

Soviet and Japanese Aerospace Literature

Throughout 1991 the *AIAA Journal* will carry selected abstracts on leading research topics from the Soviet aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Pulsed Lasers from the USSR and Japan.

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Soviet Aerospace Literature This month: Pulsed Lasers

A90-50873 Bifurcations and chaos in a repetitively pumped CO₂ laser (Bifurkatsii i khaos v CO₂-lazere s periodicheskoi nakachkoi). A. F. GLOVA, S. N. KOZLOV, V. V. LIKHANSKII, and V. P. IARTSEV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, July 1990, pp. 894-896. 12 Refs.

Conditions for the appearance of chaotic pulsations in the output intensity of the radiation from a CO₂ laser with strong (100 percent) periodic pump modulation are investigated both experimentally and theoretically. Numerical simulation results on dynamic lasing regimes are shown to agree well with experimental data.

A90-45107 Periodically pulsed excimer laser with a two-circuit excitation scheme (Impul'sno-periodicheskii eksimernyi lazer s dvukhkonturnoi skhemoi возбуждения). V. V. ATEZHEV, V. S. BUKREEV, S. K. VARTAPETOV, and A. N. ZHUKOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 16, Jan. 26, 1990, pp. 1-4.

A thyatron-based two-circuit scheme for the excitation of a periodically pulsed excimer laser is described. It is shown that this scheme can be used not only to improve the pumping energy but also to optimize the weight and size parameters of the laser or to achieve high repetition frequencies.

A90-34629 Picosecond optoelectronics (Pikosekundnaia optoelektronika). P. P. VASIL'EV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, March 1990, pp. 268-287. 168 Refs.

The general principles of picosecond optoelectronics and recent developments in this field are reviewed. Particular attention is given to methods of ultrashort pulse generation by injection lasers. Results of experimental studies of picosecond photoconductors, used as electromagnetic oscillators (Hertz dipoles), and studies of the Vavilov Cerenkov electro-optic effect are reported. Some applications of picosecond optoelectronics in physical studies, metrology, and superfast data processing are discussed.

A90-14530 Investigation of a pulsed oxygen-iodine chemical laser (Issledovanie impul'snogo khimicheskogo kislorodno-iodnogo lazera). N. F. BALAN, R. M. GIZATULLIN, A. V. DUBROVSKII, V. A. KATULIN, A. I. KUROV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Aug. 1989, pp. 1587-1592. 12 Refs.

A pulsed chemical oxygen-iodine laser with a cooled trap is studied experimentally. A specific output energy of 2.2 J/liter was achieved with the use of CH₃I as the donor of atomic iodine. Using C₃F₇I as the donor, laser action was obtained at oxygen pressures up to 11 mm Hg.

A90-50868 Numerical simulation of fine-scale self-defocusing of radiation in pulsed CO₂ amplifiers (Chislennoe modelirovanie melkomasshtabnogo samovozdeistviia izlucheniia v impul'snykh CO₂-usiliteliakh). S. V. FEDOROV and M. S. IUR'EV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, July 1990, pp. 881-883. 11 Refs.

It is shown that fine-scale distortions of the beam profile can arise in the case of the propagation of a laser beam with an initial smooth intensity profile through a pulsed CO₂ amplifier because of thermal self-defocusing. The transverse scale of these perturbations is of the order of several millimeters. Phase modulation of the input beam facilitates the development of the beam instability. In the region of developed self-defocusing, the effect drastically alters the beam structure, i.e., it breaks the beam into filaments.

A90-45127 A microsecond-range neodymium-glass laser with a controllable monopulse duration (Lazer mikrosekundnogo diapazona na neodimovom stekle s upravliaemoi dlitel'nost'iu monoimpul'sa). B. V. ANIKEEV and V. V. KRUTIAKOV, *Ukrainskii Fizicheskii Zhurnal* (ISSN 0503-1265), Vol. 35, Feb. 1990, pp. 209-213. 7 Refs.

