (as compared to the theoretical value of 0.333). This value was obtained by analyzing over 66,000 events. A brief discussion is given of the effect of the magnetic field on the motion of the electron. It is shown that the electron direction must be measured with respect to the magnetic field direction after setting certain constraints on the selection of the angular range. Orig. art. has: 3 figures, 1 table, 5 formulas.

SUB CODE: 18/ SUBM DATE: 00/ ORIG REF: 005/ OTH REF: 007

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Card 2/2

L 2535-66 EWT(m)/EWA(d)/EWP(t)/EWP(z)/EWP(b) JD

ACCESSION NR: AP5021359 UR/0120/65/000/004/0182/0187
621.318.3:621.384.634

AUTHOR: Akhmanov, V. V.; Barkov, L. M.; Nikol'skiy, B. A.; Sokolov, B. V.; Khakimov, S. Kh.; Shestakov, V. D.; Bobovikov, R. S.; Dobretsov, Yu. P.; Zamolodchikov, B. I. 50 30 B

TITLE: An arrangement for producing pulsed magnetic fields of strengths up to 150 kilogauss

SOURCE: Pribory i tekhnika eksperimenta, no. 4, 1965, 182-187

TOPIC TAGS: pulsed magnetic field, thyratron, synchrocyclotron

ABSTRACT: The units of an apparatus for producing a pulsed magnetic field of 146 kilogauss in a space of about 600 cm^3 are described. Pulsed magnets of beryllium bronze are powered by a capacitor bank of 0.1 farad capacitance. The capacitors are charged through limit resistances to 2 kv from a thyratron rectifier, and a I-100/5 ignitron is used as the switching element. Synchronization and control for operation with a synchrocyclotron are obtained by a special circuit. This arrangement for obtaining the pulsed field operates reliably. In the tests two separate magnets were used, each producing a field of 146 kilogauss. The use of the I-100/5

Card 1/2

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ACCESSION NR: AP5021359

20

ignitron when proper heating and cooling were maintained prior to switching in the field secured operation without breakdown for 20—40 hr at a switching rate of 10/min. The joint operation of the pulsed magnet with the synchrocyclotron required some rearrangement of the control system to guarantee that no particle was emitted without accompaniment of a pulsed magnetic field. "The authors express their thanks to V. I. Danilov, T. N. Tomilina, and I. B. Yanchevich for carrying on the work. The authors are grateful to I. I. Gurevich and V. P. Dzhelepov for their constant interest and help in the work. The authors express their thanks to V. I. Smirnov, F. Ye. Gugnin, I. P. Lavrushkin, Yu. V. Maksimov, A. V. Shestov, V. I. Ivanov, I. M. Markachev, A. F. Burtsev, B. V. Degtyarev, N. P. Chistyakov, and M. T. Berezov for their aid in maintaining and operating the equipment." Orig. art. has: 11 figures and 1 table. [04]

ASSOCIATION: Institut atomnoy energii GKAE, Moscow (Institute of Atomic Energy GKAE); LYaP OIYaI ; NII EFA; MIFI

SUBMITTED: 17Jun64 ENCL: 00 SUB CODE: EM NP

NO REF SOV: 001 OTHER: 003 ATD PRESS: 4110

Card 2/2

5(4) SOV/74-28-3-5/6

AUTHOR: Akhmanova, M. V. (Moscow)

TITLE: Infrared Absorption Spectra of Minerals (Infrakrasnyye spektry pogloshcheniya mineralov)

PERIODICAL: Uspekhi khimii, 1959, Vol 28, Nr 3, pp 312-335 (USSR)

ABSTRACT: In the present survey the papers published in the last few years in the field of infrared spectrum analysis of minerals and some inorganic compounds are systematized. A number of important theoretical and methodical questions concerning infrared spectroscopy could not be considered in this paper. For this reason the author recommends the reading of some papers (Refs 1-11) which deal with these problems. In spite of the comparatively limited number of investigations in this field it can be said that the data existing outline the possibilities and the usefulness of applying this method to the solution of various chemical, mineralogical and geochemical problems. The investigation of infrared spectra can be very suitable in determining the proceeding of reactions in solid substances and in particular in amorphous and vitreous materials. As can be seen from many papers, the data obtained on the basis of X-ray and electronographic analyses can be

Card 1/3

checked and corrected by means of this method. The combination of all these methods can be regarded as very promising. In spite of the prospects in the use of infrared spectroscopy also some unfavorable factors have to be mentioned. Some difficulties arising because of the spectra of some minerals being but little characteristic as well as owing to the weak effect of the cation on the change of the spectral structure, are very important. They limit primarily the analytical possibilities of this method and are the cause of its comparatively low sensibility. The smallest amounts of the mineral to be determined which could so far be found in the most favorable case in the rock by means of investigation of its infrared spectra, were $\sim$1 - 2% (e.g. quartz in sedimentary rock, analysis of carbonates and sulfates (Ref 17)). Other difficulties have a transitory character. They occur in consequence of the deficiencies of the modern apparatus and the incompleteness of the investigation methods. They are also the cause for the difficulties the scientists have to cope with in devising quantitative methods of the phase analysis by means of infrared spectra and for the fact that these determinations are relatively inaccurate. Yet, the success

achieved in the last few years in the field of the analytical method and in particular in the development of the comfortable "tablet technique" (Ref 8) for the investigation of infrared spectra of powders as well as the intensive research work done in all countries in the field of the building of apparatus permit an optimistic judgement of this method. There are 18 figures, 2 tables, and 122 references, 17 of which are Soviet.

