57-9-36/40

AUTHOR: Gross, Ye.F., Zakharchenya, B.P., Pavinskiy, P.P.

TITLE: Diamagnetic Exiton Levels and Cyclotron Resonance (Diamagnitnyye urovni eksitona i tsiklotronnyy rezonans)

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 9, pp. 2177 - 2180 (USSR)

ABSTRACT: New phenomena are described. Nearer towards the series border, where diamagnetic displacement in the case of a lacking magnetic field attains the amount of the distance between the neighboring terms of the series, a spectrum, consisting of nearly equidistant lines, was observed at a distance between the lines of H = 29 cooOersted of the order of 2 cm^{-1}. This striped spectrum is continued also beyond the series boundary, where, with a lacking magnetic field, (H=0) the through-going spectrum which corresponds to exiton dissociation is located. The farther one penetrates into the shortwave range, the less distinct does the structure of the spectrum become, and the spectral lines approach more closely to one another over a distance of 1,6 cm^{-1}. Hereafter their distribution becomes irregular. These lines are observed on the base of the through-going spectrum, where its intensity does not take a monotonous course but shows absorption maxima. The distance between the maxima is reduced as the shortwave part of the spectrum is approached. Thus, the spectrum

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Diamagnetic Exiton Levels and Cyclotron Resonance

here consists of absorption maxima upon which the aforementioned striped spectrum is impressed in form of a thin structure. The intensity of the absorption maxima becomes weaker to the extent as they shift towards the violet part of the spectrum, and coalesce with the limit of the continuous absorption. Investigations showed that the through-going exiton spectrum is a superposition of the absorption spectra corresponding to the exiton states at various μ-values. μ - is the magnetic quantum number of the exiton. There is 1 figure and 2 Slavic references.

ASSOCIATION: Physical-Technical Institute AN USSR, Leningrad
(Fiziko-tekhnicheskiy institut AN SSSR, Leningrad)

SUBMITTED: July 8, 1957

AVAILABE: Library of Congress

Card 2/2

GROSS Ye. F.

AUTHOR: Vol'kenshteyn, M. V., Doctor of Physico-Mathematical Sciences 30-11-22/25

TITLE: An International Symposium on the Hydrogen Bond in Ljubljana (Mezhdunarodnyy simpozium po vodorodnoy svyazi v Lyublyane)

PERIODICAL: Vestnik AN SSSR, 1957, Vol. 27. Nr 11, pp. 137-139 (USSR)

ABSTRACT: Scientists from Yugoslavia, the West- and Easteuropean countries, Australia, the USA, Canada, the USSR, Scandinavia and the state of Israel participated in the symposium held from July 29 to August 3. More than 60 speakers got a hearing. The soviet delegation read 6 papers: Ye.F.Gross talked on "The vibration spectrum of the hydrogen bond". D.N.Shigorin on "The nature of the hydrogen bond and its influence upon the vibration- and electron-spectra of the molecules", V.M.Chulanovskiy on "The spectroscopic investigation of the hydrogen bond", M.V.Vol'kenshteyn on "The behavior of the hydrogen bonds in vitrification (steklovaniye)", N.D.Sokolov "On the quantum theory of the hydrogen bond" A.N.Terenin and V.Filimonov "The hydrogen bond between adsorbed molecules and the structural OH-groups on the surface of solid bodies". Many papers were devoted to the spectroscopy of the hydrogen bond. Important information was

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An International Symposium on the Hydrogen Bond in Ljubljana. 30-11-22/23

given by Dzh.Pimentel (USA) on the spectral properties of the compounds at low temperatures and G.Marriman (England) on the investig tion-results of the crystalline modifications of cellulose by means of the method of polarized infrared spectra. E. Lippert (German Federal Republic) gave an extensive survey of the influence exerted by the hydrogen bonds upon the electron-spectra. The session in which the participants especially dealt with the problems of the crystallography of the compounds with those of hydrogen, was opened by Dzh.Bernal, England, with an extensive report on the part played by the hydrogen bonds in solids and in liquids for which the participants showed great interest. R.Pepinskiy (USA) talked on the investigation of the hydrogen bond by means of the X-ray and neutronographic method. U.Shneyder (Canada) and others also dealt with this method. The following sessions mainly dealt with problems of the theory of the hydrogen bond. Speaker was: Ch.Koulson, England. His statement caused a lively discussion in which above all the American scientists participated. Although there exists no strict definition on the conception of the hydrogen bond , , all participants in the discussion agreed that the evidence of the quantum-mechanical process of the formation of a donor-acceptor bond (donorno-akteptornaya svyaz') were necessary for the

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An International Symposium on the Hydrogen Bond ... Ljubljana. 30-11-22/23

determination of the hydrogen bond.

AVAILABLE: Library of Congress

Card 3/3

Gross, Ye.F.

53-3-5/5

AUTHOR: Gross, Ye.F.

TITLE: The Spectrum of the Excitation of Exitons in a Crystal Lattice (Spektr vozbuzhdeniya eksitonov v kristallicheskoy reshetke)

PERIODICAL: Uspekhi Fiz. Nauk , 1957, Vol. 63, Nr 3, pp. 575 - 611 (USSR)

ABSTRACT: The present survey is arranged as follows: Introduction, investigation of the structure of the long-wave edge of the principal absorption of a cuprous oxide crystal at room temperature and at the temperature T = 77,3°K (liquid nitrogen). The hydrogen-like series of narrow absorption lines. The optical spectrum of the excitation of exitons in a crystal lattice. The yellow exiton series in a Cu_2O-crystal. Comparison of the exiton spectrum with that of the hydrogen atom. Free and polarized exitons. The green exiton series in a Cu_2O crystal at the temperature of liquid nitrogen (77,3°K) and at the temperature of liquid helium (T = 4,2°K). (The wave length of the newly found absorption lines of the yellow and green exiton series in Cu_2O are given in a table). The exiton spectrum in Cu_2O at T = 1,3°K (liquid helium). The Stark effect at the lines of the exiton spectrum (in a homogeneous and in an inhomogeneous electric field).

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55-3-5/6

The Spectrum of the Excitation of Exiton in a Crystal Lattice

The Zeeman effect on the lines of the yellow exiton series. The investigation of the structure of the principal absorption in other crystals. (Experimental data are available only for some crystals). Thus, a complicated structure consisting of a group of 11 narrow and 4 broader bands was observed in the spectrum of cadmium sulphide at 4,2°K at the absorption edge. Besides, a considerable distortion of lines was observed in the case of some CdS crystals. Also in HgJ_2-crystals a structure of the absorption edge was observed. In PbJ_2-crystals a group of 4 narrow lines was observed on the absorption edge of this crystal at T = 4,2°K. Next, some observations made in the case of other crystals are enumerated. There are 21 figures, 8 tables and 58 references, 33 of which are Slavic.

AVAILABLE: Library of Congress

Card 2/2

AUTHORS: Gross, Ye. F. Corresponding Member AN USSR 20-4-15/60
Shultin, A. A.

TITLE: The Interaction Between Intermolecular and Lattice Vibrations in Crystals According to the Data of Infrared Spectra(Vzaimodeystviye vnutrimolekulyarnykh i reshetochnykh kolebaniy kristallov po dannym infrakrasnykh spektrov).

PERIODICAL: Doklady Akad.Nauk SSSR, 1957, Vol. 115, Nr 4, pp. 689-692 (USSR)

ABSTRACT: At first reference is made to the present state of the problem and to some earlier papers. The problem of the interaction of phonons with the innermolecular vibrations is of great interest. Therefore the author examines the infrared absorption spectra of monocrystalline samples of $Ba(NO_3)_2$ and $Pb(NO_3)_2$. It was the purpose of these investigations to clear up the problem of the existence and the peculiarities of the "compound" transitions (whose intensities are markedly dependent on temperature). The probability of such transitions must also depend on the type of the inner-ionic excitation and on the type of lattice vibrations. In the crystals selected here the composed NO_3^- - ions play the part of structural units which have internal degrees of freedom. These ions are plane equilaterial triangles having the nitrogen atom in the center. Such a system has 6 normal vibrations with frequencies in the range 700- 1500 cm^{-1}. The samples of lead nitrate

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and barium nitrate consisted of plates 0,3ox1ox2omm or 0,56x1ox x2o mm in dimension respectively. The spectra obtained at -16o° and + 2o° are illustrated by diagrams. The analysis of the selection rule by the group theory leads in crystals belonging to the space group T_h^6 to the following conclusions: All inner group vibrations must be effective in the absorption and this is also observed in reality. But in addition to that, much weaker absorption bands are also noticed in the spectra. The clearly expressed absorption maxima that lie symmetrically to the absorption peak might furnish a contribution toward their explanation. These concomitant bands might be caused by compound transtions in which the quantum numbers of the inner-ionic and the lattice levels simultaneously change. That means that, when a light quantum is absorbed in these transitions, an exiton is produced and at the same time a phonon is created or disappears. Most of these weak bands can be explained by the scheme given here. There are 4 tables and 19 references, 3 of which are Slavic.

The Interaction Between Intermolecular and Lattice Vibrations in Crystals According to the Data of Infrared Spectra. 20-4-15/60

ASSOCIATION: Leningrad State University imeni A.A.Zhdanov (Leningradskiy gosudarstvennyy universitet imeni A.A.Zhdanova)

SUBMITTED: March 23, 1957

AVAILABLE: Library of Congress.

Card 3/3

GROSS, E. F.
Physico-Technological Institute, Acad. Sci. Leningrad, U. S. S. R.

"Optical Spectrum and Magneto-Optical Properties of Excitons."

paper submitted at Intl.' Conf. on Semiconductors, (IUPAP) 18 - 22 Aug 58, Rochester, New York.

Abstract available.

SOV/30-58-10-2/53

AUTHOR: Gross, Ye. F., Corresponding Member, AS USSR

TITLE: An Important Problem of Modern Physics (Vaznnaya problema sovremennoy fiziki) **Excitons** in the Crystal Lattice (Eksitony v kristallicheskoy reshetke)

PERIODICAL: Vestnik Akademii nauk SSSR, 1958, Nr 10, pp 11-19 (USSR)

ABSTRACT: The concept o **excitons** was introduced into physics in 1931 by the Soviet scientist Ya. I. Frenkel'. Exitons are supposed to be capable of migrating on a crystal. In theory the idea of Frenkel' was developed further by the foreign scientists - **Vannier** (1937) and N. F. Mott (1938) among others. According to M '., exitons are hydrogen-like quasi-atoms which move on crystals, as well as neutral forms. In the opticheskaya laboratoriya Fiziko-tekhnicheskogo instituta Akademii nauk SSSR (Optical Laboratory of the Physico-Technical Institute, AS USSR) some phenomena were recently discovered which prove the existence of **excitons** in the crystal lattice (N. A. Karryyev, B. P. Zakharchen', A. A. Kaplyanskiy, B. S. Nazbirin, M. A. Yakobson, V. V. Sobolev, and others). The pattern of **exciton** movement in the crystal lattice is represented in figure 1. Figure 2 shows

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An Important Problem of Modern Physics. **Excitons** in the Crystal Lattice

the spectrogram of a hydrogen-like series in the crystal of cuprous oxide at a temperature of T = 1.4°K. As the effects of Shtark and Zeeman observed in the exiton spectrum prove, **excitons** are huge forms in the crystal. Mention was made of the studies by A. G. Samoylovich and L. L. Korenblit (1955). Two **excitons** of small and large radius can exist in one crystal. In figure 3 patterns of para- and ortho **excitons** are shown. Recently I. Tsukuti (Ref 2) reported on the **exciton** level in his theoretical study. I. M. Dykman, S. I. Pekar, F. I. Ansel'm, L. I. Korovin, and I. P. Ipatova also work on this problem. Figure 4 gives a diagram of the origin of resonance luminescence and figure 5 of inducing luminescence of **excitons**. Apart from electrons, holes and phonons, **excitons** play an important role in many physical phenomena in the crystal lattice. As the studies of A. V. and A. F. Ioffe (1956) show, **excitons** play an important part in the thermal conductivity of crystals. Research of **excitons** and their role in the crystal lattice is still in its beginning stages. There are 5 figures.