The paper proposes an improved method for obtaining external feedback in an Nd(3+) - glass laser without constraints on frequency and angle spectra. The effect of the Q-switched-front duration on the laser kinetics is investigated, and the conditions for the breakdown of the pulse-generation mode of the laser are determined. The generation of a monopulse mode whose duration could be controlled electro-optically over a wide range is demonstrated.

A90-44984 A comparison of YAlO₃:Nd(3+) and YAG:Nd(3+) as active media for a compact repetitively pulsed laser with an SBS mirror (Sravnenie YAlO₃:Nd(3+) i YAG:Nd(3+) kak aktivnykh sred dlia kompaktного impul'sno-periodicheskogo lazera s VRMB-zerkalom). P. P. PASHININ, V. S. SIDORIN, and E. I. SHKLOVSKII, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, May 1990, pp. 563-567. 9 Refs.

The relative efficiencies of two compact lasers with GeCl₄ SBS mirrors with self-starting laser concept were compared: one based on YAlO₃:Nd(3+) as an active medium and the other based on YAG:Nd(3+). It was found that the use of YAlO₃:Nd(3+) crystals resulted in a 1.5- to 2-fold increase in laser efficiency, as compared with the YAG:Nd(3+) laser. The pulse energy of the YAlO₃:Nd(3+) laser emitting in a single-mode regime at a pulse repetition rate up to 10 Hz amounted to about 75 mJ. A YAlO₃:Nd(3+) laser system with two SBS mirrors was designed, which emits a train of short (about 1.5 ns) pulses with an energy of 0.5 J.

A90-44983 Causes of the efficiency reduction of a pulsed CO₂ laser with nonself-maintained discharge under increased energy inputs (Prichiny snizheniya KPD impul'snogo CO₂-lazera s nesamostoitel'nym razriadom pri povyshennykh energovkladakh). V. I. BARANOV, R. K. BEVOV, R. SH. ISLAMOV, I. V. KOCHETOV, S. V. KHOMENKO, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, May 1990, pp. 558-560. 19 Refs.

The effects of the electric field intensity and specific pumping power on the energy characteristics of a pulsed atmospheric-pressure CO₂ electroionization laser were investigated theoretically and experimentally. A nonthermal mechanism for the reduction of lasing efficiency in connection with increasing energy input is found. This mechanism involves a non-Boltzmann population of the upper vibrational levels of nitrogen molecules.

A90-44975 Optical measurement of the surface temperature of metals under pulsed laser irradiation (Opticheskoe izmerenie temperatury poverkhnosti metallov pri impul'som lazernom obluchenii). A. A. UGLOV, A. N. ERMOLAEV, and V. I. ZAVIDEI, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, April 1990, pp. 519-522. 5 Refs.

High-speed optical pyrometry and spectrometry were used to investigate the surface temperature variations of various metals (Ti, Mo, Zr, Nb, W, and U10 steel) heated by pulsed laser radiation at 1.06 micron in a protective helium atmosphere in the power density range from 10,000 to 1-million W/sq cm. The auto-oscillation mechanism of the interaction between the radiation and the metal surface is shown to develop when temperatures close to the metal boiling point are attained.

A90-44969 Conversion of 9.3-9.6-micron pulsed laser radiation into the second harmonic in ZnGeP₂ crystals (Preobrazovnie impul'snogo lazernogo izlucheniia diapazona 9,3-9,6 mkm vo vtoruiu garmoniku v kristallakh ZnGeP₂). I. U. M. ANDREEV, A. N. BYKANOV, A. I. GRIBENIUKOV, V. V. ZUEV, V. D. KARYSHEV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, April 1990, pp. 476-480. 11 Refs.

A pulsed TEA CO₂ laser was used to investigate the effect of pump radiation parameters (mode structure, wavelength, and pulse duration), focusing conditions, absorption coefficient, and temperature on the efficiency of conversion into the second harmonic and on angular dependences of phase matching in ZnGeP₂ crystals. Good agreement between experimental and theoretical results is observed.