AKHMANOVA, M.V.

PHASE I BOOK EXPLOITATION SOV/4443

Akademiya nauk SSSR. Komissiya po analiticheskoy khimii

Metody opredeleniya primesey v chistykh metallakh (Methods of Determining Admixtures In Pure Metals) Moscow, 1960. 411 p. (Series: Its: Trudy, 12) 3,500 copies printed.

Resp. Eds.: A.P. Vinogradov, Academician, and D.I. Ryabchikov, Doctor of Chemical Sciences; Ed. of Publishing House: M.P. Volynets; Tech. Ed.: T.V. Polyakova.

PURPOSE: This collection of articles is intended for chemists, metallurgists, and engineers.

COVERAGE: The articles describe methods for detecting and determining various admixtures and their traces in pure metals. Also discussed are many chemical, physicochemical, electrochemical, spectrochemical and luminescence methods of analyzing materials of high purity. The editors state that these methods have been developed within the last five or six years by various Soviet scientific institutes, and are now widely used in research and factory laboratories of the Soviet Union. No personalities are mentioned. References, mostly Soviet, accompany each article.

Card 4/9

AKHMANOVA, M.V.

PHASE I BOOK EXPLOITATION SOV/4445

Akademiya nauk SSSR. Komissiya po analiticheskoy khimii

Metody opredeleniya primesey v chistykh metallakh (Methods of Determining Admixtures in Pure Metals) Moscow, 1960. 411 p. (Series: Its: Trudy, 12) 3,500 copies printed.

Resp. Eds.: A.P. Vinogradov, Academician, and D.I. Ryabchikov, Doctor of Chemical Sciences; Ed. of Publishing House: M.P. Volynets; Tech. Ed.: T.V. Polyakova.

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69273
S/051/60/008/04/011/032
B201/B691

AUTHORS: Akhmanova, M.V. and Kuril'tsikova, G.Ye.

5.2400A 24.3410

TITLE: The Infrared Absorption Spectra of Hydroxofluoroboron Complexes of Potassium and Sodium

PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 4, pp 498-504 (USSR)

ABSTRACT: The authors obtained the infrared (1600-700 cm^{-1}) absorption spectra of $K_3B_3O_3F_6$, $K_2B_3O_3F_4OH$, $Na_3B_3O_3F_6$, KBF_3OH and $NaBF_3OH$. The complexes were obtained using a method described by Ryss (Ref 1). In all cases the spectra were obtained with the complexes in the solid state. Samples were suspended in isobutyl alcohol (particle dimensions less than 5 μ) and deposited on KBr plates. An IKS-11 spectrometer with an NaCl prism and a photo-electro-optical amplifier was employed. The infrared spectra are shown in Figs 1 and 2 and the frequencies of the band maxima (in cm^{-1}) are listed in Tables 1 and 2. Analysis of the results obtained shows that: (1) the $K_3B_3O_3F_6$ and $K_2B_3O_3F_4OH$ spectra coincide within the experimental error; (2) the KBF_3OH and $NaBF_3OH$ spectra are also identical; (3) the spectrum of $Na_3B_3O_3F_6$ differs from the spectra of $K_3B_3O_3F_6$ and $K_2B_3O_3F_4OH$. A qualitative interpretation of the spectra, based on comparison with the spectra of boron and

Card 1/2

VAYNSHTEYN, E.Ye.; MIKHAYLOVA, G.V.; AKHMANOVA, M.V.; KUTSENKO, Yu.I.

Method of spectrum determination of iron, calcium, magnesium, chromium, nickel, silicon and boron in zirconium. Trudy Kom. anal. khim. 12: 142-150 '60. (MIRA 13:8)
(Zirconium--Analysis) (Spectrum analysis)

VAYNSHTEYN, E.Ye.; BELYAYEV, Yu.I.; AKHMANOVA, M.V.

Determination by spectrum analysis of cadmium, antimony, bismuth, lead and tin in tungsten and molybdenum. Trudy Kom. anal. khim. 12:236-254 '60. (MIRA 13:8)
(Tungsten--Analysis) (Molybdenum--Analysis)
(Spectrum analysis)

AKHMANOVA, M.V.; LEONOVA, L.L.;

Investigating the metamictization of zircons by the use of infrared absorption spectra. Geokhimiia no.5:401-414 '61. (MIRA 14:5)

1. V. I. Vernadskiy Institute of Geochemistry and Analytical Chemistry, Academy of Sciences U.S.S.R., Moscow.
(Zircon) (Metamict state)
(Spectrum, Infrared)

AKHMANOVA, M.V.

Use of infrared absorption spectra in the study of structure of natural borates. Zhur.strukt.khim. 3 no.1:28-34 Ja-F '62.
(MIRA 15:3)

1. Institut geokhimii i analiticheskoy khimii Vernadskogo AN SSSR.

(Borates--Spectra)

AKHMANOVA, M.V.; KURIL'CHIKOVA, G.Ye.

