ISNN:2181-1296

SHAROF RASHIDOV NOMIDAGI
SAMARQAND DAVLAT UNIVERSITETI

САМАРКАНДСКИЙ ГОСУДАРСТВЕННЫЙ
УНИВЕРСИТЕТ ИМЕНИ ШАРОФА РАШИДОВА

SAMARKAND STATE UNIVERSITY NAMED
AFTER SHAROF RASHIDOV

ILMIY AXBOROTNOMA

НАУЧНЫЙ ВЕСТНИК
SCIENTIFIC JOURNAL

ANIQ VA TABIIY FANLAR SERIYASI

Matematika, Mexanika, Informatika
Fizika, Kimyo, Biologiya, Geografiya

№ 1/2 (155)
2026

ISSN 2181-1296

ILMIY AXBOROTNOMA

НАУЧНЫЙ ВЕСТНИК SCIENTIFIC JOURNAL

2026-yil, 1-son (155/2) ANIQ VA TABIIY FANLAR SERIYASI

Matematika, Mexanika, Informatika, Fizika, Kimyo, Biologiya, Geografiya

Samarqand viloyat matbuot boshqarmasida ro‘yxatdan o‘tish tartibi 09-25.
Jurnal 1999-yildan chop qilina boshlagan va OAK ro‘yxatiga kiritilgan.

BOSH MUHARRIR **R. I. XALMURADOV, t.f.d., professor**
BOSH MUHARRIR O‘RINBOSARLARI: **H.A. XUSHVAQTOV, f-m.f.d., dotsent**

TAHRIRIYAT KENGASHI:

Sh.A.Alimov	- O‘zFA akademigi	**M.X.Ashurov**	- O‘zFA akademigi
S.N.Lakayev	- O‘zFA akademigi (SamDU)	**B.J.Axmedov**	- O‘zFA akademigi
M.M.Kamilov	- O‘zFA akademigi	**Q.G‘.G‘ulomov**	- O‘zFA akademigi
A.G.Yagola	- Moskva davlat universiteti professori (Rossiya)	**A.A.Zaxidov**	-Texas Nanotexnologiya instituti professori (AQSh)
Alberto Del Bimbo	-Florensiya universiteti professori (Italiya)	**N.B. Ferapontov**	- Moskva davlat universiteti professori (Rossiya)
Sh.Tugizov	-Kaliforniya universiteti professori (AQSh)	**V.L.Popov**	-Berlin texnika universiteti professori (Germaniya)
A.S.Soleev	- f.-m.f.d., professor (SamDU)	**N.F.Bunkin**	- Moskva davlat texnika universiteti professori (Rossiya)
I.A.Ikromov	- f.-m.f.d., professor (SamDU)	**Haji Akber Aisa**	-Xinjiang tibbiyot universiteti professori (Xitoy)
B.X.Xo‘jayarov	- f.-m.f.d., professor (SamDU)	**E. A. Abduraxmonov**	- k.f.d., professor (SamDU)
L.Sabirov	-f.-m.f.d., professor (SamDU)	**N. K. Muxamadiyev**	- k.f.d., professor (SamDU)
A.Jumaboyev	-f.-m.f.d., professor (SamDU)	**L. A. Bulavin**	- Kiev milliy universiteti
X.Bozorov	-k.f.d., professor (SamDU)	**X. Q. Xaydarov**	- b.f.d., professor (SamDU)
O.Q.Quvondiqov	-f.-m.f.d. professor (SamDU)	**Z. I. Izzatullayev**	- b.f.d., professor (SamDU)
A.Z.Xasanov	-f.-m.f.d. professor (SamDU)	**A.B.Hasanov**	-tex.f.d., professor (SamDU)
Muhammad Suzuri bin Hitam	- Terengganu universiteti professori (Malayziya)	**Sh. T. Xoliqulov**	- q.-x.f.d., professor (SamDU)
K.D.Kuliyev	- f.-m.f .n. professor (SamDU)	**S. B. Abbosov**	- g.f.d., professor (SamDU)
A.M.Xolxo‘jayev	-f.-m.f.d., professor (SamDU)	**M.E. Mo‘minov**	-f.-m.f.d., professor (SamDU)
J.Abdullayev	-f.-m.f.d., professor (SamDU)	**I.I.Jumanov**	-tex.f.d., professor (SamDU)
A.R.Axatov	-tex.f.d., professor (SamDU)	**N.S.Mamatov**	-tex.f.d., professor (TIQXMMI)
D.B.Xursanov	- g.f.f.d., dotsent (SamDU)	**A.Sh.Yarmuxamedov**	-f-m.f.n., dotsent (SamDU)
F.Nazarov	-tex.f.d., dotsent (SamDU)	**X.S.Xaydarov**	-f-m.f.n., dotsent (SamDU)