A90-44965 Amplification of high-intensity ultrashort IR pulses in reduced pressure TE CO₂ amplifiers (Ob usilenii UKI IK izlucheniia bol'shoi intensivnosti v TE CO₂-usiliteliakh ponizhennogo davleniia). V. D. TARANUKHIN, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, April 1990, pp. 454, 455. 6 Refs.

The paper presents a theoretical investigation of the amplification of high-intensity ultrashort pulses in TE CO₂ amplifiers. It is shown that, in the case of such amplification, the removal of the spatial degeneracy of rotational levels in a CO₂ molecule due to the optical Stark effects makes it possible to reduce the active-medium pressure of the amplifier to several atmospheres.

A90-43038 A study of the efficiency of the use of repetitively pulsed CO₂ lasers for fault detection in metals (Issledovanie effektivnosti primeneniia impul'sno-periodicheskikh CO₂-lazerov dlia defektoskopii metallov). N. P. BIRIUKOVA, V. E. CHABANOV, N. G. BOGORODSKII, V. M. SOKOLOV, V. A. KHAMCHISHKIN et al., *Defektoskopiia* (ISSN 0130-3082), No. 3, 1990, pp. 51-57. 5 Refs.

Results of an experimental study concerned with the possibility of using repetitively pulsed CO₂ lasers for the ultrasonic inspection of metals are reported. In particular, the characteristics of laser-generated ultrasound in metals are examined with particular reference to results obtained for steel, brass, and AlMg alloy. It is shown that the use of industrial CO₂ lasers for the nondestructive evaluation of metals is not practical.

A90-34637 Characteristics of multipass amplifiers (Kharakteristiki mnogoprokhodovykh usilitel'ei). I. V. EPATKO, P. P. PASHININ, and R. V. SEROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, March 1990, pp. 310-313. 6 Refs.

A method for calculating multipass amplifier systems is proposed which is based on certain properties of the Franz Nodvik equation. The condition for maximum-efficiency operation of the amplifier is determined. An analysis is made of the efficiency, backward wave amplification, and pulse shape distortion as a function of the principal amplifier parameters: weak-signal gain coefficient, mirror reflection coefficient, and number of passes. A comparison is made with traditional single-pass schemes.

A90-30346 The possibility of a large increase in the frequency of an ionizing laser pulse in a gas (O vozmozhnosti sil'nogo povysheniia chastoty ionizuiushchego lazernogo impul'sa v gase). V. B. GIL'DENBURG, A. V. KIM, and A. M. SERGEEV, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 51, Jan. 25, 1990, pp. 91-93. 9 Refs.

The effect of tunneling ionization in plasma is investigated analytically using a one-dimensional interaction model based on an electric field equation and an expression for the electron concentration growth rate. It is shown that the mechanism of the tunneling ionization of atoms by the field of an electromagnetic field can be used for the efficient control of a high-intensity laser radiation spectrum.

A90-44953 High-power repetitively pulsed Nd:glass solid-state lasers with an active element that has the shape of a plate (Moshchnyi impul'sno-periodicheskii tverdotel'nyi lazer na neodimovom stekle s aktivnym elementom plastinchatoi formy). M. A. BORIK, P. V. GORBUNOV, I. K. DANILEIKO, B. I. DENKER, A. D. IVANOV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, April 1990, pp. 398-403. 20 Refs.

A laser has been developed which uses high concentration phosphate KNFS glass with an active element in the form of a 9 x 15 x 0.42 cm plate. A mean output power of 180 W was achieved at pulse repetition rates of 5 and 10 Hz. The effects of illuminator parameters, plate thickness, and concentration of the activator in the glass on the maximum achievable laser output power are investigated on the basis of a modal description of pump-radiation absorption in the illuminator, taking into account the actual spectra of the pump-lamp radiation and absorption in the active element.

A90-43014 Coherent pulsations of a laser operating on an inhomogeneously broadened line (Kogerentnye pul'satsii generatsii lazera, rabotaiushchego na neodnorodno ushirennoi linii). K. V. VLADIMIRSKII and A. A. NORVAISHAS, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 310, No. 4, 1990, pp. 853-857. 8 Refs.

