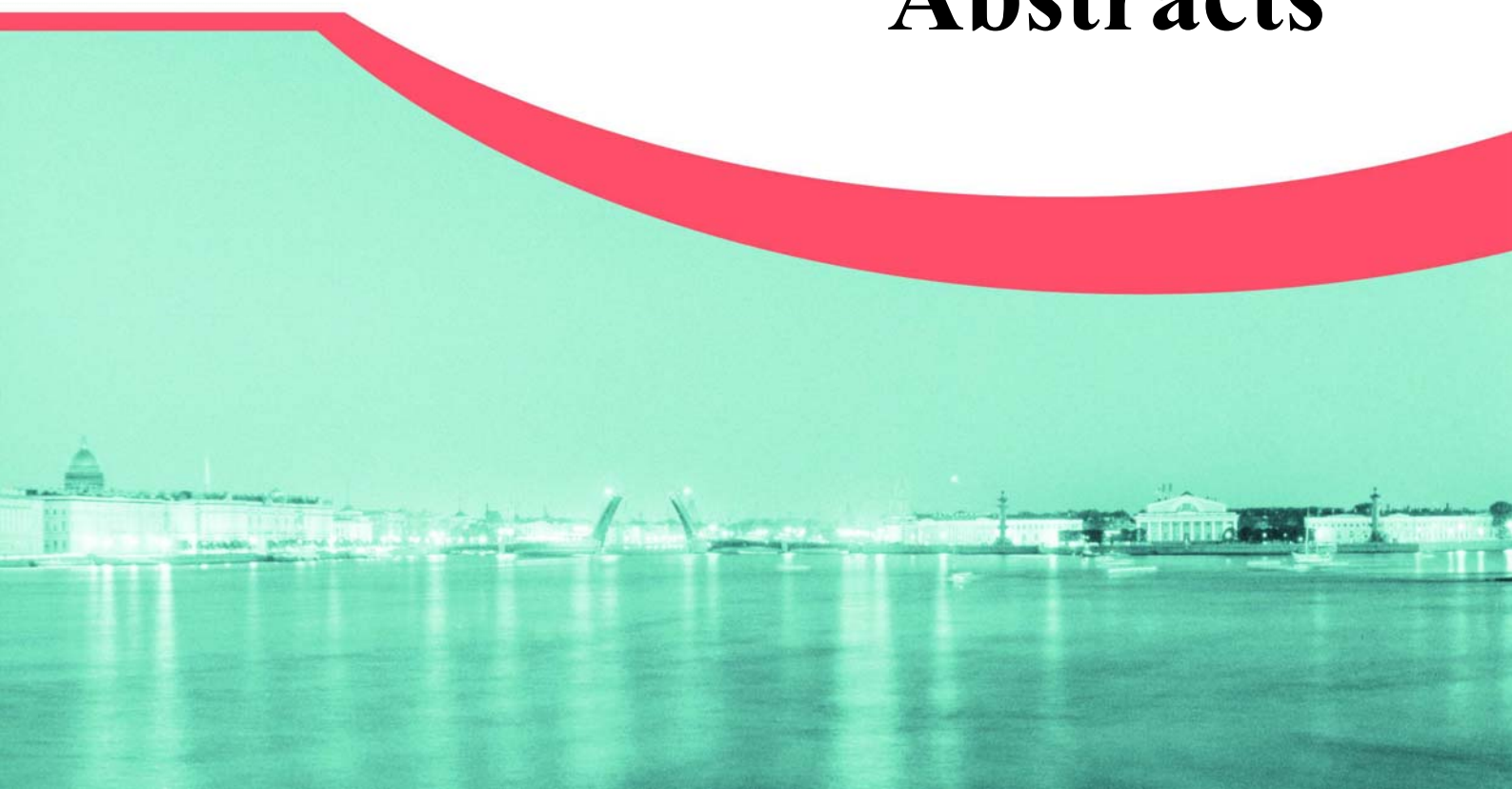




**III International Conference  
«Basic Problems  
of Optics'2004»  
18-21 October 2004  
Saint-Petersburg**

**Abstracts**



“BASIC PROBLEMS OF  
OPTICS’2004”

ABSTRACTS OF THE THIRD INTERNATIONAL  
CONFERENCE  
SAINT-PETERSBURG  
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## **Session 1. Basic spectroscopy and quantum optics**

### **HIGH PRECISION LASER SPECTROSCOPY AND HYPERFINE STRUCTURE OF HYDROGEN ATOM**

Andreev A.V.

Physics Department, M.V.Lomonosov Moscow State University, Moscow,  
Russia

The theory of hyperfine atomic structure formation is proposed. The calculated spectra are compared with the results of high-precision measurements of  $8D_{3/2} - 8D_{5/2}$  and  $12D_{3/2} - 12D_{5/2}$  transitions in hydrogen and deuterium. The good agreement between the theoretical and experimental spectra is demonstrated.

### **STRONG RESONANCE LIGHT REFLECTION ON CONDITION OF APPRECIABLE OPTICAL SATURATION**

Kazakov A.Ya., Fofanov Ja.A.\*

Saint-Petersburg State University of Aerospace Instrumentation, Saint-Petersburg, Russia

\*Institute for Analytical Instrumentation RAS, Saint-Petersburg, Russia

Reflection of resonant radiation from dielectric border to which gas of active atoms adjoins is discussed. Induced at interaction of atoms with a field polarization deforms the reflection coefficient. Dependence of this coefficient on frequency of falling radiation and an angle of falling which can accept any values including relatives to an angle of total internal reflection is investigated. Thus the density of gas and amplitude of radiation falling on border are not assumed small.

### **THE ULTRAHIGH RESOLUTION SPECTROSCOPY ON THE CONTRADIRECTIONAL MODES OF THE RING LASER**

Grishachev V.V., Denisov V.I., Zhotikov V.G.\*, Kuryatov V.N.\*\*,  
Nasedkin E.F.\*\*

Lomonosov Moscow State Univ., Physics Dept., Moscow, Russia

\*The Ministry of Education and Science of RF, Moscow, Russia

\*\*POLYUS RDI, Moscow, Russia

Use of technique laser gyroscope on the basis of the gas ring laser for the spectral dispersion and absorption analysis of matter allows carrying out researches with the ultrahigh resolution with respect to frequency less than  $10^{-16}$ . Instrument sensitivity is limited to technical methods of laser stability and exceeds all known methods.

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**SPATIAL STRUCTURES OF ATOMIC BOSE-EINSTEIN  
CONDENSATES AT WEAKLY NONLOCAL INTERATOMIC  
INTERACTIONS**

Krepostnov P.I., Popov V.O., Rosanov N.N., Smirnov V.A.  
Research Institute for Laser Physics, Saint-Petersburg, Russia

We present the results of the theoretical analysis of the effect of inter-atomic interaction non-locality on the features of localized (soliton-like) and periodic spatial structures of atomic Bose-Einstein condensates. For one- and two-dimensional solitons we show the main characteristics of soliton's internal modes. We have found exact periodic solutions of the generalized Gross-Pitaevskii equation in the form of two and three plane waves. The formation of vortex arrays in result of interference of three condensate waves is described.

**RESONANCE DIPOLE-DIPOLE INTERACTIONS BETWEEN  
ATOMS IN AN OPTICAL DIPOLE TRAP**

Yanyshchev D.N., Grishanin B.A., Zadkov V.N.  
Physics Faculty and International Laser Center, M.V.Lomonosov Moscow  
State University, Moscow, Russia

Theoretical study of computer simulation results for stochastic dynamics of two atoms trapped in an optical dipole trap under the action of a probe resonant radiation is presented. Consider the atom's losses under action of the collision and diffusive processes.

**DISSIPATIVE LIGHT MASKS IN ATOM LITHOGRAPHY**

Bezverbnny A.V., Prudnikov O.N.\*, Taichenachev A.V.\*, Tumaikin A.M.\*\*,  
Yudin V.I.\*\*

Tomsk State University, Tomsk, Russia  
\*Novosibirsk State University, Novosibirsk, Russia  
\*\*Institute of Laser Physics of SB RAS, Novosibirsk, Russia

Atom lithography in dissipative light mask with direct deposition of atoms on substrate is considered. The influence of the spontaneous emission and optical pumping on the spatial structure of the average light-induced force on atom is investigated.

**THE ROLE OF SPECTROSCOPY OF SINGLE SPECTRAL LINES OF  
OPTICAL VIBRONIC TRANSITIONS IN OBTAINING OF  
FUNDAMENTAL KNOWLEDGE ABOUT PHYSICAL PROCESSES  
IN COMPLEX ORGANIC MOLECULES**

Vandyukov E.A., Ivanov V.P., Mirumyantz S.O.  
FGUP NPO GIPO, Kazan, Russia

The analysis of behavior of the single spectral lines of vibronic transitions of complex molecules in different conditions of demonstration was conducted. As a result the common approach for interpretation of reasons of their frequency dependence was developed and the appearance of characteristics of the very free complex molecule in every case of observation was substantiated.

## **MICROWAVE SPECTROSCOPY OF MAGNETO-OPTICAL TRAP FOR $^{85}\text{Rb}$ ATOMS**

Entin V.M., Ryabtsev I.I.

Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia

A microwave induced resonances were observed in fluorescence of laser cooled rubidium atoms prepared in a magneto-optic trap. This resonances were studied in various experimental conditions and discussed.

## **PARAMETRIC CONVERSIONS AT CONSECUTIVE NONLINEAR OPTICAL INTERACTIONS WITH NONMULTIPLE FREQUENCIES**

Rodionov A.V., Chirkin A.S.

M.V. Lomonosov Moscow State University, Russian Federation

We develop the quantum theory of a parametric amplification in the field of the low-frequency pump. Such amplification occurs at interactions of the light waves with nonmultiple frequencies. The analysis is based on the reordered form of the momentum operator which has been obtained by the differentiation method. Statistical properties of photons of interacting frequencies and their mutual correlations have been studied.

## **THE DYNAMICS OF ATOMIC SYSTEMS IN A FINITE-Q CAVITY**

Rusakova M.S.

Samara Municipal Nayanova University, Samara, Russia

According to modern trends in optics development and on the basis of exactly solvable Jaynes-Cummings model (JCM) quantum theory of the atom-field interaction is described in the paper. Taking into account real experimental conditions, the generalized JCM dynamics is investigated, including the cavity quality finiteness, multilevel model analogous with different kind of transitions, multiphoton transitions and cavity detuning.

## **RADIATION RELAXATION OF ATOMIC MULTIPOLES IN WEAK LIGHT FIELDS**

Bezverbny A.V.

Tomsk State University, Tomsk, Russia

Dynamics of radiation relaxation of atomic multipoles for ground state of atom at rest is considered in the case of weak saturation of dipole transition. New features of maximal characteristic times of relaxation are found in dependence of the times on type of transition  $J_g \rightarrow J_e$ , ellipticity and detuning of field frequency from resonance.

## **OPTICAL TRANSMISSION OF QUARTZ FIBER IRRADIATED BY FAST AND THERMAL NEUTRONS**

Afanasiev A.N., Myalitsin L.A., Sadykov N.R.