Obuna indeksi – yakka tartibdagi obunachilar uchun **- 5583,**
tashkilot, korxonalar uchun **- 5584**

M U N D A R I J A
C O N T E N T S

№	Maqola nomi	Article title	Bet/ page
1.	Yuqori chastotali II-turdagi radio portlash spektral kuzatuvlaridan foydalanib magnit maydon kuchini baholash **Pulatov D., Mirtoshev Z.**	Estimation Of The Coronal Magnetic Field Strength Using High-Frequency Type Ii Radio Burst Observations **Pulatov D., Mirtoshev Z.**	**5-11**
2.	Rayxon (OCIMUM) o‘simligi efir moyi kimyoviy tarkibiga iqlim omillarining ta’sirini GX–MS usulida tadqiq etish **Siddikova Y., Saifullaeva Sh., Mukhamadiyev A., N.Fazlieva, Nayimova B., Muhamadiyev N.**	Study of the influence of climate factors on the chemical composition of basil (ocimum) essential oil using the GH–MS method **Siddikova Y., Saifullaeva Sh., Mukhamadiev A., N.Fazlieva, Nayimova B., Muhamadiev N.**	**12-20**
3.	Bentonitni montmorillonit bilan boyitishning samarali usullari va termal ishlov berishning kation almashinuvi quvvatiga ta'siri **Mamadoliev I., Abdikamalova A., Ruzieva S.**	Effective methods for bentonite enrichment with montmorillonite and the impact of thermal treatment on cation exchange capacity **Mamadoliev I., Abdikamalova A., Ruzieva S.**	**21-28**
4.	$KPbBr_3$ asosidagi peroled tuzilmalarida zaryad tashish mexanizmlari va energetik sathlarning moslashuvi **Rahmonova M., Muxamadiyev N.**	Charge transport mechanisms and energy level alignment in $KPbBr_3$ -based peroled structures **Rahmonova M., Mukhamadiev N.**	**29-36**
5.	*N*-(4-(((7-Nitroxinazolin-4-il) amino) metil)fenil) siklogeksankarboksamid sintezi **Gaybullaev Sh., Takhirov Y., Chao Niu, Bozorov Kh.**	Synthesis of N-(4-(((7-nitroquinazolin-4-YL) amino) methyl) phenyl) cyclohexanecarboxamide **Gaybullaev Sh., Takhirov Y., Chao Niu, Bozorov Kh.**	**37-41**
6.	3-brom-pirido[2,3-*d*]pirimidinonlarning sintezi **Khushnazarov Z., Turgunov D., Bozorov Kh.**	synthesis of 3-bromo-pyrido[2,3-d]pyrimidinones **Khushnazarov Z., Turgunov D., Bozorov Kh.**	**42-46**
7.	Zarrachalar tezlatkichlarida materiallarning aktivatsiyasi va radiatsion xavflar **Temirov J., Khasanov Sh., Safarov A., Karimberganova Q.**	Material activation and radiological hazards in particle accelerators **Temirov J., Khasanov Sh., Safarov A., Karimberganova Q.**	**47-57**
8.	Geoinformatsion dasturlar yordamida demografik atlaslar yaratishning afzalliklariga nazar **Tukhtamishev Sh., Khudoyarova Sh., Shirinboyev D.**	Advantages of creating demographic atlases using geoinformation software **Tukhtamishev Sh., Khudoyarova Sh., Shirinboev D.**	**58-62**
9.	Siklopropilatsetilen asosida atsetilen spirtlari sintezi, ularning nazariy energetik xarakteristikalari va nadfoksidaza oqsili (7U8G) bilan molekulyar birikish tahlili **Ziyadullaev M.E., Nurmanov S.E., Buriev F.Kh., Abdukhalikov F.J.**	Synthesis of acetylenic alcohols based on cyclopropylacetylene, their theoretical energetic characterization, and molecular docking analysis with nadph oxidase (7U8G) protein **Ziyadullaev M.E., Nurmanov S.E., Buriev F.Kh., Abdukhalikov F.J.**	**63-71**
10.	Tetratsiklik tieno[3,2-*d*]pirimidinonlarning siklooksigenaza-2 ingibitorlari sifatida *in silico* tadqiqi **Nasrullaev A., Buronov A., Gaybullaev Sh., Bozorov Kh.**	In silico evaluation of tetracyclic thieno[3,2-d]pyrimidinones as potential cyclooxygenase-2 inhibitors **Nasrullaev A., Buronov A., Gaybullaev Sh., Bozorov Kh.**	**72-76**
11.	H3PO4, KOH va ZnCl2 yordamida olingan faollashtirilgan ko‘mirning morfologik va strukturaviy xususiyatlarining qiyosiy tahlili **Ergasheva D., Mukhamadiyev A., Mukhamadiyev N., Uzokov J.**	Comparative analysis of the morphological and structural properties of activated carbon prepared using H_3PO_4, KOH, and $ZnCl_2$ **Ergasheva D., Mukhamadiev A., Mukhamadiev N., Uzokov J.**	**77-81**
12.	CO_2 NI quyosh nuri ta’sirida samarali konversiyalashni ta’minlovchi g-C_3N_4/$CoNi_2S_4$ geterotuzilmali nanomateriallar sintezi va fizik-kimyoviy xossalari **Samiev A., Nizamov U.N., Mirzaev Sh., Ruzimuradov O., Nasimov A.**	Synthesis and physicochemical properties of γ-C3N4/CoNi2S4 heterostructured anomaterials providing efficient conversion of CO2 under the influence of sunlight **Samiev A., Nizamov U.N., Mirzaev Sh., Ruzimuradov O., Nasimov A.**	**82-87**