Coherent pulsations of a laser operating on an inhomogeneously broadened line are investigated theoretically. Differences between the discrete and continuous inhomogeneous-broadening models are shown to be decisive in solving the initial nonlinear equations. Numerical experiments show that solutions in the form of lasing bursts do not exist for the double-line model. Instead, stable two-frequency lasing occurs in the parameter range considered. Attention is given to such characteristics as field attenuation in the resonator between bursts, transition from the oscillatory solution to the exponential one, and change in the solution signs.

A90-34615 Control of the spectral composition of the emission of an atmospheric-pressure CO₂ laser with a pulse width of 40 microseconds (Upravlenie spektral'nym sostavom izlucheniia CO₂-lazera atmosfernogo davleniia s dlitel'nost'iu impul'sa 40 mks). L. N. VITSHAS, I. D. MATIUSHCHENKO, V. G. NAUMOV, V. D. PIS'MENNYI, L. V. SHACHKIN et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, Jan. 1990, pp. 60-62. 7 Refs.

Experiments are reported which demonstrate the feasibility of a high-power CO₂ laser generating 40-microsecond pulses at a single rotational line using a system of coupled selective and nonselective resonators. It is shown that, during operation at a single rotational line, the efficiency and divergence of the laser remain practically constant. The emission divergence is shown to be anisotropic in the presence of a high-velocity flow of the active medium.

A90-29166 The possibility of light-pulse compression under SBS in a plasma (O vozmozhnosti szhatiia impul'sa sveta pri VRMB v plazme). A. A. ANDREEV and A. N. SUTIAGIN, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Dec. 1989, pp. 2457-2461. 12 Refs.

The paper examines the possibility of the compression of a high-power light pulse under stimulated Brillouin scattering in a laser plasma in the regime of the amplification of a Stokes pulse from the thermal noise level, taking into account optical heating of the plasma. It is shown that the laser plasma can be a suitable medium for the substantial compression of high-power pulses of long-wavelength radiation from the subnanosecond range to durations of dozens of picoseconds and for the compression of pulses of short-wavelength radiation from dozens of picoseconds to the subpicosecond range.

A90-19266 Compensation for induced birefringence in the active elements of repetitively pulsed amplifiers (Kompensatsiia navedennogo dvulucheprelomleniia v aktivnykh elementakh usilitel'ei impul'sno-periodicheskogo deistviia). R. A. GANEEV, V. V. GORBUSHIN, A. V. ZINOV'EV, D. B. KOKURIN, T. USMANOV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1816-1818.

The rotation of the polarization plane was used to compensate for thermally induced birefringence in the active elements (neodymium glass, YAG) of repetitively pulsed amplifiers. It is shown that the use of a polarization plane rotator between the amplifier modules makes it possible to reduce the depolarization of the probing emission from 30 to 2 percent, with the three-dimensional distribution of the intensity of linearly polarized emission passing through the system amplifier-rotator-amplifier remaining unchanged.

A90-19261 Some emission characteristics of a pulsed TEA CO₂ laser with liquid crystal modulator (Nekotorye kharakteristiki izlucheniia impul'snogo TEA CO₂-lazera s ZhK modulatorom). T. N. BELIMENKO, V. V. DANILOV, O. B. DANILOV, D. A. SAVEL'EV, and A. I. SIDOROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1786-1790. 8 Refs.

Spatial-temporal modulation of the emission of a pulsed TEA CO₂ laser has been achieved using an intracavity spatial-temporal light modulator based on a liquid crystal. Lasing with a pulse width of 100 ns and an energy of 0.8 mJ was obtained for a single modulator element, with a spatial resolution of 4/mm over an angle of 7 degrees. The possibility of controlling the amplitude and temporal position of a lasing pulse by means of a liquid crystal modulator is demonstrated. The characteristics of lasing in the presence of an intracavity liquid crystal modulator are discussed.