Russian Federal Nuclear Center, All-Russia Research Institute of Technical Physics, Snezhinsk, Russia

The results of study of the dynamics of an optical transmission of quartz fibers exposed to gamma radiation and neutron of nuclear reactor are presented. The flux of fast neutrons and flux of thermal neutrons were  $10^{14}$  n/cm<sup>2</sup>  $10^{15}$  n/cm<sup>2</sup> respectively. The doses of gamma-radiation were 1 Mrad at dose rates of  $10^8$  R/s and  $10^6$  R/s respectively. Optical transmission of irradiated fibers was measured on the wavelength 850 nm. Recovery process was registered after irradiation.

## **AMOUNT TO QUANTUM INFORMATION WHEN WRITING THE SCENE IN OPTICAL ECHO-HOLOGRAM**

Nefediev L.A., Rusanova I.A.

Kazan State Pedagogical University, Kazan, Russia

The explored process of the transformation to classical information mortgaged in scene, in potential (structured) quantum information resonance ambience when writing optical echo-holograms. The explored conditions to efficiency of such transformation from geometry of the experiment and parameter agitating pulse.

## **INFLUENCE OF THE POLARIZATION OF SPIN PARTICLES WITH HALF-INTEGER SPIN ON THE CURVATURE AND THE TWISTING OF THEIR TRAJECTORIES**

Sadykov N.R.

Russian Federal Nuclear Center - All-Russia Research Institute of Technical Physics Snezhinsk (Chelyabinsk region), Russia

Using the geometrical optics approximation, we establish the existing of the additional curvature effect for trajectory of spin particles with half-integer spin and nonzero mass. The effect is determined by the polarization (chirality) and the twisting of the particle trajectory. The effect is the reverse to earlier predicted (analogue of the Magnus optical effect for spin particles) – the additional twisting of the spin particle trajectory when moving along the curved trajectory. Also the additional twisting effect for trajectory of spin particle in absorbent environment is considered.

## **RESEARCH OF A SPECTRUM OF RADIATION He-Ne OF THE LASER**

Osipova N.G.

Far-Eastern State Transport University, Khabarovsk, Russia

In work the experimental way of research of character of radiation He-Ne of the laser working in a continuous mode is submitted.



## **LASER FORMING OF MICROOPTICAL ELEMENTS BY THE METHOD LOCAL AMORPHIZATION OF GLASS-CERAMICS**

Veiko V.P., Kieu Q.K., Tkachov A.S., Novikov B.

Saint-Petersburg State University of Information Technologies, Mechanics and Optics, Saint-Petersburg, Russia

In the given work the possibility of forming of microoptical elements by the method local amorphization of glass-ceramics under action of radiation Nd-YAG-laser is considered. Dependence of geometrical parameters modified zones from duration of laser influence is investigated. Optical parameters are measured depending on modes of laser processing.

## **MODELLING OF TRANSMITTING PROPERTIES OF OPTICAL BUNDLES**

Afanasiev A.N., Sadykova M.O., Sadykov N.R., Parshukov I.E.

Russian Federal Nuclear Center - All-Russia Research Institute of Technical Physics Snezhinsk (Chelyabinsk region), Russia

The parameters of transmitting function in optical bundles are calculated on the basis of the analysis of cross noise. For field amplitudes in imaging fiber bundles subject to relations factors the system of the evolutionary differential equations is received for modelling of processes taking place.

## **REFLECTION AND REFRACTION OF A LIGHT BEAM CARRYING THE ANGULAR ORBITAL MOMENTUM**

Fedoseyev V.G.

Institute of Physics, University of Tartu, Riia 142, 51014 Tartu, Estonia

The peculiarities of reflection and refraction of a light beam carrying the orbital angular momentum at a plane interface of isotropic media are discussed. It is shown that this process should be accompanied by the transverse shifts of the centres of gravity of the reflected and transmitted beams in the opposite directions as well as by the appearance of the transverse Abraham linear momentum.

## **AGGREGATION OF INDOCYANINE GREEN IN WATER SOLUTIONS**

Kulyabina T.V.

Saratov State University, Saratov, Russia

We have examined indocyanine green molecules aggregation in water and salt-water solutions. It has been discovered that the solution absorption spectra changes and a new absorption band emerges in the long-wave part of the spectra. The character of the changes depends on storage time, solution composition and dye concentration.

## **Session 2. Bistability, self-organizing and chaos in optics**

### **STOCHASTIC DYNAMICS AND BAYESIAN PARAMETER ESTIMATION OF VERTICAL CAVITY SURFACE EMITTING LASERS**

Beri S., Luchinsky D.G., McClintock P.V.E., Mannella R.\*,  
Iwanishewski I.\*\*, Grigorieva E.V.\*\*\*

Department of Physics, Lancaster University, Lancaster UK

\*Dipartimento di Fisica, Università di Pisa, Pisa Italy

\*\*Institute of Physics, Nicholas Copernicus University, Torun Poland

\*\*\*Department of Physics, Belarus State University, Minsk Belarus

The polarization switches of a VCSEL are investigated aiming to reveal the mechanism that produces transitions and to provide a tool to measure the internal parameters of the device.

### **DIAGNOSTICS OF A CHAOTIC REGIMES IN THE RING RESONATOR MODEL**

Avdeev S.M., Denisov P.E.

Tomsk State University, Tomsk, Russia

The families of bifurcation diagrams are constructed on the basis of the data of simulation of processes in the ring resonator. The analysis of a bifurcation diagrams allows to choose the parameters at which various modes take place, for example a mode of the determined (dynamic) chaos. The estimation of «degree of the chaotic character» processes is given by the method of the autocorrelation analysis at some parameters of nonlinear ring resonator model.

### **CONTINUOUS - WAVE SELF-MODULATION IN GUIDING THIN-FILM STRUCTURES**

Sotskaya L.I., Sotsky A.B., Khomchenko V.V., Khomchenko A.V.

Institute of Applied Optics of NAS, Mogilev, Belarus

The self-modulation of reflected light beam in waveguiding multilayer structures was observed with a low-power continuous-wave He-Ne laser in the case of excitation of guided modes by the prism-coupling technique. This effect associated with the interface influence on optical nonlinearity in thin-film structures.

**NON-STATIONARY LASING REGIMES IN MONOLITHIC SOLID-  
STATE LASER WITH PERIODIC MECHANICAL STRESS  
MODULATION**

Chekina S.N., Sidorov S.S.\*

Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State  
University, Moscow, Russia

\*Prokhorov General Physics Institute of the Russian Academy of Sciences,  
Moscow, Russia

The features of non-stationary dynamics of bidirectional ring chip-laser (Nd:YAG) were theoretically and experimentally investigated in the presence of mechanical stress modulation in active medium.

**DESCRIPTION OF NONLINEAR ELECTROMAGNETIC WAVES IN  
FERROELECTRIC IN FRAMEWORK OF THE MAXWELL-  
DUFFING MODEL**

Maimistov A.I., Kazantseva E.V.

Moscow State Engineering Physics Institute, Moscow, Russia

Propagation of the nonlinear electromagnetic waves in ferroelectrics is considered in the framework of the Maxwell equations and the Duffing anharmonic oscillator with negative mass. The system of these equations has the families of exact analytical solutions representing a steady state waves, both solitary waves and periodic (cnoidal) waves. Stability of the solitary waves under collisions and harmonic perturbation has been demonstrated by numerical simulation.

**APPLICATION OF FOURIER FILTERING FOR DESIRED PHASE  
DISTRIBUTION FORMATION IN NONLINER OPTICAL  
FEEDBACK SYSTEMS**

Chushkin V.A., Larichev A.V.\*, Nikolaev I.P.\*, Razgulin A.V.

Moscow State University, Computational Mathematics and Cybernetics  
Department, Moscow, Russia

\*Moscow State University, International Laser Center, Moscow, Russia

We consider a new formulation of the problem of making a desired phase distribution from phase-distorted input radiation by means of controllable spatial Fourier filters in the feedback loop of a nonlinear optical system. A theoretical approach based on the gradient method for optimal Fourier filter design is developed. The results of numerical simulation are discussed.

**SPATIAL STRUCTURE OF RADIATION IN THE PROCESS OF  
SELF-FREQUENCY DOUBLING**

Novikov A.A., Laptev G.D.\*, Chirkin A.S.

Faculty of Physics of M.V.Lomonosov Moscow State University, Moscow,  
Russia\*International Laser Center of M.V.Lomonosov Moscow State University,  
Moscow, Russia

The process of self-frequency doubling in active nonlinear crystal located into the cavity is investigated. The dependence of spatial distribution (transverse mode structure) of laser radiation and its second harmonic on parameters of cavity, crystal and pumping is studied using numerical solution of equation for diffraction and self-frequency doubling.

**NEW TYPES OF WEAKLY AND STRONGLY COUPLED SOLITONS  
IN WIDE-APERTURE LASERS WITH A SATURABLE ABSORBER**

Rosanov N.N., Fedorov S.V., Shatsev A.N.

Research Institute for Laser Physics, Saint-Petersburg, Russia

We present results of theoretical and numerical research of spatial soliton complexes with weak or strong coupling of individual solitons in wide-aperture lasers with a saturable absorber. We demonstrate that the transition to strong coupling is accompanied by bifurcations of transverse energetic flows.

**SELF-OSCILLATIONS OF LIGHT FIELDS ON NONLINEAR  
INTERACTIONS IN MOLECULAR MEDIA WITH PROTON  
PHOTOTRANSFER**

Gorbach D.V., Miksyuk Yu.I.\*, Tolstik A.L.

Belarusian State University, Minsk, Belarus

\*Belarusian Pedagogical State University, Minsk, Belarus

The theoretical models have been constructed for the light-field transformations by nonlinear interferometers and also from dynamic holograms formed on multiwave interactions in molecular media with proton phototransfer. The conditions for realization of different dynamic interaction modes including regular intensity pulsations of the light beams at the output of nonlinear-optical systems with constant input intensity have been determined.

**MAPS OF LYAPUNOV'S EXPONENTS FOR THE MODEL OF  
PROCESSES IN RING INTERFEROMETER WITH NONLINEARITY  
SATURATION**

Izmailov I.V., Poizner B.N., Shergin D.A.

Tomsk State University, Tomsk, Russia

Model of processes in nonlinear ring interferometer with nonlinearity saturation is proposed. There are calculation results of Lyapunov's exponents for the suggested model (which is constructed in the form of discrete map) in this work. Tendencies of dynamics are shown.

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**LASER PASSIVE MODE-LOCKING UNDER CONDITIONS OF  
HIGH-ORDER FREQUENCY DISPERSION FOR REFRACTIVE  
INDEX**

Komarov A.K., Komarov K.P.

Institute of Automation and Electrometry RAS, Novosibirsk, Russia

We have found that the high-order frequency dispersion for refractive index of intracavity elements can lead to multistability, multihysteresis dependence of number of ultrashort pulses on pump power, and also to threshold dependence of self-start of passive mode-locking on a power of seed pulses.

**INFLUENCE OF MULTIPHOTON PROCESSES ON NONLINEAR  
DYNAMICS IN MODEL OF RING INTERFEROMETER WITH A  
KERR'S MEDIUM**

Lyachin A.V.

