

17 APR 1972 EXACTLY  
 PROCESSED AND PROPERTIES INDEX  
 THE AND 4TH COPY

BC B-I-5

Spectroscopic grading of alloy steels. L. M. IVANOV and G. L. MANNING (Zavod. Lab. 1977, 6, 68-70).—A scheme for spectral analysis of alloy steels is described. R. T.

COMMON ELEMENTS  
 COMMON TRANSITION METALS  
 OPEN  
 MATERIALS INDEX

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

GROUPS	GROUPS	GROUPS	GROUPS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1ST AND 2ND ORDERS  
PROCESSES AND PROPERTIES INDEX

A-1

BC

Intensity of spectral lines in an arc with carbon electrodes. S. I. MANDELSTAM (Compt. rend. Acad. Sci. U.R.S.S., 1935, 18, 533-533).— The effect of large amounts of NaCl or KCl on the intensities of the spectral lines of elements present in traces in the C arc is attributed to the lowering of the temp. of the arc. The effect is analysed with the aid of the Saha formula, and observed results are in qual. agreement with the theory. P. J. G.

ASH-31A METALLURGICAL LITERATURE CLASSIFICATION

147080	147081	147082	147083	147084	147085	147086	147087	147088	147089	147090	147091	147092	147093	147094	147095	147096	147097	147098	147099	147100	147101	147102	147103	147104	147105	147106	147107	147108	147109	147110	147111	147112	147113	147114	147115	147116	147117	147118	147119	147120	147121	147122	147123	147124	147125	147126	147127	147128	147129	147130	147131	147132	147133	147134	147135	147136	147137	147138	147139	147140	147141	147142	147143	147144	147145	147146	147147	147148	147149	147150	147151	147152	147153	147154	147155	147156	147157	147158	147159	147160	147161	147162	147163	147164	147165	147166	147167	147168	147169	147170	147171	147172	147173	147174	147175	147176	147177	147178	147179	147180	147181	147182	147183	147184	147185	147186	147187	147188	147189	147190	147191	147192	147193	147194	147195	147196	147197	147198	147199	147200
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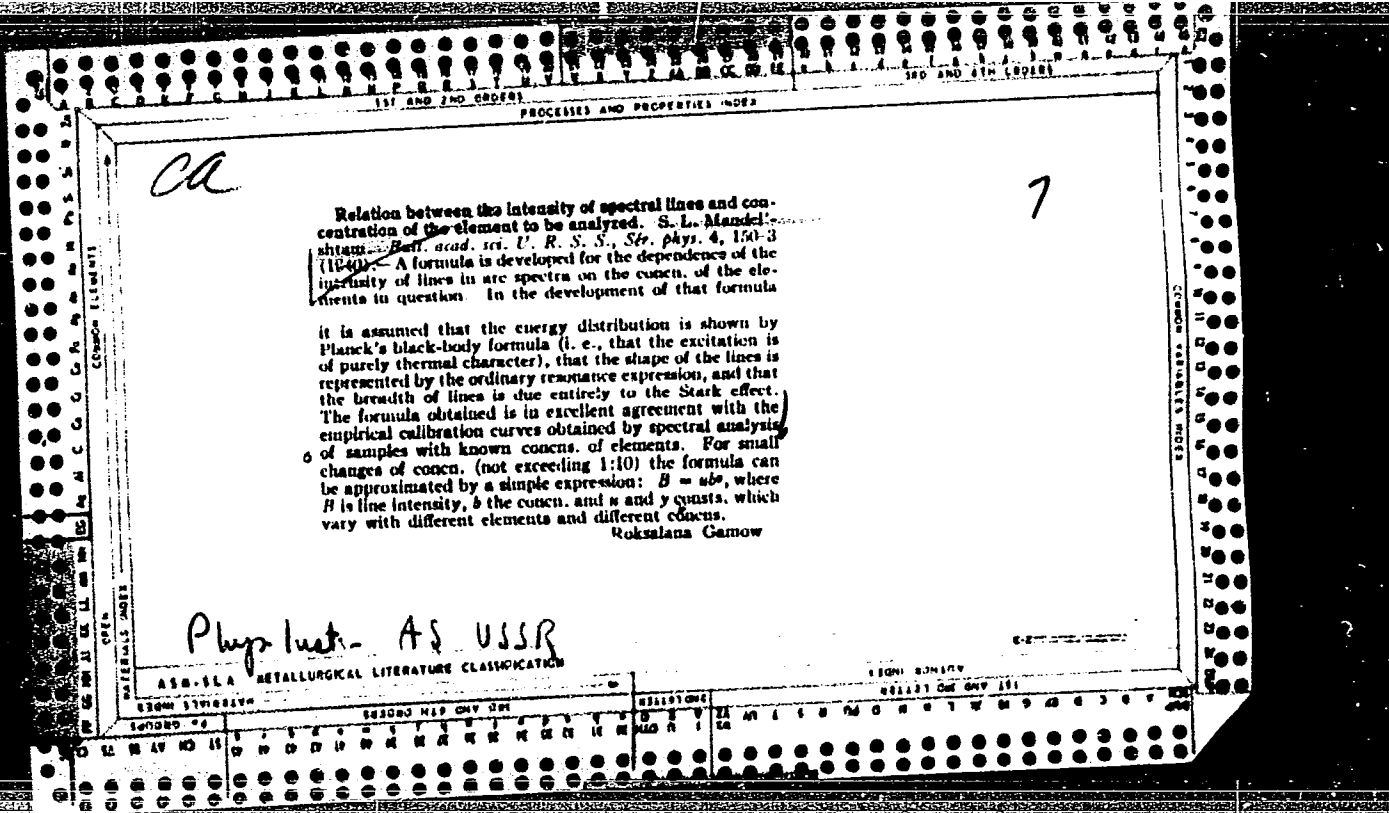
3

Use of flame in spectrum analysis. S. L. Mandel'shtam. *Compt. rend. acad. Sci. R. S. S. 22, 403-4 (1939) (in English).*—The degree of thermal dissoen. of gaseous mols. of RbCl (0.001%) at 2000° was calcd. by an approx. equation for the equil. const.  $K_p$  with values of heat of formation  $H_f$  from the literature. Values of  $K_p$  obtained were: RbCl  $6.3 \times 10^{-4}$ , RbBr  $4 \times 10^{-4}$ , RbI  $4 \times 10^{-4}$  and NaCl  $6.3 \times 10^{-4}$ , NaBr  $1.1 \times 10^{-4}$ , NaI  $4 \times 10^{-4}$  and KCl  $2.5 \times 10^{-4}$ . If the partial pressure of dissoen. of RbCl and acetone flame is  $10^{-4}$ , the degree of dissoen. of RbCl is 85% in the expts. of T. P. Borovik-Romanova (flame spectrum of 0.001% RbCl in soln.). The calcd. relative degree of dissoen. of 0.001% RbCl at 2000° in presence of 1% other alkali halides is 3% in NaCl, 6.5% in KCl, 6.5% in NaBr and 100% in NaI. These calcd. representations of the degree of dissoen. parallel the decrease of flame-spectrum line intensities of RbCl observed by Borovik-Romanova (*C. A.* 33, 4517) when these salts are present.

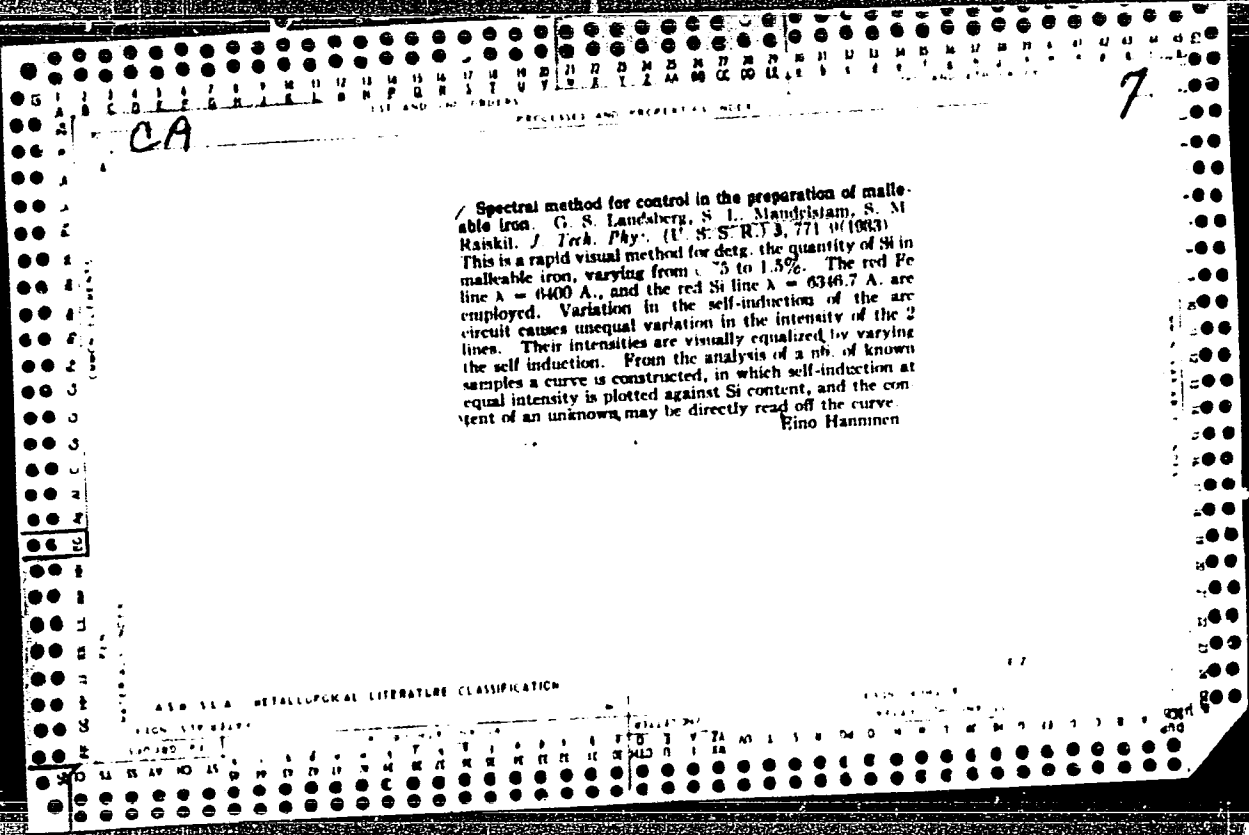
L. W. Strock

Intekov Phys. Inst. AS-USSR

ASU 314 METALLURGICAL LITERATURE CLASSIFICATION













1ST 2ND 3RD 4TH ORDER

PROCESSES AND PROPERTIES INDEX

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

COMMON ELEMENTS

COMMON VARIABLES INDEX

OPEN MATERIALS INDEX

ASB-51A METALLURGICAL LITERATURE CLASSIFICATION

SPECTRAL METHOD OF SORTING ALLOYED STEELS G. S. Landsberg, S. L. Mandel'shtam, S. V. Fulyankin and V. V. Talden. *Zavodskaya Lab.* 4, 1220 (1965). Application of spectral analysis to sorting of alloy steels is discussed. Chas. Blau

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LIST AND INDEX OF CONTENTS  
PROCESSES AND PROPERTIES INDEX

A 53  
i

*Ja*

04544. Quantitative Spectroscopic Determination of Si and Cr in Malleable Cast Iron. S. Mamonov, S. Raisky, and W. Zehden. *Techn. Phys. U.S.S.R. J. C. pp. 331-333, 1956. In German.*—A condensed spark is used as source and a visual spectroscope with photometric eyepiece is described, comparison of intensity of selected lines with neighboring iron lines being made. The range of content is 0.4% - 2% for Si and 0.02% - 0.1% for Cr. A determination of both elements takes 12-15 mins. and the accuracy is about 5% to 10%, i.e., 0.01% of the content. The results of continuous use under industrial conditions are described. F. S.

METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

SA

B62  
A

**2420. Spectroscopic Analysis of Alloy Steels.** S. Mandelstam, W. Gendrow and W. Zehden. *Techn. Phys., U.S.S.R.* 5:6, pp. 641-647, 1934. *In German.*—Two iron lines are chosen, bracketing a line of the element to be estimated. By means of a Wollaston prism two polarized spectra are produced vertically in register. By adjusting the analyser, intensities are equalised and from a calibration curve the percentage of foreign element is read off. The principle of photometry has the advantage of being workable with a few lines or even a single line, and consequently seems suitable for the light alloys. A 110/18,000-V transformer with output of 200 VA is used in conjunction with a capacity of 0.01  $\mu$ F, giving a spark length of 8 mm. Self-induction is  $10^{-6}$  H. Time of estimation including calculation is 8-10 min. with an accuracy of 10-20 % for Cr, Ni, Si, W, V, Mo, Co, Mn.