A90-34633 A pulsed dye laser with an intracavity nonlinear mirror based on a photorefractive crystal (Impul'snyi lazer na krasitele s vnutrerezonatornym nelineinym zerkalom na fotorefraktivnom kristalle). S. F. LIUKSIUTOV and O. I. IUSHCHUK, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, March 1990, pp. 297-299. 9 Refs.

An experimental implementation of a pulsed dye laser with an intracavity self-recording nonlinear mirror based on a photorefractive crystal is reported. The possibility of using a nonlinear mirror as a spectral selector is demonstrated. An equalization of spectral component intensities in the system pulsed dye laser-photorefractive crystal was observed under conditions of multiple-frequency generation.

A90-34632 A repetitively pulsed phase-conjugation YAG laser system (Impul'sno-periodicheskaya lazernaya sistema s OVf na IAG). I. I. ANIKEEV, A. A. GORDEEV, I. G. ZUBAREV, A. B. MIRONOV, and S. I. MIKHAILOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, March 1990, pp. 295-297.

A repetitively pulsed phase-conjugation YAG laser system with an output energy of 0.8 J has been developed which employs passive polarization decoupling. High energy characteristics are obtained by using a ring laser as a master oscillator, which makes it possible to avoid the need for a Faraday rotator, typically used in similar circuits. The general design and performance characteristics of the system are discussed.

A90-29159 An optically pumped UV Br₂ laser (UF Br₂-lazer s opticheskoi nakachkoi). A. S. KAMRUKOV, N. P. KOZLOV, I. U. S. PROTASOV, and E. I. USHMAROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Dec. 1989, pp. 2415-2419. 9 Refs.

Laser action is reported in molecular bromine under optical pumping. The excitation source was thermal VUV radiation from plasmadynamic discharges of magnetoplasma compressors formed directly in the laser active medium. In a Br₂:Ar = 1:450 working mixture under a pressure of 4 atm, an output energy of 1.1 J has been obtained in a laser pulse 5 microsec in duration.

A90-29156 Concentrated neodymium phosphate glasses in small repetitively pulsed amplifiers (Konsentrirovannyye neodimovyye fosfatnye stekla v malogabaritnykh impul'sno-periodicheskikh usiliteliakh). B. I. GALAGAN, B. I. DENKER, P. V. GORBUNOV, V. V. OSIKO, and E. I. SHKLOVSKII, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Dec. 1989, pp. 2400-2404. 10 Refs.

The operation of a round-trip repetitively pulsed Nd amplifier with an SBS mirror is analyzed. An average radiation power of 0.5 W can be achieved for an amplifier with a cylindrical active element made of CNPG-type glass without depolarization. An output energy of 0.4 J has been obtained experimentally at a pulse repetition rate up to 1 Hz with beam divergence close to the diffraction limit.

A90-22869 Possibility of creating repetitively pulsed copper vapor lasers with a mean lasing power greater than 1 W/cm and an effective efficiency of about 8 percent (O vozmozhnosti sozdaniia impul'sno-periodicheskikh lazerov na parakh medi s udel'noi srednei moshchnost'iu generatsii bolee 1 Vt/sm to the 3rd i prakticheskimi KPD na urovne 8 percent). I. I. KLIMOVSKII, *Teplofizika Vysokikh Temperatur* (ISSN 0040-3644), Vol. 27, Nov.-Dec. 1989, pp. 1190-1198. 10 Refs.

The operating conditions of repetitively pulsed copper vapor lasers are determined for which the effect of the discharge circuit inductance on the effective efficiency is only slight. With allowance for data obtained in an earlier study, the optimal parameters of repetitively pulsed copper vapor lasers are determined which provide a mean lasing power of about 20 W/m and an effective efficiency of 8 percent. The optimal parameters are: gas discharge tube diameter, 2 mm; pulse repetition rate, 75-100 kHz; neon gas pressure, 11 mm Hg; and electric field intensity, 30 V/cm.

A90-19277 Nonstationary theory of hyper-Raman scattering in gases (Nestatsionarnaya teoriia giperkombiniatsionnogo rasseianiia v gazakh). I. U. P. MALAKIAN, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1870-1877. 11 Refs.