Tomsk State University, Tomsk, Russia

The mathematical model of processes in a ring interferometer, which contains Kerr's medium in view of a multiphoton absorption (and swapping of an energy to a component with resonance frequency) in this medium is constructed. The model is capable to show, for example, how the multiphoton processes influence on a general view of complex dynamics.

**EXPERIENCE OF PROCESSES MODEL CONSTRUCTION IN  
NONLINEAR FIBER INTERFEROMETER**

Romanov I.V.

Tomsk State University, Tomsk, Russia

The theoretical and simulation results are represented for optical system consisting of three linear fibers containing additional nonlinear (Kerr's) media. The mathematical model consists of two differential equations and five expressions describing nonlinear phase shift dynamics and interference interaction of waves (without account of dispersion influence). Phase portraits are constructed and possibility of deterministic chaos or regular regime in the model is demonstrated.

**SPATIALLY MODULATED AND LOCALIZED NONRECIPROCAL  
STRUCTURES IN BISTABLE INTERFEROMETERS**

Romanov O.G.

Belarusian State University, Minsk, Belarus

Formation of periodical, labyrinthine and localized optical diffractive structures upon coherent interaction of light beams in nonlinear interferometers has been investigated by means of theoretical and numerical modeling.

**RELATIVE EFFICIENCY OF CONTINUOUS AND DISCRETE  
METHODS OF DYNAMICAL CONTROL OF LASERS**

Khovanov I.A., Khovanova N.A.\*, Grigorieva E.V.\*\* , Luchinsky D.G.\*\*\*,  
McClintock P.V.E.\*\*\*

Department of Stochastic Processes, Institute of Physics, Humboldt  
University of Berlin, Berlin, Germany

\*Department of Physics, Saratov State University, Saratov, Russia

\*\*Department of Physics, Belarus State University, Minsk, Belarus

\*\*\*Department of Physics, Lancaster University, Lancaster, UK

A direct comparison between continuous and discrete forms of control is investigated theoretically and numerically. Specifically we investigate energy-optimal control of switching of a periodically driven class B laser from stable to unstable pulsing regimes.

**OPTICAL VORTICES CREATION UNDER SUPERPOSITION OF  
NONCOAXIAL AND NONPLANAR BEAMS**

Yangirova V.V., Sukhorukov A.P.

Lomonosov Moscow State University, Russia

A new method of vortices generation by superposition of two noncoaxial nonplanar Gaussian beams is suggested. Analytical expressions for a chain of generated vortices were found. Propagation dynamics and vortices trajectories were described both numerically and analytically.

**HYBRID SOLITONS ENVELOPE INVESTIGATION**

Lobanov V.E., Sukhorukov A.P.

Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia

Characteristics of hybrid three-frequency solitons are investigated for (1+1)D and (2+1)D geometries by means of the variational approach. Accuracy of the method is estimated for both cases. Influence of induced cubic nonlinearity on solitons parameters in quadratic photonic crystals is analyzed using the averaged method.

### **Session 3. Optics of nanostructures and photonic crystals**

#### **OPTICAL CHARACTERISTICS OF ONE-DIMENSIONAL PHOTONIC CRYSTALS BASED ON SI FOR MIDDLE IR RANGE**

Tolmachev V.A., Perova T.S.\*, Astrova E.V., Remenyuk A.D., Pilyugina  
J.A., Moore R.A.\*

Ioffe Physico-Technical Institute, Saint-Petersburg, Russia

\*University of Dublin, Trinity College, Dublin, Ireland

Reflectance and transmission spectra were studied by FTIR spectroscopy. Good correlation of experimental spectra and calculated main and side photonic band gaps was found. The medium obtained behaves as a negative uniaxial crystal and exhibits an high optical anisotropy.

#### **LASER-INDUCED LUMINESCENCE OF THIN FILMS OF THE NANOPARTICLES CdSe/ZnS**

Chistyakov A.A., Klinov D.V.\*, Martynov I.L., Mochalov K.E.\*,  
Oleinikov V.A.\*, Zaharchenko K.V.

Moscow Engineering-Physical Institute (State University), Moscow, Russia

\*Bioorganic Chemistry Institute of RAS, Moscow, Russia

The photoluminescence of CdSe/ZnS nanoparticles in condensed phase excited by power laser radiation has been investigated. Luminescent properties of the nanoparticles have been compared to those of organic dyes. Photoluminescence quantum yield of the nanoparticles is shown to exceed that of organic dyes for two orders of magnitude. The possibility of employment of the nanoparticles for fabricating of highly effective powder luminophors has been shown.

#### **ELECTRODYNAMIC COUPLING AND PLASMON ABSORPTION OPTICAL RESONANCES IN SILVER AND COPPER PLANAR NANOSTRUCTURES**

Zamkovets A.D., Ponyavina A.N.

Institute of Molecular and Atomic Physics, National Academy of Sciences of  
Belarus

Optical spectra over the range of surface plasmon absorption resonances have been studied experimentally for silver and copper planar close-packed nanostructures placed between thin subwavelength films with various refractive indexes. The characteristics of spectral manifestation of plasmon absorption in these nanostructures were established. The effect of electrodynamic coupling on plasmon resonances was considered.

## **DISPERSION AND GROUP VELOCITY CONTROL IN PHOTONIC CRYSTAL LINEAR WAVEGUIDES**

Petrov A., Eich M.

Technical University Hamburg-Harburg, Hamburg, Germany

Photonic crystal (PC) linear waveguides are shown to have special dispersion properties. Optimizing the parameters it is possible to obtain quasi constant dispersion of several hundreds ps/nm/mm on 100 GHz bandwidth. Propagation with very small group velocities like 0.005 speed of light can be optimized to be dispersionless on the same bandwidth.

## **BRAGG REFLECTION SPECTROSCOPY OF PHOTONIC CRYSTALS WITH HIGH DIELECTRIC CONTRAST**

Sel'kin A.V., Bilibin A.Yu.\*, Menshikova A.Yu.\*\*, Pashkov Yu.A.,  
Shevchenko N.N.\*

Ioffe Physico-Technical Institute of the Russian Academy of Sciences,  
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\*Saint Petersburg State University, Institute of Chemistry, St. Petersburg,  
Russia

\*\*Institute of Macromolecular Compounds of Russian Academy of Sciences,  
St. Petersburg, Russia

A new approach to analyzing Bragg diffraction spectra of photonic crystals (PhC) is proposed around which new effective methods of structural characterization of opal-like PhC systems are developed. For the first time, making use of the Bloch mode formalism, a physically clear picture is given which describes Bragg reflection spectrum formation in the case of 3D PhC. Numerical calculation of the spectra are performed. Optical reflectance spectra of polymer opal-like PhC synthesized from mono-disperse polystyrol spheres are measured. The experimental spectra are obtained for polarized light at different angles of incidence and are well simulated in the theoretical calculations. New structural invariants are found which relate to each other multiple Bragg diffraction spectral features and angles of incidence.

## **THz REGION SIGNALS GENERATION WITHIN PHOTONIC CRYSTAL SUPERLATTICE**

Petrov E.V., Mantsyzov B.I.

M.V. Lomonosov Moscow State University, Moscow, Russia

Enhancement of THz signal generated in nonlinear one-dimensional photonic crystals is studied theoretically. It is shown that due to arrangement of photonic crystals into superlattice with spatial period closed to THz signal wavelength, it is possible to increase intensity of generated THz signal more then one order of magnitude compared with phase matched bulk material.



**PERSISTENT SPECTRAL HOLE BURNING SPECTROSCOPY IN  
«QUANTUM DOTS–MATRIX» SYSTEM: ACOUSTIC PHONON  
SIDE BANDS**

Kruchinin S.Yu., Fedorov A.V.

S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

The theory of persistent spectral hole burning (PSHB) in the inhomogeneously broadened absorption spectra of quantum dots is developed. Particular emphasis has been placed on usage of PSHB spectroscopy for analysis of interaction between electrons and acoustic phonons. An expression that describes form of differential spectra near the edge of optical absorption is obtained in analytic form for quantum dots in cases of strong and weak confinement. The conditions of experiment which results in similarity of differential spectra of single quantum dot and of an ensemble of quantum dots is determined.

**EXCITATION OF ATOMS IN THE COURSE OF PHOTOATOM  
EMISSION FROM METAL NANOPARTICLES**

Bonch-Bruevich A.M., Vartanyan T.A., Nikolaev S.D., Przhibel'skii S.G.,  
Starobogatov I.O., Khromov V.V.

S.I. Vavilov State Optical Institute, St. Petersburg, Russia

The photodetachment of excited sodium atoms from sodium metal particles of about 10 nm diameter is observed and studied. The process takes place when the sodium island film is irradiated with picosecond pulses of neodymium laser at the wavelengths of 530 and 1060 nm.

**LUMINESCENCE SPECTRA OF PLANAR NANOSTRUCTURES ON  
BASIS OF COPPER**

Soskovets Y.B., Khajrullina A.Y., Yavsin D.A.

Stepanov Institute of Physics of the National Academy of Sciences of  
Belarus, Minsk, Belarus

Luminescence spectra of planar copper nanostructures on a SiO<sub>2</sub> substrate are investigated. The obtained spectra contain three characteristic spectral bands about 400, 520, and 650 nm. Intensity and position of these luminescent bands depend on thickness of a metal layer, packing density of copper particles, and duration of oxidation. Maximal luminescence at wavelengths 400, 520, and 650 nm occurs near the region of luminescence of, respectively, quartz, copper oxide Cu<sub>2</sub>O, and plasma resonances of copper chains strengthened by hot spots near the surface of interacting particles.

### **MODIFICATION OF CUBIC SUSCEPTIBILITY TENSOR IN BIREFRINGENT POROUS SILICON**

Zabotnov S.V., Golovan' L.A., Konorov S.O., Fedotov A.B.,  
Timoshenko V.Yu., Kashkarov P.K., Zheltikov A.M.

Physics Department, M.V. Lomonosov Moscow State University, Moscow,  
Russia

Polarization-sensitive third-harmonic generation in birefringent (110) porous silicon layers reveals a modification in the cubic susceptibility tensor of silicon caused by strongly anisotropic pores. The ratio  $(\chi_{1111}^{(3)} + 3\chi_{1122}^{(3)})/\chi_{3333}^{(3)}$  of cubic susceptibility tensor components for the porous layers is shown to be 40% higher than this ratio for crystalline silicon.

### **COMPRESSION OF FEMTOSECOND CHIRPED OPTICAL PULSES BY PERIODIC AND QUASIPERIODIC NANOSTRUCTURES**

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The simulation of femtosecond chirped light pulse compression has shown that non-symmetric Fibonacci structures are more promising for a compressor design than periodic stacks. A quasiperiodic structure is found to compress laser pulses stronger and has a smaller geometrical size, unlike a periodic stack of the same number of layers. We have found that the chirped optical pulse with the carrying frequency at the beginning of any PBG is compressed better by any periodic PBG structure than that at the end of the same PBG.

### **ANISOTROPY OF MAGNETO-OPTICAL PROPERTIES AND MAGNETIC FIELD CONTROL OF LIGHT TRANSMISSION THROUGH FILMS WITH PERIODICAL MICROSTRUCTURES**

Strelniker Y.M.