№	Maqola nomi	Article title	Bet/ page
13.	Atrof muhitdagi ammiak mikrokensentratsiyasini monigitori uchun gibrid perovskit $MA_xFA_{1-x}PbI_3$ fluoressent sensori tayyorlash **Eshmuradova G.B., Tashpulatov Kh.Sh., Khursandov J.M., Normuradov O.U., Norboyev Q.M., Toshpulatov D.T.**	Preparation of hybride perovskite $MA_xFA_{1-x}PbI_3$-fluorescent sensor for the monitoring of ammonia microconcentration in environment **Eshmuradova G.B., Tashpulatov Kh.Sh., Khursandov J.M., Normuradov O.U., Norboev Q.M., Toshpulatov D.T.**	**88-92**
14.	Al^{3+} bilan modifikatsiyalangan shpinel tuzilishga ega $Li_{1.33}Al_XMn_{1.67-X}O_4$ ($0 \leq x < 0.7$) tarkibli adsorbentlarning zol-gel sintezi va fizik-kimyoviy xossalari **Begimkulova Sh.A., Nematova Sh.Sh., Baxriev I.S., Mirzaev Sh.E., Ruzimuradov O.N., Nasimov A.M.**	Sol-gel synthesis and physicochemical properties of adsorbents consisting of Al^{3+} modified spinel structure $LI_{1.33}Al_XMn_{1.67-X}O_4$ ($0 \leq X < 0.7$) **Begimkulova Sh.A., Nematova Sh.Sh., Baxriev I.S., Mirzaev Sh.E., Ruzimuradov O.N., Nasimov A.M.**	**93-99**
15.	CdCr2Se4 va CuCr4Se4 magnitli yarimo‘tkazgichda magnit-optik effektlar **Dosmurodov G.**, **Kurbaniyazov A.**, **Boboqambarova G.**	Magneto-optical effects in the magnetic semiconductor CdCr2Se4 AND CuCr4Se4 **Dosmurodov G.**, **Kurbaniyazov A.**, **Bobokambarova G.**	**100-104**
16.	Sophora lehmanni va Cicer mogoltavikum o‘simliklari yer ustki qismilarining flavonoidlari **Gafurov A.Zh, Botirov E. Kh.**	Flavonoids of aerial parts of sophora lehmannii and cicer mogoltavicum **Gafurov A.Zh, Botirov E. Kh.**	**105-109**
17.	Buxoro viloyatining balneologik resurslari va ularning aholi salomatligini yaxshilashdagi ahamiyati **Zaynutdinova D.K., Nematova Kh. Kh.**	Balneological resources of the bukhara region and their significance in improving public health **Zaynutdinova D.K., Nematova Kh. Kh.**	**110-116**
18.	Tabiiy cho‘kuvchan gruntlarni polimer-kompozitsion eritmalar bilan inyeksion mustahkamlash texnologiyasini matematik rejalashtirish **Bakhriyev N.F., Kholiqulov O.O., Nurmatova R.K.**	Mathematical planning of injection strengthening technology of natural collapsible soils using polymer-composite solutions **Bakhriyev N.F., Kholikulov O.O., Nurmatova R.K.**	**117-125**
19.	Adgezion kontaktlarda ishqalanish koeffitsiyentiga geometrik parametrlar hamda tashqi yuk ta’sirining tahlili **Bekmamatova G., Xoliqulov O., Tojinorov M.**	Analysis of geometric parameters and external load on the friction coefficient in adhesive contacts **Bekmamatova G., Xolikulov O., Tojinorov M.**	**126-131**
20.	Markaziy Osiyo iqlim sharoitida sorbsion sovutgichlardan biogaz komplekslari bilan simbiozda foydalanish istiqbollari **Abdusamiyev F., Bahriev S., Sattarov S.**	Prospects for using sorption refrigerators in symbiosis with biogas complexes in the climatic conditions of Central Asia **Abdusamiev F., Bahriev S., Sattarov S.**	**132-136**
21.	Maple tizimida algebraik ko’pxilliklarni ratsional parametrlashining nazariy asoslari va kompyuterda amalga oshirilishi **Usmonova N.**	Theoretical foundations and computer implementation of rational parameterization of algebraic manifolds in the maple system **Usmonova N.**	**137-142**
22.	$Fe_5Ga_6Gd_2YZr$ ko‘p komponentli kristallining element tarkibi va tebranish xossalarini rentgen-fluoresans (XRF) va raman spektroskopiyasi yordamida tadqiq etish **Nasirova N., Fayziyev Sh., Saidov Q., Qaxorova Sh., Sharipov M., Djuraev D.**	Investigation of the elemental composition and vibrational properties of the multicomponent crystal Fe5Ga6Gd2YZr using X-RAY fluorescence (XRF) and raman spectroscopy **Nasirova N., Fayziyev Sh., Saidov Q., Qaxorova Sh., Sharipov M., Djuraev D.**	**143-152**
23.	Xofp tipidagi tenglamalar sistemasi uchun Koshi masalasi **Erkinova D. A.**, **Imomnazarov Kh. Kh.**	Cauchy problem for a Hopf-type system **Erkinova D. A.**, **Imomnazarov Kh. Kh.**	**153-157**
24.	Ar va HCl izotopologlari o‘rtasida hosil bo‘lgan komplekslarning kvant-kimyoviy tahlili: AIM, RDG va NCI usullari yordamida solvatatsiya effektlarini o‘rganish **Khujamov U.**	Quantum-chemical analysis of complexes formed between Ar and HCL isotopologues: studying solvation effects using AIM, RDG, and NCI methods **Khujamov U.**	**158-167**