A nonstationary theory is proposed to describe hyper-Raman scattering and four-wave parametric processes in a gas medium in an ultrashort-pulse pumping field. The intensity and spectrum of the IR and UV emission generated by these processes are investigated with allowance for the nonstationary pumping characteristics, such as phase modulation and pulse shape. It is shown that the initial pump field nonlinearity and parametric processes lead to new effects, which are not observed in the case of nonstationary stimulated Raman scattering.

A90-19263 Effect of mercury and bromine additives on the characteristics of an electric-discharge HgBr laser (Vliianie dobavok rtuti i broma na kharakteristiki elektrorazriadnogo HgBr-lazera). E. A. PETRUKHIN and A. S. PODSOSONNYI, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1793-1798. 16 Refs.

Results of experiments conducted with an electric discharge HgBr laser, with mercury and bromine vapors added to the laser gas mixture, are reported. With a bromine concentration of about 10¹⁶/cu cm, a 50-percent decrease in the lasing pulse energy was observed. The addition of mercury to the active medium to a concentration of 5 x 10 to the 16th/cu cm did not lead to a decrease in the lasing pulse energy. The possibility of using mercury vapors for extending the life of repetitively pulsed HgBr lasers is discussed.

A90-22828 Amplification of microsecond laser pulses with a broad spectrum ($\Delta\lambda = \text{about } 4 \text{ nm}$) in neodymium-doped silicate and phosphate glasses (Usileniia lazernykh impul'sov mikrosekundnoi dlitel'nosti s shirokim spektrom $\Delta\lambda = \text{about } 4 \text{ nm}$ v neodimovykh silikatnykh i fosfatnykh steklakh). E. V. ESHMEMET'EVA, V. I. KOROLEV, E. P. MESNIANKIN, L. G. POPOVA, and V. A. SEREBRIAKOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Oct. 1989, pp. 2012-2019. 24 Refs.

An equation for the amplified radiation energy density is derived, taking into account the complex structure and inhomogeneous broadening of the laser transition line in Nd glass. Correct calculation of amplifiers with this equation requires knowledge of the effective cross section of induced transitions averaged over the pulse duration which is a function of the amplified radiation energy density. By releasing the inversion with a 1-ms high-power radiation pulse ($\Delta\lambda = 4 \text{ nm}$), the effective cross section of the induced transitions is measured for three glasses at several levels of the active medium excitation. The results show that the cross section depends on the level of the active element excitation.

A90-19274 Generation of tunable giant pulses in Al₂O₃:Ti lasers (Generatsiia perestraivayemykh gigantskikh impul'sov v Al₂O₃:Tilazerakh). V. P. DANILOV, T. M. MURINA, E. G. NOVIKOV, and A. M. PROKHOROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1853, 1854. 6 Refs.

A study is made of the electro-optic modulation of the resonator Q factor in an Al₂O₃:Ti laser. It is shown that the wavelength of the giant pulse emission of the laser can be continuously varied in the 760-820 nm region using a single electro-optic shutter. The energy of the giant pulse was 10-30 mJ for a pulse width of 50-70 ns.

A90-17192 Full modulation of the sensitivity of a pulsed CO₂ laser with a self-filtering unstable resonator (Polnaia modulatsiia intensivnosti impul'snogo CO₂ lazera s samofil'truishchim neustoiichivym rezonatorom). I. K. BABAEV, S. V. BARDAKOVSKII, N. A. BLINOV, I. U. P. GORBACHEV, V. M. KRASOVSKII et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 14-18.

The lasing characteristics of an electro-ionization atmospheric pressure CO₂ laser with a self-filtering unstable resonator were investigated experimentally under conditions of developed self-induced thermal lensing effects. The dynamics of lasing is discussed in relation to the mirror geometry. The results obtained indicate the possibility of a noticeable effect of nonlinear diffraction on the angular emission characteristics of the self-filtering unstable resonator.

