Soviet and Japanese Aerospace Literature

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Soviet Aerospace Literature
This month: *Crystalography and Rare-Earth Materials in Laser Applications*

A88-39889 Characteristics of the condensation of the emission spectrum of tunable lasers (Osobennosti kondensatsii spektra izlucheniia perestraivaemykh lazerov). A. N. KOLEROV, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 15, March 1988, pp. 512-516. 19 Refs.

The spectrum condensation of tunable lasers with a plasma-filled cavity was investigated for BeAl2O4:Cr(3+), KrZnF3:Cr(3+), GSGG:Cr(3+), and Al2O3:Ti(3+) laser crystals. The effect of plasma Langmuir oscillations on mode locking and Q-switching is investigated. Two spectrum-condensation modes were identified. Several dozen condensation lines were found for a cerium-containing plasma in the laser cavity.

A88-36031 The measurement of the contrast ratio of the radiation from a neodymium laser with a phase-conjugation mirror on the basis of an oscillator-amplifier scheme (Izmerenie kontrasta izlucheniia neodimovogo lazera s OVF-zerkalom po skheme generator-usilitel') V. F. EFIMKOV, I. G. ZUBAREV, and V. B. SOBOLEV, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 15, Feb. 1988, pp. 272-275. 5 Refs.

The contrast ratio was measured according to the background of the Q-switching of the radiation from a neodymium laser with a PC mirror on the basis of an oscillator-amplifier scheme. In the present scheme, the PC mirror ensures a 100-1000 fold contrast enhancement which is in agreement with calculations.

A88-36021 A Doppler velocimeter based on an iodine laser for explosion-accelerated targets (Doplerovskii izmeritel' skorosti mishenei, uskoriaemykh vzryvom, na osnove iodnogo lazera) G. B. VLASOVA, A. L. MIKHAILOV, B. A. POKLONTSEV, and A. V. FEDOROV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 24, Jan.-Feb. 1988, pp. 127-130. 6 Refs.

A laser Doppler velocimeter based on an iodine laser and Fabry-Perot interferometer has been designed for measuring the velocity of explosion-accelerated bodies. The general design of the device is described and its optical scheme is presented. The laser Doppler velocimeter described here makes it possible to measure the velocities of surfaces, including diffuse-scattering surfaces, with an accuracy to within 10 m/s.

A88-34011 Optimization of the parameters of an LiF:F2(-) laser pumped by a neodymium laser (Optimizatsiia parametrov lazera na LiF:F2/-/ s nakachkoi neodimovym lazerom) T. T. BASIEV, S. V. DOLZHENKO, B. V. ERSHOV, S. B. KRAVTSOV, S. B. MIROV et al., *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 52, Feb. 1988, pp. 400-402. 5 Refs.

Experimental results are presented for an LiF:F2(-) laser with intracavity Nd-laser pumping in which the LiF crystal with F2(-) color centers serves simultaneously as the gate and load of the Nd-laser and as an active medium lasing at 1.15 micron in its own cavity. It is shown that the output power and efficiency (0.18 percent) of the LiF:F2(-) laser with intracavity pumping by Nd-laser are higher than those obtained in extracavity pumping schemes. An increase in the optical density of the crystal is limited by the lasing power reaching the level corresponding to the maximum ray strength of the material.

A88-33985 Current trends in the development of laser glasses (Tendentsii razvitiia sovremennykh lazernykh stekol) S. G. LUNTER, V. M. MIT'KIN, M. N. TOLSTOI, and IU. K. FEDOROV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 52, Feb. 1988, pp. 266-272. 24 Refs.

The principal requirements for glasses suitable for use in solid state lasers are briefly discussed, and some current trends in the development of thermally stable laser-grade phosphate glasses based on I-III elements are reviewed. In particular, attention is given to the optimization of glass composition with respect to structural strength and low brittleness; development of new methods for machining and protecting the side surfaces of active elements; development of new glasses with low concentration

quenching, such as a lithium-neodymium-lanthanum-phosphate glass; new neodymium glasses with high chemical stability and low crystallizability; and methods for the dehydration of erbium phosphate glasses.

A88-30047 Efficient generation of the second harmonic of a nanosecond radiation pulse from a CO2 laser (Effektivnaia generatsiia vtoroi garmoniki nanosekundnogo impul'sa izlucheniia CO2-lazera) IU. M. ANDREEV, V. IU. BARANOV, V. G. VOEVODIN, P. P. GEIKO, A. I. GRIBENIUKOV et al., *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, Nov. 1987, pp. 2252-2254. 7 Refs.