UDC: 535.361 https://doi.org/10.59251/2181-3973.2025.v1.138.1.3828

MAGNETO-OPTICAL EFFECTS IN THE MAGNETIC SEMICONDUCTOR CdCr2Se4 AND CuCr4Se4

G. Dosmurodov, **A. Kurbaniyazov**, **G. Bobokambarova**
Samarkand Branch of Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Samarkand, Uzbekistan.

G. Dosmurodov Samarkand Branch of Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Samarkand, Uzbekistan.

Received: 19.01.2026
Revised: 29.01.2026
Accepted: 17.02.2026
Published: 30.03.2026

Publisher: Samarkand State University named after Sharof Rashidov.

Abstract. A study and comparative analysis of magneto-optical (MO) effects, in particular the Faraday and Kerr effects, in compounds with a chalcogenide spinel structure: and . These materials are of significant interest as promising magnetic semiconductors, exhibiting strong spin-orbit coupling and potentially high magneto-optical transmission. Measurements were carried out of the spectral dependence of the polarization plane rotation of linearly polarized light (Faraday effect) and changes in reflected light (Kerr effect) depending on the temperature and the intensity of an external magnetic field. The study covered the visible and near-infrared ranges.

Keywords: Magnetic semiconductors, chalcogenides, $CdCr_2Se_4$, $CuCr_4Se_4$, Faraday effect, Kerr effect, spin-orbit interaction.

CdCr2Se4 va CuCr4Se4 magnitli yarimo‘tkazgichda magnit-optik effektlar

Annotatsiya. Magnitooptik (MO) effektlarni, xususan Faradey va Kerr effektlarini, xalkogenid shpinel strukturasiga ega birikmalarda o‘rganish va taqqosiy tahlil qilish: va. Ushbu materiallar kuchli spin-orbital bog‘lanishni namoyish etuvchi va potensial yuqori magnitooptik o‘tkazuvchanlikka ega istiqbolli magnit yarimo‘tkazgich sifatida katta qiziqish uyg‘otadi. Polyarizatsiya tekisligini burilish burchagi (Faradey effekti) va aks ettirilgan yorug‘likning o‘zgarishini (Kerr effekti) tashqi magnit maydon kuchi va haroratga bog‘liqligini o‘lchash ishlari olib borildi. Tadqiqotlar ko‘rinadigan va yaqin infraqizil diapazonlarni qamrab oldi.

Kalit so‘zlar: Magnit yarimo‘tkazgichlar, xalogenidlar, $CdCr_2Se_4$, $CuCr_4Se_4$,, Faradey effekti, Kerr effekti, spin-orbita o‘zaro ta’siri.