Gross, Yu. F.

AUTHORS: Gross, Yu. F., Zakharchenya, B. P. 57-2-2/32

TITLE: Ionization of Excitons in a Cu_2O Crystal by an Electric Field (Ionizatsiya eksitonov v kristalle Cu_2O elektricheskim polem).

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 2, pp. 231-232 (USSR).

ABSTRACT: Reference is made to the great difference between experiment and theory, the latter proceeding from the correct assumption that the exciton in cuproud oxide is a Motta exciton. As this difference was still undetermined, the Stark effect was again investigated in a Cu_2O crystal, where first of all the test conditions were perfected. The results obtained showed a good agreement with theory. First the deficiencies of the former tests are enumerated and it is shown that all these sources of error in the determinations of the field voltages in which a successive disappearance of the members of the exciton-series takes place may easily be removed when the observations in the domain investigated are carried out by measurement of the electric potential gradient with the aid of probes. The probes were put onto a small crystalline Cu_2O plate by means of evaporation of gold in a vacuum. The probes had a distance of $1 \div 2$ mm from the silver base electrodes. The Stark effect was investigated at the exciton lines under conditions of cooling of the crystal to the tem-

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Ionization of Excitons in a Cu_2O Crystal by an Electric Field. 57-2-2/32

perature of liquid nitrogen. A spectrograph with a dispersion of 10,5 Å/mm was used for the observation of the spectrum. The consecutive disappearance of the members in the yellow exciton-series with the quantum numbers n = 4,3,2 due to the ionization of the exciton by the electric field was distinctly observed. It became evident that a field voltage of 2,5 kV/cm is necessary for the ionization of the exciton from the state with n = 4. In the case of n = 3, E = 9 kV/cm and in the case of n = 2, E = 29 kV/cm. The values for the field voltages are highly different from those measured earlier and lie near those obtained by Gamoylovich and Korenblit for the Stark effect. I. A. Polovnikova, Diplomantka in the State University, Leningrad, helped in the experiment.
There are 5 references, 4 of which are Slavic.

ASSOCIATION. **Technical Physics** Institute AS USSR. Leningrad (Fiziko-tekhnicheskiy institut AN SSSR. Leningrad).

SUBMITTED. August 22, 1957.

AVAILABLE. Library of Congress.

Card 2/2 **1. Crystals-Excitation 2. Crystals-Ionization**

Gross Ye. F.

AUTHORS: Gross, Ye. F., Razbirin, B. S. 57-2-4/32

TITLE: The Influence of Deformations on the Spectrum of CdS Crystals (Vliyaniye deformatsiy na spektr kristallov CdS).

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 2, pp. 237-239 (USSR).

ABSTRACT: Tests were made here to find out whether the deformations caused by the pasting on of crystals are responsible for the distortion of lines in the absorption-spectrum of CdS-crystals. The lengthened CdS crystals was with one end pasted to a small glass-plate. The other half remained free and did not rest against the surface of the glass. In this manner it was possible to compare the absorption-spectra of the part of crystal pasted on and of the free part at the same time in one spectrogram. The tests showed that at T = 4,2°K as well the narrow lines λλ4889-4860 Å, as the bands λλ4860-4800 Å, in the spectrum of the part of crystal pasted to the glass are narrowed to almost half of their former width and are displaced by 8-9 Å toward the short-wave side (in comparison to their position in the free part of the crystal). In this connection the shape of the spectrum of the thin lines changes in a complicated way, the distance between them becomes smaller, the intensity is redistributed, the blurring of the lines is diminished and some of them are depolarized. The absorption in

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The Influence of Deformations on the Spectrum of CdS-Crystals. 57-2-4/32

the lines λλ4857 Å and 4869 Å is intensified. The part of the crystal between the two halves (the half pasted on and the free half) yields a distorted image of spectrum with a continuous transition from the spectrum of the one half (that pasted on) to the other one (the free one). Analogous distortions were observed after putting drops of glue upon the crystal. It is shown that the quantity and the direction for the displacement in the spectrum depend on the quantity and the sign of the force deforming the crystal. This becomes evident from a comparison concerning the behaviour of the absorption-spectra of CdS crystals which are glued on glass- and quartz-bases. The spectrum of a crystal-part glued on quartz is displaced to the long-wave-side (by 1 Å) (in comparison to the crystal-part not glued on) and simultaneously with the displacement the absorption-lines become wider. This displacement to the long-wave side is connected with the expansion of the crystal by its base (on cooling quartz contracts less than CdS). It is pointed out that the pasting on of the CdS-crystals onto glass and quartz at T = 4,2°K is according to its effect equivalent to an additional cooling and heating of them. The phenomena described here show a high sensitivity of the spectrum of CdS-crystals to deformation.
There are 3 figures, and 4 Slavic references.

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The Influence of Deformations on the Spectrum of CdS Crystals. 57-2-4/32

ASSOCIATION: **Technical Physics** Institute AS USSR. Leningrad (Fiziko-tekhnicheskiy Institut AN SSSR. Leningrad).

SUBMITTED: July 29, 1957.

AVAILABLE: Library of Congress.

1. **Crystals-Deformation** 2. **Crystals-Test methods**
3. **Crystals-Test results**

Card 3/3

57-28-4-17/39

AUTHORS: Gross, Ye. F., Novikov, B. V.

TITLE: On the Problem of the Structure of a Spectral Curve of the Internal Photoeffect in CdS-Crystals (K voprosu o strukture spektral'noy krivoy vnutrennego fotoeffekta v kristallakh CdS)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 4, pp. 782-783 (USSR)

ABSTRACT: This is a letter to the editor. In connection with Ref 3 the investigation of the spectral characteristics of photoconductivity in various CdS-monocrystals at T = 77,3°K was continued. These experiments showed that the shape of the spectral curves essentially depends on the orientation of the crystals with regard to the direction of the incident light beam and on the state of its polarization. The occurrence of the absorption lines in the form of peaks or depressions in the photoeffect-curves however, is mainly not determined by these conditions (Ref 1), but depends on the type of crystal. The crystals are according to the

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57-28-4-17/39

On the Problem of the Strucutre of a Spectral Curve of the Internal Photoeffect in CdS-Crystals

nature of the spectral curves of photoconductivity divided into two groups. 1) At T = 77 3°K the peaks of the curves of photoconductivity correspond to the absorption lines λ 4870 Å and λ 4840 Å. The peak λ 4870 Å is polarized with the electric vector E⊥C, also the line corresponding to it. In the declineof the short-wave portion of the curve of photoconductivity wide maxima are observed at λ 4795 Å and λ 4730 Å. 2) The minima at the photocurrent-curve here correspond to the same absorption lines. Here, too, the polarization of the spectral curves agrees with the polarization of the absorption curves. In the short-wave part of the photocurrent-curve a wide minimum is here observed at λ 4795 Å. - A more intensive infrared illumination exerts an extinguishing influence upon the photocurrent in crystals of both groups. It especially strongly influences the long-wave part of the photocurrent-curve in crystals of the second group. A detailed description is given. There are 4 references, 4 of which are Soviet.

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57-28-4-17/39

On the Problem of the Structure of a Spectral Curve of the Internal Photo-effect in CdS-Crystals

ASSOCIATION: Leningradskiy gosudarstvennyy universitet
(Leningrad State University)

SUBMITTED: November 16, 1957

Card 3/3

57-28 4-26/39

AUTHORS: Gross, Ye. F., Abolin'sh, Ya. Ya., Shultin, A. A.

TITLE: On the Observation of the Optico Acoustic Effect in a Liquid (O nablyudenii optiko-akusticheskogo effekta v zhidkosti)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 4, pp. 832-835 (USSR)

ABSTRACT: The authors here started from the idea whether it was not possible to utilize the optico-acoustic phenomenon for the determination of the duration of existing states of excitation in the molecules of liquids and solids and to work out a method of investigation for condensed systems on the basis of this phenomenon. From these considerations experiments were performed in the authors' laboratory. In these experiments the optico-acoustic phenomena in liquids and solids were observed. In the course of these experiments in the year 1952, which were repeated in 1957 such phenomena were observed in water, methyl alcohol and ethyl alcohol. A perceptible signal was only obtained in a small

Card 1/2

On the Observation of the Optico-Acoustic Effect in a Liquid

range of the modulation frequencies at about 200 cycles. The optimum modulation frequency at which the acoustic signal attains its maximum value depends on the geometric dimensions of the chamber and on the frequency-characteristic of the microphone whose membrane touches the liquid. The spectral dependence of the optico-acoustic signal was observed in liquid ethyl alcohol. The signal was observed in the domain of from $\lambda = 0,95\,\mu$ to $4\,\mu$ where the maximum amplitude was attained at $\lambda = 2\,\mu$. A comparison of the experiments with analogous ones in which a gas had been investigated shows that the acoustic signal forming in liquids is many times weaker than that forming in gases. By a certain perfection of the scheme it will be possible to use the principle of the gas analyzer by Veyngerov also for an analysis of liquids. At present the experiments for the observation of optico-acoustic phenomena in crystals are continued. There are 3 figures, and 7 references 5 of which are Soviet.

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Leningrad State U.

SOV-57-28-10-22-40

24(6)

AUTHOR: Gross, E. F., Sholin'an, Ya. Ya., Sholtin, A. A.

TITLE: Optical-Acoustic Effect in Crystals (Optiko-akusticheskiy effekt v kristallakh)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, Vol 28, Nr 10, pp 2249-2258 (USSR) 1958

ABSTRACT: The experiments, of which this paper gives an account, for the determination of the optical-acoustic effect were performed according to a scheme used in work with fluid substances (Ref 1). These experiments substantiated the existence of such an effect in crystal. It appears from the information gained that a utilization of this effect in the investigation of the solid state of a substance is dependent on another ways and means are found of improving the experimental technique and the instrument sensitivity. This paper also covers experiments on piezoelectric properties, a Rochelle-salt crystal serving as a sample. The oscillograms obtained demonstrate that the optical-acoustic effect in Rochelle-salt crystals is very intensive and comparable to the optic-acoustic effect in gases. It was found that the optic-acoustic effect also occurs in a free Rochelle-salt crystal, which is not clamped down. The intensity in both cases,

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the clamped down and the free one, is the same. An explanation of this effect is advanced and it is assumed that the effect in both cases is due to the same causes. It was also found that the intensity of the optical-acoustic effect gradually decreases after connecting the light source. This is considered to be due to a general increase in temperature of the whole crystal and the gradual approach of the upper Curie point. The optical-acoustic effect in the crystal of Rochelle-salt is so intensive that it can be used for the solution of a number of problems. The experiments described in this paper are at present continued by investigating the spectral distribution of the optical-acoustic effect in Rochelle-salt crystals and in other ferroelectric substances. The experiments presented in this paper are only the first stage of investigations of the optical-acoustic effect in crystals. There are 5 figures and 7 references, 6 of which are Soviet.

[illegible]: July 7, 1958

S/058/62/000/005/047/119
A001/A101

AUTHORS: Gross, Ye. F., Sobolev, V. V.

TITLE: Investigation of the structure of absorption, emission and photoelectric effect at the edge of CdSe crystal fundamental absorption (Theses)

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 33, abstract 5V227 (V sb. "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 40-42)

TEXT: A fine structure is discovered at low temperatures, most complicated at 4.2°K, in absorption and emission spectra of CdSe single crystals, as well as in the spectral distribution of internal photoeffect. Absorption and emission spectra are strongly polarized. Position of lines and bands in absorption and emission spectra is constant for specimens being in free state, but varies very strongly in dependence upon strains and stresses in the specimen. Conclusions are drawn on the observed bands in CdSe absorption spectra.

[Abstracter's note: Complete translation]

Card 1/1

26 2420

S/058/62/000/005/044/119
A001/A101

AUTHORS: Gross, Ye. F., Razbirin, B. S.