D. R. H.

ASO-31A METALLURGICAL LITERATURE CLASSIFICATION

COMMON VARIANTS INDEX

MATERIALS INDEX

COMMON ELEMENTS

COMMON VARIANTS INDEX





1ST AND 2ND GROUPS      PERIODS AND PROPERTIES INDEX

ca

7

Spectral determination of silicon and chromium in malleable iron. S. L. Mendel'shtam, S. M. Raikhi and V. V. Treiden. *Zavodskaya Lab.* 8, 305-309 (1936).—The rapid visual method previously used for the detn. of Si in malleable Fe is employed (C. A. 28, 1627<sup>a</sup>). The detn. of 0.02-0.05% Cr is possible by the selection of Cr lines  $\lambda = 4234.3, 4274.3$  and  $4289.7$  Å. By using the violet part of the spectrum for Cr and the red one for Si, the 2 elements are detd. simultaneously in a specially constructed app. (illustrated), equipped with 2 stationary lenses, a simple one for the detn. of Cr, and another provided with the polarization photometer for the detn. of Si. The procedure and app. are described. Chas. Blanc

ASB-11A METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND GROUPS      PERIODS AND PROPERTIES INDEX

GROUPS      PERIODS AND PROPERTIES INDEX









PROCESSED AND PROPERTY ONLY

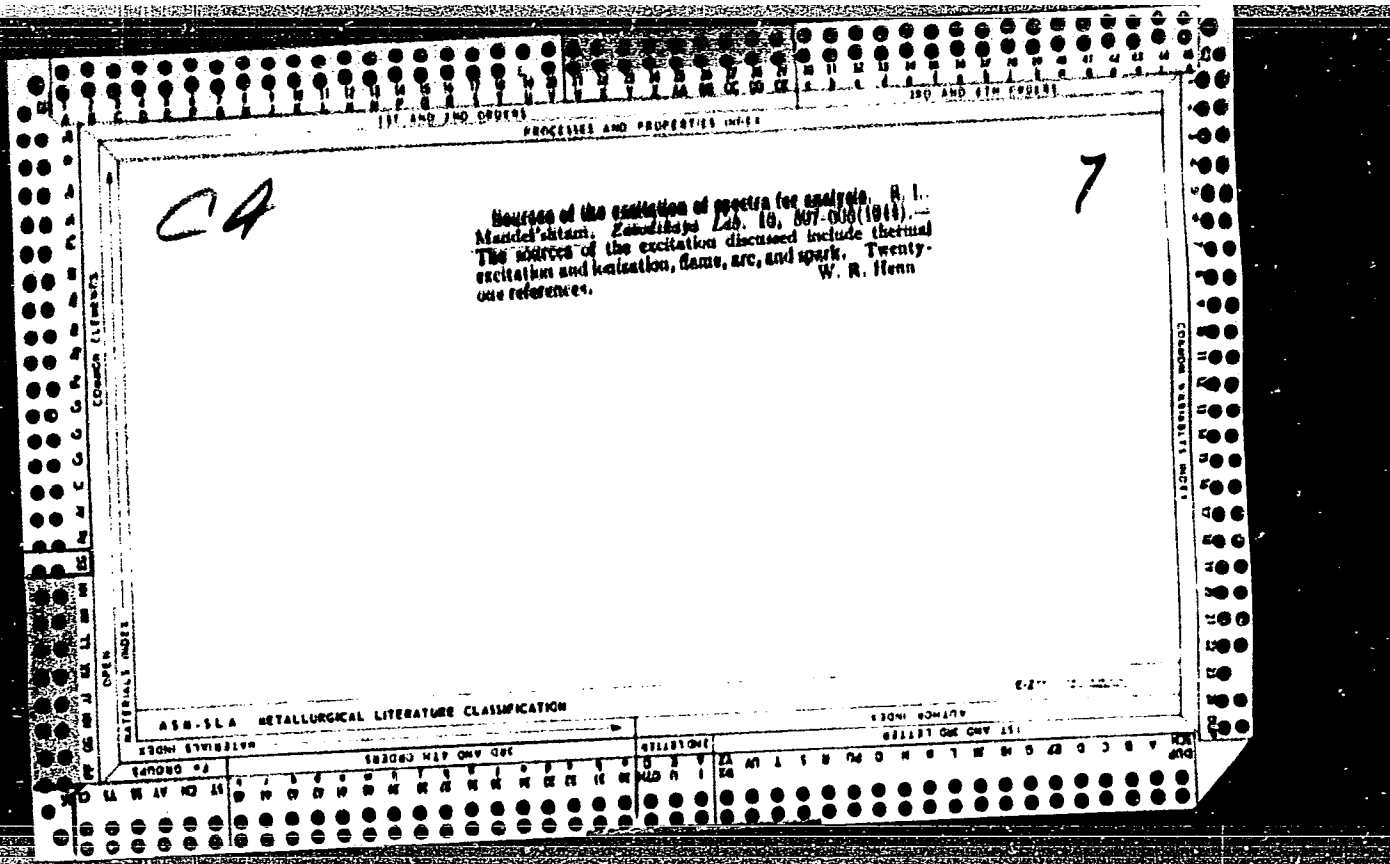
3

Stabilizing the conditions of excitation of spectrum in a  
 Volta arc. I. D. Belvakov-Bodin and S. L. Mandel'-  
 shtan. *J. Tech. Phys. (U.S.S.R.)* 14, 403 (1944),  
*U.S.S.R. Phys. Rev.* 17, 2363. - To keep the relative intensities of  
 various lines of spectrum const., the temp. of the arc and  
 consequently the current strength must be kept const. in  
 spite of the wandering of the arc over the electrode sur-  
 faces. That is achieved by a special rectifier, the output  
 of which is nearly independent of the potential drop  
 within the arc. The output voltage is 100 v., i.e., below  
 the danger level. The relative intensities of the Cu lines  
 5105.6 and 5153.2 Å. in an arc fed by a d.c. of 110 v., by  
 a d.c. of 220 v., and by the special rectifier were for 40  
 detas. const. within  $\pm 14\%$ ,  $\pm 9\%$ , and  $\pm 7.5\%$ , resp.  
 The mean deviations for the ratio of intensities of V 4875 Å.  
 to Fe 4858 Å. were, resp., 7-10%, 7-10%, and 4-6%.  
 The arc temp. on using the rectifier was higher than when  
 220 v. d.c. was used.  
 J. J. Bikerman

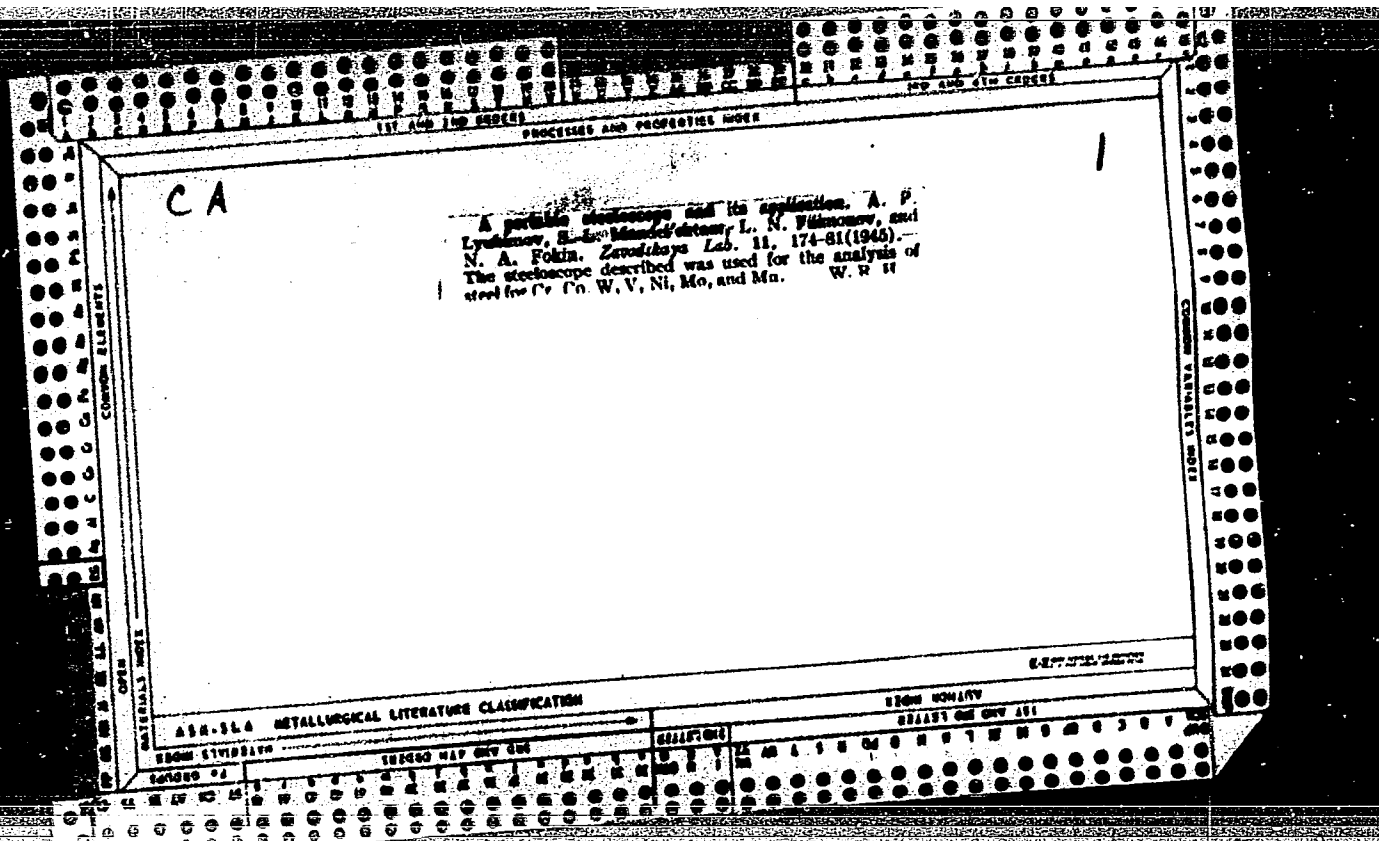
*optical Inst - AS USSR* (Probable optical Inst. of Physics  
 Inst. in P.N. Lebedev)

ASB. 31A METALLURGICAL LITERATURE CLASSIFICATION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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LIST AND END CODES		PROCEDURES AND PROPERTIES NOTES		120 AND 210 CODES	
PROCESSING AND PROPERTIES NOTES					
CA					
<p>A portable spectroscopy and its application. A. P. Lebedev, B. L. Mandelstam, L. N. Filimonov, and N. A. Fokin (Moscow Steel Inst. "Stalim"). <i>Sov. Acad. Sci. U.S.S.R., Sov. Phys.</i> 9, 745-7(1946).—A portable instrument for scrap analysis, capable of being operated in direct sunlight, is described. The optics of the instrument and the circuit of the portable generator are given. The total wt. of the instrument is 3 kg., of the generator 5 kg.</p> <p style="text-align: right;">B. Fokker</p>					
A.S.M.-I.A. METALLURGICAL LITERATURE CLASSIFICATION					
MATERIALS INDEX		EDMONT STUBS		6-27-72-1482	
COVER		EDMONT HELP ONLY SEE		EDMONT HELP ONLY SEE	
CONTRACT #2		EDMONT HELP ONLY SEE		EDMONT HELP ONLY SEE	



MANDEL'SHTAM, S. I.

An introduction to spectrum analysis. Moskva, Gos. inzh. tekhn.-teor. i zh.  
lit-ry, 1966. 259 p.

Cy. 11. 1966





1ST AND 2ND ORDER      3RD AND 4TH ORDER

PROCESSING AND PRESENTATION MODES

9

Optical and electric research on short impulse processes in the activated alternating-current arc. I. S. Abramson and S. I. Mandel'stam (Acad. Sci. U.R.S.S., Phys. Inst. im. L. Lebedeva). *Bull. acad. sci. U.R.S.S. Ser. phys.* 11, 223-7 (1947).—The authors examd. with a photomultiplier and an oscillograph the ripple appearing in the light intensity oscillogram in each cycle of a discharge. The following lines were studied: Hg 4358 Å. (low-pressure Hg-A arc) Zn I 4811 Å. (arc between Zn electrodes) Zn I 4811 Å., Zn II 4925 Å. (spark), Al II 4063 Å., and Al III 4330 Å. (spark). The oscillograms show that the temp. at the start of the discharge is higher than at the end. The oscillations seem to come from whirls of gas in the channel of the arc. S. Paksver

ASS-51A METALLURGICAL LITERATURE CLASSIFICATION

197000 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

MANDEL'SHTAM, S. L.