Магнитно-оптические эффекты в магнитном полупроводнике CdCr2Se4 И CuCr4Se4

Аннотация. Исследование и сравнительный анализ магнитооптических (МО) эффектов, в частности эффектов Фарадея и Керра, в соединениях со структурой халькогенидных шпинелей. Эти материалы представляют значительный интерес как перспективные магнитные полупроводники, демонстрирующие сильную спин-орбитальную связь и потенциально высокое магнитооптическое пропускание. Проводились измерения спектральной зависимости угла поворота плоскости поляризации плоскополяризованного света (эффект Фарадея) и изменения отраженного света (эффект Керра) от температуры и напряженности внешнего магнитного поля.

Исследования охватывали видимый и ближний инфракрасный диапазоны.

Ключевые слова: магнитные полупроводники, халькогениды, $CdCr_2Se_4$, $CuCr_4Se_4$, эффект Фарадея, эффект Керра, спин-орбитальное взаимодействие.

Interest in the study of the optical properties of semiconductor chalcogenide chromium spinels is associated mainly with the unusual behavior of the edge of the intrinsic absorption band upon magnetic ordering. In particular, in $CdCr_2Se_4$, as the temperature decreases below T_c, a strong shift of the low-energy part of the absorption edge toward lower energies is observed. A number of works [1-3] are devoted to a detailed experimental study of this phenomenon. In [4-5], in this energy region (10,000 cm^{-1}) in $CdCr_2Se_4$, significant magnetic linear and circular dichroism was discovered and the Faraday effect [5] was measured, reaching a value of $10^4 deg*cm^{-1}$. The Faraday effect in the region of 8000-15,000 cm^{-1} was also observed in thick films *of* $CdCr_2SE_4$ [6]. We have previously conducted studies of magneto-optical effects: the Faraday effect α_{ph}, magnetic linear and circular dichroism (MLD and MCD) in the region of 8000-24000 cm^{-1} [7,8] in thin films *of* $CdCr_2Se_4$ obtained by sputtering components from individual sources [9]. In the studied region, a large number of features of a resonant nature were observed in the spectra of magneto-optical effects; the temperature behavior of the features is different for different regions of the spectrum.

This article presents the results of a study of α_f, MLD and MCD in $CdCr_2Se_4$ films , and also investigates the magneto-optical properties of thin $CuCr_2Se_{4\ films}$. $CdCr_2Se_4$ is a ferromagnetic conductor with a high Curie temperature $T_c = 430\ K$; when *Cu is replaced* by *Cd* , a transition from a conductor to a magnetic semiconductor is observed. Optical properties *of* $CuCr_2Se_4$ have not been studied previously. Measurements were carried out on polycrystalline films with a thickness of 1000 A. The chemical composition and thickness of the films were controlled using X-ray fluorescence analysis [10]. The accuracy of the analysis is no worse than 5 rel.%. The single-phase nature of the composition was controlled by X-ray structural and electron diffraction analysis [11].

When measuring αf and MCD, the films were magnetized to saturation in the direction perpendicular to the plane, and linear propagation was carried out in the same direction. - polarized light. To measure the MLD, a phase plate was placed between the sample and the analyzer. The MLD measurement was carried out according to the technique [12]. In this case, the films were magnetized to saturation in their plane in two mutually perpendicular directions, the light propagated in the direction normal to the film surface, the plane of oscillations of the electric vector of the light wave made an angle of 45^0 with the directions of the magnetizing fields. In all cases, the observed effect manifested itself in the rotation of the plane of polarization of the light wave arriving at the analyzer. The rotation angle was measured with an accuracy of 0.2. In the first case, an electromagnet with drilled poles was used to magnetize the films, in the second - two mutually perpendicular pairs of Helmholtz rings. To conduct temperature studies, the films were placed in a flow-through nitrogen

cryostat, the temperature was maintained with an accuracy of no worse than 1 ^{0} .