TITLE: Investigation of the structure of main absorption edge in CdS crystals (Theses)

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 32, abstract 5V223 (V sb. "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 61-62)

TEXT: A strong variability of a group of weak thin lines at the long wavelength edge of fundamental absorption in the region from 4,860 to 4,889 A was discovered in the absorption spectrum of CdS crystals at 4.2°K. This variability, independence of absorption value of the crystal thickness and dependence of the lines on the state of crystal surface do not warrant their ascribing to the CdS principal lattice; they indicate a connection of these lines with the crystal surface. Contrary to these lines, strong bands of shorter wavelength than the narrow ones, are permanent. Their volumetric origin, a high absorption coefficient and regular distribution

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S/058/62/000/005/044/119
A001/A101

Investigation of the structure .....

testify on their exciton nature.

[Abstracter's note: Complete translation]

Card 2/2

S/058/62/000/005/045/119
A001/A101

AUTHORS: Gross, Ye. F., Yakobson, M. A.

TITLE: Luminescence of CdS crystals at the fundamental absorption edge (Theses)

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 32-33, abstract 5V224 (V sb. "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 63-65)

TEXT: A large group of narrow lines and broad bands of various intensities is observed in the region 4850-4889 Å, near the edge of CdS crystal fundamental absorption. A comparison of crystal luminescence spectrum at 4.3°K with absorption spectrum has shown that almost all absorption lines are observed in emission, i.e., luminescence is of a resonance nature. Line 4870A and bands 4858-4838 and 4813-4805 A, observed at 77°3 K in the luminescence spectrum are interpreted as the spectrum of exciton emission following their annihilation in the lattice. In various crystals of CdS, a difference in luminescent spectra is observed, corresponding to narrow absorption lines, which is due, in the authors' opinion, to impurity and surface levels in the crystal.
[Abstracter's note: Complete translation]

Card 1/1

S/058/62/000/004/105/160
A061/A101

AUTHORS: Gross, Ye. F., Kaplyanskiy, A. A., Novikov, B. V.

TITLE: Structure of photoconductivity spectral curves in crystals at low temperatures (Theses)

PERIODICAL: Referativnyy zhurnal, Fizika, no. 4, 1962, 39, abstract 4E342 (V sb. "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 66-73)

TEXT: The shape of photoconductivity spectral curves in crystals with discrete absorption edge structure at 77.3°K was studied on CdS, HgI_2, and PbI_2 single crystals. For these crystals, the maxima of photoconductivity were found to correspond to the discrete absorption lines ascribed to excitons. The shape of the absorption spectra and of the photoconductivity curves in CdS and HgI_2 chiefly depends on the mutual orientation of the crystal axis c and the electrical vector E of the exciting light. In HgI_2 crystals, when the absorption coefficient in the lines is large, a self-reversal of the maxima of photoconductivity is observed, which is related to the increased annihilation of excitons near the surface. The constant infrared illumination reduces photoconductivity; however,

Card 1/2

S/058/62/000/004/105/160
A061/A101

Structure of photoconductivity ...

its action upon the background and the peaks of photoconductivity is different in each crystal. These results are evidence of the important part played by excitons in photoconductivity phenomena.

[Abstracter's note: Complete translation]

Card 2/2

GROSS, Ye.F.; PASTRNYAK, I.

Fine structure of the spectral photosensitivity curve of cuprous oxide crystals. Fiz.tver.tela 1 no.1:162-166 Ja '59. (MIRA 12:4)

1. Leningradskiy fiziko-tekhnicheskiy institut.
(Copper oxide crystals) (Photoelecticity)

GROSS, Ye.F.; NOVIKOV, B.V.

Fine structure of the spectrum curves of photoconductivity in cadmium sulfide crystals. Fiz. tver. tela 1 no.3:357-362 Mr '59. (MIRA 12:5)

1.Leningradskiy gosudarstvennyy universitet, Fizicheskiy institut.
(Cadmium sulfide crystals) (Photoelectricity)

GROSS, Ye.F.; PASTRNYAK, I.

Formation of polarons in crystals during the absorption of light.
Fiz. tver. tela 1 no.3:518-521 Mr '59. (MIRA 12:5)

1.Leningradskiy fiziko-tekhnicheskiy institut AN SSSR.
(Excitons) (Crystal lattices)

GROSS, Ye.F.; PASTERNYAK, I.

Effect of surface treatment on the structure of the curve of spectral distribution of photoconductivity of cuprous oxide crystals. Fiz.tver. tela 1 no.5:837-840 My '59. (MIRA 12:4)

1. Leningradskiy fiziko-tekhnicheskiy institut AN SSSR.
(Copper oxide crystals) (Photoconductivity)

GROSS, Ye.F.; PASTRNYAK, I.

Optical spectrum of the formation of polarons in cuprous oxide crystals. Fiz. tver. tela 1 no.6:973-976 Je '59.
(MIRA 12:10)

1.Leningradskiy fiziko-tekhnicheskiy institut AN SSSR.
(Copper oxides--Spectra)

SOV/51-6-1-24/30

AUTHORS: Gross, E.F. and Suslina, L.G.

TITLE: Single Crystals of ZnS and the Spectrum of Their Absorption Edge at Low Temperatures (Monokristally ZnS i spektr ikh kraya pogloshcheniya pri nizkikh temperaturakh)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 1, pp 115-117 (USSR)

ABSTRACT: Zn single crystals were produced by sublimation of very pure powder in an atmosphere of argon. This method is similar to that employed for growing of CdS monocrystals in the laboratory of S.M. Ryvkin, at the Physico-Technical Institute of the Academy of Sciences of the U.S.S.R. Sublimation was carried out in a quartz tube (1, in Fig 1) placed in an electric furnace (2, in Fig 1). A quartz boat 3 filled with ZnS was placed in the hottest part of the tube 1. This boat was heated to 1270°C. Before the electric furnace was switched on, a stream of argon was passed for 1 hour via a small tube 4. This was done to expel all air from the system. The electric furnace was switched on for 2 hours. During this time the vapours of ZnS produced from the powder were moved by a stream of argon to a quartz screen 5. ZnS single crystals were found to grow on this screen and on the tube walls near it. The single crystals were in the form of colourless plates of 25 x 5 mm area

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Single Crystals of ZnS and the Spectrum of Their Absorption Edge at Low Temperatures

and their thickness varied from 0.1 mm to 0.1 μ. The single crystals were found to be uniaxial (hexagonal modification of ZnS) and the optical axis was found to lie in the plane of the crystal. Using crystals of various thicknesses the authors studied the absorption spectra in the region of 3300-3600 Å (Fig 2). Curves a, b, ϕ, g in Fig 2 represent spectra obtained using crystals of 1C, 1, 1 and 0.1 u thickness respectively. The structure of the long-wavelength edge of absorption was found to be clearly exhibited at the liquid-helium temperature (4.2°K), as shown in Fig 2. Heating of crystals from 4.2 to 77°K and then to 20°C displaces the absorption lines towards longer wavelengths and makes them less distinct. Positions of the absorption lines near the long-wavelength edge are given in various temperatures in a table on p 11[illegible]. This table lists three absorption maxima at 4.2°K and 77°K and only two such maxima at 293°K (20°C). All these maxima lie between

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Single Crystals of ZnS and the Spectrum of Their Absorption Edge at Low Temperatures

3120 and 3220 Å. Acknowledgments are made to O.A. Matveyev and L.V. Maslova for their advice on the method of growing of single crystals. There are 2 figures, 1 table and 10 references, 6 of which are Soviet, 3 English and 1 German.

SUBMITTED: July 18, 1959

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24(7), 24(6) SOV/51-6-4-29/29

AUTHORS: Gross, Ye.F., Novikov, B.V., Razbirin, B.S. and Suslina, L.G.

TITLE: Absorption Spectra of Crystals of Certain Gallium Chalcogenides (Spektry pogloshcheniya kristallov nekotorykh khalkogenidov galliya)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 4, pp 569-572 (USSR)

ABSTRACT: Linear structure in the long-wavelength edge of fundamental absorption was observed in the spectra of some semiconductors (Ref's 1-10). These lines were ascribed by some authors to exiton states and by others to excess of one of the components of the semiconductor or to a foreign impurity. The present paper reports an investigation of the absorption spectra of gallium sulphide and selenide crystals (GaS and GaSe) with hexagonal laminar structure and crystals of β-Ga_2S_3 and Ga_2Se_3. GaS crystals were obtained by melting together at 1000-1050°C stoichiometric amounts of gallium and sulphur in evacuated quartz ampules. Crystals of β-Ga_2S_3 were prepared similarly but at a higher temperature (1200-1250°C). Preparation of GaSe and Ga_2Se_3 (cubic symmetry) was described by Goryunova et al (Ref 13). GaS and GaSe were used in the form of monocrystals of thicknesses varying from several microns to 100 μ. Ga_2S_3 and Ga_2Se_3 were 50-100 μ thick. Structure in the fundamental absorption edge was observed in the spectra of GaS and GaSe at 77°K (Figs 1a and 2a respectively). Such structure was also visible in the

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absorption spectrum of GaSe at room temperature. In contrast to GaS and GaSe, no structure was observed in the fundamental absorption edges of Ga_2S_3 and Ga_2Se_3 either at room temperature or at 77°K (Figs 1б and 2б). The absence of structure in the absorption spectra of β-Ga_2S_3 and Ga_2Se_3 is probably due to a large number of randomly distributed imperfections in these crystals. Such imperfections impede formation and migration of excitons and consequently the exciton lifetime is very short. Under such conditions the exciton structure of the absorption bands may be very diffuse or it may disappear altogether. From the absorption spectra the authors deduced the energy gaps in these semiconductors. A table on p 571 lists the values of the energy gaps so deduced at 290°K (col 2) and 77°K (col 3). These values agree satisfactorily with those deduced from photoelectric measurements at room temperature, which are listed in col 3. Acknowledgments are made to N.A. Goryunova for supply of GaSe and Ga_2Se_3 and for advice on preparation of GaS and Ga_2S_3 crystals. There are 2 figures, 1 table and 17 references, 10 of which are Soviet, 5 French and 2 German.

SUBMITTED: November 27, 1958

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USCOMM-DC-60,717

24(4), 24(6) SOV/51-6-5-29/34

AUTHORS: Bansi-Griyo, M. (Bancie-Grillot), Gross, Ye.F., Griyo, E.(Grillot), and Razbirin, B.S.

TITLE: Studies of Linear Fluorescence and Absorption of Pure Cadmium Sulphide Crystals at the Temperature of 4.2°K (Issledovaniye lineychatoy fluorestsentsii i pogloshcheniya kristallov chistogo sernistogo kadmiya pri temperature 4.2°K)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 5, pp 707-710 (USSR)

ABSTRACT: The present note supplements earlier work (Refs 1, 2, 4) on fluorescence and absorption of CdS monocrystals observed at low temperatures. The monocrystals were produced by sublimation and their thicknesses were ~50 μ or less. A spectrograph of 4 Å/mm dispersion was used to obtain the spectra at 4.2°K. The fluorescence spectrum of sublimated crystals is shown schematically by the band A in the figure on p 709. This spectrum was found to contain one new line (4868.2 Å) in addition to those reported earlier (Ref 2). As before (Refs 1, 2), the fluorescence was mainly blue with very feeble emission at green wavelengths. The background between 4870 and 4942 Å and the fluorescence lines were polarized with the electric vector at right-angles to the optical axis of the monocrystal, suggesting a common origin for all of them. The absorption spectrum of the sublimated crystals is shown by the band B

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Studies of Linear Fluorescence and Absorption of Pure Cadmium Sulphide Crystals at the Temperature of 4.2°K

(the figure on p 709); it did not vary from sample to sample. Three absorption lines (4853.1, 4857.2, 4869.1 Å) were observed in unpolarized light at positions very close to three fluorescence lines at 4856.6, 4861.4 and 4870.0 Å. In the region where continuous absorption was somewhat weaker, the light which had passed through the crystal was completely polarized with the electric vector parallel to the optical axis of the crystal. The authors obtained also the fluorescence spectrum of a crystal which was not prepared by sublimation (the method of preparation is not given). This spectrum was characterized by a strong green band and a line structure in the blue region (D in the figure on p 709) which was quite different from that observed in sublimated crystals; neither the green band nor the blue lines were polarized. See also the following abstract. There are 6 references, 2 of which are Soviet, 1 Dutch, 1 French and 1 mixed (German, English and Russian).