Jul 47

USSR/Physics  
Spectral Lines  
Spectrum Analysis

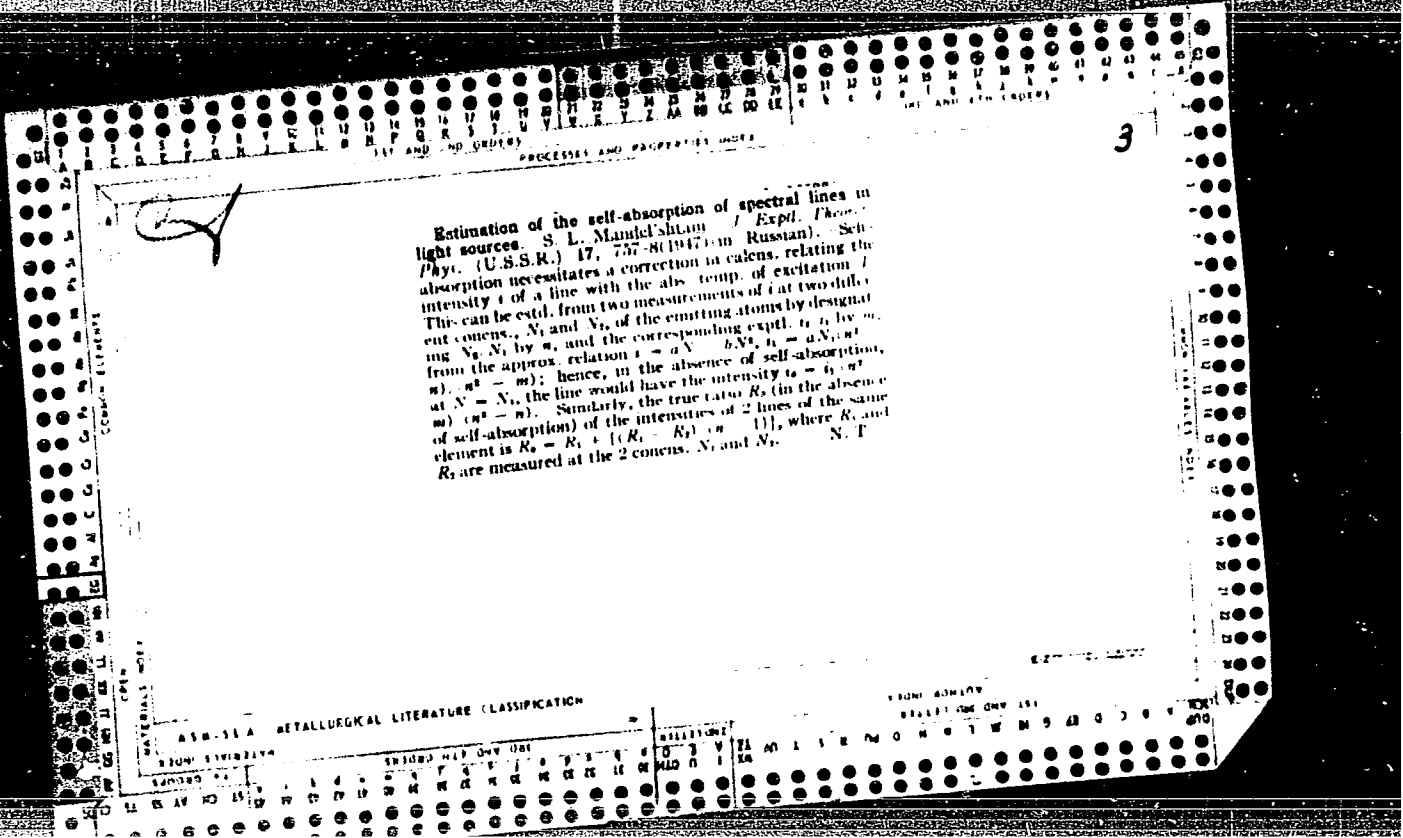
"Factors Affecting the Intensity of Spectral Lines in Flames during Spectrum Analysis,"  
V. G. Alekseyeva, S. L. Mandel'shtam, Physics Laboratory imeni P. M. Lebedev, Academy  
of Sciences of the USSR, 16 pp

"Zhur Tekh Fiz" Vol XVII, No 7

Discusses work conducted to investigate various tin compounds, the effect on the  
intensity of the lines separated in volatile compounds, the conditions for disassociation  
of salts which are introduced and the formation of new molecules in the flames, and  
approximate calculations for the degree of disassociation for various compounds.

The author attempts to explain the intensity of the spectral lines on the basis of the  
data obtained from the experiments.

PA 2472



3

*CA*

The excitation of atoms of metals in the inner cone of a flame. V. G. Alekseeva and S. L. Mandel'shtam. *J. Exptl. Theoret. Phys.* (U.S.S.R.) 17, 789-831 (1947) (in Russian). From measurements of the relative intensities of the 2810, 2830, 2983, 3080, 3175, and 3202 Å lines of Sn in the inner cone of an acetylene in flame (sepl. from the outer cone by a quartz tube), and the probabilities  $\rho$  of transition and the energies  $\epsilon$  of the upper levels, absence of a Boltzmann distribution of the excited states (in contrast to the outer cone) was concluded from the non-linearity of  $\log(\rho/\epsilon)$  as a function of  $\epsilon$ . In contrast to the outer cone, where inversion of the Na 6880, Li 6707, K 4044, and Ti 5350 Å lines occurred at the same temp. (2530°), each line gave a different temp. in the inner cone (Na 1860°, Li 2270°, K 2110°, Ti 2520°), in disagreement with Kirchhoff's law. Consequently, excitation of metal atoms in the inner cone is not thermal, chemiluminescence phenomena evidently play a major role. N. F.

ASB-31A METALLURGICAL LITERATURE CLASSIFICATION

ABRAMSON, I.S.; GEGECHKORI, N.M.; DRABKINA, S.I.; MANDEL'SHTAM, S.L.

Canal of the spark discharge. Zhur. eksp. i teor. fiz. 17 no.10:862-867 '47.  
(MLRA 6:7)

1. Fizicheskiy institut im. P.N. Lebedeva Akademii Nauk SSSR.  
(Electric spark)

Mechanism of electrical erosion of a metal. S. I. Mandel'shtam and S. M. Ralskil (Acad. Sci. U.S.S.R.) *Izv. Akad. Nauk S.S.S.R., Ser. Fiz.* 13, 549-56 (1949). Erosion of electrodes, especially in a condensed spark discharge, is considered to be a secondary process and attributed to the mech. action of metal vapor jets ("torches") formed by the discharge of high c.d. mostly from the cathode and eroding the anode. At low c.d. the process is reversed. Tests were made with a spark discharge between steel roller bearings in air. The spark energy was independent of the size of the gap. At small gaps the erosion was high and the anode was more eroded; at bigger gaps the erosion was less and stronger on the cathode. A conical cathode with a sharp point caused a higher destruction of the anode than a round cathode. Electrodes of Fe, Al, Mg, Cu were investigated; Cu caused the highest destruction on the opposite electrode. A quartz plate introduced so as to shield the "torches" without disturbing the discharge prevents erosion completely. To prevent the spreading of the "torches" one or both electrodes were enclosed in capillaries and the jets directed on a steel plate causing high erosion. In these conditions at high c.d. the jets were unstable but became stable upon introduction of a self-induction coil. Stable jets do not cause erosion, a critical min. speed of at least 2 km./sec. being required. Immersion in a liquid increases erosion probably because of a channeling of the "torches". S. Pakswar

Phys. Inst. in. Leningrad

C.A.

Spectrographic determination of nitrogen in steels. S. L. Mandel'shtam and O. B. Pal'kova (Stalin Steel Inst., Moscow). *Zavodskaya Lab.* 10, 430-4 (1950).—Method I: A 4.5-microfarad condenser, charged to 16 kv. through a kenotron, discharges through a 4 mm. regulating gap, which is in series with a 0.5-ohm resistor, a 250-microhenry inductance, and the 0.3 mm. analytical gap. The latter is kept in an atm. of 25-30 cc. of CO<sub>2</sub>. A series of 10 discharges is used per analysis; the sample is moved between discharges because of local impoverishment of the steel in N. Method II: Samples are kept in 35 cc. of CO<sub>2</sub> and excited by an activated low-voltage intermittent arc with a 110 microfarad power condenser charged to 220 v. Both the series regulating gap and the analytical gap are 0.35 mm. wide. Exposures are short (~0.5 sec.) in order to avoid local impoverishment in N. The intensity ratio of N II 3905.0 to the adjacent background is plotted as a function of N content (dctd. chemically). The limit of detection is ~0.003% N by both methods; av. deviations for sets of 5 replicates ranged from 6 to 20% of the amt. present. C. Feldman

c a.  
1951

Electronic Phenomena  
3

**Broadening of spectral lines under the action of ions and electrons.** S. L. Mandel'shtam and N. N. Sobolev (P. N. Lebedev Phys. Inst., Acad. Sci. U.S.S.R., Moscow). *Zhur. Eksp. Teor. Fiz.* 20, 323-9(1950). Criteria are derived for the applicability of collision and of statistical considerations. Collision considerations are applicable if the time of the collision  $\tau$  is much shorter than the mean time  $\theta$  elapsing between collisions. With  $\tau = \rho/r$ , where  $\rho$  = radius of the effective cross section for the collision,  $r$  = relative velocity of the colliding particles, and  $\theta = 1 - \rho^2 N$ , where  $N$  = no. of electrons or ions, cc., the criterion becomes  $\rho^2 N \ll 1$ . For spectral lines with linear Stark effect,  $\rho = \alpha/r$ , where  $\alpha$  = Stark const. for the given line, and for lines with quadratic effect,  $\rho = (\alpha\beta/2r)^{1/2}$ , hence the criteria  $R_c' = \alpha^2 N/r^2 \ll 1$  and  $R_c'' = \alpha^2 \beta N/2r \ll 1$ , resp. The corresponding criteria for the applicability of Holtsmark's statistical consideration are, resp.,  $R_s' = \alpha N/r \gg 1$  and  $R_s'' = \beta N/r \gg 1$ . The consts.  $\alpha$  and  $\beta$  are related to the consts.  $A$  and  $B$  of the linear and the quadratic Stark effects ( $\Delta\lambda = AE$  and  $\Delta\lambda = BE^2$ , resp., where  $E$  = elec. field strength) by  $\alpha = 2.7 \times 10^9 A/\lambda^2$  and  $\beta = 0.38 B/\lambda^3$ . In an elec. arc at 5000°K., for quadratic lines, the criteria are, for broadening by electron collision,  $R_c'' = 3 \times 10^8 \beta \ll 1$  and  $R_s'' = 7 \times 10^7 \beta \gg 1$ , and for broadening by ion collision,  $R_c' = 1 \times 10^{11} \beta \gg 1$  and  $R_s' = 2 \times 10^9 \beta \gg 1$ . Comparison with exper. data for lines with quadratic Stark effect shows the applicability of the collision criteria  $R_c''$ . Estn. of the abs. broadening shows that for lines with  $\beta = 1 \times 10^{11} - 1 \times 10^{10}$  it is due mainly to collisions with electrons. For lines with lower  $\beta$ , the role of Stark broadening becomes negligible, whereas for lines with higher  $\beta$ , statistical broadening may become significant. In the case of lines with linear Stark effect, collision and statistical broadening play roles to approx. the same extent. N. Thon



USSR/Astronomy - Solar Radiation,  
Ultraviolet

Feb 52

"Survey of Works on the Investigation of Shortwave  
Ultraviolet Radiation of the Sun" S. L. Mandel'-  
shtam

"Uspekh Fiz Nauk" Vol XLVI, No 2, pp 145-178

Expounds the results of investigations carried out  
in recent years on the study of shortwave ultra-  
violet radiation of the Sun with the aid of V-2  
rockets. These results are incomplete and non-  
systematic and sometimes deserve serious criticism.  
Only 3 Soviet references are given, namely,

21073

USSR/Astronomy - Solar Radiation,  
Ultraviolet  
(Contd)

Feb 52

I. S. Shklovskiy, "Iz Krymskoy Astron Obser 4,  
80, 1949; E. R. Mustel' and A. B. Severnyy, "Dok  
Ak Nauk SSSR" 80, 867, 1951; translation into  
Russian of M. Waldmeyer's "Results and Problems  
of Solar Investigation" (Foreign Lit Press, Moscow,  
1950). Acknowledges counsel of A. B. Severnyy and  
I. S. Shklovskiy.

20173

MANDEL'SHTAM, S. L.

MANDEL'SHTAM, S. L.