Dept. of Physics, Bar-Ilan University, Ramat-Gan, Israel

It is found that the magneto-optical properties of the periodic metal-dielectric composite exhibit a strong dependence on the both magnitude and direction of the applied magnetic field. In the case when the host is metallic while inclusions are dielectric the extraordinary light transmission appears which again depends on the applied magnetic field.

### **THRESHOLD PROPERTIES OF INFRARED DETECTORS IN BASE OF GeSi/Si HETEROSTRUCTURES**

Voitsekhovski A.V., Kokanenko A.P., Nesselov S.N.

Tomsk State University, Tomsk, Russia

The possibility of usage of infrared detectors with internal photoemission in base of epitaxial GeSi/Si heterostructures for detection in spectral range 8-12  $\mu\text{m}$  is considered.

## **NUMERICAL INVESTIGATIONS OF SURFACE POLARITONS IN NEAR-FIELD PROBE**

Smirnov D.S.

Saint-Petersburg State University of Information Technologies, Mechanics and Optics, Saint-Petersburg, Russia

In order to localize an electromagnetic field within a subwavelength area near-field devices typically exploit tapered fiber waveguides or probes that have an output aperture of much smaller size as compared to the light wavelength in vacuum. Development of new principles for near-field probe design has been crucial for near-field technology progress for the last ten years. Employing surface polaritons gives a new opportunity for near-field probe development. Using such properties of surface polaritons as high field localization and low radiation losses allows us to make the efficiency energy transport channel along a near-field probe to a sample. It can help for many investigations using scanning near-field optical microscopy.

## **CALCULATION OF A DIPOLE RADIATION FIELD BY A METHOD OF DIRECT INTEGRATION OF MAXWELL'S EQUATIONS: CONCLUSIONS FOR NANOOPTICS**

Sall S.A.

S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

It is shown that the direct integration of Maxwell's equations without use of a method of delayed potentials results in the correct solution of a task on a field of dipole radiation. The nanooptics tasks are considered, for which the auditing of the solutions is required.

## **INFLUENCE OF PARABENZOQUINONE ADSORPTION ON PHOTOLUMINESCENCE AND SPIN CENTERS OF SILICON NANOCRYSTAL ASSEMBLIES**

Ryabchikov Yu.V., Osminkina L.A., Vorontsov A.S., Konstantinova E.A.,  
Timoshenko V.Yu., Kashkarov P.K.

M.V. Lomonosov Moscow State University, Physics Department, Chair of OFME, Moscow, Russia

Influence of parabenzoquinone molecule adsorption on photoluminescence and spin centers of silicon nanocrystals in porous Si layers has been investigated. It was observed a quenching of the porous silicon photoluminescence, shift of photoluminescence spectrum maximum to the long wave range and increase of the electron paramagnetic resonance signal under parabenzoquinone adsorption. Obtained results are explained by a model of the formation of charged adsorption-induced centers and recharging of the surface defects, which influence the exciton recombination in Si nanocrystals.

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**LINEAR SPATIAL DISPLACEMENT OF SPECTRAL COMPONENTS  
REFLECTED BY MULTILAYER**

Goldina N.D.

Institute of Laser Physics SB RAS, Novosibirsk, Russia

The analogy with thin-film compensators of dispersion in lasers is used for the creating of linear dependence of spatial displacement of reflected beams with the different wavelengths at exit boundary of one-dimensional metal-dielectric multilayer at oblique incidence in a spectral range near 1.5  $\mu\text{m}$  for the purpose of compact WDM demultiplexers.

**THE BACKGROUND LIMITED PHOTOELECTRIC PROPERTIES  
OF MBE MCT HETEROSTRUCTURES**

Voitsekhovski A.V., Kokhanenko A.P., Filatov M.F.

Tomsk State University, Tomsk, Russia

The experimental results are represented for the background radiation influence on photoelectric and electrophysical parameters of MCT films, grown by molecular-beam epitaxy. From an analyses of carrier lifetime and resistance vs background level dependencies it is concluded that Auger recombination is dominated. The experimental data for MBE heterostructures are in good agreement with calculation results. The parameters of MBE structures are compared with ones for the volume MCT crystals during the excitation both near surface and deep in the material.

**RESONANT PHOTOLUMINESCENCE OF QUANTUM DOTS:  
DYNAMICS OF ELECTRONIC SUBSYSTEM**

Rukhlenko I.D., Fedorov A.V.

S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

Theoretical description of resonant photoluminescence in semiconductor quantum dots has been developed. This process can provide a basis of powerful method for investigation of electronic dynamics in quantum dots. Potentialities of such type optical spectroscopy have been analyzed by the example of quantum dot intraband carrier relaxation involving optical phonons from different parts of semiconductor heterostructure. Analytical expressions for the photoluminescence intensity have been obtained. Moreover we have found physical conditions whereby the photoluminescence spectra give the most direct information about the intraband relaxation rates.

### **LIFETIME MINORITY CARRIER OF THE CdHgTe EPITAXIAL LAYERS WITH NON-HOMOGENEOUS COMPOSITION AND LEVEL OF DOPING**

Voitsekhovski A.V., Kokhanenko A.P., Fedorova N.V., Filatov M.F.  
Tomsk State University, Tomsk, Russia

The experimental and theoretical results are represented for the non-homogeneous composition and doping influence on photoelectrical properties MBE CdHgTe epitaxial layers. The energy diagram control of MBE CdHgTe for recombination and photoelectric parameter improvement, noise current reduction and operation temperature, are showed. This work results explain high experimental carrier lifetime value (4 –5 mcs) in MCT structures contained high-doped n-type layer.

### **SPECTRAL AND POLARIZATION CHARACTERISTICS OF FLUORESCENCE OF QUANTUM DOT AND ACRIFLAVINE SOLID SOLUTIONS**

Kaputskaya I.A., Gorbatshevich S.K., Lukashevich O.P.  
Belarusian State University, Minsk, Belarus.

Characteristics of fluorescence of CdSe/ZnS quantum dot (QD) and acriflavine solid solutions with electronic excitation energy transfer have been studied experimentally and theoretically. It is shown that correlation of orientations of acriflavine molecule (donor) and QD (acceptor) oscillators results in polarization of QD fluorescence.

### **PROCESSES OF ELECTRON EXCITATION ENERGY TRANSFER IN NANOSYSTEMS POROUS GLASS – ADSORBED DYES MOLECULES**

Gordeeva J.A., Rishikov B.D., Saletsky A.M., Antropova T.V.\*  
M.V. Lomonosov Moscow State University, Moscow, Russia  
\*Institute of Silicate Chemistry of RAS, Saint-Petersburg, Russia

The processes of the electron excitation energy transfer (EET) between dyes molecules of different types (donor and acceptor) in the matrix of porous glasses have been investigated. The extremal character of dependence of the EET efficacy on the molecules acceptor concentration in the pores of different size was revealed. On the basis of experimental data the fractal character of the interactive dyes molecules, distributed in the pores has been specified. The dependence of fractal dimension of the system: porous glass-adsorbed dyes molecules on the pores size has been determined.

### **MORPHOLOGICAL AND STRUCTURAL CHANGES IN SILICON FILMS UNDER THE INFLUENCE OF LASER IRRADIATION**

Kazakbaeva Z.M., Makarov V.P., Makarov K.V., Snimshchikov I.A.  
Institute of Physics, National Academy of Sciences of the Kyrgyz Republic,  
Bishkek, Kyrgyzstan

The results of structural and morphological researches of the material of amorphous silicon depending on the power of laser irradiation on the films of different thickness are given in this article.

**SPATIAL FOURIER SPECTROSCOPY OF GUIDED MODES IN  
MULTILAYER THIN-FILM STRUCTURES**

Kukanov A.A., Romanenko A.A., Sotsky A.B., Khomchenko A.V.  
Institute of Applied Optics of NASB, Mogilev, Belarus

New methods for study of low dimensional thin-film structures are considered. They are based on recording and processing the angular Fourier spectrum of a light beam reflected from a prism coupler in the case of exciting a guided mode in thin-film structure.

**SURFACE POLARITONS IN LAYERED MEDIUM AND THEIR  
APPLICATION IN NEAR-FIELD OPTICS**

Libenson M.N., Logunov A.E., Martsinovsky G.A., Shandybina G.D.  
St.Petersburg State University of Information Technologies, Mechanics and  
Optics, St.Petersburg, Russia

The paper presents the results of theoretical analysis of propagation of surface polaritons in three-layered structure medium, which includes a thin layer of metal or dielectric sandwiched between media with different optical properties. The field distribution and dispersion relation of the surface polariton were investigated for such layered structure.

**SURFACE POLARITONS IN ORDERED SURFACE STRUCTURES  
WITH SMALL PERIOD**

Vladimirtsev A.V., Gruzdev V.E.\*, Martsinovsky G.A., Smirnov D.S.,  
Shandybina G.D.  
St.Petersburg State University of Information Technologies, Mechanics and  
Optics, St.Petersburg, Russia

\*S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

The paper presents the results of analysis of interference effects during excitation of surface polaritons in two-dimensional periodic surface structures. The peculiarities of excitation and propagation of surface polaritons in such structures are considered.

**THE ELECTROMAGNETIC FIELD STRUCTURE IN THE OUTPUT  
NEAR-FIELD OPTICAL PROBE APERTURE**

Arslanov N.M., Moiseev S.A.  
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Russia

We develop the theoretical and numerical approaches for the calculation of the light field parameters in near-field microscopy probe. Using Katzenellenbaum method of cross sections and numerical calculations we investigated the spatial structure of light in the microscopy probe. Our calculations demonstrate that the variation of the wall inclination corner can result to dramatic changing of the spatial structure of light in the output probe aperture.

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**OPTICAL MEASUREMENTS AND MODELLING OF INTERFACE  
ROUGHNESS IN GAAS/ALGAAS QUANTUM  
HETEROSTRUCTURES**

Dolgikh Yu.K., Eliseev S.A., Efimov Yu.P., Zhdanov G.S., Ovsyankin V.V.,  
Petrov V.V.

S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

Correlation between MBE growth conditions of GaAs/AlGaAs heterostructures and PL peak width conventionally used as a measure of interface quality has been studied. The high-quality samples exhibited spectral lines of 0.2 meV halfwidth indicating *rms* roughness of about 0.03 nm. These extremely small values agree with the best published data and can be considered as a proof of delocalized excitons averaging QW width fluctuations.

**THE EFFECTIVE GENERATION OF ANTI-STOKES RADIATION IN  
ONE DIMENSIONAL PHOTONIC CRYSTALS**

Makarov N.S., Bepalov V.G.\*

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Optics, St.-Petersburg, Russia

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The possibility of effective anti-Stokes generation in photonic crystals is studied by numerical simulation. The possibility of phase matching is shown. The conditions for 30% anti-Stokes SRS generation efficiency are determined.

## **Session 4. Optics of atto- and femtosecond pulses**

### **ATTOSECOND LIGHT PULSES: PRODUCTION, MEASUREMENT, APPLICATION**

Platonenko V.T.