Efficient (49 + or - 5 percent) second-harmonic generation was demonstrated for a nanosecond CO2-laser pulse in the IR range. The frequency of a CO2 laser with a pulse duration of about 2 ns and an intensity up to 1 GW/sq cm was doubled in an unbleached ZnGeP2 crystal. The internal efficiency was about 80 percent.

A88-29932 Effect of ion irradiation on the properties of high-temperature oxide superconductors (Vliianie ionnogo obliucheniia na svoistva oksidnykh vysokotemperaturnykh sverkhprovodnikov) S. V. ANTONENKO, I. IU. BEZOTOSNYI, A. I. GRIGOR'EV, N. N. DEGTIARENKO, V. V. EVSTIGNEEV et al., *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 46, Nov. 10, 1987, pp. 362-364.

Laser-sprayed films of YBa2Cu3O(7-y) were irradiated with He(2+) ions with an energy of 6.7 MeV. It is shown that the irradiation produces a change in the superconducting and structural characteristics of the films, leading to a degradation in the transition temperature of the superconductors. These films are much more sensitive to irradiation than Nb3Sn films.

A88-23129 Periodic structures in crystals grown in ultrasonic field V. S. ARAKELIAN, A. G. AVETISIAN, and KH. G. NALBANDIAN, *Journal of Crystal Growth* (ISSN 0022-0248), Vol. 85, no. 3, Nov. 1987, pp. 357-362. 12 Refs.

A theoretical and experimental study has demonstrated that growth in the field of standing ultrasonic waves (USWs) permits crystals to be obtained with regularly modulated properties due to periodic distribution of dopant. In melt-grown crystals the modulation is found to be caused by the thermal effect of the USWs, while in solution-grown crystals the effect is primarily related to the USW pressure. The experimental studies show that a light diffraction efficiency of 20-40 percent and a spatial regularity of modulation of 0.001 are easily obtainable.

A88-43080 Semiconductor injection lasers in optical data processing (Poluprovodnikovye inzhektsionnye lazery v opticheskoi obrabotke informatsii) A. I. ZOLOTAREV, S. P. KALASHNIKOV, V. A. KONDRAT'EV, and V. N. MOROZOV, *Injection lasers in data transmission and processing systems* (A88-43076 17-36). Moscow, Izdatel'stvo Nauka, 1987, pp. 90-163. 98 Refs.

The paper is concerned with the effect of the coherence of injection laser emission on the recording and retrieval of information from Fourier holograms, correlation processing of optical signals in matched optical filtering schemes, and interaction with acoustic waves in crystals. Optimal relationships are established between the parameters of injection lasers, optical data recording-retrieval schemes, and Fourier hologram capacity. Test data are presented for new infrachromatic photographic materials for holographic data recording in the emission band 800-900 nm. The characteristics of the diffraction of partially coherent IR emission by ordinary acoustic waves in lead molybdate and paratellurite crystals are examined. Optimal relationships are determined for the design of ultrasonic cells for injection laser control.

A88-19406 Measuring the picosecond pulse chirp of a neodymium-phosphate glass laser by nonlinear dynamic spectroscopy (Izmerenie chirpa pikosekundnykh impul'sov lazera na fosfatnom stekle s neodimom metodom nelineinoi dinamicheskoi spektroskopii) G. G. GURZADIAN, R. N. GIUZALIAN, and I. S. ZAKHARKIN, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, Aug. 1987, pp. 1660-1663. 12 Refs.

The picosecond pulse chirp of a 1.054-micron neodymium-phosphate glass laser has been measured by using a nonlinear dynamic spectrograph with a temporal resolution of 0.1 ns and a spectral resolution of 0.02 nm. Temporal scanning in the nonlinear crystal LiIO3 was carried out simultaneously with the conversion of the emission to the visible, where dynamic spectrograms were recorded. The chirp amplitude is found to increase toward the end of a pulse train up to 1.5 nm/ps.

A88-19403 An efficient pulse-pumped single-mode laser (Effektivnyi odnomodovyi lazer s impul'snoi nakachkoi) O. O. SILICHEV and E. I. KRAEV, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, Aug. 1987, pp. 1653-1655. 6 Refs.