SUBMITTED: December 31, 1958

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24(4), 24(6) SOV/51-6-5-30/34

AUTHORS: Gross, Ye.F., Griyo, E. (Grillot), Zakharchenya, B.P. and Bansi-Griyo, M. (Bancie-Grillot).

TITLE: The Effect of a Magnetic Field on the Blue Fluorescence and on the Absorption Lines of Some Pure Cadmium Sulphide Crystals at the Temperature of 4.2°K (Vliyaniye magnitnogo polya na liniii siney fluorestsentsii i na linii pogloshcheniya nekotorykh kristallov chistogo sernistogo kadmiya pri temperature 4.2°K)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 5, pp 710-711 (USSR)

ABSTRACT: Reports continuation of the work described in the preceding paper (see preceding abstract). The present work was carried out at the Physico-Technical Institute of the Ac. Sc. USSR in Leningrad. A CdS monocrystal prepared by sublimation (dimensions 4 mm x 2 mm x 60-80 μ) was placed between the poles of an electromagnet. A diffraction spectrograph with 1.7 Å/mm dispersion was used to record the fluorescence spectrum of the crystal excited by the 3650 Å line at 4.2°K. In a magnetic field of 28 000 Oe, oriented at right-angles to the optical axis of the crystal, the fluorescence lines at 4870, 4860 and 4781 Å exhibited Zeeman splitting into doublets (separations of 0.7, 0.8 and 1.2-1.3 Å respectively, cf. Fig 1). The doublet components were polarized in the same way as the original lines, i.e. with the electric vector at right-angles to the optical axis of the crystal. No splitting was observed in magnetic field up to 28 000 Oe, oriented parallel to

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The Effect of a Magnetic Field on the Blue Fluorescence and on the Absorption Lines of Some Pure Cadmium Sulphide Crystals at the Temperature of 4.2°K

the optical axis of the crystal (Fig 2). The author studied also the effect of magnetic fields on the absorption lines of sublimated CdS monocrystals. They found that the 4869.1 Å is broadened from 1.62 to 2.24 Å by a field of 28 000 Oe (directed at right-angles to the optical axis of the crystal), indicating possible Zeeman splitting into a doublet. There are 4 references, 2 of which are French, 1 Soviet and 1 mixed (French and Russian).

SUBMITTED: December 31, 1958

RUMANIA/Optics - Spectroscopy. K

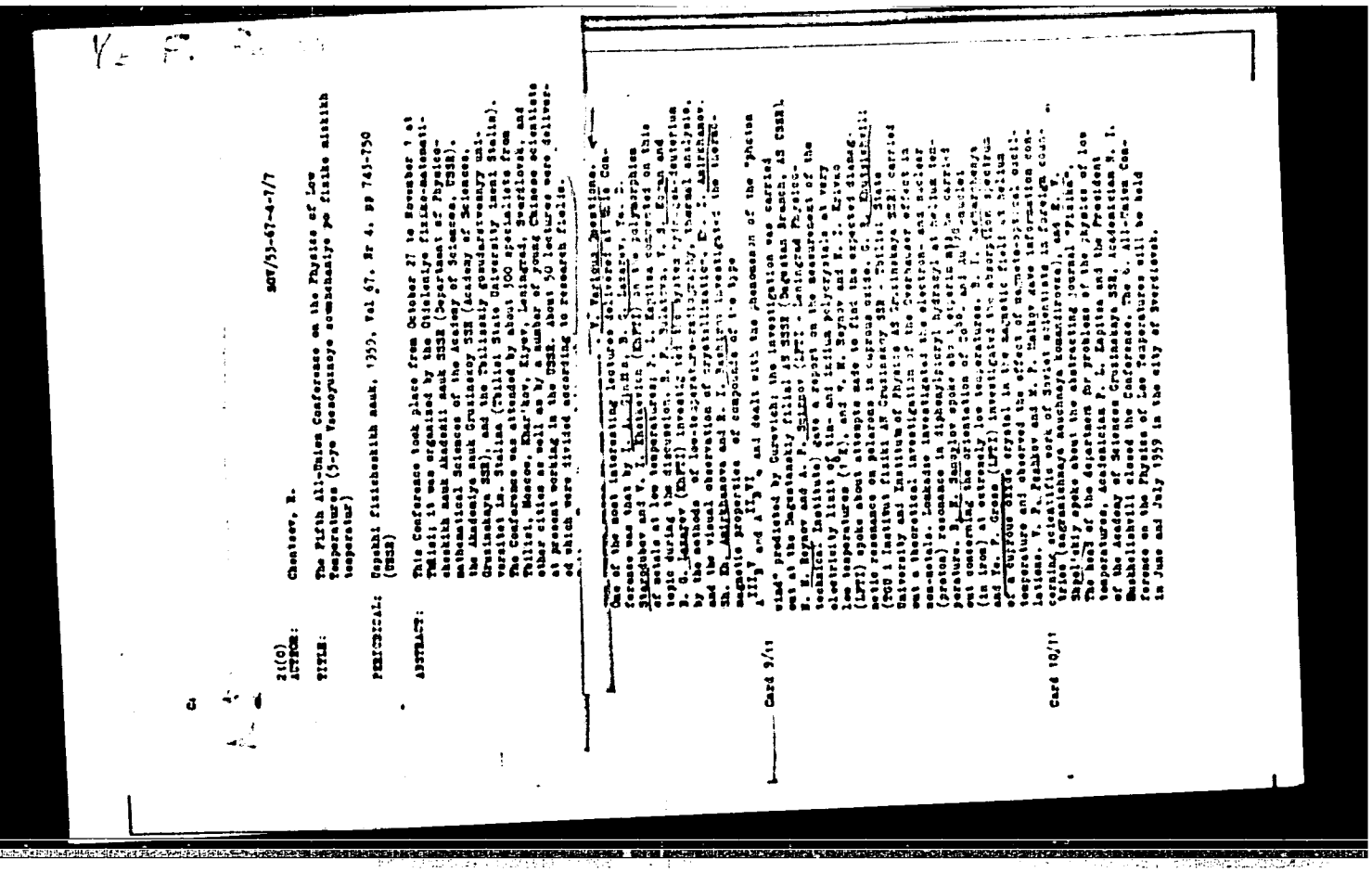
Abs Jour : Ref Zhur Fizika, No 2, 1960, 4671

Author : Gross, E.F.
Inst : -
Title : Important Problem of Modern Physics (Excitons in Crystal Lattice)

Orig Pub : An. Rom/-Sov. Ser. mat.-fiz., 1959, 13, No 2, 128-136

Abstract : Translated from Vestn. AN SSSR, 1958, No 10, See Referat Zhur Fizika, 1959, No 4, 9434.

Card 1/1



SOV/53-67-4-7/7

AUTHOR: Chaikov, L.

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ya Vsesoyuznaya konferentsiya po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi. It was organized by the Otdeleniye fiziko-matematicheskikh nauk AN SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, the Academy and Gruzinskoy SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University named after Stalin). The Conference was attended by about 300 specialists from Tbilisi, Moscow, Kharkov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered, which were divided according to research fields.

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GROSS, Ye.F.; KAPLYANSKIY, A.A.

Quadrupole optical excitation of the ground state of excitons in copper oxide crystals. Fiz. tver. tela 2 no.2:379-380 F '60. (MIRA 14:8)

1. Leningradskiy fiziko-tekhnicheskiy institut AN SSSR.
(Excitons) Copper oxide crystals)

GROSS, Ye.F.; SOBOLEV, V.V.

Fine structure of the main absorption edge of cadmium selenide single crystals. Fiz. tver. tela 2 no.3:406-413 Mar '60. (MIRA 14:8)

1. Fiziko-tekhnicheskiy institut AN SSSR, Leningrad.
(Cadmium selenide--Spectra)

S/181/60/002/007/047/047/XX
B006/B067

AUTHORS: Gross, Ye. F., Kaplyanskiy, A. A.

TITLE: Splitting of the Fundamental Absorption Edge of Cu_2O Due to the Removal of the Energy Band Degeneracy in Orientated Deformation of Crystals

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 7, pp. 1676-1677

TEXT: The authors studied the effect of deformation on the crystal spectra, which are related to 1) optical transitions between energy bands and 2) excitation of exciton states. The effect of uniaxial compression of Cu_2O crystals at $77^{\circ}K$ on their spectra of the long-wave main absorption edge, the lines λ = 6164, 6085, and 6125 A inclusive, was studied. The Cu_2O single crystals were compressed in the direction of the C_4, C_3, C_2 symmetry axes (the direction of compression is indicated by P), and the absorption spectra were taken perpendicular to P (in the direction L). The results are briefly discussed and shown in a figure. Pictures were also taken in polarized light. The main characteristics of the splitting

Splitting of the Fundamental Absorption Edge of Cu_2O Due to the Removal of the Energy Band Degeneracy in Orientated Deformation of Crystals

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B006/B067

effect - the multiplicity and the relative amounts of splitting - indicate that one of the energy bands is single, and the other is triply-degenerate (in the extreme case at $\vec{k} = 0$). This experimental result is in agreement with theoretical investigations (Ref. 11) in which it was shown, on the basis of group-theoretical considerations, that the valency band (in connection with the 2p levels of O^{2-}) is triply-degenerate, and that the free band (4s levels of Cu) is single. There are 1 figure and 11 references: 7 Soviet and 4 US.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut AN SSSR (Leningrad Institute of Physics and Technology of the AS USSR)

SUBMITTED: May 17, 1960

Card 2/2

9.4160 (3201, 1003, 1137)
26.2420

S/181/60/002/011/038/042
B006/B060

AUTHORS: Gross, Ya. F., Razbirin, B. S., and Safarov, V. I.

TITLE: A Study of the Longwave Edge of Intrinsic Absorption of Polycrystalline Films of CdS and ZnSe at Low Temperatures

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 11, pp. 2945-2949

TEXT: The authors prepared CdS and ZnS films by sublimating the powdery or crystalline initial substances onto glass or quartz bases; the films were between 0.04 and 1-2μ thick, the sputtering time ranging between 5 and 30 min. A total of over 100 specimens were examined which were all subjected to a considerable temperature gradient during sublimation (along the base the temperature varied from 600-800°C to room temperature). Fig.1 shows the spectra taken on a 0.42μ thick CdS film at 77.3°K in the range of the longwave absorption edge; while the absorption spectrum of the film has a smooth course on the "cold" part of base b, that of the film on the "warm" base (a) exhibits three distinct peaks at 4878, 4838, and 4706 A which can be assigned to the three lines with 4870, 4840, and 4720 A exhibited by the CdS monocrystal. The shift is ascribed to deforma-

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A Study of the Longwave Edge of Intrinsic Absorption of Polycrystalline Films of CdS and ZnSe at Low Temperatures

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B006/B060

tion owing to the backing and the great number of defects. The first two peaks have a half-width of 10, the third one of 30 A. SnSe exhibits the same effect. The "hot" part exhibits three peaks, two distinct ones at 4430 and 4412 A, and a very weak one at 4365 A. The half-widths are the same. One of these maxima has been already observed by G. A. Zholkevich. An investigation of the films at 4.2°K did not give different results. Electron diffraction studies showed that the difference in the spectra of "cold" and "hot" films cannot be due to different crystallization forms or amorphism of the "cold" film. The differences are explained by the fact that films forming on the "hot" parts of the base consist of considerably larger and less defective crystals than those forming on the "cold" parts. This assumption has been checked experimentally. M. A. Rumsh and V. N. Shchemelev as well as V. N. Vertsner and M. I. Rudenok are thanked for assistance in the experiments; K. V. Shalimova and N. V. Karpenko are mentioned. There are 3 figures and 7 references: 5 Soviet, 1 British, 1 French, and 1 German.