Study of the ionic states in aqueous solutions of boron- and fluorine-containing compounds of potassium and sodium by means of infrared spectra. Zhur.neorg.khim. 7 no.3:516-521 Mr '62. (MIRA 15:3)

(Complex compounds--Spectra)

AKHMANOVA, M.V.; KARYAKIN, A.V.; YUKHNEVICH, G.V.

Determination of hydroxyl groups in silicate minerals using the infrared spectra method. Geokhimiia no.6:581-585 Je '63. (MIRA 16:8)

1. Vernadsky Institute of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R., Moscow.

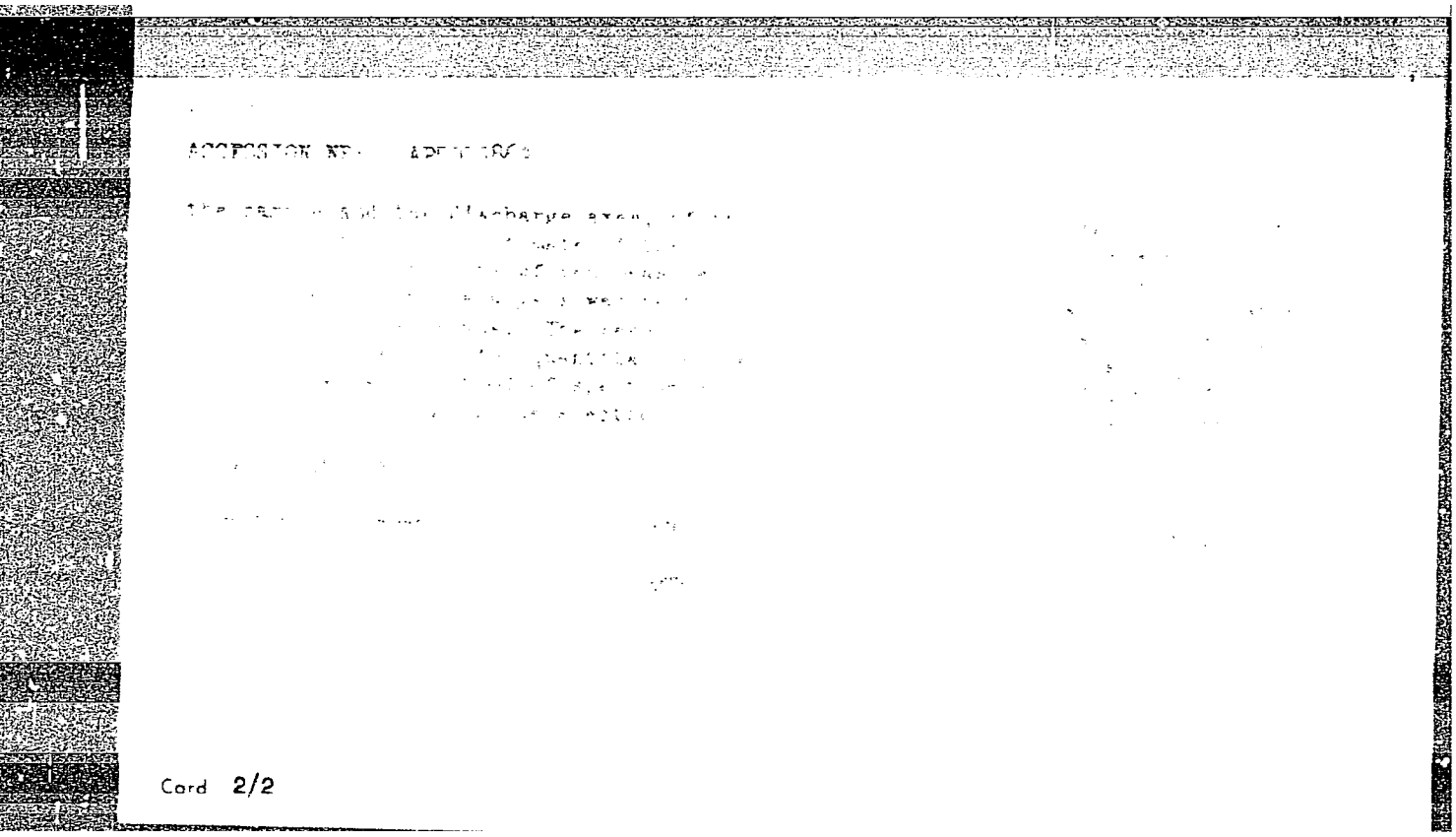
AKHMANOVA, M.V.; LEONOVA, L.L.

Study of the metamict disintegration of silicates using infrared spectroscopy. Trudy Min. muz. no.14:3-31 '63. (MIRA 16:10)

(Silicates--Absorption spectra)

ACCESSION NR: [illegible]

AUTHOR: Karyakin, A. V.; Kaygorodov, V. A.; Akhmanova, N. V.



Card 2/2

KARYAKIN, A. V.; AKHMANOVA, M. V.; KAYGORODOV, V. A. Moscow

"Moglichkeiten zur Answendung eines Impulslasers in der Spektralanalyse reiner Stoffe."

report submitted for 2nd Intl Symp on Hyperpure Materials in Science and Technology, Dresden, GDR, 28 Sep-2 Oct 65.