Algorithms are proposed for calculating stable cavity schemes for pulsed single-mode lasers to achieve a high active element fill factor and stability of the laser output parameters with respect to fluctuations of the thermooptical distortions of the active element. Results of an experimental verification of such schemes are presented.

A88-12176 Picosecond YAG:Nd laser with efficient conversion into second, third, and fourth harmonics (Pikosekundnyi IAG: Nd-lazer s effektivnym preobrazovaniem vo vtoruiu, tret'iu i chetvertuiu garmoniki) S. V. GARNOV, A. S. EPIFANOV, S. M. KLIMENTOV, and A. A. MANENKOV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Aug. 1987, pp. 1447-1449. 6 Refs.

The paper summarizes research aimed at the development of a picosecond YAG:Nd(3+) laser with a high output intensity and a high stability of the space-time and energy characteristics of the output-pulse parameters. This operation provides for high (of the order of 10 percent) coefficients of conversion into second, third, and fourth harmonics with preservation of spatial beam uniformity. It is shown that the main factors determining the high conversion efficiency and stability of the laser are the stability of the master oscillator, careful spatial filtering of the radiation, and optimization of the nonlinear-crystal lengths.

A88-12174 Features of the thermal and lasing regimes of solid-state lasers with optically dense active media (Osobennosti teplovykh i generatsionnykh rezhimov tverdotel'nykh lazerov na osnove opticheski plotnykh aktivnykh sred) A. A. DANILOV, M. IU. NIKOL'SKII, and I. A. SHCHERBAKOV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Aug. 1987, pp. 1431-1439. 16 Refs.

The thermal and lasing regimes of solid-state lasers with optically dense active media are investigated with reference to a typical example: the GSGG:Cr(3+), Nd(3+) laser. It is shown that mean lasing powers of several kW at a pump power of several dozen kW and an efficiency of 4-5 percent can be achieved for extremely small active-medium volumes on the basis of the concentration-dependent suppression of temperature gradients in conjunction with the use of waveguide active elements.

A88-12170 Modified polymers and prospects of using them in laser optics (Modifitsirovannye polimery i perspektivy ikh primeneniia v lazernoi optike) K. M. DIUMAEV, A. A. MANENKOV, A. P. MASLIUKOV, G. A. MATIUSHIN, V. S. NECHITAILO et al., *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Aug. 1987, pp. 1387-1398. 31 Refs.

The main aspects of the application of optical polymers as laser-optics elements are reviewed. It is shown that their stability with respect to laser radiation can be increased (by 10-100 times) to a level that compares well with the most stable crystals and glasses. It is also demonstrated that it is possible to increase the photostability of dyes implanted in polymer matrices (by 10 times) to their stability level in liquid solvents. Finally, the stability of transparent and dyed polymers to environmental effects can be increased substantially.

A88-12164 Solid-state lasers that are pumped by semiconductor light-emitters (Tverdotel'nye lazery s nakachkoi poluprovodnikovymi izluchateliami) I. I. KURATEV and IU. V. TSVETKOV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Aug. 1987, pp. 1332-1340. 22 Refs.

An investigation is made of the lasing characteristics of solid-state lasers pumped by semiconductor light-emitters, i.e., light-emitting diodes and laser diodes. Specifically, experimental results are presented on YAG:Nd(3+) lasers pumped by linear LED arrays and on neodymium microlasers pumped by laser diodes.

A88-12162 Spatial-temporal light modulators (Prostranstvenno-vremennye moduliatory sveta) A. A. VASIL'EV, I. N. KOMPANETS, and A. V. PARFENOV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Aug. 1987, pp. 1319-1326. 20 Refs.

The current status of optically controlled spatial-temporal light modulators (STLM) is reviewed, and functional properties and applications are discussed. Particular attention is given to the characteristics of various types of STLM image converters; the design of a hybrid STLM image intensifier with an electron-optic converter; a scheme involving YAG and dye lasers with an STLM inside the cavity; an adaptive-optic scheme for the real-time correction of phase distortions; and image-quality improvement using phase conjugation.

A88-10904 Formation of a regular surface relief in semiconductors under the effect of millisecond laser pulses (Formirovanie reguliarnogo rel'efa na poverkhnosti poluprovodnikov pod deistviem millisekundnykh lazernykh impul'sov) S. G. KIAK, A. IU. BONCHIK, V. V. GAFIICHUK, and A. G. IUZHANIN, *Ukrainskii Fizicheskii Zhurnal* (ISSN 0503-1265), Vol. 32, July 1987, pp. 1079-1083. 16 Refs.