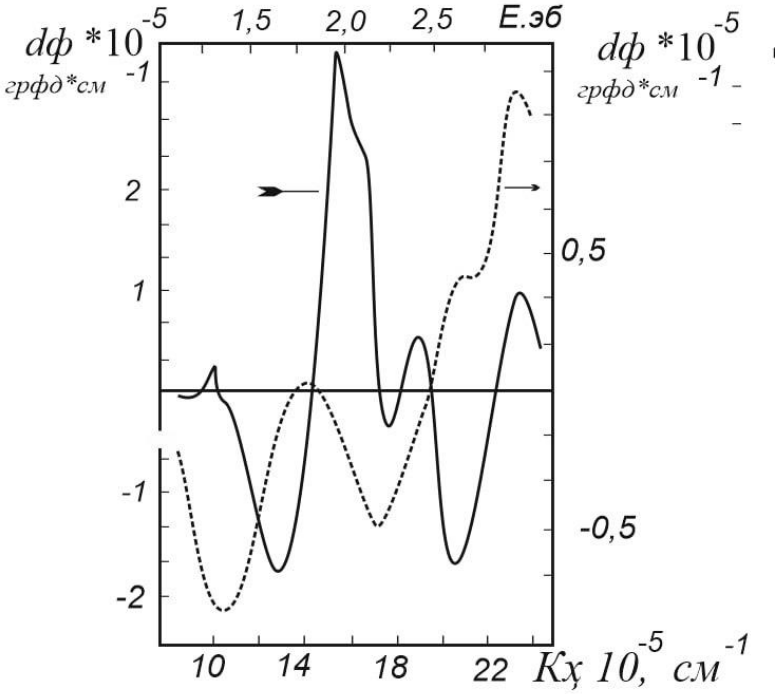


Fig. 1. Faraday effect in films: $CdCr_2Se_4$ (solid curve) and $CuCr_2Se_4$ (dashed line) of stoichiometric composition at T=100 K and 300 K , respectively.

In the region of 9000-14000 cm $^{-1}$. The magnitude and spectral dependence *of α f* in $CdCr_2Se_4$ corresponds to previously published data [5,6]. Throughout the region under consideration, the Faraday effect in both materials has a complex spectral dependence, the general form of which differs greatly from the spectral dependence of α_φ in most magnetically ordered compounds. For example, in yttrium iron garnet, lithium ferrite, iron borate, and chromium halides, the Faraday effect has a relatively smooth dispersion dependence, with the greatest increase *in α φ* observed near the intrinsic absorption edge, and intra-configurational transitions appearing in the *α φ spectra* as weak anomalies [13,14]. The form of the *α φ spectrum* in $CdCr_2Se_4$ and $CuCr_4Se_4$ indicates a predominant contribution to the Faraday effect in these materials from transitions between local levels or narrow bands. The large value *of α ph in some maxima* is also noteworthy , in particular for $CdCr_2Se_4$ at 15800 cm^{-1} , which corresponds to the radiation energy of a helium-neon laser (6328 *Å*), *α ph* reaches $5*10^5$ $deg*cm^{-1}$, in $CuCr_4Se_4$ a wide maximum with an amplitude of 6*10 4 is observed $deg*cm^{-1}$ and centered near 10,000 cm^{-1} , which also corresponds to a well-established laser range. It was noted that in this region of the spectrum, as a rule, the Faraday effect is significantly weaker, for example, in $Y_3FE_5O_{12}$ α_φ ~200 deg/cm.

In $CdCr_2Se_4$ MLD, no spectra were detected. In the range of 9000-11000, $см^{-1}$the MLD spectrum correlates with the data from [4], where $CdCr_2Se_4$ absorption in polarized light was measured on a single crystal. Thus, a comparison of the properties of the films studied here with all the data obtained so far on single crystals $CdCr_2Se_4$ indicates that the films and crystals are identical. Let us now turn directly to the MLD spectrum. This spectrum is rich in features of a resonance nature. Although, at first glance, the MCD and MLD spectra differ from each other, their main features are identical. Thus, due to different selection rules for circular and linear polarization, in the range of 13000-17000, $см^{-1}$two positive and one negative maximum are observed in the MLD spectrum, while in the MCD spectrum these maxima are of the same sign and produce a powerful broad peak. When the composition of the samples deviates from stoichiometry, as well as during annealing, the general appearance of the MLD spectrum does not change. Only the amplitudes of the maxima change, and in the low-frequency region of 9000-12000 $см^{-1}$, their positions also change. Moreover, the greatest magnitude of the MLD at the maxima and the highest peak frequency in the region of 10000-11000 $см^{-1}$are observed in the case of a stoichiometric sample. From a comparison with the data of [4], it

follows that the positive and negative maxima in the region of 10000-11000 $см^{-1}$, as in the case of MCD, are associated with transitions to sublevels of one state.