Institut geokhimii i analiticheskoy khimii im Vernadskiy Akademii nauk SSSR, Moscow.

PAVLENKO, A.S.; ORLOVA, L.P.; AKHMANOVA, M.V.; TOBELKO, K.I.

Thorbastnaesite, thorium fluorocarbonate. Zap. Vses. min. ob-va 94 no.1:105-113 '65. (MIRA 18:3)

1. Institut geokhimii i analiticheskoy khimii imeni Vernadskogo AN SSSR, Moskva.

KARYAKIN, A.V.; KAYGORODOV, V.A.; AKHMANOVA, M.V.

Two-stage method of excitation of spectra. Zhur.prikl. spekt. 2 no.4:364-366 Ap '65. (MIRA 18:8)

PAVLENKO, A.S.; ORLOVA, L.P.; AKHMANOVA, M.V.

Cerphosphorhuttonite, a mineral from the monazite group. Trudy Min.muz. no.16:166-174 '65. (MIRA 18:8)

AKHMANOVA, M.V.; MIKHAYLENKO, I.Ye.

Infrared spectroscopy method for studying radioactive potassium sulfate. Zhur. fiz. khim. 39 no.9:2273-2275 S '65. (MIRA 18:10)

1. Institut fizicheskoy khimii AN SSSR i Institut geokhimii i analiticheskoy khimii imeni V.I. Vernadskogo.

ACC NR: AT7001789 SOURCE CODE: UR/3119/66/000/004/0107/0111

AUTHOR: Akhmanova, M. V.; Mikhaylenko, I. Ye.

ORG: Institute of Physical Chemistry, AN SSSR (Institut fizicheskoy khimii AN SSSR); Institute of Geochemistry and Analytical Chemistry im. Vernadskiy, AN SSSR (Institut geokhimii i analiticheskoy khimiii AN SSSR)

TITLE: Use of infrared spectroscopy for the investigation of defects in radioactive inorganic compounds

SOURCE: AN LatSSR. Institut fiziki. Radiatsionnaya fizika, no. 4, 1966. Ionnyye kristally (Ionic crystals), 107-111

TOPIC TAGS: ir spectroscopy, crystal lattice defect, radioactivity effect, balence band, inorganic anion

ABSTRACT: The purpose of the investigation was to check on the assumption that long-lived defects can be produced in a crystal lattice of a compound (specifically, K_2SO_4) by introducing a radioactive isotope in it (S^{35}). To this end, a number of radioactive K_2SO_4 samples were prepared and stored for a long time (698 - 1067 days), after which their infrared spectra were determined with a Zeiss UR-10 spectrometer to check the presence of long-lived defects. Out of the five expected absorption frequencies, only one, corresponding to the maximum of the valence band in the short-wave region of the spectrum (1200 cm^{-1}), exhibited noticeable splitting as a result of the increase in the absorbed dose of the radioactive samples. This maximum increased in intensity

Card 1/2

ACC NR: AT7001789

with increasing initial specific radioactivity of the compound. This can be interpreted as being due to the loss of one valence electron and consequently to a change in the total electron cloud of the SO_4 group. It is expected that similar changes occur in ionic compounds of this type, which include a complex anion group. Orig. art. has: 1 figure and 2 tables.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 005

AKHMANOVA, OLGA SERGEYEVNA

1
876
.A31

O psikholingvistike; materialy k dursam yazykoznaniya On psycho-linguistics; material for a course on linguistics Moskva, Izd-vo Moskovskogo Universiteta, 1957.

62 p. diagr.
Bibliographical Footnotes.

— AKhmanova, O. S.

SOURCE: Documentary: Newsletter, Issue No. 2, issued by the Center for Documentation and Communication Research, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

1. To date, 49 papers, from 10 countries, have been scheduled for the subject Conference. They include:

USSR

AKHMANOVA, O.S., Linguistics Institute, USSR Academy of Sciences, Moscow - "Common machine languages as 'auxiliary codes' for 'mediator languages'"

ANDREYEV, N.D., Experimental Laboratory of Machine Translation, Leningrad University - (1) "Report on the activities of the experimental laboratory of machine translation (Leningrad University); (2) "Universal code of science and machine languages"

CHERNYY, V. P., LAVRENT'YEVA, O. A., and ZELENOVA, E. V., Institute of Scientific Information, USSR Academy of Sciences, Moscow - "Experimental information language for mechanization of searching of scientific and technical literature"

ZACHERMAN, A. M., and TERENT'YEV, A. P., Moscow State University - "Chemical nomenclature translation"

Report to be submitted for the Intl. Conference on Machine Searching and Translation, (for Standards on a Common Language), Cleveland, Ohio, 6-12 September 1959.

AKHMANOVA, O. S.

"Categorization in morphology"
Report to be submitted for the 9th international Congress of Linguists, Permanent International Committee of Linguistics, Cambridge Mass. 27-31 Aug 62

DENISOV, Petr Nikitich; AKHMANOVA, O.S., prof., red.; SATIROVA, S.A., red.