Results of experimental and theoretical studies of the melting behavior of Si and CdSb irradiated by a pulsed neodymium laser operating in the free-running mode are examined. It is found that, under certain energy conditions, laser irradiation leads to the formation of regular structures on the surface of the semiconductors. The structure morphology is largely

determined by the crystallographic orientations of the irradiated surfaces and by two different physical mechanisms associated with the anisotropy of the thermophysical characteristics of the materials and the effect of capillary forces in the molten layer.

A88-10812 The application of 'skewed' elements to laser radiation frequency conversion (Primenenie "skoshennykh" elementov dlia preobrazovaniia chastoty lazernogo izlucheniia) V. I. BREDIKHIN, V. I. KATSMAN, S. P. KUZNETSOV, A. I. MAKAROV, and A. K. POTEMKIN, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, June 1987, pp. 1263-1265. 9 Refs.

It is shown that, in the case of laser radiation (oee-type phase-matching) frequency conversion, the use of 'skewed' elements with planes parallel to the natural growth face makes it possible to significantly increase the efficiency of crystal utilization without a loss in the conversion efficiency. The results of skewed element testing under neodymium laser SHG are presented. The tuning characteristics of frequency doubling and tripling elements are discussed.

A88-10807 The study of the spectral and energy characteristics of lasing in the green spectral region by lithium fluoride with radiation color centers (Issledovanie spektral'nykh i energeticheskikh kharakteristik generatsii izlucheniia v zelenoi oblasti spektra ftoridom litiia s radiatsionnymi tsentrami okraski) A. P. VOITOVICH, V. S. KALINOV, S. A. MIKHNOV, and S. I. OVSEICHUK, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, June 1987, pp. 1225-1229. 7 Refs.

The spectral and energy characteristics of lasers utilizing lithium fluoride with F2 and F3(+) color centers in transverse and longitudinal pumping schemes are studied. The feasibility of obtaining stable narrow-band radiation in the 510-570 nm range using a selective resonator is demonstrated. Consideration is given to the effect of lithium-fluoride crystal processing by excimer laser radiation at a wavelength of 308 nm on the spectroscopic and lasing characteristics of the F3(+) color center. After this processing, the laser efficiency in the green spectral region increases by more than a factor of two (reaching an efficiency of 14 percent).

A88-10806 Spectrally limited picosecond pulses from an actively mode-locked YSGG:Cr(3+), Er(3+) laser (lambda = 2.79 microns) (Spektral'no-ogranichennye pikosekundnye impul'sy lazera na ISGG:Cr3+,Er3+(xxxxxxxxxx)s aktivnoi sinkhronizatsiei mod) K. L. VODOP'IANOV, L. A. KULEVSKII, P. P. PASHININ, A. F. UMYSHKOV, and I. A. SHCHERBAKOV, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, June 1987, pp. 1219-1224. 10 Refs.

Active mode locking by synchronous electrooptical modulation of cavity losses is used to obtain ultrashort pulses at lambda = 2.79 microns in a laser utilizing chromium- and erbium-doped yttrium-scandium-gallium garnet crystal. The spectrally limited single laser pulses selected from the train were characterized by a discretely adjustable duration in the range of 40-220 ps. It is shown that continuous tuning of the laser radiation spectrum is possible within 1/cm near the gain line center. For a single spike energy of 4 m/J and tau = 40 ps, the laser radiation power amounted to 100 MW (TEM00 mode).

A88-10756 A Q-switched GSGG:Cr, Nd laser with an efficient pumping system (Lazer na GSGG: Cr, Nd s effektivnoi nakachkoi i moduliatsiei dobrotnosti) A. D. GONDRA, V. M. GRADOV, A. A. DANILOV, V. V. DYBKO, E. V. ZHARIKOV et al., *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, May 1987, pp. 916, 917.

The development of a highly efficient (3 percent) Q-switched laser utilizing chromium- and neodymium-activated GSGG crystals is discussed. The results are compared with those for a YAG:Nd(3+) laser.

A87-50862 Thermocapillary convection of melts and its role in laser-plasma synthesis and laser-induced amorphism (Termokapilliarnaia konvektsiia rasplava i ee rol' v protsessakh lazerno-plazmennogo sinteza i lazernoi amorfizatsii) A. A. UGLOV, I. IU. SMUROV, A. G. GUS'KOV, and S. A. SEMAKHIN, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, June 1987, pp. 1221-1224. 10 Refs.