A90-15577 Fluctuations of pulsed laser radiation in the case of thermal self-defocusing under conditions of atmospheric turbulence (Fluktuatsii impul'snogo lazernogo izlucheniia pri teplovom samovozdeistvii v turbulentnoi atmosfere). V. V. VOROB'EV, T. G. KRASIL'NIKOVA, and N. S. TIKHONOVA, *Radiofizika* (ISSN 0021-3462), Vol. 32, Sept. 1989, pp. 1063-1071. 8 Refs.

The spectra and structure functions of log amplitude and phase fluctuations of laser radiation under thermal blooming are calculated on the basis of a smooth perturbation method. The spectrum dynamics is investigated in a wide range of spatial frequencies. The applicability of geometrical-optics and diffraction asymptotics to the calculation of the fluctuations is studied.

A90-14538 Parametric amplification of ultrashort pulses of the 10-micron wavelength region under two-photon absorption of the pump (Parametricheskoe usilenie UKI desiatimikronnogo diapazona pri dvukhfotonnom pogloshchenii nakachki). I. M. BAIANOV, Z. A. BIGLOV, V. I. A. GAIVORONSKII, and V. M. GORDIENKO, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Aug. 1989, pp. 1629-1632. 11 Refs.

Picosecond pulse generation is studied numerically in the 10-micron region under the parametric amplification of injected 10-micron radiation in the field of a high-power ultrashort pulse from an Nd laser in nonlinear proustite. The calculation takes into account two-photon pump pulse absorption and phase modulation of interacting pulses by an electron-density wave. These effects reduce the parametric amplification efficiency by two orders of magnitude (for a pump pulse intensity of 1.2 GW/sq cm) and lead to 'pulling out' of the signal pulse to the pump pulse leading edge and its shortening without substantial spectral broadening.

A90-12456 The optimization of the shape of mirrors in a multipass pulsed laser amplifier with an optically inhomogeneous active medium (Optimizatsiia formy zerkal mnogoprokhodnogo impul'snogo lazernogo usilitelia s opticheskii neodnorodnoi aktivnoi sredoi). I. B. KOVSH, M. V. PIATAKHIN, B. M. URIN, and V. G. SHEVCHENKO, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, June 1989, pp. 1287-1291. 5 Refs.

The possibility of compensating for the optical inhomogeneities developing in a laser active medium during pumping and stimulated emission by correcting the shape of the mirrors used is discussed. Specific calculations were carried out for multipass CO amplifiers with Cassegrainian optics. It is shown that slight variations in the curvature of Cassegrainian telescope mirrors make it possible to reduce the average beam divergence at the amplifier output by 5-6 times as compared with the case of strictly cylindrical (spherical) mirrors if the radiation pulse durations are comparable to the time of formation of pump-induced optical inhomogeneities in the active medium.

A90-14504 The spectral characteristics of the radiation from a pulsed single-frequency CO₂ laser (Spektral'nye kharakteristiki izlucheniia impul'snogo odnochastotnogo CO₂-lazera). B. F. KUNTSEVICH and V. V. CHURAKOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, July 1989, pp. 1320-1328. 28 Refs.

The paper presents an improved model for a pulsed single-frequency CO₂ laser which accounts for the effect of the 'vibrational' mechanism on radiation frequency sweeping. The model makes it possible to obtain qualitative agreement with experimental data. The calculations carried out with this model show that the spectral bandwidth of the pulse at the base level amounts to several dozen MHz when the pressure, input energy, and photon lifetime in the cavity vary within typical limits.

A90-14485 Excitation of ultrarelativistic Langmuir waves by an electromagnetic radiation pulse (Vozbuzhdenie ul'trarelativistskikh lengmuirvskikh voln impul'som elektromagnitnogo izlucheniia). S. V. BULANOV, V. I. KIRSANOV, and A. S. SAKHAROV, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Aug. 25, 1989, pp. 176-178. 6 Refs.

An analysis is made of the excitation of fast Langmuir waves in plasma by a relativistically strong electromagnetic pulse. It is shown that the excitation of plasma waves by a relativistically strong electromagnetic pulse is largely determined by the pulse front width. The characteristics of the excited wave are determined, and the pulse evolution is examined. The possibility of particle acceleration by the field of an excited longitudinal field is discussed.