[Principles of language modeling; based on materials of auxiliary languages for machine searching and translation] Printsipy modelirovaniia iazyka; na materiale vspomogatel'nykh iazykov dlia avtomaticheskogo poiska i perevoda. Moskva, Izd-vo Mosk. univ., 1965. 204 p.
(MIRA 18:7)

AKHMATOV, A.P.; BLINOV, P.I.; BOLOTIN, V.F.; BORODIN, A.V.; GAVRIN, P.P.; ZAVOYSKIY, Ye.K.; KOVAN, I.A.; OGANOV, M.N.; PATRUSHEV, B.I.; PISKAREV, Ye.V.; RUSANOV, V.D.; SMOLKIN, G.Ye.; STRIGANOV, A.R.; FRANK-KAMENETSKIY, D.A.; CHEREMNYKH, P.A.; CHIKIN, R.V.

[Magnetoacoustic resonance in a plasma] Magnito-zvukovoi rezonans v plazme. Moskva, In-t atomnoi energii, 1960. 23 p. (MIRA 17:2)

83757

S/056/60/039/003/002/045
B004/B060

26.1410

AUTHORS: Akhmatov, A. P., Blinov, P. I., Bolotin, V. F., Borodin, A. V., Gavrin, P. P., Zavoyskiy, Ye. K., Kovan, I. A., Oganov, M. N., Patrushev, B. I., Piskarev, Ye. V., Rusanov, V. D., Smolkin, G. Ye., Striganov, A. R., Frank-Kamenetskiy, D. A., Cheremnykh, P. A., Chikin, K. V.

TITLE: Magnetoacoustic Resonance in the Plasma

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 3 (9), pp. 536-544

TEXT: The authors wanted to study the penetration of oscillations into the plasma taking place transversally to a static magnetic field. From the physical point of view, this process has a course similar to acoustic oscillations, with the difference that the magnetic pressure $H^2/8\pi$, and not the gas pressure, is effective here. (1) is written down as a resonance condition: $\alpha H_0/\omega R\sqrt{4\pi\rho} = 1$, where α is a dimensionless number characterizing the type of oscillations, H_0 the strength of the

Card 1/4

static magnetic field, ρ the density of the plasma, ω the cyclic frequency, and R the radius of the plasma cylinder. The following is written down for the radial amplitude of the plasma motion velocity: $v_r \approx \tilde{H}u_{ph}/H_0 \approx \tilde{H}/\sqrt{4\pi\rho}$ (H = strength of the magnetic alternating field, u_{ph} = phase velocity of the magnetic field). The interaction of an electromagnetic high-frequency field $\tilde{H}$ with a cold plasma was experimentally investigated in a cylinder in the presence of an axial quasistatic magnetic field H_0. Fig. 1 shows the scheme of the apparatus used for the experiments. In one such experimental series the alternating field had a frequency of 12.5 Mc/sec, while in another series the frequency was 50 Mc/sec. The plasma glow was recorded by means of an ФЭУ-19 (FEU-19) photomultiplier and an ОК-17М (OK-17M) oscilloscope, while the penetration of high-frequency oscillations into the plasma and the radial amplitude distribution of the magnetic alternating field were studied with the aid of a magnetic probe. The experiments were conducted with hydrogen, helium, argon, and air at an initial pressure of

10^{-4} - 6.10^{-3} torr. The oscillograms of Figs. 2,3 show that resonance phenomena appear in the range between 300 oersteds and 5 kilooersteds. Fig. 4 shows the effect of resonance on the spectral lines of hydrogen. There is a dependence of the amplitude H_r of the magnetic resonance field on the amplitude of the $\tilde{H}$-field. Fig. 5 shows the spatial distribution of the amplitude H_r of the resonance field in hydrogen and argon. As may be seen from Fig. 6, the resonance shows a fine structure. This effect is being further investigated. A gas temperature of 2.5 ev was calculated from the Doppler broadening of the H_β line (Figs. 7,8) corresponding to 0.8 A. Experimental data for H_r confirmed the validity of equation (1). Experiments with argon at frequencies above the hybrid frequency yielded no appreciable difference as compared with the effect observed with frequencies below the hybrid frequency. The authors assume that the appearing oscillations propagated obliquely, not perpendicularly to H_0. This was confirmed by measurement of the azimuthal component of the magnetic field H_φ (Fig. 9). The authors thank I. V. Kurchatov, Academician, for interest displayed in the work. There are 9 figures and 4 references: 2 Soviet, 1 US, and 1 German.