913 AEC-tr-2320  
PHOTOELECTRIC INVESTIGATION OF THE SPECTRUM  
FROM THE CHANNEL OF A SPARK DISCHARGE. L. A.  
Valnshteyn, A. M. Leontovich, E. P. Malyuskina, and S. L.  
Mandel'shtam. Translated from Zhur. Ekspil. i Teoret.  
Fiz. 24, 328-36 (1963). 14p. Available from Associated  
Technical Services (Trans. 8068R), East Orange, N. J.

A description is given of the method and apparatus for  
photoelectric registration of the intensity of spectral lines  
in a single pulse of a spark discharge, using an oscilloscope.  
An investigation is made of the change taking place during  
the process of development of a spark discharge in air, of  
the intensities of the spectral lines of nitrogen of various  
degrees of ionization, and of the line  $H_{\alpha}$ . A number of in-  
terrelations which characterize the excitation of the  
spectrum in the discharge channel have been established.  
(auth)

3

MANDEL'SHTAM, S. L.

USSR.

537,523.4  
 11093. Elementary processes in the spark-discharge  
 channel. S. L. MANDEL'SHTAM AND M. K. SAKHODANV.  
 Zh. eksper. teoret. fiz. i aplik. 40:1-7 (1953) In Russian.  
 In connection with experimental results described  
 by Valushteln, Leontovich, Malyavkin and Man-  
 del'shtam [Abstr. 8331 (1954)] this paper analyses  
 the conditions of spectrum excitation and ionization  
 of atoms in the spark-discharge channel. It is found  
 that, while the distribution of the atoms among the  
 excitation levels follows the Boltzmann equation,  
 their ionization is described by the Saha equation, the  
 electron temperature being taken as temperature in  
 both cases. The period of equalization of the  
 electron and gas temperatures is  $\sim 10^{-7}$  sec, that of  
 attaining equilibrium distribution for excitation is of  
 the order of  $10^{-10}$  sec and for ionization  $10^{-7}$  sec.  
 Although experiments were conducted with sparks in  
 air, the conclusions are probably applicable to other  
 gases, too. I. LACUMEN

*[Handwritten signature]*

MANDEL'SHTAM, S. L.

USSR/Physics - Spark discharge

Card 1/1 Pub. 43 - 27/97

Authors : Mandel'shtam, S. L.

Title : Excitation of a spectrum in a spark discharge channel

Periodical : Izv. AN SSSR, Ser. fiz, 18/2, 261-262, Mar-Apr 1954

Abstract : Brief reviews are presented of several works carried out at the P. N. Lebedev Physics Institute of the Academy of Sciences USSR concerning the excitation of spectra at the beginning of a spark discharge. The reviews pertain mostly to the work of G. G. Dolgov and S. L. Mandel'shtam who studied the density and temperature of the gas in a spark discharge, the work of Mandel'shtam and associates in studying the time of illumination of different spectral lines. The results obtained in these works are briefly described.

Institution : Academy of Sciences USSR, The P. N. Lebedev Physics Institute

Submitted : .....

MANDEL'SHTAM, S. L.

USSR/Physics - Spectral analysis

Card 1/1 Pub. 43 - 4/62

Authors : Abramson, I. S., and Mandel'shtam, S. L.

Title : Certain problems of photoelectric spectral analysis methods

Periodical : Izv. AN SSSR. Ser. fiz. 18/6, 635-643, Nov-Dec 1954

Abstract : Certain problems connected with the photoelectric spectral analysis methods were discussed during the 9-th All-Union Conference on Spectroscopy. The major advantages of the photoelectric analysis methods are listed as follows: considerable speed-up of the analysis process, and its automatization and greater measurement accuracy. The basic elements of a photoelectric spectrum registration system - source of spectrum excitation, spectral apparatus, photo-electric radiation receivers, photo-current registration units, etc. are described. The various scientific fields with great prospects for spectroscopy are listed. Diagrams, graphs.

Institution : Acad. of Sc., USSR, The P. N. Lebedev Phys. Inst. and the Commission on Spectroscopy

Submitted : .....

MANDEL'SHTAM, S.L.

KIBISOV, G.I., kandidat khimicheskikh nauk; STERIN, Kh.Ye., kandidat fizikomatematicheskikh nauk; VREDEN-KOBETSKAYA, T.O., mladshiy nauchnyy sotrudnik; MANDEL'SHTAM, S.L., doktor fiziko-matematicheskikh nauk, redaktor; GUROV, K.P., redaktor; SOKOLOVA, T.F., tekhnicheskii redaktor.

[Spectrum analysis; annotated list of Soviet works on spectrum analysis, 1931-1950] Spektral'nyi analiz; annotirovannyi ukazatel' sovetskikh rabot po spektral'nomu analizu, 1931.-1950. Moskva, 1955. 181 p. (MLRA 8:12)

1. Akademiya nauk SSSR. Komissiya po spektroskopii. (Bibliography--Spectrum analysis)

MANDEL'SHTAM, S.L.; SUKHODREV, N.K.

Applicability of Kirchoff law to the emission of gaseous discharge plasma. Izv. AN SSSR Ser. fiz. 19 no.1:11-14 Ja-F '55.  
(MIRA 8:9)

1. Fizicheskiy institut imeni P.N. Lebedeva Akademii nauk SSSR  
(Spectrum analysis) (Spectrometer)

MANDEL'SHTAM, S.L.; TINDO, I.P.

Additional data on the photoelectric investigation of spark channel spectra. Izv. AN SSSR. Ser. fiz. 19 no.1:60-61 Ja-F '55. (MIRA 8:9)

1. Fizicheskiy institut imeni P.N. Lebedeva Akademii nauk SSSR  
(Spectrum analysis) (Spectrometer)



Mandel'shtam, S.L.

3337. Method of evaporation and its use in the determination of boron and other impurities in uranium. S. L. Mandel'shtam, N. N. Semenov and Z. M. Turovskaya (P. N. Lebedev Phys. Inst. Acad. Sci., U.S.S.R., Moscow). *Zhur. Anal. Khim.*, 1956, 11 (1), 9-20. — To increase the sensitivity of the spectrographic determination of very small concn. of impurities in heavy metals, particularly U, a method, based on the separation of the processes of evaporation and excitation, the separation of the impurities from the basic element and the aggregation of the impurities, has been developed and applied to the determination in U of  $< 7 \times 10^{-4}$  per cent. of B,  $< 1 \times 10^{-4}$  per cent. of Cu, Fe and Ni, and  $< 1 \times 10^{-3}$  per cent. of V. The accuracy is within  $\pm 15$  per cent. of the content. The apparatus and method are described. G. S. Smirni.

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MANDELSHTAM, S.

"Spectrum-Excitation in Spark Discharges", a paper presented at the Sixth International Spectroscopical Colloquium, Amsterdam, 14-15 May 1954.

Academy of Sciences of the USSR, Moscow.

Translation-D560119

<sup>H</sup>  
WANDELSTAM, S. L., Moscow  
<sub>A</sub>

"Untersuchungen der Funkenentladung," a paper submitted  
at the Third International Conference on gaseous Electronics, V. Kobe, 22-27  
Jun 57

001065

MANDEL'SHTAM, S., Moscow.

"Cross Stability of Toroid Discharges by Comparison with Vortex Theory,"  
a paper submitted at the Third International Conference on Ionization  
Phenomena in Gases, 11-15 Jun 57, Venice.

SO:B-3,087,498

MANDEL'SHTAM, S.L.; CHULANOVSKIY, V.M.

The Tenth All-Union Conference on Spectroscopy and its  
Applications. Opt. i spektr. 2 no.1:143 Ja '57. (MLRA 10:2)

(Lvov--Spectrum analysis--Congresses)

MANDEL'SHTAM, S. L.

3  
1-4846

*[Handwritten initials]*

Broadening and shift of spectral lines in gas-discharge plasma. M. A. Mazing and S. L. Mandel'shtam (P. N. Lebedev Phys. Inst., Acad. Sci. U.S.S.R., Moscow). *Optika i Spektroskopiya* 2, 276-8 (1957).—The widening and the shift (both in Å.) in the following lines of Ca in emission spectrum at atm. pressure were, resp.:  $\lambda$  4875 Å. ( $3^1D_2-4^1P_1$ ) 0.108, 0.027;  $\lambda$  4578 Å. ( $3^1D_2-4^1F_3$ ) 0.107, 0.030;  $\lambda$  5041 Å. ( $3^1D_2-8^1P_1$ ) 0.120, 0.023;  $\lambda$  5180 Å. ( $4^1P_1-5^1D_2$ ) 0.124, 0.013. The Stark const. for 4878-Å. and 4578-Å. bands was, resp.,  $6.5 \times 10^{-11}$  and  $11.3 \times 10^{-11}$  cm.<sup>3</sup> sec.<sup>-1</sup>, and the  $n_0$  value of N<sub>2</sub> was  $0.9 \times 10^{18}$  cc.<sup>-1</sup> which agrees well with results obtained by other methods. The sensitivity of the method was 0.002 Å.

A. P. Katiobv

*[Handwritten initials]*

Mandel'shtam, S.L.

AUTHOR: Bekabran, I. Ye., 100-1-10/10

TITLE: Conference on Electric Contacts (Sovetskoye proelektricheskoye kontaktan)

PERIODICAL: Avtomatika i Telemekhanika, 1957, Vol. 19, Nr 1, pp. 99-100 (USSR)

ABSTRACT: This conference took place in Moscow from November 26<sup>th</sup> to 28<sup>th</sup> 1956. It was organized by the Institute for Automation and Remote Control AN USSR together with the Scientific Research Institutes. 170 representatives from 53 organizations took part: 33 institutes and 20 making firms. 25 lectures were given.

S.L. Mandel'shtam, V.P. Shabanovskiy, and N.K. Samoilov (Moscow) showed, that a spark-discharge is characterized by a high density of the energy emitted by the electrodes, the energy dispersion from the cathode taking the form of an explosion, L.S. Palatnik (State University, Khar'kov) proved, that in the transmitting effects of an electric spark treatment the physical and chemical features of the electrodes and the surrounding medium are of great importance. He proposed criteria for transmission and interaction between the electrodes. B.N. Zelot'ysh (Central Scientific Research Laboratory for an Electrical Spark Treatment of Materials AN USSR) showed, that the magnitude of erosion is connected with the heat constants of the materials and that it is proportional to the energy content

Card 4/5

MANDEL'SHTAM, S. I.

The possibility of a metal composition analysis in an arc furnace without sampling. V. N. Balandina and S. I. Mandel'shtam. *Zavodskaya Lab.* 23, 646-8 (1967). The analysis of the spectrum of the glowing metal during smelting in an arc furnace, without taking a sample from the furnace, was tested. By using the arc in the furnace as the excitation source of the spectrum, the spectrum was photographed with a portable spectrograph with glass prisms, located at 4-5 m. from the arc. The spectrograph slit received its light from the arc, the glowing electrodes, the slag surface, etc. When the photographs were to be taken the electrodes were raised above the slag surface. The slag was not tapped, nor were any additions made while the spectrum was photographed. For comparison, the metal and slag were sampled immediately prior to the exposure, and sent for spectrum analysis in the lab. The ratio of the background intensity to the line intensity in the furnace detm. was satisfactory, but the line reabsorption was observed at lower concns. of the alloying metals.  $^{23}Cr$  and  $Mn$  were volatilized from the fused metal. This method of analysis is practical.

1-4E2c  
 1-4E4J  
 1-4E3D

W. M. Sterubers

NS  
 Phys. Inst. im P. N. Lebedev, AS USSR



*Mandel'shtam S.L.*

AUTHOR: Mandel'shtam, S.L., Doctor of Physical-Mathematical Sciences, 30-8-9/37  
Striganov, A.R., Doctor of Physical-Mathematical Sciences

TITLE: A Symposium on Spectrography at Chicago (Simpozium po spektroskopii v Chikago)

PERIODICAL: Vestnik Akademii Nauk SSSR, 1957, Vol. 27, Nr 8, pp.60-62 (USSR)

ABSTRACT: The authors of this report attended the above mentioned symposium (29.April - 1.May). More than half of the reports was devoted to the various problems concerning the practical application of the emission spectral analysis; the corresponding devices and exhibits were demonstrated. The works on the determination of P, S, C in steel were of special interest. In his report N. Launani (Sweden) pointed out the possibility to determine P in steels by means of a quantometer. E. Lushera (Switzerland) dealt with the problem of the immediate registering in the ultraviolet of the vacuum. Special interest was caused by the reports on the application of the method of transmission in spectroanalysis which was applied for the first

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A Symposium on Spectrography at Chicago

30-8-9/37

time in the USSR (N.S. Sventitskiy and Taganov). The author of this paper reported on "The spectral analysis according to the Evaporation Method" and "Graduation Graphics for the Case of an Isotope Spectral Analysis". It is remarkable that for spectral analysis the American colleagues mainly apply the photoelectric method.