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86449

A Study of the Longwave Edge of Intrinsic Absorption of Polycrystalline Films of CdS and ZnSe at Low Temperatures

S/181/60/002/011/038/042
B006/B060

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR Leningrad (Institute of Physics and Technology of the AS USSR, Leningrad)

SUBMITTED: July 28, 1960

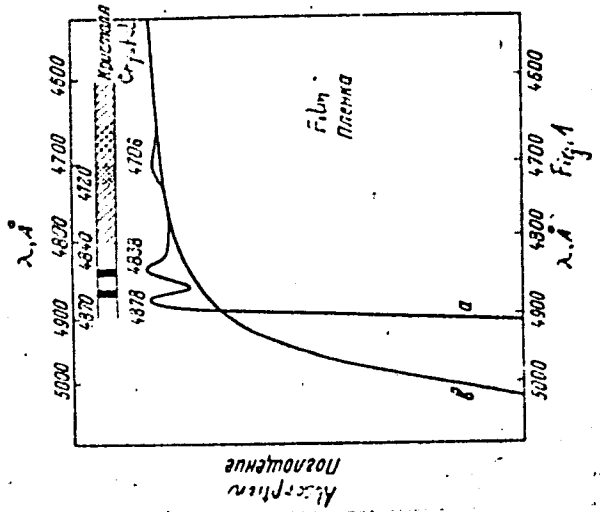

Fig. 1

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86451

9.4160 (3201, 1003, 1137)
26.2420

S/181/60/002/011/041/042
B006/B060

AUTHORS: Gross, Ye. F. and Kaplyanskiy, A. A.

TITLE: Study of the Effect of Oriented Deformations on the Spectrum of the Fundamental Absorption Edge of Cu_2O Single Crystals

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 11, pp. 2968-2981

TEXT: This is a very detailed report on studies made on monoaxially compressed Cu_2O single crystals. As a consequence of this deformation, an anisotropic polarized splitting of the longwave edge was observed to take place along with an exciton structure of the Cu_2O absorption spectrum. Multiplicity, amount of splitting, and polarization in the spectra were examined with different directions of compression. The method used for the investigation was similar to the one described in Refs. 13,14. The specimens were about 1 x 2 x 4 mm large platelets placed in a special press inside a Dewar vessel (77°K). The spectra were taken in polarized ($E \parallel P$, $E \perp P$) and unpolarized light by an MDR-51 (ISP-51) spectroscope, dispersion ~5A/mm, and a УФ-85 (UF-85) camera. The spectra were all taken

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Study of the Effect of Oriented Deformations on the Spectrum of the Fundamental Absorption Edge of Cu_2O Single Crystals

S/181/60/002/011/041/042
B006/B060

in the direction L which was perpendicular to the direction of compression P ($L \perp P$), with P being oriented along the axes C_4, C_3, and C_2; Figs. 1-3 show pictures of the polarized splitting of the absorption edge of Cu_2O. The spectra in the figures are described in the text and certain characteristics are pointed out. The magnitude of the splitting is in all cases ($L \perp P$; $P \parallel C_4$, $P \parallel C_3$, $P \parallel C_2$) directly proportional to the compression pressure. The polarized splitting was calculated, and the theoretical and experimental splitting amounts Δ were intercompared ($\Delta = \nu - \nu_0$, ν_0 being the position of the line in the free crystal). The agreement is satisfactory. From results obtained it was possible to infer the character of the energy levels. The results can be explained by assuming that the triple degeneracy of the valency band in deformation is removed at $\vec{K} = 0$. The final part of the paper under consideration deals with the effect of the crystal deformation upon the yellow exciton series of Cu_2O (V. T. Agekyan, a student of LGU (Leningrad State University) participated in

Study of the Effect of Oriented Deformations on the Spectrum of the Fundamental Absorption Edge of Cu_2O Single Crystals

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this investigation). It was found that at $P \parallel C_4$ the set is sharply shifted in the direction of longer waves; the same, but less markedly, applies to $P \parallel C_3$, and at $P \parallel C_2$ a polarization effect appears in addition to this shift. The uniform shift of the lines allows the conclusion that deformation has an effect upon the position of the band, but not upon the individual exciton levels; a relationship was found, furthermore, to exist between the hydrogen-like exciton levels with $n \geq 2$ and the degenerate band. A. G. Zhilich is finally thanked for discussions on theoretical problems. There are 7 figures, 2 tables, and 29 references: 17 Soviet, 10 US, 1 French, 1 Japanese, and 1 Italian.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR Leningrad (Institute of Physics and Technology of the AS USSR, Leningrad)

SUBMITTED: August 4, 1960

Legends to
Fig. 1: polarized splitting of the absorption edge spectrum of Cu_2O on a crystal compression in the direction of the symmetry axis of 4th order; Fig. 2: the same on a compression in the direction of the symmetry axis of 3rd order; Fig. 3: the same for a compression in the direction of the symmetry axis of 2nd order.
Legend to Fig. 7: spectrogram of the yellow exciton series of Cu_2O in monoaxially compressed crystals.

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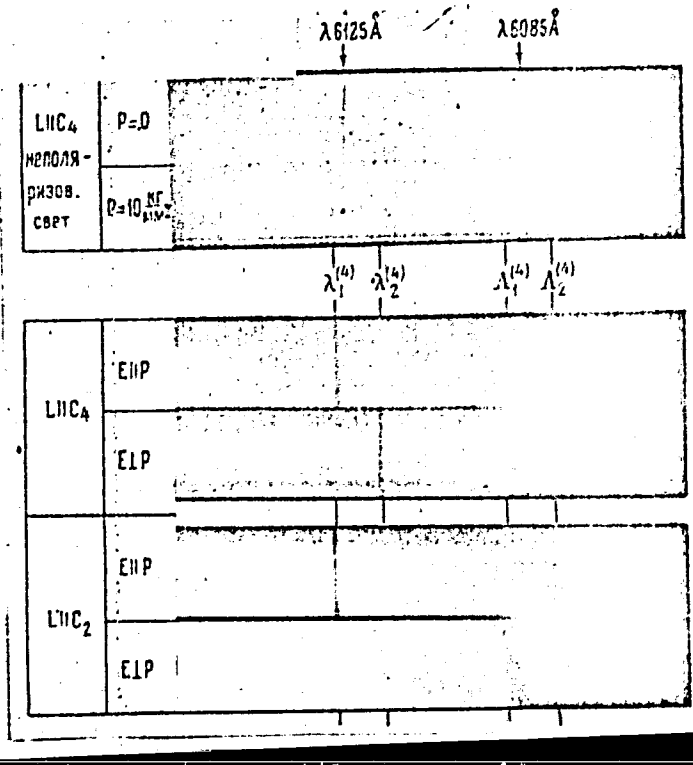
B006/B060



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S/181/60/002/011/041/042
B006/B060

Рис. 1. Поляризованное расщепление спектра края поглощения Cu_2O при сжатии кристаллов вдоль оси симметрии 4-го порядка.

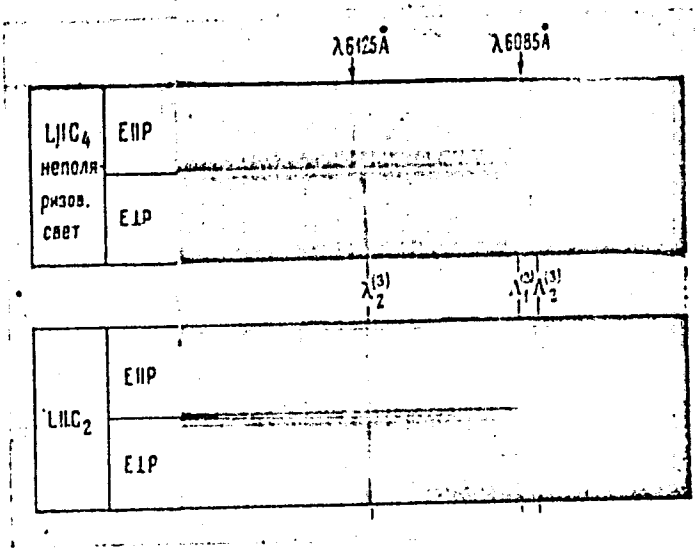

Рис. 2. Поляризованное расщепление спектра края поглощения Cu_2O при сжатии кристаллов вдоль оси симметрии 3-го порядка.

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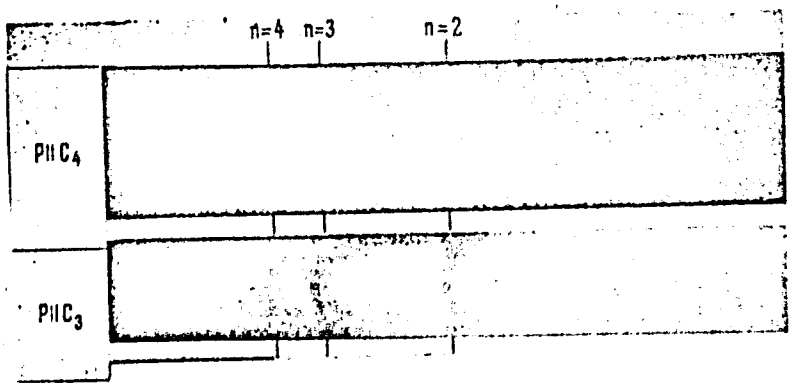
B006/B060



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B006/B060

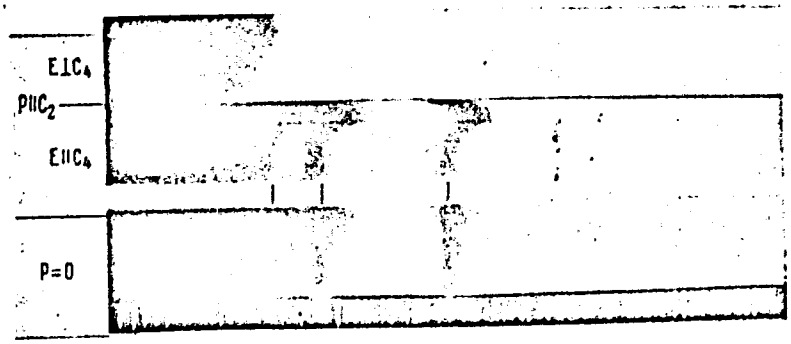

Рис. 7. Спектрограммы желтой серии экситона Cu_2O в одноосно-напряженных кристаллах.

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68888
S/051/60/008/02/015/036
E201/E391

24.3500

AUTHORS: Gross, Ye.F., Razbirin, B.S. and Shekhmamet'yev, R.I.

TITLE: Investigation of the Reflection and Luminescence Spectra of Copper Halides at Low Temperature

PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 2, pp 232 - 238 (USSR)

ABSTRACT: This paper is based on the results of the diploma work of B.S. Razbirin and R.I. Shekhmamet'yev carried out at Leningradskiy gosudarstvennyy universitet im. Zhdanova (Leningrad State University im. Zhdanov) in 1955-1957. The paper reports the results of an investigation of the diffuse reflection and luminescence spectra of CuI (Figures 1, 2), CuBr (Figures 3-5) and CuCl (Figure 6) crystals at 77 °K in the spectral region around the fundamental absorption edges of these three compounds (some of these results have been reported earlier, cf. Ref 8). The crystals were used in the form of sublimated layers deposited in vacuo on glass plates and in the form of fine-grained powders. Luminescence was excited with ultraviolet light from a mercury lamp SVDSh-1000:

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E201/E391

Investigation of the Reflection and Luminescence Spectra of Copper Halides at Low Temperature

for CuI and CuBr the 3 660 Å wavelength was used and for CuCl shorter wavelengths (3 100 - 3 500 Å) were employed. The reflection spectra were obtained using a continuous-spectrum source (an incandescent lamp). The reflection and luminescence spectra of the same sample were recorded by means of a quartz spectrograph Q-12 with 50 Å/mm dispersion in the 4 000 Å region. The results obtained can be summarized as follows:

1) The reflection and luminescence spectra of copper halides are similar. The positions of the long-wavelength absorption edges of CuCl, CuBr and CuI do not differ greatly. Reflection maxima identical with absorption lines are obtained for all these crystals in the region of the absorption edge. The luminescence spectra of the three crystals have groups of narrow lines, of which those lying at shorter wavelengths coincide with the appropriate absorption lines. The luminescence spectra contain also wide bands at longer wavelengths;

2) Adsorbed gases affect strongly the structure of the

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68888
S/051/60/008/02/015/036
E201/E391

Investigation of the Reflection and Luminescence Spectra of Copper Halides at Low Temperature

luminescence and reflection spectra of CuI and CuBr crystals. After adsorbed gas is removed the luminescence and reflection spectra recover their original form (this process can be repeated many times);
3) The luminescence spectra of CuI and CuBr contain groups of equidistant lines similar to those observed in other semiconducting crystals (CdS, CdSe, ZnS, ZnO, etc);
4) The results obtained indicate that the short-wavelength weak luminescence lines of CuI, CuBr and CuCl, which coincide with absorption lines and are not greatly affected by surface treatment, are due to processes occurring in the crystal lattice. The long-wavelength strong luminescence lines, which are very sensitive to surface treatment, are due to some processes occurring at the surface. There are 6 figures and 12 references, 6 of which are Soviet, 3 English and 2 French, 1 German.