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Magnetoacoustic Resonance in the Plasma

S/056/60/039/003/002/045
B004/B060

SUBMITTED: April 2, 1960

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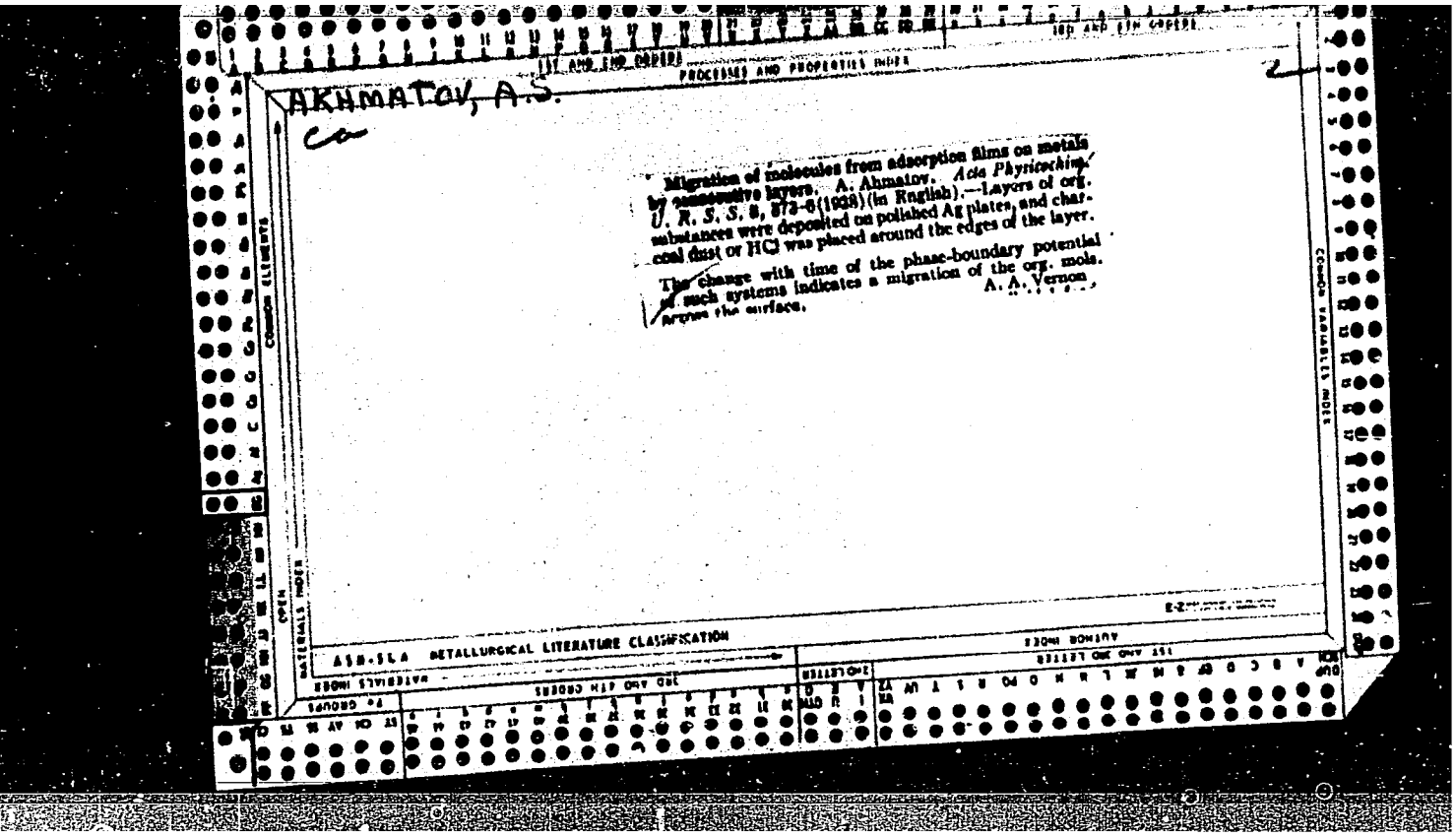


AKHMATOV,A8

1. AKHMATOV, A.: PAVLOVA, Ye.

2. USSR (600)

"The Change in Interphase Potential during the Photochemical Decomposition of Monolayers of Gliadin," Zhur. Fiz. Khim, 13, No. 11, 1939. Moscow, Viem, Physico-Chemical Lab., Department of Photobiology., Received 26 June 1939.

9. [redacted] Report U-1615, 3 Jan. 1952.

42449

S/725/61/000/003/001/008

AUTHORS: Akhmatov, A.P., Zinov'yev, O.A., Chernetskiy, A.V.

TITLE: Some microwave methods for the measurement of electron concentrations in a plasma.