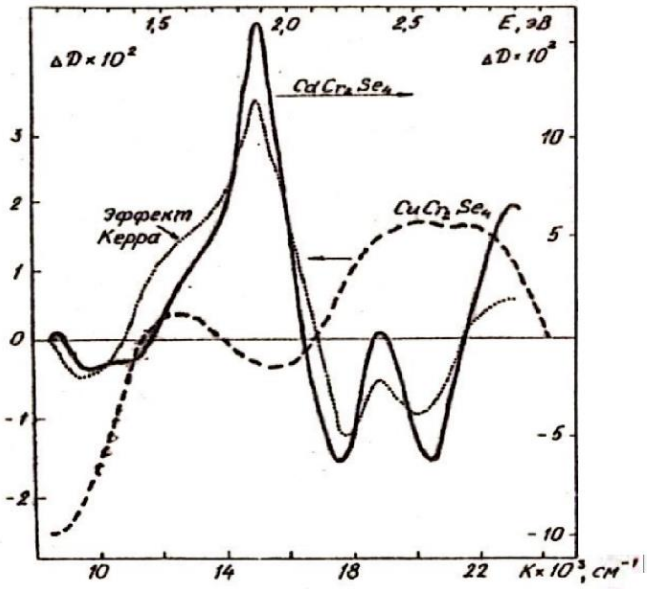


Fig. 2. MKD for films $CdCr_2Se_4$ and $CuCr_2Se_4$thickness of 1000 A for T = 100 K and T = 300 K, respectively, and the polar Kerr effect measured in [15] on a single crystal $CdCr_2Se_4$ $\Delta D = D_- + D_+ = lg\,(I_0/I_\mp)$, I_0, $I_\mp$are the intensities of light incident on and transmitted through the sample for left (-) and right (+) circular polarization. The Kerr effect is plotted in arbitrary units.

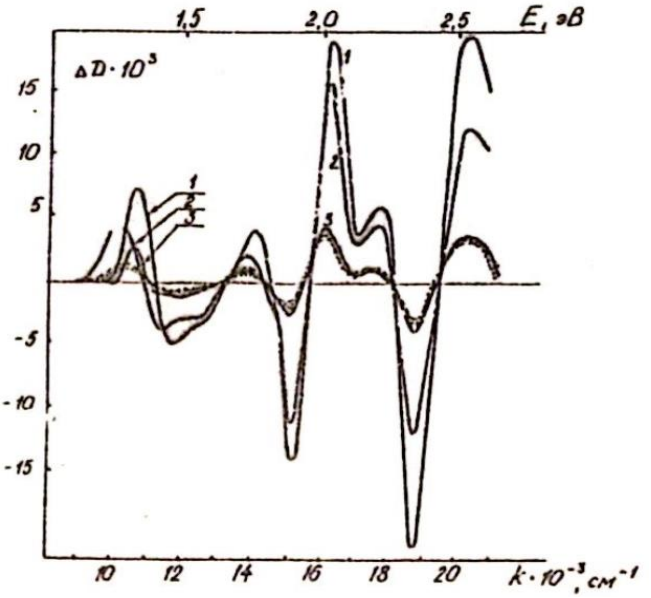


Fig. 3. MLD for films $CdCr_2Se_4$of compositions: 1. $Cd_{0.9}Cr_2Se_{4.1}$, 2. $Cd_{0.65}Cr_{2.2}Se_{4.15}$, 3. $Cd_{1.3}Cr_{1.6}Se_{4.1}$The dotted line and points show the MLD spectra for parts of film No. 3, annealed in vacuum and selenium atmosphere.

Measurement temperature 100 K,$\Delta D = D_{\parallel} - D_{\perp}$,$D_{\parallel,\perp} = \lg\,(I_0/I_{\parallel,\perp})$ - the intensity of light polarized parallel and perpendicular to the magnetization. Confirmation of strong magneto-optical activity: Both compounds exhibit a significant magneto-optical response (e.g., the Kerr or Faraday effect) in the region of their optical absorption, which is caused by the strong spin-orbit interaction and hybridization of the electron states involved in the magnetic structure (in particular, 3d electrons).

Relationship of the MOE to magnetic ordering: Measurement of the magneto-optical properties as a function of temperature demonstrated a clear correlation between the MOE magnitude and the degree of magnetic ordering (ferromagnetic at and at low temperatures). The Curie point can be accurately determined using magneto-optical measurements, which are often more sensitive to phase transitions than measurements of electrical conductivity or magnetic susceptibility.

Spectral dependence and nature of excitations: Analysis of the spectral dependence of the MOE (e.g., the dispersion of the Kerr effect) made it possible to identify the main electronic transitions responsible for the magneto-optical activity. In [the original text], transitions associated with dd excitations and/or transitions between band levels, heavily mixed with chromium levels, are dominant. In copper electrons exert an additional influence, which can alter the nature of the spectral features. A comparison of the magneto-optical responses and (assuming both materials were studied within the framework of the present study) showed that substituting copper for cadmium significantly alters the electronic structure and, consequently, the magnitude and spectral characteristics of the magneto-optical effect. This underscores the high sensitivity of the magneto-optical properties to changes in the cation sublattice.