AVAILABLE: Library of Congress

Card 2/2

AUTHOR  
TITLE

53-1b-11/18  
MANDEL'SHTAM, S.L., YEFREMOV, A.I.  
Investigations of the Short-Wave Ultraviolet Radiation of the Sun  
(Issledovaniya korotkovolnovo ul'travioletogo izlucheniya solntsa.  
Russian)

PERIODICAL

Uspekhi Fiz. Nauk, 1957, Vol 63, Nr 1b, pp 163 - 180 (U.S.S.R.)

ABSTRACT

The present paper gives a short report on recent results obtained by experimental and theoretical work on the short-wave radiation of the sun which were published since the first survey given of this topic (S.L. MANDEL'SHTAM, Uspekhi Fiz. Nauk, Vol 46, p 145 (1952)). The author further suggests that experiments be carried out by means of artificial earth satellites.

The radiation of the photosphere: The authors describe the paper by H. CLEARMAN, Astrophys. J. Vol 117, p 29 (1953) as the most important in this field. Above all the presence of various elements in the sun is discussed, something is also said on molecular bonds. According to the authors' opinion this paper by Clearman does not contain any essentially new results. Other papers (among them theoretical ones) are then discussed.

The radiation of the chromosphere was investigated by the spectral analysis of light by means of spectrographs. Photoelectric receivers with separation of a narrow spectral region were also used. By special systems

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53-1b-11/18

Investigations of the Short-Wave Ultraviolet Radiation of the Sun

the optical axis of the spectrograph could be oriented to the sun, while the rocket covered the upper part of its orbit. In this manner the recorded spectrum could be farther advanced into the short-wave region. Various papers on this problem are discussed.

The radiation of the corona was investigated in earlier as well as in more recent works by means of photoelectric receivers, i.e. photon counters which separate narrow spectral regions by filters. The papers on this problem are discussed in short.

The variations of radiation and the experiments carried out by means of artificial earth satellites. The results given in the preceding articles indicate the existence of very considerable variations of intensity of the line  $L_{\alpha}$  emitted by the chromosphere and of the roentgen region of the spectrum emitted by the corona. These variations are doubtlessly connected with physical processes taking place in the chromosphere and in the corona of the sun. These variations of the intensity of short-wave ultraviolet ionizing radiation of the sun cause considerable perturbations in the terrestrial atmosphere (disturbance of radio communication, magnetic storms etc.). The attempt was recently made to connect these variations with solar eruptions.

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Investigations of the Short-Wave Ultraviolet Radiation of the Sun

The international geophysical year just coincides with the 11 years' period of maximum solar activity, which is very favorable for the investigations of the variations of the intensity of short-wave solar radiation. Artificial earth satellites should be well suited for this purpose. Experiments planned in the USA are mentioned. In the U.S.S.R. the measurements of solar radiation will be begun in the roentgen region of the spectrum. The individual spectral regions will be separated by filters. The radiation currents will be measured by a single receiver. The block system of an apparatus for the recording of the roentgen region of the solar spectrum is illustrated by a drawing. Multipliers of beryllium bronze will be used as radiation receivers for secondary electrons. In front of the receiver are placed filters consisting of aluminum, beryllium, and polyethylene filters of various thicknesses. The calculated transmission curves of various filters are illustrated by a diagram and discussed. Every other two filters are changed in series. In the disk with the filters there are also normal holes through which the radiation directly impinges on to the photocathode. The signals (voltage pulses) coming from the receiver impinge on to a counting and recording radiotechnical system. At the output of this system continuous voltages develop proportional to the counting speed of the pulses. The

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53-1b-11/48

Investigations of the Short-Wave Ultraviolet Radiation of the Sun  
following stage in the investigations with earth satellites consists  
of the determination of the line spectra of the chromosphere and the  
corona of the sun. (With 13 illustrations, 5 tables).

ASSOCIATION  
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SUBMITTED  
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Not given

Library of Congress

Card 4/4

MANDEL'SHTAM, S. L.

53-2-3/9

AUTHOR: Mandel'shtam, S.L.

TITLE: **A Short Sketch of the Life and Activities of G.S. Landsberg, Academician**  
(Kratkiy ocherk zhizni i deyatelnosti Akademika G.S. Landsberga)

PERIODICAL: Uspekhi Fiz Nauk, 1957, Vol. 63, Nr 2, pp. 289 - 299 (USSR)

ABSTRACT: The course of the life of Grigor Samuilovich Landsberg was lacking spectacular events, as it often happens in the case of eminent scientists, but the more brilliant was his scientific career. The development of spectral analysis in the Soviet Union is closely connected with the name of Landsberg. Landsberg was born in Vologda on January 22nd, 1890, he was the son of an official of the State Forest Service. He commenced his studies at the Mathematical-Physical Faculty of the Moscow University in 1908, and he left it with an excellent diplome. He published his first scientific paper on very high resistances in 1915. Later on, he was called to the arms. From 1918 to 1920 he lectured at the Agricultural Institute in Omsk and after his return to Moscow he became a collaborator at the Institute for Physics and Biophysics. 1923 he was appointed assistant and later

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53-2-3/9

**A Short Sketch of the Life and Activities of G.S. Landsberg, Academician**

an lecturer at the Institute for Theoretical Physics of the Moscow University. From 1923 to 1931 he was professor at the Second Moscow University, (which is now the Pedagogical Institute). Landsberg's work was strongly influenced by Mandel'shtam in the years from 1925. Numerous investigations of Rayleigh's scattering (releyevskoye rasseyaniye) were conducted by Landsberg and his students in these years. Landsberg and Mandel'shtam examined theoretically the combination scattering and, in 1930, they discovered the fine structure of the Rayleigh line (liniya Rayleigh). They discovered the selective scattering light in 1931. 1932 Landsberg was appointed corresponding member of the Academy of Science of the USSR. He recognized, above all others, the possibilities of spectral analysis for purposes of material examination, and he received the Stalin prize for investigations dealing with the same subject. At the beginning of the war, in 1941, Landsberg supervised the erection of emergency installation of the Physical Institute of the Academy of Science of the USSR in Kazan'. 1946 he became an acting member of the Academy of Science of the USSR. He was one of the organizers of the new Physical-Technical Faculty of the Moscow University. There are 2 figures.

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Mandel'shtam, S.L.

8(2)

PHASE I BOOK EXPLOITATION

SOV/1855

Soveshchaniye po elektricheskim kontaktam. Moscow. 1956.

Elektricheskiye kontakty; trudy soveshchaniya (Electrical Contacts; Transactions of the Conference) Moscow, Gosenergoizdat, 1958. 303 p. 4,150 copies printed.

Editorial board: B.S. Sotskov (Resp. Ed.), V.V. Usov, R.S. Kuznetsov, I.Ye. Dekabrun, and Z.S. Kirillova; Ed.: I.Ye. Dekabrun; Tech. Ed.: K.P. Voronin.

PURPOSE: This collection of articles is intended for engineers and technicians designing, developing and operating electrical apparatus and is concerned with electric contact materials. It may also be useful in scientific research institutes and laboratories.

COVERAGE: This book comprises reports delivered at the Electric Contacts Conference held in Moscow in November, 1956. These papers cover physical processes occurring during connecting or disconnecting, methods of designing and testing electric contacts, production and characteristics of contact materials. During this conference of the Institut avtomatiki telemekhaniki AN SSSR (Institute of Automation and Telemechanics, Academy of Sciences, USSR) participants approved periodic conferences of physicists, metallurgists, chemists and apparatus design specialists to discuss problems of electric contacts, which are the components of electric

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## Electrical (Contacts (Cont.))

SOV/1855

apparatus primarily influencing the reliability of electric systems, especially d-c control systems. Their physical, thermal, mechanical and chemical processes have still not been well analyzed. References are given at the end of most of the reports.

## TABLE OF CONTENTS:

Foreword	3
I. PHYSICAL PROCESSES	7
Kragel'skiy, I.V. (Institut mashinostroyeniya AN SSSR - Machine-Building Institute, Academy of Sciences, USSR) Contact Area of Rough Surfaces	7
According to the author, ideal smooth surfaces of mica protrusions measure 20 A, on the best quartz crystal 100 A, on highly polished metal surfaces 0.05 - 0.1 micron, and on rough metal surfaces 100-200 microns. Moreover, the machined surfaces usually have a wavy structure. The author has devoted his paper to finding methods of calculating the actual area of contact of surfaces. After a detailed theoretical and practical analysis he derives formulas for practical use by designers. There are 6 references, of which 5 are Soviet and 1 English.	
Card 2/11	

Electrical Contacts (Cont.)

SOV/1855

Mandel'shtam, S.L., Sukhodrev, N.K. and Shabanskiy, V.P. (Fizicheskiy Institut AN SSSR - Institute of Physics, Academy of Sciences, USSR) Processes Occurring on Electrodes During an Arc Discharge 25

This article is an abridged version of the report delivered at the 10th Spectroscopy Symposium. It was printed in full in the transactions of this symposium. It is based on the results of research carried out by the authors at the Institute of Physics. The authors found that processes of arc discharge are different for the plate and cathode. Photographs of spots, left after the discharge show a different structure, the plate spot being much larger than the cathode arc.

Zolotykh, B.N. (Tsnilektron, Academy of Sciences, USSR) Dynamics of the Process of Electric Erosion of Metals by Electric Pulse Discharge 27

The author explains briefly the theoretical fundamentals of this phenomenon and discusses in detail its basic regularities, the additivity law, the relation between erosion volume and spark energy, the relation between erosion volume and thermal constants of metals, the polarity of electric erosion and its relation to pulse duration. He reports results of experimental investigation of the formation of spots and indentations on electrode surfaces caused by single pulse discharge. He refers to G.V. Gusev and A.S. Zingerman and thanks A.I. Kruglov, Zh.Ye. Gryazunova and I.P. Korobova.

Card 3/ 11

MANDELSHTAM, D. L.

AUTHOR: Ukholin, S. A., Candidate of Physical-Mathematical 30-2-38/49  
Sciences

TITLE: New **Studies** in the Field of Spectroscopy (Novyye raboty  
v oblasti spektroskopii). Conference in Moscow (Soveshchaniye  
v Moskve)

PERIODICAL: Vestnik Akademii Nauk SSSR, 1958. . . . . Nr 2, pp. 107-107  
(USSR)

ABSTRACT: The 11<sup>th</sup> All Union Conference for Spectroscopy was held from  
December 2 to December 10, 1957 in Moscow. The topics were  
particular problems of spectroscopy and questions of lumin-  
escence. About 600 representatives of scientific research in-  
stitutes of the AS USSR and the academies of the Union repu-  
blics, of the branch institutes and the universities of 36  
cities of the country took part. Among the guests there were  
scientists from China, Roumania, Yugoslavia, the German Demo-  
cratic Republic, the German Federal Republic, the USA, Eng-  
land, and France. In 7 general meetings and 12 sectional meet-  
ings 132 reports were heard and discussed. They treated the  
theoretical and experimental determination of the atom con-  
stants, the spectroscopy of the plasma, of the crystals and

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New Studies in the Field of Spectroscopy.  
Conference in Moscow

3C-2-38/49

of the transition stages, the investigation of intermolecular interactions, and the investigation of the conversion of the electric energy and spectroscopy of the stages of molecular oscillation. The opening speech was held by S. L. Mandel'shtam, Chairman of the Commission for Spectroscopy. S. E. Frish reported on Soviet spectroscopy during the last 40 years, and A. F. Prikhot'ko reported on the investigation of molecular crystals especially at low temperatures. There were also many discussions.

AVAILABLE: Library of Congress

1. Spectroscopy-Applications 2. Luminescence

Card 2/2

MANDEL'SHEAM, S.L.; SUKHODREV, N.K.; SHABANSKIY, V.P.

Processes on spark-discharge electrodes. Fiz.sbor. no.4:148-  
154 '58. (MIRA 12:5)

1. Fizicheskiy institut imeni P.N.Lebedeva AN SSSR.  
(Electric spark) (Electrodes)

MAZING, M.A.; MANDEL'SHTAM, S.L.

Broadening and shift of spectrum lines in the plasma of a  
gas discharge. Fiz.sbor. no.4:305-307 '58. (MIRA 12:5)

1. Fizicheskiy institut imeni P.N.Lobedeva AN SSSR.  
(Spectrum analysis) (Electric discharges through gases)

BALANDIN, V.N.; MANDEL'SHTAM, S.L.

Possibility of analyzing the composition of a metal in an  
arc furnace without taking a sample. Fiz.sbor. no.4:387-  
388 '58. (MIRA 12:5)

1. Fizicheskiy institut imeni P.N.Lebedeva AN SSSR.  
(Metals--Spectra)



SOV/48-22-6-1/28

AUTHOR: Mandel'shtam, S.L.