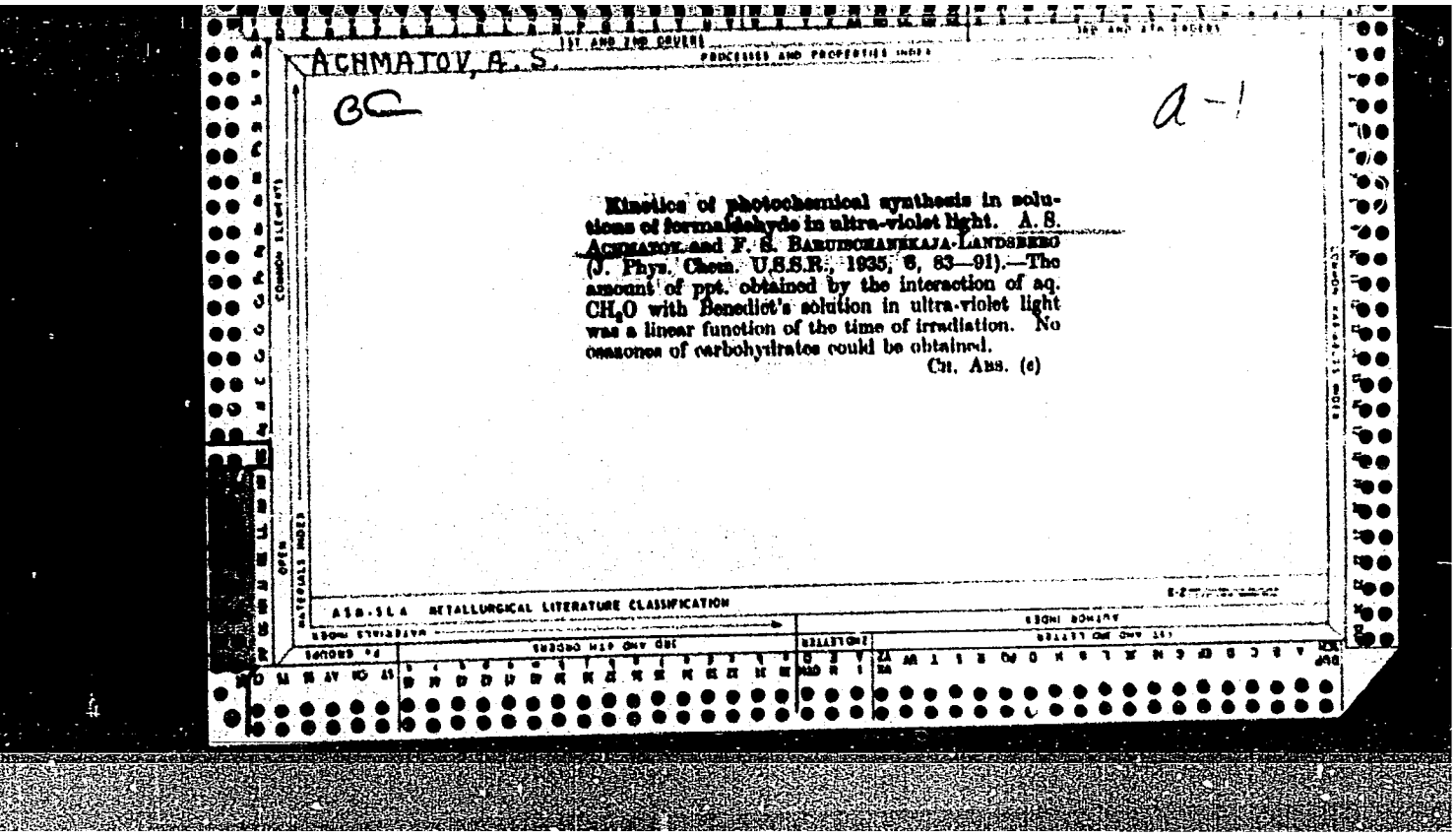
SOURCE: Nekotoryye voprosy tekhniki fizicheskogo eksperimenta pri issledovanii gazovogo razryada; nauchno-tekhnicheskiy sbornik, no.3. A.V. Chernetskiy & L.G. Lomize, eds. Moscow. Gosatomizdat, 1961, 3-30.

TEXT: This is a state-of-the-art report on the use of microwave methods for the measurement of various parameters (electron density, temperature, collision energy losses, etc.) of the plasma of a gaseous discharge without introducing additional electrons and, hence, perturbations into the plasma. The primary objective of this paper is the electron-concentration determination by means of (1) microwave transillumination, and (2) by interferometry. Macroscopic Maxwellian theory of electromagnetic waves in an ionized gas is expounded in conformity with Al'pert, Ya.L., Ginzburg, V.L., Feynberg, Ye.L. Rasprostraneniye radiovoln (Radiowave propagation). Moscow. Gostekhizdat, 1953. In the resulting equation for the propagation of a normally incident plane electromagnetic wave, the dependence of the global specific inductive-capacitance term on the properties of the plasma remains

generators appears to difficult an engineering task to be practicable. The history of the adaptation of methods previously used in optics to the determination of microwave-propagation characteristics by phase and amplitude comparison is briefly reviewed and major attention is focused on the microwave interferometer described by Wharton, C.B., & Slager, D.M., in IRE Trans. Nucl. Sci., v.NS-6, no.3, 1959, 20, and in J.Appl.Phys., v.31, no.2, 1960, 428. This system, which comprises a measuring and a reference channel, serves well with relatively weak discharges in a gas, but is increasingly affected by noise at greater discharge intensities. The device proposed by Dropkin, H.A., IRE Nat. Conv. Rec., v.6, no.1, 1958, 57, which employs a frequency shifter, is described and termed more noise-proof and more accurate. The inadequate time-resolving power of this device is said to be overcome by the employment of two super-HF generators as proposed by Thompson, M.C., & Vetter, M.J., Rev. Scient. Instrum., v.29, no.2, 1958, 148, which is described in detail, and operational procedures specified by Wharton, Howard, et al., in the Trans. 2d Internat'l Conf. etc., 1959, 675, are reported. There are 11 figures and 23 references (12 Soviet, 7 English-language, and 9 English-language papers in their Russian translation).

ASSOCIATION: None given.

Card 3/3



ACHMATOV, A. S.