The role of thermocapillary convection in mass transfer processes in melts is investigated analytically and experimentally using vacuum-arc melted Ni63-Ta37 and Cu50-Zr50 alloys. It is shown that thermocapillary convection not only leads to the transfer of alloying components to the deeper layers of the melt but also may produce, in certain cases, a significant temperature redistribution in the liquid phase. Convective transfer dominates over conduction when the product of Re and Pr is greater than 1. In the experiments, the structure of the amorphous and crystalline layers in the solidified alloys is found to be in qualitative agreement with the structure of a thermocapillary vortex.

A87-50860 Laser vapor phase deposition of semiconductors (Lazernoe osazhdenie poluprovodnikov iz gazovoi fazy) N. V. KARLOV, B. S. LUK'IANCHUK, E. V. SISAKIAN, and G. A. SHAFEEV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0357-6765), Vol. 51, June 1987, pp. 1211-1215. 5 Refs.

The pyrolytic effect of IR laser radiation is investigated with reference to the initiation and control of the vapor phase deposition of semiconductor films. By selecting the gas mixture composition and laser emission parameters, it is possible to control the deposition and crystal formation processes on the surface of semiconductors, with the main control action achieved due to the nonadiabatic kinetics of reactions in the gas phase and high temperatures in the laser heating zone. This control mechanism is demonstrated experimentally during the laser vapor deposition of germanium and silicon films from tetrachlorides on single-crystal Si and Ge substrates.

A87-50859 Large-scale vortex-structure melt segregation during rapid cooling (Krupnomasshtabnoe vikhrevoe strukturnoe rassloenie rasplava pri bystrom okhlazhdenii) A. A. UGLOV, S. V. SELISHCHEV, and S. A. SEMAKHIN, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, June 1987, pp. 1199-1202. 7 Refs.

With reference to experimental results obtained for annealed specimens of Ni60-Nb40, it is shown that laser irradiation of metals may lead to the simultaneous motion of the melt and the solid, with a cyclic transition from the liquid state to the solid and vice versa. The simultaneous motion of the melt and the solid, when accompanied by melt alloying, may give rise to the large-scale (vortex) segregation of the concentration field of the corresponding chemical quantities.

A87-50858 Generation and annealing of nonequilibrium defects under conditions of laser irradiation (Generatsiia i otzhig neravnovesnykh defektov pod deistviem lazernogo izlucheniia) V. A. BOBYREV, V. I. BOIKO, F. V. BUNKIN, B. S. LUK'IANCHUK, and E. R. TSAREV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, June 1987, pp. 1180-1192. 48 Refs.

Some problems associated with the laser generation of nonequlibrium surface defects in solids are examined. In particular, attention is given to the generation and annealing of nonequilibrium vacancies during the laser heating of metals, formation and annealing of microscopic vacancy pores, and the effect of nonequilibrium vacancies on the rate of diffusion processes, including acceleration of heterogeneous reactions and accelerated degradation of reflective coatings on metal optics due to repetitively pulsed laser heating. Attention is also given to nonequilibrium processes occurring during the laser synthesis of thin films.

A87-49122 A long-wavelength IR laser utilizing hot holes in germanium (Dlinnovolnovyi IK lazer na goriachikh dyrkakh v germanii) A. A. ANDRONOV, IU. V. MITIAGIN, A. V. MURAV'EV, V. N. MURZIN, IU. N NOZDRIN et al., *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, April 1987, pp. 702-704. 10 Refs.

The spectral composition of radiation from long-wavelength IR lasers utilizing p-Ge is studied. The alteration of the lasing spectrum is studied for a large interval of magnetic and electric field intensities. A single-frequency lasing regime is implemented. The feasibility of developing single-frequency p-Ge lasers in the 70-120 micron range which can be used efficiently in high-resolution long-wavelength IR spectroscopy is demonstrated.

A87-46064 Effect of laser diffusion heat treatments on the structure and properties of titanium and its alloys (Vliianie lazernoi khimikotermicheskoi obrabotki na stroenie i svoistva titana i ego splavov) IU. M. LAKHTIN, IA. D. KOGAN, D. P. SHASHKOV, L. A. TEPLOVA, and N. S. IUDINA, *Akademiia Nauk SSSR, Izvestiia, Metally* (ISSN 0568-5303), May-June 1987, pp. 161-166. 8 Refs.