TITLE: Opening Address (Vstupitel'noye slovo)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol. 22, Nr 6, pp. 647-649 (USSR)

ABSTRACT: This speech was made on the occasion of the opening of the XI. All-Union Congress on Spectroscopy, which took place immediately after the October festivities (during the first days of November 1957) at Moscow. The author mentions that under Soviet rule important discoveries were made in this field in the USSR, above all in the field of atomic and molecular spectroscopy, by Vavilov and Cherenkov. Further, the works by D.S.Rozhdestvenskiy, S.I.Vavilov, G.S.Landsberg, V.A.Fok, A.N.Terenin and V.N.Kondrat'yev, which deal with this field, are mentioned. The author further points out that applied spectroscopy is particularly well developed in the USSR, and that it is being used in various ways for research work and production control. The author spoke a few words in connection with the decease of G.S.Landsberg, Member, Academy of Sciences, USSR and former head of the commission for spectroscopy, which took place this year.

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SOV/48-22-6-1/28

Opening Address

The author further tells that the last congress on spectroscopy, which took place at L'vov was attended by 1600 delegates, and that 300 lectures were delivered. The excessive number of delegates and the great number of subjects to be dealt with by lectures were disadvantages which caused the organizers of the congress to convene such meetings every year, but only for one particular field of spectroscopy. Thus, it is intended this year to deal only with the physical problems of spectroscopy, and that problems of applied spectroscopy will form the sole subject of the XII. meeting. The author is, however, of the opinion, that recently a "dangerous tendency" has been developing in the USSR with a view of forming two groups of "spectroscopists": The "atomists" and the "moleculists". For the convenience of the delegates it was decided that on forenoons lectures of a general character will be held, while special lectures will figure on the afternoon program. Finally, the author stresses the importance of maintaining contact with other countries, and he mentions the names of foreign scientists who attended the congress to which they had been invited: Professor Badareu (Roumania),

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SOV/48-22-6-1/28

Opening Address

Professor Bartel's (German Federal Republic), Professor and Mrs. Grillet (Griyo) (France), Professor Lokhte-Khol'tgreven (German Federal Republic), Professor Ritohl' (German Democratic Republic), Professor Thompson (England), Professor Yanke (German Democratic Republic), Professor Khadzhi (Yugoslavia), Professor Chzhou-Tun-Tsin (Chinese People's Republic), Professor Dike (USA), and Professor Lecomte (France).

1. Spectroscopy--USSR
2. Scientific personnel--Performance

Card 3/3

SOV/48-22-6-20/28

**AUTHORS:** Vaynshteyn, L. A., Koloshnikov, V. G.,  
Mazing, M. A., Mandel'shtam, S. L.,  
Sobel'man, I. I.

**TITLE:** On the Broadening and Displacement of Spectral Lines in a Highly Ionized Plasma (Ob ushirenii i sdvige spektral'nykh liniy v vysokoionizovannoy plazme)

**PERIODICAL:** Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol. 22, Nr 6, pp. 718-719 (USSR)

**ABSTRACT:** The investigation of the breadth and shape of spectral lines does not characterize the excitation of atoms with sufficient accuracy, and therefore an investigation of the breadth and the displacement of the lines is more advantageous for determining the causes of these phenomena. The principal cause of the broadening and displacement of spectral lines in a highly ionized plasma is its interaction with charged particles. For lines with quadratic Stark effect the impact theory of broadening results in the following expressions for the breadth of lines and their displacement:

$$\gamma = 11.4 C_h^{2/3} \nu^{1/3} N, \quad \Delta = 9.8 C_h^{2/3} \nu^{1/3} N,$$

where  $C_h$  denotes the constant of the quadratic Stark effect,

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On the Broadening and Displacement of Spectral  
Lines in a Highly Ionized Plasma

SOV/48-22-6-20/28

$v$  - velocity,  $N$  - the density of the excited particles. Herefrom it follows that the ratio between the breadth and the displacement of  $C_{4.7}$  and  $N$  is independent and equal to:  $\gamma/\Delta = 1.6$ . In the case of interaction of a different kind, as e.g. according to the equation by Van der Vaal  $\gamma/\Delta = 2.8$ . The task to be carried out by the present paper was to find a correct explanation of the interaction between radiating atoms and charged particles, i. e. the applicability of the aforementioned  $\gamma$ - formula with respect to the lines with quadratic Stark effect. As objects the lines Ar II, which are excited in the channel of the spark discharge, were selected. Measurements of breadths and displacements of lines were carried out photographically. Results are given by a table. By checking these results it was found that those obtained by experiment contradicted theoretical results completely. This is explained by the fact that the initial expression for the displacement of the frequency of the atom oscillator  $\Delta\omega = C_{4.7}/R^4$ , where  $R$  denotes the distance to the exciting electron, is not applicable in this case because the electrons playing the principal part in

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On the Broadening and Displacement of Spectral  
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the broadening of the lines form a Weisskopf radius that is too small. The field formed by the electrons turns out to be so strong on this occasion that the Stark effect ceases to be quadratic and goes over to linearity. There is no reason to believe that the field changes slowly and is quasistatic as is alleged by a well-known theory. The problem is still being discussed. There are 1 table and 3 references, 2 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR  
(Physics Institute imeni P. N. Lebedev, AS USSR)

1. Spectroscopy
2. Electron gas--Spectra
3. Perturbation theory

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24(3), 24(7)

SOV/ 51-6-6-2/34

AUTHORS: Sukhodrev, N.K. and Mandel'shtam, S.L.

TITLE: On the Temperature of Electrode Vapours in a Spark Discharge  
(O temperature parov elektrodov v iskrovom razryade)

PERIODICAL: Optika i spektroskopiya, 1959, Vol 6, Nr 6, pp 723-728 (USSR)

ABSTRACT: Vapour temperatures in a spark are usually assumed to be equal to electron temperatures of atoms and ions of the vapour. Electron temperature can be determined from the relative intensity of two or more spectral lines, provided atoms are distributed in excited levels according to Boltzmann's law. Earlier measurements (Refs 2, 3) yielded values  $\sim 10\,000^\circ\text{K}$  for temperatures of electrode vapours in electric sparks; these values refer to colder (outer) parts of vapour clouds ("flames"). The present paper discusses determination of temperatures in hotter parts of vapour clouds. Al III, Sn IV and Si IV lines were used (Table 1). Aluminium, tin and silicon were used because their atoms have sufficiently high ionization and excitation potentials to allow determination of temperatures above  $10\,000^\circ\text{K}$ . A glass spectrograph ISP-51 was used for Al III lines (visible region) and a quartz spectrograph ISP-22 was used for Sn IV and Si IV lines (ultraviolet region). The apparatus used is shown in Fig 1. The image of a spark  $S_1$  was focused on a spectrograph slit via an intermediate slit  $d$ , a concave mirror  $O_2$  and a rotating plane

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## On the Temperature of Electrode Vapours in a Spark Discharge

mirror  $M_1$ . The latter was rotated at 1-3 mm/sec producing a time scan (display) of the spark on a recording film in the spectrograph. The time resolution of the spark spectra ranged from  $\sim 0.04$  to  $0.1 \mu\text{sec}$ . Sparks were synchronized with rotation of  $M_1$  by means of a device, shown at the bottom of Fig 1, which ensured that a spark at  $S_1$  was produced when the image of  $S_1$  was focused at the spectrograph slit. The spark discharge circuit parameters were:  $C = 0.01-1 \mu\text{F}$ ,  $L = 2-3000 \mu\text{H}$ . The voltage across the spark gap  $S_1$  was 15 kV and the distance between electrodes was 2.5 mm. A record of a spectrum obtained between tin electrodes is shown in Fig 2; it contains Sn IV, Sn I, N II and O II lines. The results are given in Tables 2-6. Table 2 refers to sparks between tin electrodes (Sn IV lines). The results of Table 3 (Sn IV lines) were obtained with one tin and one copper electrode. Table 4 gives temperatures deduced from Sn IV and N II lines. Table 5 gives the results obtained with one aluminium or 10%-Al bronze electrode (Al III lines). Table 6 gives temperatures deduced from experiments with "silumin" electrodes containing 10% Si (Si IV lines). The temperatures deduced from Sn IV lines were  $\sim 28\ 000^\circ\text{K}$ , from Al III lines they were  $30\ 000^\circ\text{K}$  and from Si IV lines they were  $35\ 000^\circ\text{K}$ . Because of high scatter of the results

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On the Temperature of Electrode Vapours in a Spark Discharge

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it was impossible to say whether the differences between these three sets of temperatures were due to a definite cause or accidental. Since the spark-channel temperature, deduced from N II and N III lines, is  $\sim 35\ 000^{\circ}\text{K}$ , the results obtained suggest that tin, aluminium and silicon vapours were heated and excited in the spark channel itself. Acknowledgments are made to L.P. Malyavkin and V.K. Bardin for their help in experimental work. There are 3 figures, 6 tables and 13 references, 6 of which are Soviet, 2 English, 1 German and 4 international.

SUBMITTED: July 8, 1958

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SOV/51-7-2-2/34

AUTHORS: Tskhay, N.S. and Mandel'shtam, S.L.

TITLE: On the Influences which Affect the Intensity of Lines in the Flame Spectrum (O vliyaniyakh na intensivnost' spektral'nykh liniy v spektre plameni)

PERIODICAL: Optika i spektroskopiya, 1959, Vol 7, Nr 2, pp 141-151 (USSR)

ABSTRACT: The authors studied changes in the intensities of the lines in the flame spectra of sodium and strontium when the form of the compound used to introduce the element was altered and the changes which occurred on introduction of compounds of other elements. To find the reasons for these changes it is necessary to investigate the variations produced in the density of free sodium or strontium atoms in the flame and the variations in the conditions of excitation of these atoms. The method of anomalous dispersion was used to measure the densities of atoms in the flame. The apparatus used is shown schematically in Fig 1a; it is based on D.S. Rozhdestvenskiy's interferometer. To measure the densities of atoms at various distances from the axis of an acetylene flame (1 in Fig 1a) the interference fringes were localized at the centre of the flame parallel to its axis. By means of three plane mirrors 2, 3, 4 and a lens 5, the flame and the interference fringes were projected on to

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SOV/51-7-2-2/34

On the Influences which Affect the Intensity of Lines in the Flame Spectrum

a spectrograph slit 6, at right angles to the latter. A three-prism spectrograph ISP-51 was used. Solutions of the compounds employed were injected into the flame by means of an atomizer of the usual type. The flame diameter was 11 mm when Na, K or Mg were introduced into it, 9 mm for Li and 7 mm when Sr, Ca and Ba were used. The densities of atoms were measured at a height of 15 mm above the blue part of the flame. The experiment consisted of measuring the displacement of the interference fringes near an absorption line of the element studied. The change in the refractive index of the flame which produced this displacement is related directly to the atom density  $N$  by Sellmeier's formula. The displacement of the interference fringes was measured with a microscope with an error of  $\pm 5\%$ . Apart from the atom density  $N$  which was a mean across the flame, the authors determined also the distribution of atoms across the flame by measuring the displacement of the interference fringes at various distances from the centre of the flame. The authors recorded also photographically the intensities of the atomic lines and they measured the flame temperature (using self-reversal of the lines). First the authors studied the effect of the compound which was used to introduce sodium or strontium. Sodium atoms were introduced in the form of NaCl, Na<sub>2</sub>CO<sub>3</sub> and Na<sub>2</sub>SO<sub>4</sub> and strontium atoms were introduced as

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## On the Influences which Affect the Intensity of Lines in the Flame Spectrum

$\text{SrCl}_2$  and  $\text{Sr}(\text{NO}_3)_2$ . Displacement of the central interference fringe was measured at distances of 1.3 and 2.6 Å from a sodium line at 5890 Å and at a distance of 0.52 Å from a strontium line at 4607 Å. Secondly the effect of  $\text{MgCl}_2$ ,  $\text{CaCl}_2$ ,  $\text{SrCl}_2$  and  $\text{BaCl}_2$  on the density of sodium atoms in the flame and the effect of  $\text{NaCl}$  and  $\text{CaCl}_2$  on the density of strontium atoms in the flame were investigated. The authors measured the displacement of the central interference ring at a distance of 1.3 Å from a sodium line at 5890 Å and at a distance of 0.52 Å from a strontium line at 4607 Å. The results (Figs 2-7) show that the changes in the intensities of sodium and strontium lines, under conditions discussed above, are due to simultaneous effect of two factors: (1) a change in the free atom density in the flame due to a change in the rate of supply of the solution and (2) a change in the conditions of excitation due to a change in the flame temperature. This conclusion is confirmed by theoretical calculations. There are 8 figures and 16 references, 5 of which are Soviet, 5 English, 1 German, 1 Dutch, 2 Swedish and 2 others.