M.V. Lomonosov Moscow State University, Moscow, Russia

We discuss physics of high order harmonic generation, the problem of attosecond soft X-ray pulses separation from the total high order harmonics field, the problem of pulses duration measurements and attosecond pulses applications for the metrology of intra-atomic processes.

### **EFFICIENT HARMONICS GENERATION OF FEMTOSECOND $\text{Cr}^{4+}$ :FORSTERITE LASER RADIATION**

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Faculty of physics and ILC of Lomonosov MSU, Moscow, Russia

\*Photochemistry Center, Russian Academy of Sciences, Moscow, Russia

Theoretical and experimental investigations of efficient harmonics generation of femtosecond  $\text{Cr}^{4+}$ :forsterite laser radiation in nonlinear crystals under near zero group-velocities mismatch condition are reported. The efficiency of second harmonic generation exceeds 70%.

### **MULTIFILAMENTATION SCENARIO OF A FEMTOSECOND PULSE WITH INITIAL PERTURBATIONS**

Kosareva O.G., Panov N.A.

M.V. Lomonosov State University ILC, Moscow, Russia

Dynamics of development, interaction and birth of new filaments in the pulse with several initial intensity perturbations is investigated.

### **«HOT-SPOTS» TRACES UNDER FEMTOSECOND PULSE STOCHASTIC MULTIFILAMENTATION**

Shlenov S.A., Kandidov V.P.

M.V. Lomonosov Moscow State University, Physics Faculty and International Laser Center, Moscow, Russia

Non-linear foci spatio-temporal traces have been studied by numerical simulations. These foci form the bunch of random filaments in femtosecond laser pulse.



## **SELF-FOCUSING OF FEW-CYCLE OPTICAL WAVE PACKETS**

Berkovsky A.N., Kozlov S.A., Shpolyanskiy Yu.A.

St.-Petersburg State University of Information Technologies, Mechanics and Optics, St.-Petersburg, Russia

Various scenarios of self-focusing of axisymmetric few-cycle light pulses in optical media with non-resonant dispersion and nonlinearity have been investigated. It is shown that inseparable for such short pulses space-time dynamics may provide formation of complex electromagnetic structures like light "dumbbells" and "bubbles". Spectral supercontinuum generating in dispersive self-focusing is shown to develop considerably both to red and blue spectral regions. A significant blue shift may occur at a shock-wave turnover of a pulse profile.

## **ON THE ANALYTICAL DESCRIPTION OF NONLINEAR PROPOGATION PULSES IN UNIAXIAL CRYSTAL**

Khalyapin V.A., Sazonov S.V.

Kaliningrad State University, Kaliningrad, Russia

Combinational approach for construction of soliton-like solutions of nonlinear wave equations was suggested. This approach includes method of analytical continuation of dispersion parameters on the complex plane and average variational principle of Ritz-Whitham. On the basis of this approach solution of system of nonlinear equations, outlining propagation pulses in uniaxial crystal was found.

## **THE DYNAMICS OF DIELECTRIC PLASMA POLARIZATION COMPONENTS IN A STRONG FIELD OF PULSES OF SEVERAL ELECTRIC FIELD OSCILLATIONS**

Stumpf S.A., Korolev A.A.

Saint-Petersburg State University of Information Technologies, Mechanics and Optics, Saint-Petersburg, Russia

The material equation system is obtained, describing a dielectric polarizing dynamics and free electron concentration in a strong field of extremely short light pulses. The evolution equation for the electric field of high-intensive pulse containing several field oscillations is deduced for dielectric media, concerning its dispersion and non-linearity, especially, of plasma nature.

## **ABOUT SPECTRAL SUPERCONTINUUM SELF-COMPRESSING**

Belov D.L., Kozlov S.A., Shpolyanskiy Yu.A.

Saint-Petersburg State University of Information Technologies, Mechanics and Optics, Saint-Petersburg, Russia

We show that the dynamics of rms spectral width of extremely short pulse on the initial period of its propagation in transparent media with arbitrary dispersion and non-resonant electronic nonlinearity is well described by the parabolic law for every type of its evolution scenario. We distinguish the areas of spectral and energetic parameters of pulses and media, that correspond to the scenario of spectral supercontinuum self-compression.

**2D NONPARAXIAL SELF FOCUSING OF TE-POLARIZED LIGHT  
PULSES CONSISTING OF SEVERAL LIGHT FIELD  
OSCILLATIONS IN NONLINEAR MEDIA WITH DISPERSION**

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and Optics, St. Petersburg, Russia

The fundamental patterns of 2D nonparaxial few-cycle TE-polarized light pulses spectra dynamics in the nonlinear media with dispersion have been demonstrated. It has been shown that heterogeneous broadening of the spectrum into the high-frequency and low-frequency areas as well as the “third harmonic” generation results in more effective than in the linear case narrowing with the appearance of the aliform disturbance in the central part of the pulse.

**GENERATION OF ULTRASHORT SIGNAL SEQUENCE DURING  
TWO FEW-CYCLE PULSES INTERACTION IN NONLINEAR  
DIELECTRIC MEDIA**

Bakhtin M.A., Kozlov S.A.

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and Optics, Saint-Petersburg, Russia

Interaction of two unidirectional few-cycle light pulses with different group velocities in nonlinear dielectric medium is considered. It was shown that for pulses input intensities that enough for spectrum ultrabroadening the generation of ultrashort signal sequence may occur. The shape of resulting signals in sequence is nearly rectangular.

**SUPERCONTINUUM GENERATION IN THE PROCESS OF  
FEMTOSECOND PULSE MULTIFILAMENTATION**

Kosareva O.G., Panov N.A.

M.V. Lomonosov State University ILC, Moscow, Russia

The influence of initial perturbations disposition on a pulse spatial profile on the efficiency of transformation the powerful femtosecond laser pulse energy to the supercontinuum in air is investigated.

**ON THE NATURE OF INCREASE IN SPONTANEOUS  
MULTIPHOTON-EXCITED FLUORESCENCE FROM A SPHERICAL  
PARTICLE IN THE BACKWARD DIRECTION: GEOMETRIC-  
OPTICS APPROACH**

Panina E.K., Geints Yu.E., Zemlyanov A.A.  
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

The angular distribution of the radiation from a source of spontaneous fluorescence excited inside a spherical particle exposed to laser radiation has been considered. Within the geometric-optics approximation, the equation describing the mean intensity of the radiation from the front and rear hemispheres of the particle has been obtained. The position of the emitting source of secondary radiation inside the particle has been calculated numerically as a function of the diffraction parameter of the particle and the refractive index of the particulate matter in the case of one-, two-, and three-photon excitation of fluorescence. The numerical estimates of the mean intensity in the forward and backward directions in an ethanol droplet with the radius of  $a=10\ \mu\text{m}$  has been carry out.

**ON THE INFLUENCE OF TRANSVERSAL PERTURBATIONS ON  
NON STATIONARY ULTIMATELY SHORT PULSES IN SYSTEM OF  
TUNNELING QUANTUM TRANSITIONS**

Nesterov S.V., Sazonov S.V.\*  
Tomsk State University, Tomsk, Russia  
\*Kaliningrad State University, Kaliningrad, Russia

The dynamic of non stable ultrashort pulse, which was described by three dimensional sin-Gordon equation, in the system of tunneling transition was investigated. On base proposed modification of method "averaging Lagrangian", which use the technique double average – on phase and group variables, the influence of transversal perturbations on breather like pulse with arbitrary number of oscillations. The conclusion is obtained, that on eikonal stage transversal perturbations unambiguously further to self focusing of pulses. The influence of diffraction is analyzed. We are shown, that number of pulse oscillation less then certain critical value, the diffraction not capable to equilibrate the self focusing effect.

**INTEGRAL CHARACTERISTICS OF ELASTIC SCATTERING OF  
LIGHT IN TRANSPARENT SPHERICAL PARTICLE AT THE  
IRRADIATION OF SUPERSHORT LASER PULSES TRAIN**

Apeksimov D.V., Geints Yu.E., Zemlyanov A.A.  
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

The analytical equations have been derived for the integral optical characteristics of spherical particles exposed to a series of femtosecond laser pulses (factor of efficiency of scattering, absorption, and backscattering). These characteristics have been calculated numerically for the particles of different size irradiated in three different modes: by continuous-wave laser radiation, by a single pulse, and by a train of femtosecond laser pulses at the varied pulse duration and on/off ratio of laser pulses.

**LASER-INDUCED DAMAGE OF SEMICONDUCTORS UNDER  
ULTRA-SHORT PULSED ACTION**

Gruzdev V.E., Komolov V.L.

S.I. Vavilov State Optical Institute, St-Petersburg, Russia

We report the results of the theoretical analysis of initial stage of the processes in solids under the intensive ultra-short laser pulse action that lead finally to the damage of the solid lattice.

**DIFFRACTION FROM THE RING APERTURE: PULSE APPROACH**

Frolenkova M.V., Tolmachev Yu.A., Kytmanov A.V.

Saint-Petersburg State University, Saint-Petersburg, Russia

The problem of delta-shaped plane pulse diffraction from the ring aperture is formulated and solved in general form and for some particular cases. The reaction of a linear system to an initial pulse process is compared with the results of the computer simulation.

**FOCUSIGN OF THE SEQUENCE OF PULSES FOR OPTICAL  
DECODING PROCESS**

Frolenkova M.V., Tolmachev Yu.A., Kytmanov A.V.

Saint-Petersburg State University, Saint-Petersburg, Russia

The paper demonstrates the process of focusing of the sequence of pulses by the specially arranged system of rings. Barker code is used for the example of delta-correlated sequence. The form of signal in the focal point is shown to be proportional to the first derivative of the initial signal.

**SIMULATION OF FEMTOSECOND LASER PULSE PROPAGATION  
IN WATER AEROSOL**

Kouzminsky L.S., Militsin V.O., Kandidov V.P.

Physics Faculty, M.V. Lomonosov MSU, Moscow, Russia

The main aim of this work is to build the new wave model which may be used to solve the problems of femtosecond laser pulse propagation in the water aerosol. The model is supposed to be applied to the high-power laser pulse filamentation in the Earth atmosphere.

**ELLIPTICAL BEAMS AS A REMEDY FOR CONTROL  
FILAMENTATION OF POWERFUL FEMTOSECOND PULSE IN AIR**

Fedorov V.Yu.

Physics Faculty, M.V. Lomonosov MSU, Moscow, Russia

Possibility control filamentation process of powerful femtosecond pulse in air is investigating. On basis of numerical simulation increase of ellipiticity of intensity distribution in transverse section of pulse lead to filament forming on a greater distance from laser system were shown.

## **Session 5. Coherent processes of light interaction with matter**

### **QUANTUM MEMORY TECHNIQUE FOR INTENSIVE PULSES OF LIGHT BASED ON THE PHOTON ECHO IN THE OPTICALLY DENSE GASES**

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<sup>\*\*</sup>Graduate School of Information and Communications, Inha University, Incheon, S.Korea

<sup>\*\*\*</sup>Department of Physics, Lund Institute of Technology (LTH), Lund, Sweden

We study the possibility of quantum memory for intensive pulses of light using photon echo effects in the optically dense medium. The Maxwell-Bloch equations are solved analytically and numerically for several possible schemes of the photon echo. Our results demonstrate the wide possibilities of the photon echo technique for quantum memory processing both for weak and intensive pulses of light with most short possible pulse duration.