SUBMITTED: June 3, 1959

Card 3/3

S/051/60/008/04/014/032
E201/E691

AUTHORS: Gross, Ye.F., Suslina, L.G. and Komarovskikh, K.F.

TITLE: Investigation of the Absorption Spectra of Zinc Sulphide Crystals

PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 4, pp 516-520 (USSR)

ABSTRACT: The paper deals with polarization of the line structure of the absorption edge of hexagonal ZnS monocrystals at 4.2 and 77°K and with the absorption spectra of sublimated polycrystalline ZnS films. Monocrystals of ZnS were grown in the authors' laboratory by sublimation of ZnS powder in a neutral atmosphere (Ref 2). To avoid the effect of deformations on the absorption spectrum, the monocrystals were attached to substrates at one end only, the other end remaining free. The spectra were obtained at 77 and 4.2°K in polarized and natural ultraviolet light using a quartz spectrograph ÇF-12 (25 Å/mm linear dispersion in the 3200 Å region). The line structure of the absorption edge of ZnS monocrystals was found to be polarized (Fig 1). At 4.2°K the 3205 Å line was completely polarized with its electric vector at right angles to the optical axis of the crystal (E ⊥ c), i.e. it could be represented by a plane absorption

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S/051/60/008/04/014/032
E201/E691

Investigation of the Absorption Spectra of Zinc Sulphide Crystals

oscillator. The 3180 Å line was unpolarized or slightly polarized and the 3115 Å line was strongly polarized with E || c (the absorption oscillator close to a linear electric dipole). The nature of polarization of the spectrum of ZnS monocrystals is similar to polarization found in other uniaxial crystals with discrete structure of the absorption edge (Refs 4-6). Thin crystals (d~0.1 μ) were found to stick to the base and the consequent deformation produced displacement of the absorption lines (Table 1), as well as broadening (the 3205 Å line). The absorption spectra of some "free" crystals were also found to be displaced by 1-2 Å due to internal stresses produced during growth of the monocrystals or due to differences in attachment to the bases. The authors investigated also the absorption spectra (Fig 2) of polycrystalline ZnS films produced by sublimation in vacuo. At 4.2°K the following absorption lines were observed (the widths are given in brackets): 3212 Å (10 Å), 3190 Å (10 Å), 3128 Å (20 Å); all these are shown in Fig 2a. In some films a weak line at 3271 Å (20 Å width) could be seen (Fig 2б). The positions of the absorption lines in polycrystalline ZnS films at 4.2 and 77°K are listed in Table 2. Comparison of the data in Tables 1 and 2 shows that the positions and

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Investigation of the Absorption Spectra of Zinc Sulphide Crystals

widths of the absorption lines of polycrystalline films are close to the positions and widths of ZnS monocrystals stuck to substrates. It follows that the films have hexagonal structure. The 3212, 3190 and 3128 Å lines of the ZnS films and the corresponding lines in the spectra of monocrystals are the lines of the lattice itself (exciton excitation). The 3271 Å line of ZnS films is due to lattice defects (for example excitation of "impurity" excitons in the defective regions). There are 2 figures, 2 tables and 9 references, 8 of which are Soviet and 1 English.

SUBMITTED: August 13, 1959

Card 3/3

83927
S/051/60/009/004/030/034
E201/E191

26.1512

AUTHORS: Bancie-Grillot, M., Ye.F. Gross, E. Grillot and Razbirin, B.S.

TITLE: The Effect of Temperature on Two Series of Bands in the Green Fluorescence Spectrum of Pure Cadmium Sulphide at Low Temperatures

PERIODICAL: Optika i spektroskopiya, 1960, Vol 9, No 4, pp 542-544

TEXT: Very pure cadmium sulphide, which does not luminesce at room temperature, exhibits intense green fluorescence at the temperature of liquid air (Refs 1-3). The spectrum consists of two vibrational series whose maxima are given by $\nu_1 = 19\,450 - 300n$ cm^{-1} and $\nu_2 = 19\,310 - 300p$ cm^{-1}, where n and p are small integers. The present paper reports further studies on the effect of temperature on the relative intensities of the two series, between 4 and 77 °K. In some crystals only the second series (ν_2) was observed at 4 °K; heating of these crystals to the boiling point of liquid nitrogen destroyed gradually this series, which was (also gradually) replaced by the first series at 77 °K. If a crystal exhibited only the first series at 4 °K, then

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The Effect of Temperature on Two Series of Bands in the Green Fluorescence Spectrum of Pure Cadmium Sulphide at Low Temperatures

heating to 77 °K did not produce the second series. In crystals with both series at 4 °K heating to 77 °K weakened the bands of the second series so that only the first series (slightly broadened) remained at 77 °K, as shown in Fig 1. On application of an electric field (about 1 kV/cm) to a crystal immersed in liquid helium and exhibiting both series, the intensity of the first series bands was raised and the intensity of the second series was lowered, as shown in Fig 2. Further studies of the effects of electric fields are proceeding. Acknowledgement is made to N.M. Reynov for his help in work with liquid helium. There are 2 figures and 4 references: 1 Dutch, 1 French and 2 mixed (English, German, Dutch, Russian and French).

SUBMITTED: May 3, 1960

Card 2/2

80052
S/020/60/132/01/25/064
B014/B014

24.7100

AUTHORS: Gross, Ye. F., Corresponding Member of the AS USSR, Kaplyanskiy, A.A.

TITLE: The Optical Anisotropy of Cubic Crystals Which Causes the Effect of Spatial Dispersion. Quadrupole Exciton Absorption of Light in Cuprous Oxide

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 1, pp. 98-101

TEXT: When examining the absorption spectrum of monocrystalline samples of Cu_2O ($T = 77^\circ$ K) the authors of the present paper detected the effect of anisotropic light absorption ($\lambda = 6125$ A), which is unusual in the case of cubic crystals. It was found that in the spectrum of light passing through a Cu_2O lamina the intensity of these absorption lines is not equal in two arbitrarily chosen states of polarization which are perpendicular to each other. The degree of polarization and the integral intensity vary from specimen to specimen and also when the direction of the beam changes. A sufficiently large Cu_2O crystal was bred and used to determine the dependence of intensity and polarization of these lines upon the direction of the beam in the crystal

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The Optical Anisotropy of Cubic Crystals Which Causes the Effect of Spatial Dispersion. Quadrupole Exciton Absorption of Light in Cuprous Oxide

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B014/B014

lattice. Thin sheets, which were differently oriented relative to the crystallographic axes, were cut out of this crystal. It was found that the intensity and the degree of polarization of the lines under consideration are fully determined by the orientation of the beam relative to the crystallographic axes. The results obtained are described by means of the spectrogram shown in Fig. 1 and the scheme shown in Fig. 2. Herefrom it may be seen that the spatial distribution of intensity and of the state of polarization has some elements of cubic symmetry. When taking account of polarization only (neglecting absorption intensity) it is possible to determine seven "optical" axes along which absorption is isotropic. The anisotropy of the absorption lines is ascribed by the authors to electric quadrupole transitions since the observable dependence of intensity and polarization upon the direction of light inside the crystal corresponds to the spatial field distribution of an electric quadrupole system. In discussing the results obtained here the authors refer to papers by S.I. Pekar et al. (Refs. 12 and 13) in which it was pointed out that optical anisotropy of cubic crystals associated with the occurrence of excitons is theoretically possible. Furthermore, a paper by V.L. Ginzburg (Ref. 14) is referred to, in which spatial light dispersion was taken into consideration.

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The Optical Anisotropy of Cubic Crystals Which Causes the Effect of Spatial Dispersion. Quadrupole Exciton Absorption of Light in Cuprous Oxide

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B014/B014

The detection of quadrupole transition makes complementary demands on the theory of the exciton state of the crystal, in which dipole transitions are forbidden and quadrupole transitions allowed. In conclusion, reference is made to a model devised by A.G. Zhilich (Ref. 2) for these transitions. The authors thank M.A. Rumsh and V.N. Shchemelev for their assistance in experiments. There are 2 figures and 14 references, 10 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk SSSR (Institute of Physics and Technology of the Academy of Sciences of the USSR)

SUBMITTED: February 2, 1960

4

Card 3/3

81717
S/020/60/133/01/15/070
B014/B011

24.7700

AUTHORS: Gross, Ye. F., Corresponding Member of the AS USSR,
Sobolev, V. V.

TITLE: Photoluminescence Within the Edge of the Fundamental Absorption of Mixed CdSe - CdS Crystals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 1, pp. 56-59

TEXT: In their long introduction the authors discuss the complicated structure of emission and absorption arising at low temperatures in a number of crystals (CdS, CdSe, HgI_2, ZnS, and others) within the longwave absorption edge. In the present paper, the authors study the photoluminescence of macrocrystalline CdSe-CdS solid solutions of CdSe single crystals and of macrocrystalline CdSe- and CdS layers within their absorption edge. The emission and absorption spectra of CdSe single crystals are analyzed in the first chapter. The great analogy with the spectra of CdS single crystals is pointed out. The structure is discussed in greater detail, and, among other things, the great differences existing between

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B014/B011

Photoluminescence Within the Edge of the Fundamental Absorption of Mixed CdSe - CdS Crystals

the bands of different crystals are described. The second chapter treats pure macrocrystalline CdS- and CdSe layers. Agreement is found between the emission and absorption lines of the CdS layers and those of the CdS single crystals. The emission lines of CdS layers at T = 4.2°K exhibit triplet structure, whereas the single crystals have a doublet structure. According to the authors' results, the emission of CdSe layers has a triplet structure. At T = 77.3°K the emission of the CdS layers consists of structureless bands, the CdS single crystals and pure CdSe layers have a doublet structure. The third chapter deals with the macrocrystalline layers of mixed CdSe-CdS crystals. In the case of T = 4.2°K, the photoluminescence of all of the 20 samples under consideration has a structure, and the line spectrum consists of a few weak lines. On heating to 77.3°K, the emission intensity drops, the clearness of the structure and the intensity of the shortwave lines of the edge emission likewise drop sharply, while the intensities of the shortwave components of the doublet and triplet structures rise. There are 3 figures and 18 references: 8 Soviet, 2 French, 3 German, 1 British, and 4 American.