The characteristics of the formation of a hardened layer on titanium alloys during laser diffusion heat treatments are investigated experimentally using samples of commercial titanium VT1-0, pseudo-alpha alloys AT-3 and AT-6, and an alpha-beta alloy, VT-22. It is shown that a maximum increase in the hardness of alpha and alpha-beta titanium alloys, without a substantial loss of ductility, is produced by laser carbosiliconizing and carboboriding. These treatments also increase the high-temperature (500 C) strength of titanium and its alloys, which is explained by the formation of a complexly alloyed alpha-prime solid solution strengthened by borides or silicides.

A87-43548 The evolution of the periodic structure on the surface of a semiconductor under laser irradiation (Evoliutsiia periodicheskoi struktury na poverkhnosti poluprovodnika pri lazernom vozdeistvii) V. V. KAPAEV, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, March 1987, pp. 536-545. 16 Refs.

The evolution of the shape of the corrugation which forms on the surface of germanium and silicon under laser irradiation is studied theoretically. With an increase in the energy and number of laser pulses, the periodic structure (PS) spectrum broadens while the period for which the corrugation depth is at a maximum shifts with respect to the value corresponding to the resonance of the surface plasmon. It is concluded that electrodynamic nonlinearity plays a decisive role in PS formation.

A87-43540 An SBS mirror with a plasma shutter in a double-pass laser amplifier (VRMB-zerkalo s plazmennym zatvorom v dvukhprokhodovom lazernom usilitele) S. IU. NATAROV, P. P. PASHININ, E. I. SHKLOVSKII, and I. A. SHCHERBAKOV, *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, March 1987, pp. 477-480. 11 Refs.

A gadolinium scandium gallium garnet: Cr (3+), Nd (3+) laser with an SBS mirror and plasma shutter is studied. The use of these lasers permits control of the radiation duration in a wide range. In the regime of SBS-compression of light pulses in CCl4, a Stokes pulse duration of about 5 ns is obtained which is close to the theoretical limit.

A87-43532 Mode-locking in a neodymium laser with a shutter made of gadolinium-scandium-gallium garnet (Sinkhronizatsiia mod neodimovogo lazera s zatvorom iz gadolinii-skandii-gallievogo granata) M. I. DEMCHUK, E. V. ZHARIKOV, A. M. ZABAZNOV, I. A. MANICHEV, V. P. MIKHAILOV et al., *Kvantovaia Elektronika* (ISSN 0368-7147), Vol. 14, Feb. 1987, pp. 423, 424. 11 Refs.

The mode-locking regime of a neodymium laser using shutters made of GSGG crystals is studied. With a GSGG transmission coefficient of 20 percent and a crystal length of 1 cm, ultrashort pulses with a minimum duration of 80 ns and an energy of 0.5 mJ are generated. It is shown that GSGG crystals can be used successfully as passive shutters for mode-locking in the NIR range (lambda = 1.06 microns). The advantages of these shutters over those utilizing polymethine dyes are discussed.

A87-43483 Comparision of bulk and surface optical-breakdown thresholds in NaCl crystals (Sopostavlenie porogov opticheskogo proboia v ob'eme i na poverkhnosti kristallov khloristogo natriia) V. N. SMIRNOV, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 57, March 1987, pp. 523-530. 22 Refs.

The paper examines formation thresholds of bulk and surface microscopic and macroscopic damage in NaCl specimens under the effect of CO2-laser pulses. At diameters of the irradiated region of less than 1 mm, the bulk microdamage threshold is lower than the surface threshold. It is concluded that near-surface plasma is produced by superthreshold heating of absorbing irregularities of the surface layer of the specimen due to crystal-growth and surface-finishing processes.

A87-35940 Phase conjugation during vector self-diffraction by polarization holograms (Obrashchenie volnogo fronta pri vektornoi samodifraktsii na poliarizatsionnykh gologrammakh) A. A. BORSHCH, N. V. KUKHTAREV, and V. N. SEMIOSHKO, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Feb. 1987, pp. 307-310.