### **ECHO OF BOSE-EINSTEIN CONDENSATES IN DUAL OPTICAL LATTICE**

Elyutin S.O., Maimistov A.I.

Moscow Engineering Physics Institute, Moscow, Russia

We have observed numerically a quantum mechanical probability current echo response generated by an ensemble of the drops of Bose-Einstein condensates (BEC) loaded in the cells of optical dual lattice. The revival was excited with the pulses of two-photon optical radiation due to Raman scattering. Depending on the strength of the bosonic atoms repulsion the oscillatory echo effect changes for the echo pulse damping analogous to a Mott phase transition from a superfluid phase to an insulator. The echo temporal form and the role of inhomogeneous broadening are discussed.

### **REFLECTION OF OPTICAL WAVES FROM PUMP BEAM AT NONCOLLINEAR PARAMETRIC INTERACTION**

Sukhorukov A.P., Sukhorukova A.K.

Lomonosov Moscow State University, Russia

The theory of optical beam switching with up-frequency conversion is developed. We consider parametric beam multiplexing and trapping into a parametric waveguide walls of which are two noncoaxial pump beams.

**EFFECT OF ELECTROMAGNETIC-ACOUSTICAL  
TRANSPARENCY IN PARAMAGNETIC CRYSTAL**

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\*Kaliningrad State University, Kaliningrad, Russia

Possibility of synchronous control of hyper sound and light propagation in low-temperature paramagnetic is investigated. Properties of electromagnetic and acoustical transparency are combined in this effect. It is shown, that under fixed values of external magnetic field intensity and pump the transmission band is created for light and sound simultaneously.

**SELF-BEND OF THE LIGHT BEAM IN PHOTOREFRACTIVE  
GYROTROPIC CRYSTAL OF BITHMUT TITANATE UNDER  
EXTERNAL AC ELECTRIC FIELD**

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Tomsk State University of Control Systems and Radioelectronics, Tomsk,  
Russia

\*Mozyr State Pedagogical University, Mozyr, Belarus

The results of experimental investigation of light beam self-bending in optical activity photorefractive crystal of bithmut titanate under external ac electric field are obtained. These results confirm numerical simulation. It was shown the shift of beam center depends on the entrance beam polarization.

**A NEW MECHANISM OF PRE-BREAKDOWN GENERATION OF  
ELECTRON-HOLE PAIRS IN CRYSTALS: MULTI-PHOTON  
AVALANCHE EFFECT**

Perlin E.Yu., Ivanov A.V., Levitskii R.S.

S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

A theory of multi-photon avalanche is developed in a three-band model for dielectrics or semiconductors. It is shown that, due to multi-photon avalanche, there exists a specific range of excitation intensities  $j$ , around  $j \sim 10^{11}$  W/cm<sup>2</sup>, in which a slight increase in the intensity produces a sharp increase (by several orders of magnitude) in the density of non-equilibrium electron-hole pairs. The effect can result in the breakdown of the material.

**POLARIZATION RECORDING OF DYNAMIC HOLOGRAMS IN  
SOLUTIONS OF LASER DYES**

Ormachea O., Tolstik A.L.

Belarusian State University, Minsk, Belarus

The schemes of holographic recording on multiwave interactions in dye solutions have been analyzed. A method for self-amplification of polarization gratings when lasing is realized within the dye cell has been proposed, enabling more than one-order improvement of the diffraction efficiency. It has been found that polarization of the diffracted wave is dependent on the diffraction order and may be coincident with or orthogonal to polarization of the signal wave.

**DIFFRACTION EFFICIENCY OF NON-STATIONARY PHASE GRATINGS IN THE SYSTEM OF THREE-LEVEL CENTERS**

Kucherenko M.G., Rusinov A.P.

Orenburg State University, Orenburg, Russia

The kinetics of formation and relaxation of non-stationary phase holographic grating is explored. Distortions of the shape of recorded and disintegrating structure in detail investigated. The analysis of time dependence of the diffraction efficiency for phase gratings is executed.

**ADAPTIVE SPECKLE-INTERFEROMETER BASED ON DYNAMIC REFLECTION HOLOGRAM FORMED IN (100) CUT BTO CRYSTAL**

Romashko R.V., Shandarov S.M.\*, Kulchin Yu.N., Burimov N.I.\*,

Limarev D.V.\*, Kargin Yu.F.\*\*, Volkov V.V.\*\*

Far Eastern State Technical University, Vladivostok, Russia

\*Tomsk State Univ. of Control Systems and Radioelectronics, Tomsk, Russia

\*\*N.S. Kurnakov Institute of General and Non-Organic Chemistry of Russian Academy of Sciences, Moscow, Russia

An experimental and theoretical study of adaptive processing of non-stationary speckled waves by dynamic reflection holographic gratings formed in photorefractive BTO crystal without applying external electrical field is presented.

**GAS DYNAMICS AND RAY OPTICS OF QUASI-STEADY-STATE GAS LASERS**

Mat'ev V.Yu.

Russian Federal Nuclear Centre – All-Russian Scientific-Research Institute of Experimental Physics, Sarov, Russia

Features of gas dynamics and ray tracing of the active medium are considered for the steady-state gas lasers.

**THE REGIMES OF OPTICAL TRANSPARENCY IN ANISOTROPIC MEDIA**

Sazonov S.V., Ustinov N.V.

Kaliningrad State University, Kaliningrad, Russia

The regimes of the nonlinear propagation of the two-component pulses through resonant optically uniaxial media at a presence of the permanent dipole moment are studied. The features of different regimes are noted in the case of dense media and also for the media with expressed positive and negative birefringence.

**POLARIZATION CHARACTERISTICS OF TWO-BEAM COUPLING  
ON REFLECTION HOLOGRAPHIC GRATING IN (100) CUT  
 $\text{Bi}_{12}\text{TiO}_{20}$  CRYSTAL**

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Russia

The results of an experimental investigation of the polarization dependences for two-beam interaction on a reflection grating in the  $\text{Bi}_{12}\text{TiO}_{20}:\text{Ca}$  crystals is presented. The experiments were performed by using the semiconductor (660 nm), He-Ne (633 nm) and CuBr (578 nm) lasers. The peak values of exponential gain coefficient observed at optimal polarization were determined as 0.83, 2.44 and 2.04  $\text{cm}^{-1}$  for the wavelengths of 660, 633 and 578 nm, respectively.

**INTERACTION OF LIGHT BEAMS IN WAVEGUIDES BTO/BSO**

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Sciences, Moscow, Russia

The interaction of the Gaussian light beams in planar waveguide BTO/BSO is investigated. The numerical simulation of interaction of light beams, propagating at one waveguide mode is obtained. The elastic interaction occurs and the dark notch in the intensity distribution can be realized.

**POLARIZED LIGHT INTERACTION WITH A FILM OF  
AZOCONTAINING POLYMER POSSESSING LIQUID-  
CRYSTALLINE PROPERTIES**

Uraev D.V., Shmalhausen V.I.

Physics Department of M.V. Lomonosov Moscow State University, Moscow,  
Russia

We propose the theoretical model of elliptic-polarized light interaction with a film of azocontaining polymer possessing nematic properties. The processes of intermolecular interaction of azo dye with non photochromic polymer group have been taken into account. We have suggested the way to getting simplified analytical expressions for dynamics of photoorientation and analyzed approaches introduced into the model.



## **PROPAGATION OF COHERENT OPTICAL RADIATION THROUGH MOVING MEDIA**

Rosanov N.N., Sochilin G.B., Kiselev A.I.S.\*, Kiselev An.S.\*,  
Tarabanko A.V.\*

Research Institute for Laser Physics, Saint-Petersburg, Russia

\*Saint-Petersburg State University of Information Technologies, Mechanics  
and Optics, Saint-Petersburg, Russia

We present the results of the theoretical analysis of the effect of motion of transparent media (fluids) on propagation of coherent optical radiation. We consider both the approximation of geometrical optics and diffraction phenomena. In the approximation of geometrical optics, we describe distortions of rays and radiation polarization state due to medium motion. We demonstrate also the effect of radiation scattering (diffraction) on the inhomogeneity of the fluid motion velocity and derive the scattering cross-section and other scattering characteristics.

## **MONTE CARLO SIMULATION OF FEMTOSECOND NIR PULSE PROPAGATION IN POROUS MEDIUM (PAPER)**

Shelepina D.N.

ILC MSU, Moscow, Russia

The model of porous medium like paper was proposed and Monte Carlo simulation of femtosecond NIR pulse propagation within the limits of the model was realized. Simulated time dependencies of scattered light intensity illustrated dynamics of multiple scattering in such objects.

## **THEORY OF QUASI-STATIONARY THREE-FREQUENCY PARAMETRICALLY COUPLED WAVES IN QUADRATIC PHOTONIC CRYSTAL**

Ermakova S.V., Lobanov V.E., Sukhorukov A.P.

Lomonosov Moscow State University, Moscow, Russia

Stability and small amplitude oscillations of optical modes in quadratically nonlinear photonic crystals are investigated. We take into consideration the synchronisms for both SHG and sum frequency generation. Properties of quasi-stationary waves are analyzed by numerical simulation of the SVA equations, the harmonic model of nonlinear grating and the average model.

## **WAVE FRONT SENSOR BASED ON PHASE KNIFE**

Goncharov A.S., Larichev A.V.

M.V. Lomonosov Moscow State University, Moscow, Russian Federation

We have suggested to use optical system with phase knife for registration of wave front shape of optical radiation. Theoretical and numerical analyses of sensor based on phase knife has been executed, algorithms of the phase function reconstruction and schemes of sensor realization has been developed, area of expedient application has been discovered. An essential characteristics of sensor components has been determined for its realization, and sensor efficiency under different operating modes has been tested numerically and experimentally.

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**ON THE SURFACE ELECTROMAGNETIC WAVE EXCITATION  
UNDER NON-COLLINEAR LASER LIGHT SCATTERING BY A  
METAL SURFACE GRATING**

Andreev A.V., Korneev A.A., Nazarov M.M., Prudnikov I.R., Shkurinov A.P.  
M.V. Lomonosov Moscow State University, Moscow, Russia

We have analytically investigated the process of the surface electromagnetic wave (surface plasmon) excitation under non-collinear laser light scattering on a metal grating. It is shown that plasmon's diffraction on the grating produces a splitting of dispersion curves in a reciprocal space and the appearance of a band gap. It is also established that the above splitting depends on a type of the surface relief and drastically changes the surface-plasmon generation efficiency. On the basis of the obtained results we have explained surface-plasmon generation peculiarities seen in our experiments.

**EXPERIMENTAL MODEL FOR INVESTIGATIONS OF MULTI-  
LAYERED TURBID MEDIUM**

Lychagov V.V.

Saratov State University, Department of Optics, Saratov, Russia

We had investigated experimentally distribution of scattered photons in medium with defined optical properties. A method bases on the theory of diffusion wave spectroscopy (DWS), basic term of which is "photon density wave". We applied our setup for modeling of human mucous tissue.