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B014/B011

Photoluminescence Within the Edge of the Fundamental Absorption of Mixed CdSe - CdS Crystals

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk SSSR (Institute of Physics and Technology of the Academy of Sciences, USSR)

SUBMITTED: March 28, 1960

4

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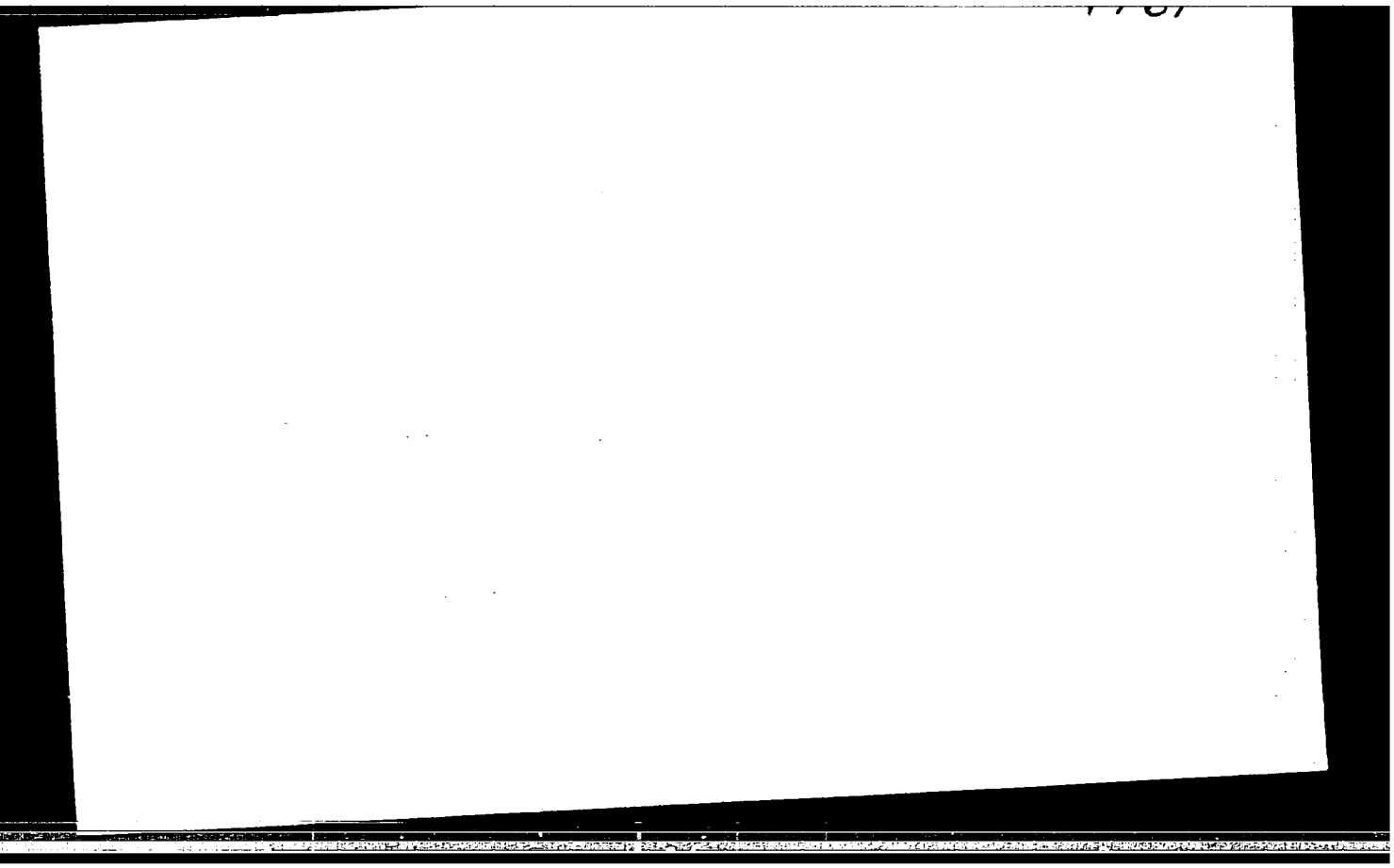

GROSS, Yevgeniy F. and NOVIKOV, B. V.

"Fine Structure of Spectral Curves for Excitation of Photoconducttivity and Luminescence and its Connection with Exciton Absorption."

REPORT TO be submitted for the Intl. Conference on Photoconductivity, IUPAP, Cornell University, Ithaca, N. Y., 21-24 Aug 1961.

Leningrad State Univ.

89299

S/181/61/003/001/041/042
B102/B204

26.2421

AUTHORS: Gross, Ye. F., Zakharchenya, B. P., and Konstantinov, O. V.

TITLE: Effect of the inversion of a magnetic field in the exciton absorption spectrum of a CdS crystal

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 305-308

TEXT: Studies of the effect of a magnetic field upon the absorption spectrum of CdS, on which the authors have made a report in Ref. 1, are intended to determine the exciton energy spectrum and its relation to the band structure in CdS. The experiments described here were carried out with 1 - 3μ thick foils of CdS single crystals, whose optical axis $\vec{A}$ was in the plane of the foil. $\vec{H}$ was either parallel or perpendicular to $\vec{A}$. ($\vec{A}$ is considered to be a vector, because the crystal has no inversion center). The crystals were cooled to 1.3°K and remained free from deformation. In the case of $\vec{E} \parallel \vec{A}$, the exciton absorption lines with λ = 4853, 4813, and 4806 A were weak and so narrow that the effect of the $\vec{H}$-field upon them could be easily observed. The line with λ = 4813 A, on

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Effect of the inversion of a magnetic...

which the inversion effect could be best observed, had a satellite line with λ = 4814 A. At $\vec{H} \perp \vec{H}$, the 4813-line split up into a doublet, whose center of mass was shifted toward higher energies relative to the original line. The weak 4814-line, whose origin is not quite clear, is also split up into a doublet; the components are weak and not so far apart as those of the main line. In the case of inversion of the field direction, the manner of splitting is considerably changed (shift of the main doublet $\Delta\lambda$ = 0.4 A; intensity change). The essential change in the spectrum occurring when the field direction is inverted, consists in a shift of the Zeeman components and in a change of their intensity; the same effect is attained if the field is left as it is, and the crystal is rotated through 180°. Also the line with 4853 A, which is not split in the field, shows no effect of inversion. The line with 4806 A shows a complex splitting, and the inversion effect may be observed only with difficulty. The change of the absorption spectrum cannot be explained within the framework of the spectroscopy of an isolated atom, above all, because the effect is in contradiction to the invariance of the Schrödinger equation with respect to time reversal. The question is now

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examined as to what possibilities are left by the invariance of the quantum-mechanical equations with respect to the time reversal for excitons in the crystal. The invariance is formulated by means of the Onsager principle for the conduction tensor: $\sigma_{\mu\nu}(\vec{k},\omega,-\vec{H}) = \sigma_{\mu\nu}(-\vec{k},\omega,\vec{H})$. Then the power absorbed per cm^3 with a given λ and $\vec{H}/H$ $W(\vec{H}) = \frac{1}{2}\sum_{\mu,\nu} E_\mu E_\nu \mathrm{Re}\sigma_{\mu\nu}(\vec{k},\omega,\vec{H})$ and $W(-\vec{H}) = \frac{1}{2}\sum_{\mu,\nu} E_\mu E_\nu \mathrm{Re}\sigma_{\mu\nu}(-\vec{k},\omega,\vec{H})$. Herefrom, the change in the absorption spectrum in the case of inversion of $\vec{H}$ may be observed. In the presence of an inversion center in the absorbing medium, the effect would not be observable. The shift of the Zeeman components in the case of field inversion may be due to the following effect: The excitons excited by the electromagnetic wave move translatorily with $\vec{v} = \hbar\vec{k}/\mu$ (μ - effective exciton mass) and, in the presence of a constant magnetic field, they generate the field $\vec{E} = \hbar[\vec{k},\vec{H}]/c\mu$. In a crystal without inversion center, the exciton state has a dipole moment $\vec{d}$, and to the energy of the exciton in the magnetic field, $-(\vec{d},\vec{E})$ is added additively. $\vec{d}$ is parallel to $\vec{A}$, and the energy determining the shift

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equals $\Delta\varepsilon \sim (\vec{A},[\vec{k},\vec{H}])$. If any of these vectors are parallel, $\Delta\varepsilon = 0$ - and thus no effect may be observed, e.g., with $\vec{A} \parallel \vec{H}$. There are 1 figure and 6 references: 3 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR imeni akad. A. F. Ioffe Leningrad (Institute of Physics and Technology of the AS USSR imeni Academician A. F. Ioffe, Leningrad)

SUBMITTED: August 24, 1960

GROSS, Ye.F.; SHEKHMAMET'YEV, R.I.

Connection between edge luminescence and the structure of the basic absorption edge. Fiz. tver. tela 3 no. 3:889-894 Mr '61. (MIRA 14:5)

1. Leningradskiy gosudarstvennyy universitet imeni A.A. Zhdanova.
(Absorption of light) (Luminescence)

GROSS, Ye.F.; ZAKHARCHENYA, B.P.; KANSKAYA, L.M.

Investigating the Stark effect of excitons in oriented single crystals of cuprous oxide. Fiz. tver. tela 3 no. 3:972-978 Mr '61. (MIRA 14:5)

1. Fiziko-tekhnicheskiy institut AN SSSR, Leningrad.
(Stark effect) (Copper oxide--Spectra)

22059

S/181/61/003/004/025/030
B102/B209

9.4177(105,1482)

AUTHORS: Gross, Ye. F. and Novikov, B. V.

TITLE: The relation between background and the fine-structure maxima of the spectral curves of photoconductivity in CdS single crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 4, 1961, 1249-1252

TEXT: In previous papers (ZhTF, vyp. 4, 913, 1956 and DAN SSSR, 110, no. 5, 761, 1956), the authors reported on the discovery of a complex structure of the spectral photocurrent distribution at T = 77°K in the range of the known exciton absorption lines. These distribution curves may be divided into two classes: The first class contains those in which the exciton absorption lines coincide with the photocurrent maximum, while the second class encompasses such in which the exciton absorption lines coincide with the photocurrent minima. According to this classification, the crystals differ essentially in the character of the short-wave drop of photoconductivity. In a later paper, the effect of defects and surface condition of CdS crystals upon absorption lines and photocurrent curves was studied. These studies

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The relation ...

have now been continued. Both classes of CdS crystals have a structureless background. Fig. 1 shows that the relative values of maxima and background differ greatly in different specimens. In the curves denoted by a, E was perpendicular to C (E - electric vector of the exciting light, C - optical axis of the crystal), whereas in those indicated by b, E was parallel to C. Like M. S. Brodin, the authors found that the background is considerably polarized in the direction of the electric vector E⊥C. The structure of the photoconduction curves vanishes in many cases if the surface of the crystal is subjected to a slight treatment. In this manner, curve a in Fig. 2 was obtained from a3 (Fig. 1) by wiping the surface of the crystal with wet cotton. The sensitivity of the specimen decreased. The structure of the curve after polishing had such a shape that the crystal had to be assigned to the second class. The authors also determined the spectral distribution curves of polycrystalline CdS films sputtered upon glass backings. In such films which exhibited a structured absorption edge, also a structure of the photoconduction curves was found. The background was very high in this case, and the fraction of radiation used to determine the structure accounted only for some per cent. These facts speak in favor of an interrelation between the photoactive background (or part of it) and the lattice imperfections. Films

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B102/B209

The relation ...

having no structure of the absorption edge had completely smooth photocurrent curves at 77°K. V. L. Broude, V. V. Yeremenko, V. S. Medvedev, M. K. Sheynkman, N. N. Chikovani, and M. S. Brodin are mentioned. There are 2 figures and 10 references: 7 Soviet-bloc and 3 non-Soviet-bloc. The two references to English-language publications read as follows: D. Dutton, Phys. Rev. 112, 785, 1958; D. G. Thomas, J. J. Hopfield, Phys. Rev. 116, 573, 1959.