SUBMITTED: September 9, 1958

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MANDELSTAM, S. L.

21(0), 24(0) SOV. SCI. PHASE I BOOK EXPLOIATION Akademiya nauk SSSR. Fizicheskii Institut

Ed.: I. L. Fabelinskiy, Doctor of Physical and Mathematical Sciences; Eds. of Publishing House: A. L. Chernyak and V. G. Bergaut, Tech. Ed.: Yu. V. Ryling, Kamillovich Landsberg; I. Ye. Tem in Memory of Urigortov; (Chairman), Academician; P. A. Mazulin, Doctor of Physical and Mathematical Sciences; S. L. Mandelstam, Doctor of Physical and Mathematical Sciences; I. L. Fabelinskiy, Doctor of Physical and Mathematical Sciences; P. S. Zhaberskiy, Candidate of Physical and Mathematical Sciences; and G. P. Motulevich (Secretary), Candidate of Physical and Mathematical Sciences.

PURPOSE: This book is intended for physicists and researchers engaged in the study of electromagnetic radiations and their role in investigating the structure and composition of materials. CONTENTS: The collection contains 30 articles which review investigations in spectroscopy, optics, molecular optics, semiconductor physics, nuclear physics, and other branches of physics. The introductory chapter gives a biographical profile of G. S. Landsberg, Professor and Head of the Department of Optics of the Division of Physical Technology at Moscow State University, and reviews his work in Rayleigh scattering, gases, spectra, and analysis of metals, etc. No personalities are mentioned. References accompany each article.

Barzmin, P. A., V. I. Malyshev, and M. M. Sushchinskiy. The Work of G. S. Landsberg in the Field of Molecular Spectroscopy V Formation Processes in an Activated Discharge Generator Operating Under Conditions of Low Arc Currents

Aleksanyan, V. T., Kh. Ye. Stepan, A. L. Liberman, I. M. Kurnet, and I. Tyun-Khiza, and B. A. Kazanaky. The Possibility of Establishing the Configuration of Stereoisomeric Disubstituted Cyclohexane on the Basis of a Combined Scattering Spectrum

Andreyev, N. N. Standing Sound Waves of Large Amplitude Relation of the Width of Combined Scattering Lines to Temperature

Subyaza, F. A., and V. A. Farkhant. A Medium With Negative Absorption Coefficient

Vladimirovskiy, V. V. Nuclear Transitions in Monoperical Nuclei of Vologdanskaya, M. V. Optical Properties of Substances in the Vitreous State

Vul'fson, K. S. New Methods of Increasing the Effectiveness of Radiation Thermocouples

Ginsburg, V. L., and A. P. Levanyuk. Scattering of Light Near Points of Phase Transition of the Second Type and the Critical Curie Point

Isakovich, M. A. Irradiation of an Elastic Wall Vibrating Under the Action of Statistically Distributed Forces

Levin, L. M. The Dimming of Light by a Cloud

Masing, N. A., S. L. Mandelstam, and V. G. Kolochnikov. The Broadening and Shifting of the Spectral Lines of a Gas Discharge in Plasma

Malyshev, V. I., and V. M. Nurin. Investigation of the Hydrogen Bond in Substances Whose Molecules Contain Two Hydroxyl Groups

MANDELISH TAM, S L

44702  
 24.3/20  
 AUTHORS: Granovskiy, V.L., Luk'yanov, S.Yu., Spivak, G.V. and Sirotenko, I.G.  
 TITLES: Report on the Second All-Union Conference on Gas Electronics

PERIODICAL: Radiotekhnika i Elektronika, 1959, Vol 4, Nr 9, PP 1359 - 1358 (USSR)

ABSTRACT: The conference was organized by the Ac.Sc.USSR, the Ministry of Higher Education and Moscow State University. A.A. Jdanov - "Measurement of the Gas Density During the Dynamic Operation of a Discharge" (see p 1366 of the Journal). A.V. Sedosparov - "The Nature of a Stratified Positive Column". V.I. Fargal' and Yu.M. Lagan - "The Theory of Probes for Arbitrary Pressure". Yu.H. Merkulov - "The Positive Column of a Discharge in a Stationary Regime". M.P. Kovtunak - "Influence of the Processes of the Annihilation of the Negative Ions on Their Concentration in the Column". M.D. Gaborich and I.K. Pasachnik - "Anomalous Scattering, Excitation of Plasma Oscillations and Plasma Resonance". Ya.L. Klimatorich - "Energy Lost by Ring Particles for the Excitation of the Oscillations in Plasma (the Langmuir paradox)" and "The Theory of Nonlinear Dependence of the Temperature on the Cathode Region of a Pulse Discharge on the Material of the Electrodes". S.A. Makalain and B.M. Klyarfeld - "Formation of Light Spots on the Wall of a Gas Discharge (see p 1301 of the Journal)". M.G. Matzava - "Distribution of Binary Mixtures of Inert Gases in a d.c. Discharge". V.G. Stepanov and V.F. Zakharchenko - "Some Phenomena in 'Married Plasma'". V.G. Stepanov and V.F. Zakharchenko - "The Possibility of Obtaining Highly Concentrated Plasmas". "Some Characteristics of the Discharge in an Ion Pump and in a Magnetic Isolation Vacuum Gauge". Ye.Y. Kucherskiy and O.K. Nazarenko - "Properties of a Discharge with a d.c. Field". "Oscillations in a Magnetic Field" (see p 1355 of the Journal). The paper by M. Biberman and B.A. Veklanko considered the appropriate methods for determining the concentration of atoms at the radiation levels. V.I. Sobel'man and L.A. Vaynshteyn read a paper on "A Secondary Theory of the Stark Broadening of the Spectral Lines in Plasma". M.A. Masini and S.M. Mandallalam - "The Broadening and the Shift of Spectral Lines in a Gas-discharge Plasma". P. Leut (England) - "The Kinetics of Electron Collisions Leading to the Excitation of the Molecular Hydrogen in a Hydrogen Discharge". V.M. Kolesnikoy et al. - "Some Properties of the Arc Discharge in an Atmosphere of Inert Gases". A.A. Mak and M.P. Kozupakov - "Production of High Temperatures by Means of Spark Discharges".

24(7)

SOV/48-23-8-18/25

AUTHORS: Mandel'shtam, S. L., Mazing, M. A.

TITLE: Widening and Shift of Spectral Lines in the Plasma of Gas Discharge

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1959, Vol 23, Nr 8, pp 1017-1020 (USSR)

ABSTRACT: In the present paper the widening of spectral lines with quadratic Stark effect due to charged particles is investigated. The equations (1) for the width and shift of the lines are described. To compare theory with experimental results, the dependence of width and shift on the constant of the quadratic Stark effect and the ratio of width to shift are investigated. The results show remarkable disagreement with the theory by Weisskopf and Lindholm. Analysis of this disagreement resulted in the development of an unsteady theory of the widening of lines. According to the assumptions of the theory, a smaller effect of the collision of electrons with atoms as well as inelastic collision of electrons with atoms are taken into account. For this theory, the non-dimensional parameter  $\beta$  is given by formula (2), which characterizes the width and shift of

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Widening and Shift of Spectral Lines in the Plasma of Gas Discharge SOV/48-23-8-18/25

lines. The ratio of width to shift depends on this parameter. Figure 1 shows a comparison of theoretical values - calculated by the unsteady theory - to experimental results. Good agreement could be obtained. It was found that this theory permits the determination of electron density from the width and shift of lines. Table 4 compares electron densities calculated by the steady and unsteady method. There are 1 figure, 4 tables, and 2 references, 1 of which is Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR  
(Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

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24(7)

SOV/49-23-9-1/57

AUTHOR:

Mandel'shtam, S. L.

TITLE:

Introductory Speech at the Prof. M. L. Joliot Conference  
on Spectroscopy

PERIODICAL:

Izvestiya Akademii nauk SSSR. Seriya fizicheskaya 1959,  
Vol 23, Nr 9, pp 1054-1056 (USSR)

ABSTRACT:

In his introductory speech the author stated that problems of theoretical spectroscopy had been dealt with at the 11th Conference and that at the 12th Conference (November 19-20, 1958, Moscow) the application of spectroscopy to atomic and molecular spectral analysis will be treated. Whereas, during recent years, concentration could be determined only up to a concentration of  $10^{-4}$  -  $10^{-6}\%$ , a survey given by L. V. Lipin in form of a lecture showed that today already concentrations may be determined within the range of  $10^{-7}$  -  $10^{-9}\%$  which are of importance e.g. for semiconductor engineering. It was stated with satisfaction that Soviet spectroscopy performed pioneer work in the course of recent years with respect to the determination of gases dissolved in metals and alloys. In Soviet industry photoelectrical methods are at present about to be introduced into spectral analysis, and the importance of these methods for automation is pointed out. Employment of these

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807/48-23-9-1/57

Introductory Speech at the Twelfth All-Union  
Conference on Spectroscopy

methods in the American aluminum industry is given as an example, and it is pointed out that the development of photoelectrical methods in X-ray spectral analysis still leaves much to be desired. I. B. Borovskiy gave a survey of this problem. A considerable number of lectures dealt with analysis methods for powdered specimens and rare earths as well as with the physical bases of spectral analysis. Atomic spectral analysis is considered to be an independent branch of science with a well developed theory, and is widely in use. Further, the molecular spectral analysis is investigated, and it is found that, in contrast to atomic spectral analysis, only some partial problems are solved in this case. For the development of control methods in the production of the chemical industry three papers by V. M. Chulanovskiy, P. A. Bazhulin, and M. M. Sushchinskiy, and by B. S. Neporent are considered to be of importance. Ten papers deal with paramagnetic electron and nuclear resonances, and in connection with the development of luminescence spectral analyses the scientists F. D. Klement, E. V. Shpol'skiy, and A. F. Prikhot'ko are mentioned. P. P. Fedilov occupied himself with spectroscopic polarization methods and L. A. Tumerman dealt with the application of spectroscopical methods in bio-

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SOV/48-23-9-1/57

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Conference on Spectroscopy

chemistry and biology. The instruments IKS-14, SF-1, DFS-12, and others, which are produced by the Soviet industry for molecular analyses, are mentioned. The scientists S. A. Borovik, Member of the Commission for Spectroscopy, I. A. Shoshin, who is also a member of this commission, and V. S. Miliyanchuk are mentioned, who have died since the last conference, and honorable mention is also made of G. S. Landsberg, the former initiator and chairman of these conferences.

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24(7)  
AUTHORS:

507/48-23-9-26/57  
Buzlov, M. N., Vinogradov, A. E., Ivanov, L. K., Kutsova,  
O. B., Mandel'zhim, S. I.

TITLES:

A Photoelectric Stylometer With Final Control of the Position  
of Invisible Lines of the Spectrum  
Izvestiya Akademi nauk SSSR. Seriya fizicheskaya. 1959.  
Vol 23, Nr 9, pp 1110 - 1112 (USSR)

ABSTRACT:

By replacing the glass-dispersion optical system by a quartz-  
(quartz) or diffraction optical system (Fig 2), the range of  
operation of the PMS-1-type stylometer may be considerably  
extended, especially if, by means of an electron-optical con-  
verter, the invisible lines of the spectrum may be detected.  
Two variants of the type PMS were developed and tested by the  
authors: the converter operates as an anion-cathode (photo-  
tube) and the device has an untransmitted window, so that a visual ob-  
servation of the spectrum within the wave length range of  
6000-4000 Å is possible. Figures 1 and 2 show the course of the  
rays in these two instruments, in which the shifting of the  
spectrum with respect to the outlet slit is brought about by  
rotating the dispersion system. The line intensity of these

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instruments is comparable to that of instruments the spectrum  
of which is investigated by means of a quartz-  
prism. The range of the electron-optical converter is described  
in detail by means of the electron-optical converter is described  
and for both instruments a survey of the principal charac-  
teristic features is given. The focal distances of the mirror  
objectives of the collimator are 600 and 750 mm respectively,  
the refraction angle (quartz prism) in one of the instruments  
is 60°, whereas the diffraction grating of the other has 600  
grating lines per millimeter. The electron-optical arrangement  
makes it possible to observe the fine details of complicated  
spectra, especially of iron, and this device is said to have  
a great future. There are 2 figures.

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MAN DEL'S H I AM 36

21(7)

SOV/56-36-4-66/70

AUTHORS:

Mazing, M. A., Mandel'shtam, S. L.