**FORMATION OF OPTICAL PULSES IN A LASER WITH A  
COHERENT ABSORBER IN THE PRESENCE OF NEAR DIPOLE-  
DIPOLE INTERACTIONS**

Afanas'ev A.A., Vlasov R.A., Mikhnevich S.Yu., Lemeza A.M.  
Institute of physics of NASB, Minsk, Belarus

The formation of optical pulses in a laser with a coherent absorber? with allowance for near dipole-dipole interactions, is considered. The conditions of constant-form pulses are determined.

**THERMODEFORMATIONAL MECHANISM OF SURFACE  
NONLINEARITY**

Ivanov V.I., Kliment'ev S.V., Okishev K.N.  
Far Est State Transport University, Khabarovsk, Russia

The thermodeformational surface nonlinearity mechanism of thin polymer film is investigated by self-action lens method.

## **SPECTRAL RESEARCHES OF HUMAN BLOOD AT VARIOUS PARAMETERS HEMATOCRIT AND CONCENTRATIONS OF GLUCOSE SOLUTION**

Gorskaya N.I.

N.G. Chernishevsky Saratov State University, Saratov, Russia

Among modern physical methods of research in biology and medicine one of conducting places is borrowed by optical methods, including traditional methods optical spectroscopy, based on the analysis of spectra of reflection, transmission and fluorescence of biological fabrics. For effective treatment hematological of the patients the methods of exact diagnostics of diseases and control above change of a condition of the patients are required during treatment. The methods of optical spectroscopy in their complex use are the effective tool of research of processes occurring in biological fabrics. The comparison of results of researches to results of mathematical modeling of transmission spectra of a biological fabric received in the given work, allows to define not only spectral distributions of optical parameters of biological environment, but also their changes occurring under action of the various factors, resulting to change of a functional - morphological condition of a biofabric. The transmission spectra of samples of blood with the various indications hematocrit, hemoglobin, concentration glucose are submitted. The comparative researches and analyses of the received spectra are carried out.

## **DEGENERATE FOUR-WAVE MIXING WITH ELECTROMAGNETICALLY INDUCED TRANSPARENCY**

Nikoghosyan G.V.

Institute for Physical Research of Armenian National Academy of Sciences,  
Ashtarak-2, Armenia

Influence of electromagnetically induced transparency on light storage and stopping of light has been investigated. Conditions for generation enhance and suppression has been obtained.

## **TWO-BEAM INTERACTION IN DYNAMIC HOLOGRAMS IN MEDIUMS WITH NON-LINEAR ABSORPTION: EFFECTIVE WEAKENING OF STRONG BEAM**

Kessel S.V., Staselko D.I.\*

Saint-Petersburg State University of Information Technologies, Mechanics  
and Optics, Saint-Petersburg, Russia

\*S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

Numerical simulation of light beams interaction in dynamic holograms was held to consider influence of non-linear absorption introduction on energy transform efficiency in steady-state conditions. High effectiveness of asymmetric geometry of hologram recording in these conditions is shown as well as possibility to reduce rapidly requirements for beams intensity and medium non-linearity.

## **STOKES RADIATION SPECTRAL CHANGES DUE TO INTERPLAY AMONG TRANSIENT STIMULATED RAMAN SCATTERING AND DIFFRACTION**

Lobanov S.A., Bepalov V.G.\*

Saint-Petersburg State University of Information Technologies, Mechanics and Optics, Saint-Petersburg, Russia

\*S.I. Vavilov State Optical Institute, Saint-Petersburg, Russia

Numerical simulations show that spectrum of Stokes component widens at growth of conversion coefficient due interplay of transient stimulated Raman scattering and diffraction.

## **MANAGEMENT OF PHASE-MEMORY IN ECHO-HOLOGRAPHY**

Nefediev L.A., Hakimzyanova G.I.

Kazan State Pedagogical University, Kazan, Russia

The locking effect of the echo - holographic information is reviewed, which one will be realized at disturbance of a variable-duration correlation of an inhomogeneous broadening of a resonance line on different time frames, at the expense of superposition on a sample of inhomogeneous electrical fields.

## **THE UNUSUAL STRUCTURE IN CONOSCOPIC FIGURES OPTICAL ACTIVITY CRYSTALS**

Pikoul O.J., Rudoy K.A., Stroganov V.I.

The Far Eastern State Transportation University, Khabarovsk, Russia

The unusual structure was found out in conosopic figures of optical activity crystals. It differs from the Erie figures. The reason of these peculiarities is the circular polarization of light.

## **THE ELECTROOPTICAL METHOD OF CRYSTALLOGRAPHIC DIRECTIONS DEFINITION IN $\text{LiNbO}_3$**

Litvinova M.N., Krishtop V.V.

Far Eastern State Transport University, Khabarovsk, Russia

In paper the optical method of definition of crystallographic directions of lithium niobate is given. The experimental results correspond to theoretical calculations.

## **AMPLIFICATION OF FARADAY EFFECT IN OPTICAL FIBER**

Mil'kov J.A.

Far-Eastern State Transport University, Khabarovsk, Russia

In the work experimentally received amplifications of Faraday effect in optical fiber. The corner of turn of a plane of polarization has made 105 degrees.

### **SPECIAL CONOSCOPICAL PICTURES IN PYROELECTRICAL CRYSTALS**

Bortulev S.N., Karpets Yu.M., Stroganov V.I.

Far Eastern State Transport Universitu, Xabarovsk, Russia

Когерентные процессы взаимодействия света с веществом (стендовый) Unconvetntional that allow to investigate optical, electrical and thermal properties of crystals pyrotltetric IR sensors are described.

### **COVARIANT DESCRIPTION OF ELECTROMAGNETIC WAVES IN CIRCULAR BIANISOTROPIC WAVEGUIDES**

Novitsky A.V.

Belarussian State University, Minsk, Belarus

Guided propagation of electromagnetic waves in circular bianisotropic structures is considered. Covariant equations, which describe field evolution, and dispersion equations of multilayered fibers were obtained.

### **THE INTERRELATIONSHIP BETWEEN FOUR-BEAM REFLECTION IN ONE - AXIS CRYSTALS WITH CRYSTALLOGRAPHIC ANISOTROPEE**

Faleev D.S., Karas K.G.

Far Eastern Transport University Khabarovsk, Russia

The results of analysis of four-beam reflection in one - axis negative crystals are presented.

### **OPTIMAL REGIMES FOR LASER COOLING OF SOLIDS**

Andrianov S.N., Bochkarev V.V.\*, Gerasimov K.I.\*\*\*, Falin M.L.\*\*

FGUP NPO GIPO, Kazan, Russia

\*Kazan State University, Kazan, Russia

\*\*\*KPhTI KSC RAS, Kazan, Russia

The expression obtained for the coefficient of performance for optical thermal machine in the reversed thermodynamic cycle with the account of heat release sources. Using this expression and performed spectroscopic research, the optimal regimes are defined for laser cooling of various type samples.

### **THEORY OF REFLECTION GRATINGS RECORD BY AMPLITUDE-INHOMOGENEOUS LIGHT BEAMS IN PHOTOPOLYMERS AT PHOTO-INDUCED ABSORPTION**

Dovolnov E.A., Sharangovich S.N.

Tomsk State University of Control System and Radioelectronics, Tomsk, Russia

In the work the theoretical model of reflection gratings record by 2D-inhomogeneous light beams in photopolymeric media (PPM) at photoinduced optical absorption is developed. Polymerization and diffusion mechanisms and diffusion coefficient changing during record time are also taken into consideration. The solution has been obtained in the view of spatial-temporal dependence of the first harmonic of refraction index grating.

**GENERALIZED CONSTITUTIVE EQUATIONS FOR LINEAR  
BIANISOTROPIC MEDIA**

Barkovsky L.M., Furs A.N., Galynsky V.M.  
Belarussian State University, Minsk, Belarus

Generalized constitutive equations of Drude-Born-Fedorov type for linear bianisotropic media are obtained. These equations describe anisotropy, bigyrotropy, optical activity and magnetoelectric non-reciprocal properties of materials. Symmetry analysis of received equations is carried out with respect to space and time inversion and transformations of Lorentz group.

**KRAVCHUK OSCILLATORS - RESONANT MEDIA GENERAL  
MODELS: COHERENT DYNAMICS IN THE LASER FIELDS**

Savva V.A., Khlus O.V.  
B.I. Stepanov Institute of Physics NASB, Minsk, Belarus

Kravchuk quantum oscillators are built. Their dynamics in the laser fields is investigated on the base on exact analytical solution obtained.

**MODELLING OF THERMOCHEMICAL PROCESS ON THE METAL  
TARGET SURFACE IN THE FIELD OF SCANNING LASER  
RADIATION**

Sarnakov S.M., Shandybina G.D.  
St.Petersburg State University of Information Technologies, Mechanics and  
Optics, St.Petersburg, Russia

Results of experimental researches and the modelling description the processes of ablation connected to vapor-phase oxidation and return sedimentation of products of reaction to the irradiated surface and leading to instabilities of a straight track of laser influence are submitted.

**SPATIAL COHERENCY OF STOKES RADIATION IN  
NONSTATIONARY SRS**

Shamrov N.I.  
Ogarev State University of Mordovia, Saransk, Russia

The function of spatial coherency of Stokes radiation is calculated in depending on the pump beam geometry and Fresnel number.

**POWERFUL BESSEL BEAM PROPAGATION AND MEDIUM  
IONIZATION**

Vlasov R.A., Khasanov O.K.\*, Smirnova T.V.\*  
The B.I.Stepanov Institute of Physics, Minsk, Belarus  
\*The Institute of Solid State and Semiconductor Physics, Minsk, Belarus

The transformation of the hollow Bessel beams in media with complex type of nonlinearity including Kerr and quintic is investigated. The peculiarities of ionization process in this case are analyzed as well.

**THE INFLUENCE OF THERMAL ANNEALING ON  
PHOTOREFRACTIVE SCATTERING OF LIGHT IN CRYSTAL  
NIOBATE LITHIUM**

Stroganov V.I., Syuy A.V.\*, Lihtin V.V.\*

Far Eastern State Transport University, Khabarovsk, Russia

\*Komsomolsk-on-Amur State Technical University, Komsomolsk-on-Amur,  
Russia

Pictures of central part of photorefractive light scattering on crystal  $\text{LiNbO}_3:\text{Fe}$  (0,3 %) under frequent preliminary irradiation ( $P=1-2$  mW,  $\lambda=0,6328$   $\mu\text{m}$ ) and consequent thermal annealing during 30 minutes at temperature  $200$   $^{\circ}\text{C}$  are received.

**APPLICATION OF LASER SPECTROSCOPY METHODS OF  
DYNAMIC LIGHT SCATTERING FOR INVESTIGATION OF  
HUMAN SERUM ALBUMIN DENATURATION**

Vlasova I.M., Mikrin V.E., Saletsky A.M.

Moscow State University, Moscow, Russia

Within the frames of model systems a human serum albumin denaturation at the presence of an ionic detergent SDS, and also thermal denaturation of this protein at different values pH were investigated by laser spectroscopy methods of light scattering.

**MANIPULATING LIGHT PULSES IN ATOMIC GASES IN TRAPS:  
SEMICLASSICAL THEORY**

Troshin A.S., Vasil'ev N.A.