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova
Fizicheskiy institut (Leningrad State University imeni
A. A. Zhdanov, Institute of Physics)

SUBMITTED: September 26, 1960

Card 3/4

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

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

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

[illegible]
[illegible]

24,7700 (1137, 1138, 1160, 1482)

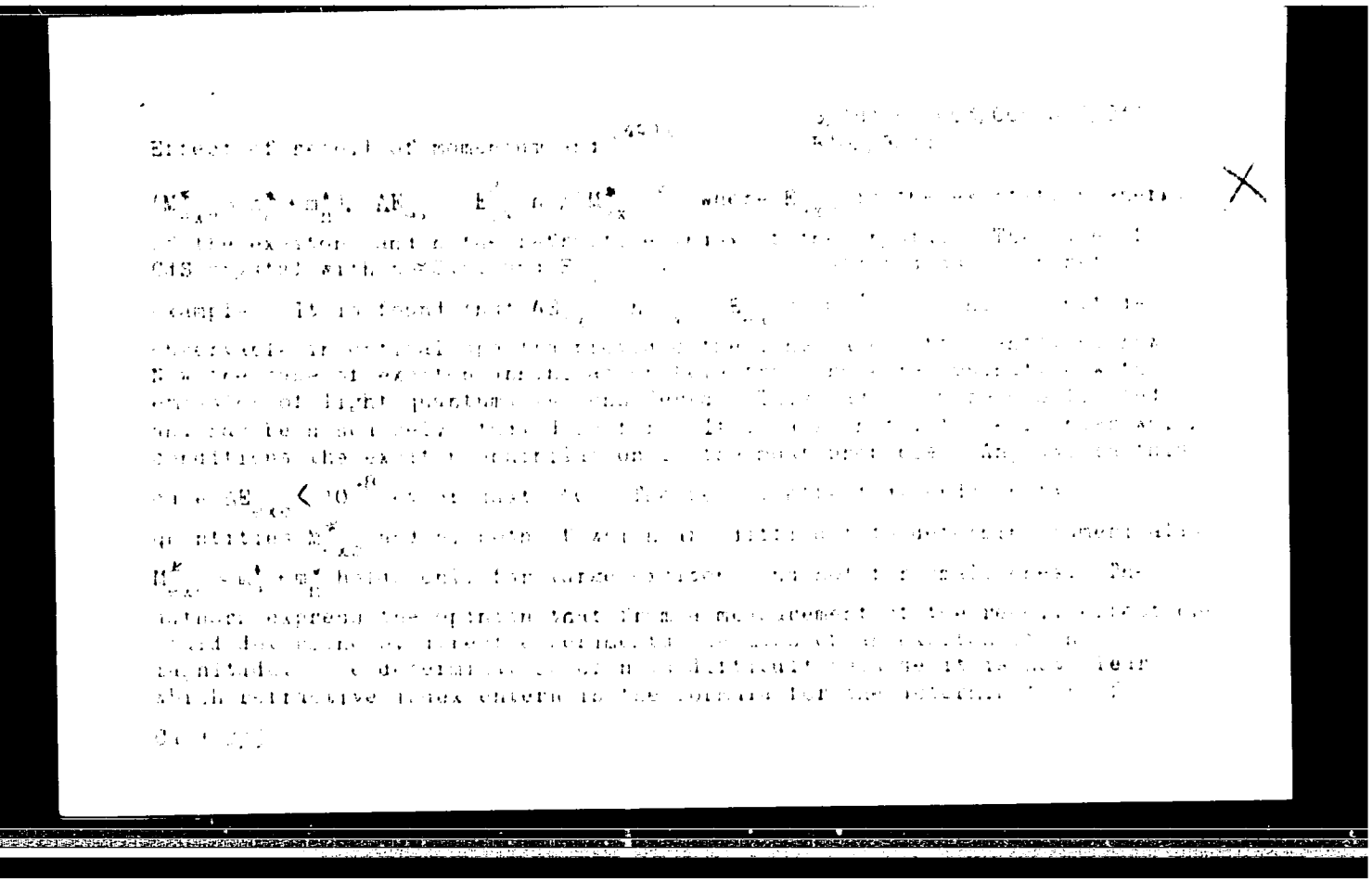
AUTHOR: [illegible] F.

TITLE: Effect of recoil [illegible] momentum and energy [illegible] [illegible] production and annihilation of [illegible]

PERIODICAL: Fizika tverdogo [illegible]

TEXT: The nature of [illegible] er emitting line. The recoil energy [illegible] to conserve energy is $\Delta E = E^2/2Mc^2$ where E is the excitation energy [illegible] ΔE of the system and M its mass. For gamma quanta [illegible] can be of the order of an electron volt [illegible] for example, E 2 ev and M 1.6·10^{-24} g, ΔE [illegible] not measurable and is not observable even [illegible] related [illegible] one considers, however, the [illegible] the effect [illegible] absorption the situation becomes more convenient [illegible] [illegible] mass is only about 1/2000 [illegible]

Card 1/[illegible]



ΔE_{exc}. On account of the dependence of M^{*}_{exc} on the direction of propagation of light, the exciton recoil effect should also depend on the angle, and in anisotropic crystals on the direction of polarization of light. The effect should be experimentally observable in exciton spectra, e.g. from a determination of $\nu_{abs} - \nu_{emiss}$. Such a line displacement of $\sim 10^{-4}$ ev has in fact been observed in luminescence spectra (HgJ_2, CdS). However, it is not yet granted that this displacement has no other origin. There are 6 references: 3 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova (Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: February 23, 1961

29693
S/181/61/003/010/019/036
B104/B108

24,2100 (1147, 1164, 1482)

AUTHORS: Gross, Ye. F., Zakharchenya, B. P., and Razbirin, B. S.

TITLE: Magneto-optical effects in the absorption spectrum of a cadmium-sulfide crystal

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3083 - 3091

TEXT: The Zeeman displacement of the two groups of absorption lines of cadmium-sulfide crystals was investigated (4889 - 4860 Å; 4860 - 4660 Å). Experiments were made in magnetic fields of up to 35,000 oe at temperatures of 4.2 and 1.3 °K. The long-wave group was investigated with the aid of thin crystals (from ~1μ up to some tens of microns). The dispersion of the diffraction-grating spectrograph used was 4 Å/mm and 1.7 Å/mm. Line splitting was found to depend on the polarization and on the direction of the magnetic field. A diamagnetic line shift was observed which is increasing with the magnetic field strength and with the quantum number (in the case of the hydrogen-like lines). The Zeeman splitting of the weak lines between 4889 and 4854 Å was not uniform for all lines studied. In a discussion of these results the authors show that

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S/181/61/003/010/019/036
B104/B108

Magneto-optical effects in the...

an electric field acts on the exciton levels in a magnetic field. A. G. Samoylovich and L. A. Korenblit (DAN SSSR, 100, 43, 1955) studied the action of a Lorentz field on an exciton moving in a magnetic field. The results obtained here are explained as follows: The excitons of a CdS crystal have a dipole moment caused by the asymmetry of the intracrystalline field. The axis of this dipole is directed along the optical axis $\vec{A}$ of the crystal. If $\vec{A} \parallel \vec{H}$, the electric Lorentz field is perpendicular to the dipole axis, and if $\vec{A} \perp \vec{H}$, it is parallel to the dipole axis. In the first case, the Stark effect obviously reaches a minimum. In the second case, a Stark effect is observed on exciton levels of greater radii. The discovered diamagnetic shift of absorption lines confirms the existence of exciton series which are related to the complex band structure in a CdS crystal. The Zeeman effect proves the complex energy structure of an exciton in a CdS crystal. The appearance of a Lorentz field in magneto-optical exciton effects indicates the existence of a movable exciton system. There are 3 figures, 2 tables, and 12 references: 8 Soviet and 4 non-Soviet. The three most recent references to English-language publications read as follows: E. F. Gross, J. Phys. Chem. Sol., 8, 172, 1959; J. J. Jopfield and J. G. Thomas, Phys.

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29693
S/181/61/003/010/019/036
B104/B108

Magneto-optical effects in the...

Rev. Sit., 1, 7, 1960; R. G. Wuler and J. O. Dimmok, Phys. Rev. Sit., 3, 372, 1959.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe, AS USSR, Leningrad)

SUBMITTED: May 17, 1961

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29699 S/181/61/003/010/028/036
B125/B102

24,3500 (1137, 1138)

AUTHORS: Gross, Ye. F., and Shekhmamet'yev, R. I.

TITLE: Complex structure of excitation spectra of luminescence of HgI_2 and PbI_2 crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3162 - 3166

TEXT: The authors determined the excitation curves for luminescence of HgI_2 crystals and of sublimed PbI_2 layers at T = 77°K. According to V. A. Arkhangel'skaya and P. P. Feofilov (DAN SSSR, 108, 803, 1956; Opt. i spektr., II, vyp. 1, 1957), the intensity of each luminescence band of an HgI_2 crystal is in different ways a function of the intensity of the light source. The first series of HgI_2 crystals has been grown in the authors' laboratory by K. F. Lider who employed slow crystallization from a solution of HgI_2 in acetone. A second series of specimens was grown from the gaseous phase. Fig. 1 shows the luminescence intensity of HgI_2 crystals as a function of the exciting wavelength at T = 77°K. No

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Complex structure of...

absorption lines correspond to the apparent peaks at 5360 and 5280 Å (± 20 - 30 Å) found on the excitation curve 2. The structure of the excitation curve for red luminescence of the same HgI_2 crystals was found to be hardly influenced by surface treatment. The various luminescence bands correspond to various crystal centers. The yellow-green and the red luminescence are closely related to the exciton absorption lines. Fig. 2 shows the excitation curves for red luminescence of an HgI_2 single crystal at T = 77°K. For excitation with E⊥C the peak at 5330 Å does not appear on the excitation curve. For E∥C the peaks at 5330 and 4932 Å will occur. The latter is due to incomplete polarization of the absorption line λ = 4932 Å. The authors also investigated the excitation spectrum of the low-temperature luminescence of various PbI_2 crystals. The specimens were sublimated at ~400°C upon a glass backing. The spectral lines found are curved, deformed, and are shifted relative to the absorption line λ = 4948 Å of PbI_2 single crystals toward the short-wave region of the spectrum. The

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Complex structure of...

results of this paper point to a close connection between broad luminescence bands of HgI_2 and PbI_2 crystals and the structure of the self-absorption edge. The maxima and minima of the luminescence excitation curves could correspond to lines with exciton structure. The authors' experiments have shown that excitons play an essential part in the luminescence excitation of crystal centers and defects. There are 3 figures and 8 references: 6 Soviet and 2 non-Soviet. The reference to the English-language publication reads as follows: S. Nikitine et G. Perny. C. R., 240, 64, 1955; S. Nikitine. Phil. Mag., 4, 1, 1959.

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova (Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: June 2, 1961

Card 3/6 3

GRIYO, E. [Grillot, E.]; GROSS, Ye.F.; BANSI-GRIYO, M. [Bancie-Grillot, M.]; NOVIKOV, B.V.

Multiformity of spectral photosensitivity curves of pure CdS crystals. Fiz.tver.tela 3 no.11:3519-3521 N '61. (MIRA 14:10)

1. Fiziko-tekhnicheskiy institut im. A.F.Ioffe AN SSSR, Leningrad.
(Photoconductivity) (Cadmium sulfide—Spectra)

S/181/61/003/011/051/056
B104/B138

24,3430 (1227,1395,1163)

AUTHORS: Gross, Ye. F., Kalyuzhnaya, G. K., and Nedzvetskiy, D. S.

TITLE: Complex structure of the absorption spectrum of monocrystalline gallium phosphide

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3543-3545

TEXT: Single crystals of GaP were investigated at nitrogen temperature. Single crystals 4 to 5 mm long, 0.3 mm to a few microns thick were obtained from the melts by crystallization (G. Wolff et al., Bull. Am. Phys. Soc., 29, 1, 1954). In transmitted light thin crystals appeared orange and thick ones yellow-green. The absorption spectra were taken with an ИСП-67 (ISP-67) spectrograph with a camera of 1800 mm focal length. In the region studied the dispersion was 10.5 Å/mm. The absorption edge of a GaP single crystal is shown in Fig. 1. This spectrum was taken for specimens that had been cooled slowly. Rapidly cooled specimens had only one broad line (5363.2 Å) which is shifted into the long wave range by a few angstroms. The lines can be grouped in pairs: an intense narrow and a weak narrow line, a weak and a strong broad line, and two broad lines. The distance

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Complex structure of the absorption ...

between the lines in each pair is 130 cm^{-1} within the limits of error. It is concluded from this structure that the valence band of the crystal consists of three bands from each of which the electrons make transitions to two discrete levels below the bottom of the conduction band, under the action of light. A possible energy level scheme is shown in Fig. 2. There are 2 figures, 1 table, and 7 references: 2 Soviet and 5 non-Soviet. The three most recent references to English-language publications read as follows: E. O. Kane. J. Phys. Chem. Solids, 1, 249, 1957; F. Stern, R. M. Talley. Phys. Rev., 108, 158, 1957; R. Braunstein. J. Phys. Chem. Solids, 8, 280, 1959.

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