TITLE:

On the Widening of Spectral Lines in a Highly Ionized Plasma  
(Ob ushirenii spektral'nykh liniy v sil'no ionizovannoy plazme)

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36,  
Nr 4, pp 1329-1331 (USSR)

ABSTRACT:

Already in earlier papers the authors measured width and shift of spectral lines in spark discharges (Ref 1); here a short introductory report is given about this problem and also about the theoretical connections between line width, shift, and the plasma parameters. The authors carried out much more accurate measurements of the line width  $\gamma$  and the shift  $\Delta$  of 50 Ar II - lines as well as of some He I -lines in the plasma of a spark discharge in argon and helium. Experimental data:  $U = 14$  kv,  $C = 0.02$  F,  $L = 10$  H,  $T = 30 - 40000$  K, electron concentration  $\sim 10^{17}$  cm<sup>3</sup>. The spectra were photographed by means of a spectrograph with a dispersion of  $2\text{\AA}/\text{mm}$ . The accuracy of measuring line width amounted to 5 - 10%, the smallest still recordable shift was  $\sim 0.03$  Å. The results obtained from measuring

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 On the Widening of Spectral Lines in a Highly Ionized Plasma

6 Ar II -lines are shown by a table; they are typical of this kind of measurements.

$\lambda, \text{\AA}$	$10^{-11}, \text{sec}^{-1}$	$10^{-11} \Delta \text{sec}^{-1}$	$\gamma/\Delta$
4579.4	5.1	0.45	11.5
4460.4	3.8	0.66	5.8
4598.8	8.4	2.7	3.1
3561.0	12	5.0	2.4
3559.5	13	5.6	2.3
4474.8	15	7.8	1.9

There are 1 figure, 1 table, and 6 references, 3 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR  
 (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: February 12, 1959

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24(7)

SOV/56-37-2-4/56

AUTHORS: Lebedev, S. V., Mandel'shtam, S. L., Rodin, G. M.

TITLE: On the Short-wave Radiation of a Vacuum Spark

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959,  
Vol 37, Nr 2(8), pp 349-354 (USSR)

ABSTRACT: The spectra of the highly ionized atoms in a spark discharge are in the ultraviolet range and in the range of soft X-ray radiation; it was investigated down to  $6 \text{ \AA}$  (Ref 1). In this case the excitation energy amounts to 2000 ev. In the present paper the authors give results obtained from investigating these spectra within the range  $\lambda < 6 \text{ \AA}$ , as well as an evaluation of the discharge temperatures by means of a spectroscopic method. (Analogous temperature measurements have already been carried out by Akimov and Malkov (Ref 2).) The measuring method is first briefly described (iron electrode - one plate and one cylinder, distance 4 mm; initial pressure in the discharge chamber  $1 \cdot 10^{-5} \text{ mm Hg}$ ; current source: condenser  $3.3 \mu\text{F}$ , 40 kv,  $1.5 \mu\text{H}$ ,  $0.2 \Omega$ ,  $i_{\text{max}} = 4.8 \cdot 10^4 \text{ a}$ ; absorption of the longer-wave radiation by

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On the Short-wave Radiation of a Vacuum Spark

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beryllium filters; recording: photomultiplier FEU-25 and cathode ray oscillograph. Total sensitivity of the FEU: 10 a/lumen; filter dimensions: thickness 0.25 mm, diameter 18 mm; scintillators: tetraphenyl-butadiene in polystyrene and CsI(Tl), 5 mm thick . The results are given in form of characteristic oscillograms. Three series of measurements were carried out under various conditions and by using the two above-mentioned scintillators, and the latter are described in detail. The second part of the paper deals with temperature evaluation. The value obtained for electron temperature in the case of a spark discharge in a vacuum was found to amount to  $2 \cdot 10^5$  °K. These evaluations agree with measurements. Figure 5 shows the temperature dependence of the intensity of the lines of multiple charged ions for an electron concentration  $n_e = 10^{18}$  electron/cm<sup>3</sup>; the curves from Al V to Al X are given. The position of the curves shows to what extent temperature evaluation depends on ionization - the curves shift with increasing ionization towards higher temperatures; to the here mentioned temperature of  $2 \cdot 10^5$  °K there corresponds the Al VII peak. There follows a

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On the Short-wave Radiation of a Vacuum Spark

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short discussion of the excitation mechanism, which might explain the spectral composition of the observed radiation. There are 5 figures, 1 table, and 8 references, 4 of which are Soviet.

ASSOCIATION: Fizicheskii institut im. P. N. Lebedeva Akademii nauk SSSR  
(Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: March 3, 1959

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3.2430(1482,2806)

33304

S/560/61/000/010/002/016  
D299/D302

172450  
AUTHORS:

Mandel'shtam, S. L., Tindo, I. P., Voron'ko,  
Yu. K., Shurygin, A. I., and Vasil'yev, B. N.

TITLE:

Study of solar X-radiation. I. Geophysical-  
rocket measurements

SOURCE:

Akademiya nauk SSSR. Iskusstvennyye sputniki  
Zemli. no. 10. Moscow, 1961, 12-21

TEXT: This is the first of 3 investigations on X-radiation  
in the range below  $10 \text{ \AA}$  carried out by research rockets and the  
2nd and 3rd Sputniks. Provisional results of these measurements  
were set forth in brief in an earlier study. Experimental  
method: The measurements described in the present article were  
carried out during the flight of 2 research rockets. The prime  
object of the measurements was to accumulate experimental data  
and to develop a method for subsequent measurements by means of

Card (1/5)

33301

S/560/61/000/010/002/016  
D299/D302

Study of solar...

earth-satellites. As detectors, photon counters were used, as these are more sensitive in the spectral range  $< 10 \text{ \AA}$  than vacuum photomultipliers. The sensor unit was placed on the instrument container which turned automatically towards the sun. Special precautions were taken to ensure that no corpuscular radiation should interfere with the measurements. In the first launching, the sensor unit incorporated 2 similar counters directed towards the sun; one of the counters had a magnetic shield, and the other had none. In the second launching, both counters had magnetic shields, but the second counter was at an angle of  $15^\circ$  towards the sun, recording non-solar radiation only. Standard counters of type CBT-9 (SBT-9) were used. The characteristics of the counters are described. The counting rate was calculated from the telemetered data. The 2 rockets were launched on July 21, 1959, in the morning and evening respectively. On that day, the solar activity was intense. Results: A figure shows the dependence of the counting rate on altitude.

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A considerable X-ray flow was recorded from altitudes of 95 km up. Owing to the stability of orientation of the container with respect to the sun, it was unnecessary to make allowance for the angular dependence of counter efficiency. From the counting-rate data, the energy distribution and the magnitude of the energy flux outside the atmosphere were calculated. The data processing was based on the expression  $m_{incl} = m_{vert} \Phi(z)$ ,

where  $m_{incl}$  is the mass of an inclined air-column of  $1 \text{ cm}^2$  cross-section lying between the apparatus and the sun,  $m_{vert}$  the mass of a vertical column equal to the atmospheric pressure at the given altitude, and  $\Phi(z)$  is determined by the zenith angle of the sun  $z$ . A figure shows the counting rate as a function of  $m_{incl}$ . Assuming the spectral region under investigation to be continuous, it is possible to construct the photon-distribution curve by means of the counting-rate curves, the mass

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coefficients of absorption of air, and the spectral-sensitivity curve of the counters. A figure shows the photon-distribution curves as a function of wavelength. The energy distribution in the morning and evening launchings was found to differ by a factor of 3. It is difficult to ascertain whether this difference is real. The main source for the continuous radiation is electron bremsstrahlung in the field of hydrogen and helium ions. The obtained electron temperature considerably exceeded the value of  $T_e \approx 1 \div 3 \times 10^6$  °K obtained in subsequent investigations by space-ships. A comparison of measurements conducted by Friedman (in 1953) during a minimum-period of solar activity with the authors' measurements (in December 1960, by space-ship) after a maximum-phase showed that the temperature and intensity of radiation are greatly dependent on the phase of the sun cycle. As the above-described rocket investigations were carried out for very low positions of the sun above the horizon (in contra-

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distinction to Friedman's investigations), further systematic measurements are required. In ensuing articles, the results of measurements carried out on the 2nd and 3rd Sputniks will be given, as well as a description of the electronic equipment. There are 11 figures and 20 references: 8 Soviet-bloc and 12 non-Soviet-bloc. The 4 most recent references to the English-language publications read as follows: G. Elwert, J. Geophys. Res., 66, 391, 1961; H. Friedman, Trans. Intern. Astr. Un., 10, 706, 1960, Cambridge Univ. Press; T. A. Chubb, H. Friedman, R. W. Kreplin, J. Geophys. Res., 65, 1831, 1960; R. W. Champion, R. A. Minzner, Plan. and Space Science, 1, 259, 1959. X

SUBMITTED: May 17, 1961

Card 5/5

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AUTHORS:

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Vasil'yev, B.N. and Shurygin, A.I.

TITLE:

Studies of solar X-ray emission. II

SOURCE:

Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli.  
no.11. Moscow, 1961. Rezul'taty nauchnykh  
issledovaniy, provedennykh vo vremya poletov vtorogo  
i tret'yego kosmicheskikh korabley-sputnikov, 3-14

TEXT:

In a previous paper (Ref.1: Iskusstvennyye sputniki  
Zemli, no.10, Izd-vo AN SSSR, 1961, p.12) the authors reported  
measurements of the intensity of solar X-ray emission below 10 Å  
which were carried out with the aid of geophysical rockets. In  
the present paper they report the corresponding results obtained  
with the second and third Soviet spaceships on August 19-20 and  
December 1-2, 1960. The aim of the measurements was to investi-  
gate the intensity over an extended period of time (of the order  
of a day or two). Preliminary results have been given by the  
authors in another paper (Ref.2: Dokl. AN SSSR, 140, 1058, 1961).  
The second spaceship carried six end-window photon counters  
(15 mg/cm<sup>2</sup> beryllium foils) with an oxygen-neon quenching mixture.  
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Studies of solar X-ray emission. II S/560/61/000/011/001/012  
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These counters were developed under the direction of I. A. Prager and S. M. Perel'man. The counters had a sensitivity of between 0.1 and 0.2 pulses/photon in the wavelength range 3-7.5 Å. The counters were mounted so that their axes were oriented along six directions at equal angles to each other; the field of view of each counter was 45°. The telemetric record showing the counting rate as a function of time is reproduced. It is estimated that the flux of radiation in the range 2-10 Å, which was recorded during the flare of August 19 (15 hr 33 min) was of the order of  $7 \cdot 10^{-5} - 1.5 \cdot 10^{-2}$  erg cm<sup>-2</sup> sec<sup>-1</sup>. The apparatus mounted on the third spaceship was somewhat modified. Three types of probes were employed so that the solar radiation below 10 Å could be continuously monitored together with interference due to radiation-belt particles. The main detectors were two parallel-connected CBT-9 (SBT-9) counters with mica windows (1.6 mg cm<sup>-2</sup>) and located in a lead screen 1 mm thick. The counters were supplied by solar batteries. In addition, there were two "control counters" which were mounted at right angles to the direction of the sun. A tantalum plate was placed in front of the counter

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Studies of solar X-ray emission.II S/560/61/000/011/001/012  
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windows and served as a target for the radiation-belt particles. The counters were practically insensitive to solar X-ray radiation. A third pair of counters was mounted on the outer surface of the third spaceship. These counters were similar to those carried by the second spaceship. The aim was to estimate the spectral energy distribution by comparing the indications of the beryllium and the mica counters. The telemetric record obtained with the aid of the third spaceship is reproduced. It is estimated that the flux of radiation below  $10 \text{ \AA}$  was  $2.5 \cdot 10^{-4} \text{ erg cm}^{-2} \text{ sec}^{-1}$ . Moreover, the intensity of radiation in this spectral region remained constant within  $\pm 20\%$  during the observations. This was due to the fact that on December 1-2, 1960 the sun was very quiet and there was only one flare (importance  $1^+$ ). The question of the flux and the energy of the particles recorded in these experiments is being examined at the present time. There are 10 figures and 2 tables.

SUBMITTED: June 26, 1961

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MANDEL'SHTAM, S.L.; NEDLER, V.V.

Sensitivity of emission spectrum analysis. Opt.i spektr. 10  
no.3:390-397 Mr '61. (MIRA 14:8)

(Spectrum analysis)

KOLOSHNIKOV, V.G.; MAZING, M.A.; MANDEL'SHTAM, S.L.; MARASANOV, Yu.P.

Using a Fabry and Perot etalon for the study of line widths  
in pulse discharge spectra. Opt. i spektr. 11 no.4:556-558 0  
'61. (MIRA 14:10)  
(Electric discharges) (Scintillation spectrometry)

84

BAZHULIN, P.A.; MANDEL'SHTAM, S.L.; STRIGANOV, A.R.

Conference on optics and spectroscopy. Vest. AN SSSR 31 no.2:91-  
92 F '61. (MIRA 14:2)

(Optics—Congresses)