Conclusion. Study of magneto-optical effects in and confirms them potential as promising materials for optoelectronics and spintronics, which requires efficient control of light using a magnetic field. The obtained data provide an important basis for further theoretical modeling of the electronic and magnetic properties of these chalcogenide semiconductors, as well as for the development of devices using magneto-optical information conversion.

References

1. Harbeke G., Pinch H. Magnetoabsorption in Single-Crystal Semiconducting Ferromagnetic Spinels. Phys. Rev. Lett. 17, 1090 – Published November 21, 1966 .
2. Harbeke G., Lehmann HW Optical transision and band structure model for cadmium chromium chalcogenides // Sol. st. commun. -1970. -Y.8. -N.16. -P.1281-1285.
3. M. Taniguchi, Y. Kato, S. Narita Thermoreflectance spectra of CdCr2Se4 in the vicinity of the Curie temperatureVolume 16, Issue 2, 15 January 1975, Pages 261-264.
4. Hlídek P., Barvík I., V. Prosser, M. Vaněček, M. Zvára. Polarization Dependence of Transmission and Photoconductivity in $CdCr_2Se_4$. P. K45-K49.
5. Golik L.L., Z.I. Kunkova, T.G. Aminov, V.T. Kalinniko . Magneto-optical properties of CdCr2Se4 single crystals in the absorption edge region . FTT - 1980. - V. 22, No. 3 - P. 877-880.
6. Golik L.L., Grigorovich S.M., Elinson M.I., Kunkova Z.E., Ukrainsky Yu.M. Absorption and Faraday effect in CdCr2Se4 films // FTT. 1977. - V. 19, No. 2. - P629-631.
7. Edel'men I.S. , Kononov V.P. , Vasil'ev G.G. , Dusmurodov G., Suvorov V.M. Magnetic dichroism in thin films of $CdCr_2Se_4$. FTT - 19 78 . - T. 19 , - P. 629 .
8. Ovchinnikov S.G., Edelman I.O., Dustmuradov G. Energy structure and magneto-optical effects in CdCr2Se4 // FTT. 1977. -V.21, No. 10.-C2927-2934.
9. Berzhanovsky V.N., Gavrichkov S.A., Drokin N.A., Kononov V.P., Chernov V.K., Chistyakov N.S., Edelman I.S., Synthesis and physical properties of magnetic films of chromium chalcogenide spinels. – In: Properties of film single crystals of magnetically ordered substances. Krasnoyarsk, 1978, - pp. 19-28.
10. Berzhinsky V.N., Bondarenko G.V., Kononov V.P., Misyul S.V. Structural studies of chromium chalcogenide spinel films. – In: Properties of film single crystals of magnetically ordered substances. Krasnoyarsk, 1978, - pp. 75-83.
11. Shigeki Sakai, Takuo Sugano and Yoichi Okabe. Optical Properties of Vacuum-Deposited CdCr2Se4 Thin Film. 1976 Jpn. J. Appl. Phys . P. 2023.
12. Edelmen I.S., Malakhovsky A.V. Magnetic birefringence in $FeBO_3$. FTT, 1978, v . 15, pp . 3084-3086.
13. Dillon JF, Kamimura HJ Appl. Phys. Chem. Soc., 1966, v.27, p. 1531.
14. G. B. Scott , DE Lacklison , H. I. Ralph , and J. L. Page . Magnetic circular dichroism and Faraday rotation spectrum of $Y_3Fe_5O_{12}$. Phys. Rev. B 12, 2562. 1978.

SAMARQAND DAVLAT UNIVERSITETI ILMIY AXBOROTNOMASI

НАУЧНЫЙ ВЕСТНИК SCIENTIFIC REPORTS

Texnik muharrir **Sh.Xoliqulov**

Muharrirlar:

I.Sulaymonov - fil.f.d., dotsent
E.Arziqulov - f.-m.f.d., dotsent
O.Yusupova - fil.f.n., dotsent

Mas'ul muharrir:

A. Sh. Yarmuxamedov - f.-m.f.n.

Muassis: Samarqand davlat universiteti Manzil: 140104,
Samarqand shahri, Universitet xiyoboni, 15.
Telefon: (0 366) 240-38-47, Faks: (0 366) 239-13-87 e-mail:
axborotnoma.uz
SamDU «Ilmiy axborotnoma» jurnali tahririyati kompyuterida terildi. Bosishga 30.03.2026-yilda ruxsat etildi. Qog'oz o'lchami A-4. Nashriyot hisob tabog'i 10,00
Buyurtma raqami 833. Adadi 30 nusxa.

ISSN 2181-1296