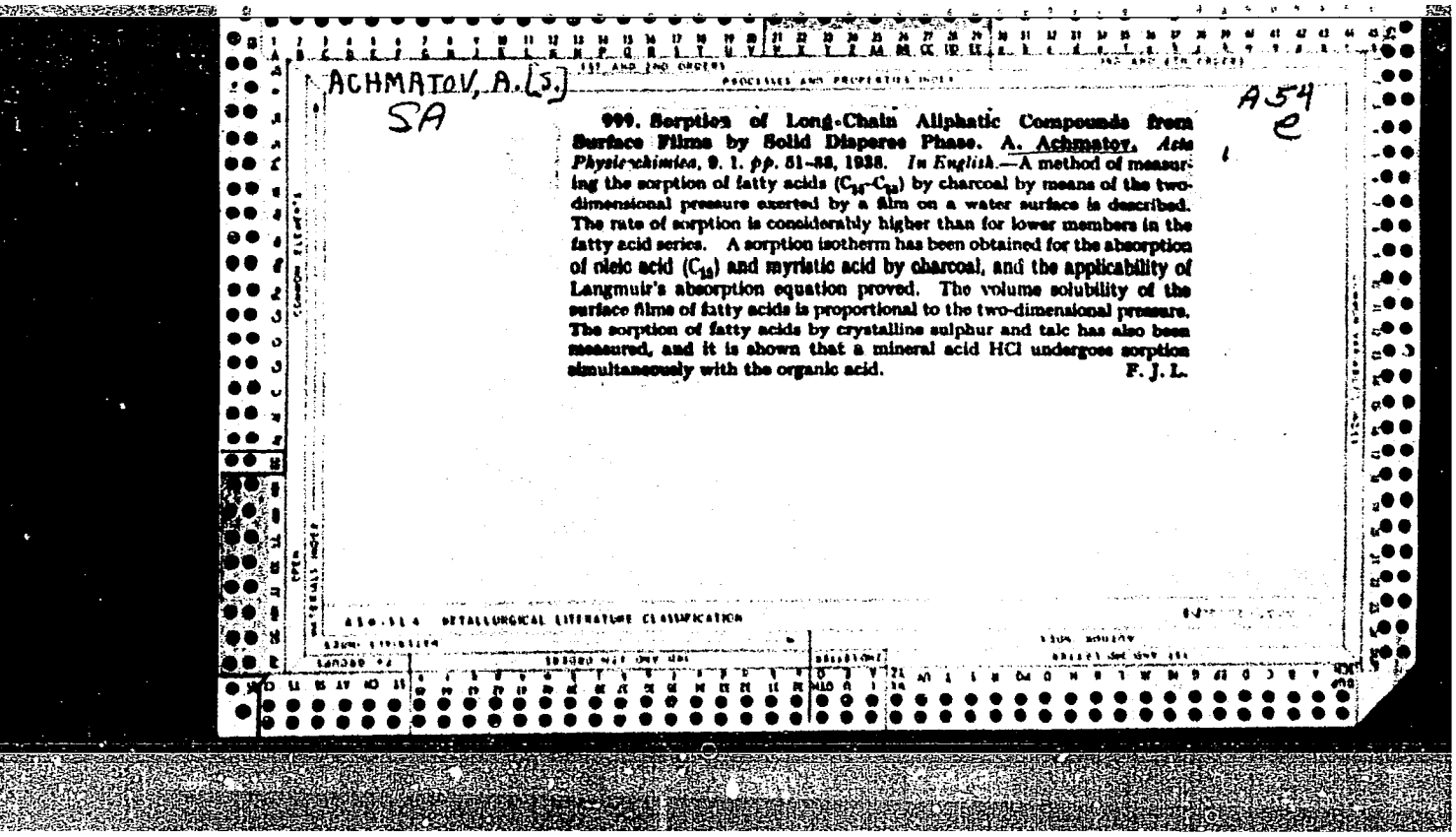
BC

a-1

Kinetics of photochemical synthesis in solutions of formaldehyde in ultra-violet light. A. S. ACHMATOV and F. S. BARUDSCHANSKAJA-LANDSBERG (J. Phys. Chem. U.S.S.R., 1935, 6, 83—91).—The amount of ppt. obtained by the interaction of aq. CH_2O with Benedict's solution in ultra-violet light was a linear function of the time of irradiation. No osazones of carbohydrates could be obtained.

CH. ABS. (e)

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



ACHMATOV, A. [S.]
SA

A54
e

999. Sorption of Long-Chain Aliphatic Compounds from Surface Films by Solid Disperse Phase. A. Achmatov. *Acta Physicochimica*, 9. 1. *pp.* 51–88, 1938. *In English.*—A method of measuring the sorption of fatty acids (C_{16}-C_{18}) by charcoal by means of the two-dimensional pressure exerted by a film on a water surface is described. The rate of sorption is considerably higher than for lower members in the fatty acid series. A sorption isotherm has been obtained for the absorption of oleic acid (C_{18}) and myristic acid by charcoal, and the applicability of Langmuir's absorption equation proved. The volume solubility of the surface films of fatty acids is proportional to the two-dimensional pressure. The sorption of fatty acids by crystalline sulphur and talc has also been measured, and it is shown that a mineral acid HCl undergoes sorption simultaneously with the organic acid. F. J. L.