A.I. Herzen State Pedagogical University of Russia, Saint-Petersburg, Russia

The detailed analysis of the field-induced transparency and formation of exceptionally low group velocity of the probe light pulse in presence of coupling light is performed in the framework of completely non-linear semiclassical theory. Physical conditions considered correspond, on the whole, to those realised in experiments <sup>1,2</sup>. The developed theory demonstrates that the output of the probe pulse can be effectively manipulated (as though the pulse being "confined" and "released", and even repeatedly), when the coupling pulse is switched off and on, as it was shown in experiment <sup>2</sup>. The significant difference between actual physical situations and interpretation of experimental results obtained in papers <sup>1,2</sup> and in more recent papers <sup>3-5</sup> is discussed as well.

**THE READOUT OF SUPERIMPOSED GRATINGS FORMING IN  
PHOTOPOLYMER MATERIAL BY AMPLITUDE-  
INHOMOGENEOUS LIGHT BEAMS**

Kuznechov V.V., Sharangovich S.N.

Tomsk State University of Control System and Radioelectronics, Tomsk,  
Russia

In the work the theoretical model of readout of superimposed transmitted gratings stored by 2D-inhomogeneous light beams in photopolymeric media (PPM) is developed. The coupling equations and their solutions have been derived with the perturbative expanding method. The optical transfer function and cross-talk between phase gratings are studied.

**PROPAGATION OF GAUSSIAN LIGHT BEAMS IN CRYSTAL  
Bi<sub>12</sub>SiO<sub>20</sub>, PLACED IN A STRONG ELECTRIC FIELD**

Yakouchyk T.G., Shepelevich V.V.

Mozyr State Pedagogical University, Mozyr, Belarus

Dependence of the maximal intensity of a light beam at output from crystal Bi<sub>12</sub>SiO<sub>20</sub> on orientation angle for any azimuth of polarization of input beam under conditions of screening self-focusing is investigated.

**MULTIBEAM REFLECTION OF LIGHT**

Prokopovitch M.R., Smyshljaeva M.M.

The Far East State University of Transportation, Khabarovsk, Russia

Full internal reflection of light extending in the anisotropic environment, from isotropic environments is considered. Thus the falling beam breaks up to two pairs beams with orthogonal polarization.

**DOUBLE CONOSCOPICAL PICTURES IN OPTICAL CRUSTALS**

Alekseeva L.V., Povh I.V., Kravzova N.A., Stroganov V.I.

Far Eastern State Transport Universitu, Xabarovsk, Russia

The results of the investigations of double conoscopic figures appeared in some cases in absense of analyser as presented. It is shown that in the systems like Frenel's rombohedra double conoscopic figures can be abserved by eye without polariser and analyser.

**THEORETICAL MODELING OF SELF-FOCUSING AND SELF-  
DEFOCUSING PHENOMENA IN A PHOTOREFRACTIVE**

**Ba<sub>0.77</sub>Ca<sub>0.23</sub>TiO<sub>3</sub> CRYSTAL**

Matusevich V., Zagorskiy A.E.\*, Shepelevich V.V.\*, Kowarschik R.,  
Kissling A.

Institute of Applied Optics, Fiedrich Shiller University Jena, Jena, Germany

\*Laboratory of Coherent Optics and Holography, Mozyr State Pedagogical  
University

We present two theoretical models that describe light 2D-beam self-focusing and self-defocusing in a photorefractive Ba<sub>0.77</sub>Ca<sub>0.23</sub>TiO<sub>3</sub> crystal without external electric field and without background illumination. Numerical computations show a good agreement with experimental results.

**TEMPERATURE DEPENDENCES OF THE OPTICAL ABSORPTION  
IN Bi<sub>12</sub>TiO<sub>20</sub> CRYSTAL DOPED BY Ca**

Dubrovin A.N., Zhnykina M.A., Itkin S.I.

State University of Control Systems and Radioelectronics, Tomsk, Russia

The temperature dependences of the optical absorption in Bi<sub>12</sub>TiO<sub>20</sub>:Ca crystal were investigated. We have used to illuminating the crystal the quasimonochromatic radiation of light-emitting diodes from red (660 nm), yellow (570 nm) and green (525 nm) regions of the spectrum.



## **CORRECTION ALGORITHM FOR SPECTROGRAM, DETECTED WITH AOTF-BASED SPECTROMETERS**

Lopukhov N.V., Pozhar V.E.

Scientific Technological Center of Unique Instrumentation RAS, Russia,  
Moscow

The procedure of measurement of AOTF-based spectrometers characteristics was developed, which allows implementation of previously discussed algorithm for elimination of artifacts, caused by ghost window.

## **OSCILLATION OF SPECTRUM COMPONENTS OF TM-POLARIZED MONO MONOCHROMATIC BEAM IN NON-LINEAR MEDIUM**

Bogumirsky O.B.

Saint-Petersburg State University of Information Technologies, Mechanics  
and Optics, St. Petersburg, Russia

New spectrum equations describing non-paraxial dynamics of 2d monochromatic TM-polarized beam in transparent optical medium with cubic nonlinearity are derived. These equations are approximately analytically solved. The solutions are analyzed numerically.

## **PHOTON ECHO AND CONTROL OF NARROWING OF A HOMOGENEOUS LINEWIDTH OF MOLECULAR GAS AT ITS COOLING IN SUPERSONIC JETS**

Popov I.I.

Mari State University, Yoshkar-Ola, Russia

The report is devoted to observation of photon echo (PE) in the cooling supersonic jets of molecular iodine vapors and to optical echo-spectroscopy of its. The PE method and the experimental results are described. The experimental decrement curves of intensity PE with pressure boost of two views of vapors of molecular Iodum: in cooling supersonic molecular jets and which is taking place in a state of a temperature balance are given.

## **DETERMINATION OF CONCENTRATION IN LAMELLAE PHOSPHOLIPIDS**

El'nikova L.V.

A.I. Alikhanov SSC RF ITEP, Moscow, Russia

We compare the Ising model thermodynamics parameters, obtained by numerical simulations, and FTIR spectroscopy results for lamellar phases of water-phospholipidic (DMPC, DPPC) mixtures.

### Postdeadline session

#### THE PROPAGATION OF ELECTROMAGNETIC SOLITONS IN MEDIUM WITH QUADRATIC AND QUBIC NONLINEARITIES WITH ACCOUNT FOR DIFFRACTION

Bugay A.N., Sazonov S.V.

Kalinigrad State University, 14, Nevskogo St., 236041 Kaliningrad, Russia

The influence of diffraction on propagation of ultimately short electromagnetic pulses in medium with quadratic and cubic nonlinearities is examined. The conditions of stable propagation with respect to selffocusing in different regimes are determined.

#### ACCOUNT OF MOLECULAR OXYGEN DESORPTION IN ANALYSIS OF LUMINESCENT ADSORBATES SIGNALS

Kucherenko M.G., Chmereva T.M., Goukouv V.V.

Orenburg State University, 460352, Orenburg, Russia

Mathematical model of adsorbates delayed fluorescence pulse form, taking into account the desorption of oxygen molecules from surfaces of substrate as a result interactions with phonons is proposed. Temperature dependency of pulsed luminescent signal parameters of molecular probes is investigated.

#### OPTICAL AND LUMINESCENT PROPERTIES OF THE SCHEELITE TYPE CRYSTALS: $\text{SrWO}_4$ , $\text{SrMoO}_4$ and $\text{CaMoO}_4$

Kitaeva I.V.<sup>\*</sup>, Kolobanov V.N.<sup>\*</sup>, Mikhailin V.V.<sup>\*</sup>, Spassky D.A.<sup>\*\*</sup>

<sup>\*</sup> Synchrotron Radiation Laboratory, Physics Faculty, Moscow State University, 119992 Moscow, Russia

<sup>\*\*</sup> Skobeltsyn Institute of Nuclear Physics, Moscow State University, 119992 Moscow, Russia

The analysis of reflectivity spectra of  $\text{SrWO}_4$ ,  $\text{SrMoO}_4$  and  $\text{CaMoO}_4$  allowed to explain some fundamental features of the electronic structure of these crystals. Particularly, it was shown that calcium electronic states don't participate in forming of the bottom of the conduction band. The conclusions about the nature of the luminescence center of the investigated crystals were also made.

#### COHERENT BACKSCATTERING OF IMPULSE ELECTROMAGNETIC RADIATION BY ENSEMBLES OF COOLED ATOMS

Datsyuk V.M., Kupriyanov D.V., Sokolov I.M., Havey M.D.<sup>\*</sup>

Saint-Petersburg State Polytechnical University, Saint-Petersburg, Russia

<sup>\*</sup>Physics Department, Old Dominion University Norfolk, Virginia

Coherent backscattering process of pulse radiation on ensembles of the cooled atoms is discussed. By using methods of diagrammatic technique we receive analytical expressions for correlation functions of the diffused light, allowing to take into account all major factors influencing on scattering process - all hyperfine and Zeeman structure of the basic and excited states of atoms, polarization of initial radiation, the real form and the sizes of a

atomic cloud, its spatial heterogeneity, movement of atoms and polarization of atoms on the angular momentum. On the basis of these equitations time dependence of full intensity and the amplification factor for backscattered light on duration of a pulse, polarization scheme, optical thickness of scattered medium and main frequency of a light pulse is investigated. Concrete calculations are carried out for the ensembles of rubidium 85 cooled in magneto-optical traps.

### **THE INVESTIGATION OF LASER HEAT INFLUENCE ON THE ABSORBING MEDIUM**

Popova E.M., Rinkevichius B.S., Tolkachev A.V.

Moscow Power Engineering Institute (Technical University), Russia

In present work the investigation of laser heat influence on the absorbing medium is carried out.

### **SPECTRAL PECULIARITY OF TWO FEMTOSECOND PULSES OF DIFFERENT WAVELENGTHS INTERACTING IN THE NEAR-BOUNDARY AREAS OF AN OPTICAL KERR MEDIUM**

Krylov V.N.,\* Bepalov V.G.,\* Staselko D.I.,\* Milogliadov E.V.,\*\*  
Seyfang G.\*\*

\*State Optical Institute, St.Petersburg, Russia

\*\* Swiss Federal Institute of Technology, Zurich, Switzerland

We report on the investigation of the interaction of weak UV femtosecond pulses with the intense IR pulses in the fused silica sample. We measured the spectrum of the transmitted UV pulses as a function of the delay time between the UV and IR input pulses. We demonstrate and analyze the remarkable shift of the UV spectrum when two pulses interact in the near-boundary areas to the entrance and the exit of the sample.

### **EXPERIMENTAL STUDIES ON THE QUADRUPOLE CONTRIBUTION TO MAGNETOCHIRAL EFFECT IN QUARTZ CRYSTAL**

Khyshov A.A.

Institute for Physics of Microstructures RAS, Nizhny Novgorod, Russia

The results are presented of experimental studies on the quadrupole contribution to nonreciprocal magneto-optical linear birefringence (magneto-chiral effect). The measurements were performed in quartz crystal by polarization Sagnac interferometer and double-pass optical scheme using two linear quarter-wave phase plates.

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