Theoretical and experimental results are presented on vector self-diffraction (VSD) under conditions of anisotropic linear absorption in semiconductors. Vector holograms were recorded in CdS crystals using second-harmonic radiation from a neodymium-phosphate glass laser at a wavelength of 0.526 micron. The holograms thus recorded made it possible to realize phase conjugation with a 90-deg rotation of the polarization plane under VSD. Phase doubling in a diffracted non-Bragg beam was also obtained.

A87-35928 Moisture measurement with a lidar based on a parametric light generator (Izmerenie vlazhnosti PGS-lidarom) A. P. KUBYSHKIN, V. I. KUZNETSOV, A. V. MIGULIN, I. N. ROI, and A. I. KHOLODNYKH, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Feb. 1987, pp. 219-223. 5 Refs.

The paper describes the design and operation of a parametric-light-generator lidar intended to measure atmospheric water-vapor content. An experimental lidar of this type has been constructed which makes wide-band moisture measurements using the differential absorption technique at a wavelength of 0.93 micron with a spatial resolution of 7.5 m. The possibility of wavelength tuning over a wide spectral region (0.65-3.5 microns), encompassing the vibrational transitions of many atmospheric gases, may make this lidar suitable for determining the concentrations of other atmospheric constituents. A block diagram of the lidar is presented.

A87-43483 Comparision of bulk and surface optical-breakdown thresholds in NaCl crystals (Sopostavlenie porogov opticheskogo proboia v ob'eme i na poverkhnosti kristallov khloristogo natriia) V. N. SMIRNOV, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 57, March 1987, pp. 523-530. 22 Refs.

The paper examines formation thresholds of bulk and surface microscopic and macroscopic damage in NaCl specimens under the effect of CO2-laser pulses. At diameters of the irradiated region of less than 1 mm, the bulk microdamage threshold is lower than the surface threshold. It is concluded that near-surface plasma is produced by superthreshold heating of absorbing irregularities of the surface layer of the specimen due to crystal-growth and surface-finishing processes.

A87-35940 Phase conjugation during vector self-diffraction by polarization holograms (Obrashchenie volnogo fronta pri vektornoi samodifraktsii na poliarizatsionnykh gologrammakh) A. A. BORSHCH, N. V. KUKHTAREV, and V. N. SEMIOSHKO, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Feb. 1987, pp. 307-310.

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Japanese Aerospace Literature This month: *Laser Optics*

A88-41321 Degenerate photon echoes - Simultaneous storage of multiple optical data. M. MITSUNAGA, M. K. KIM, and R. KACHRU, *Optics Letters* (ISSN 0146-9592), Vol. 13, June 1988, pp. 536-538. 13 Refs.

It is shown that simultaneous and spatially overlapping multiple photon echoes can occur following application of a single optical pulse followed by multiple pairs of couterpropagating pulses in various directions (degenerate photon echoes). This scheme has been experimentally verified in Pr(3+):LaF3 for the doubly degenerate case. In the small-pulse-area regime, the two echoes are observed to be independent with no cross talk between them. From the viewpoint of transient optical memory, this makes it possible to store multiple independent optical data in one sample spot and to retrieve any one of them, thereby multiplying the memory capacity of the crystal.

A88-40652 Chaos in a directly modulated semiconductor laser. YOSHIKAZU HORI, HIROYUKI SERIZAWA, and HISANAO SATO, *Optical Society of America Journal, B: Optical Physics* (ISSN 0740-3224), Vol. 5, May 1988, pp. 1128-1133. 9 Refs.

The fundamental possibility of chaos generation in directly modulated semiconductor lasers is studied on the basis of the rate equation with the form of a driven nonlinear oscillator. The origin of chaos generation and the effect of the spontaneous emission factor, which affects the nonlinearity of the dumping force and the restoring force in the rate equation, have been clarified.

A88-40645 Laser instability and chaotic pulsation in a CO2 laser with intracavity saturable absorber. MAKI TACHIKAWA, KAZUHITO TANII, and TADAO SHIMIZU, *Optical Society of America Journal, B: Optical Physics* (ISSN 0740-3224), Vol. 5, May 1988, pp. 1077-1082. 27 Refs.

A CO2 laser with a gaseous saturable absorber shows a variety of periodic self-pulsation, passive Q switching (PQS), depending on the lasing conditions and the characteristics of the absorbing molecules. A novel rate-equation model is presented, that comprehensively describes the transient pulse structures of PQS in the CO2 laser system. The numerical calculation based on the present model predicts that a chaotic PQS pulsation also is realized in a limited parameter region.