A89-49366 The effective reflection of a pulse sequence from a four-wave mirror with thermal nonlinearity under parametric feedback (Effektivnoe otrazhenie serii impul'sov ot chetyrekhvolnovogo zerkala s teplovoi nelineinost'iu v rezhime parametricheskoi obratnoi svyazi). M. S. BARASHKOV, I. M. BEL'DIUGIN, M. V. ZOLOTAREV, I. I. KRUIZHILIN, M. I. KRYMSKII et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 792-795. 7 Refs.

A four-wave mirror with thermal nonlinearity has been experimentally realized with the interaction of counterpropagating waves under parametric feedback with a nonreciprocal element. The effective reflection of a sequence of pulses with duration of about 300 ns from a neodymium-glass laser with maximal reflection coefficients greater than 30 has been demonstrated. The quality of the radiation reflected from the mirror is studied. A significant reduction in the steady-state lasing threshold has been shown with thermal nonlinearity at small angles of the interacting beam convergence, compared to the case of counterpropagating convergence.

A89-49362 Efficient CO₂ laser SHG in a GaSe crystal (Effektivnaia GVG CO₂-lazera v kristalle GaSe). G. B. ABDULLAEV, K. R. AL-LAKHVERDIEV, M. E. KARASEV, V. I. KONOV, L. A. KULEVSKII et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 757-763. 17 Refs.

In GaSe single crystals, efficient second harmonic generation (SHG) of a CO₂ laser has been obtained with a pulse repetition rate up to 100 Hz. The phase-matching angles in GaSe have been measured at pumping wavelengths of 9.3, 9.6, 10.3, and 10.6 microns. Also, the threshold power density of the surface optical damage and of the formation of a plasma jet on the GaSe surface are measured. In a 0.65-cm thick GaSe sample, SHG efficiency up to 9 percent has been achieved. A comparison is made between GaSe and ZnGeP₂ as materials for CO₂ laser SHG.

A90-12444 The effect of self-defocusing on CO₂ laser frequency sweeping (Vlianie samovozdeistviia na svipirovaniye chastoty CO₂-lazera). V. I. BARANOV, T. K. KIRICHENKO, V. P. KOZOLUPENKO, V. V. LIKHANSKII, D. D. MALIUTA et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, June 1989, pp. 1167-1172. 14 Refs.

Radiation frequency variations during a CO₂ laser emission pulse are studied experimentally and theoretically. It is shown that the density distribution in the CO₂ medium, due to nonuniform heat release, differs from the results of calculations performed earlier on theoretical models. Good quantitative agreement is obtained between numerical and experimental dependences of the radiation frequency drift for various parameters of the active medium and resonator.

A90-11182 Repetitively pulsed Nd-glass slab lasers. B. I. DENKER, A. V. KIR'IANOV, A. A. MALIUTIN, I. KERTESZ, N. KROO et al., *IEEE Journal of Quantum Electronics* (ISSN 0018-9197), Vol. 25, Sept. 1989, pp. 1979, 1980. 6 Refs.

The possibility of obtaining high laser output energies at 1.32 micron using thin LiNdLa phosphate glass slabs with a high Nd(3+) concentration is discussed. Comparison data for 1.054 micron are also given. In the experiments, 3 x 14 x 125-mm slabs were prepared from LiNdLa phosphate glass with Nd concentration 1.2 x 10 to the 21st/cu cm. The uncoated slab facets were tested in a silver-coated quartz tube reflector pumped by 450-microsec flash-lamp pulses. The light passing through the slab returns to it after reflection from the tube surface. Most of the radiation falls on the wider side of the slab at large angles of incidence, thus maximizing its path inside the slab. The 150-mm laser resonator was formed by two flat mirrors. At 1.32 microns an output mirror of reflectivity $r = 95$ percent was used (with r less than 10 percent at 1.054 micron), while at 1.054 micron, $r(\text{output}) = 50$ percent was chosen. The pump-energy dependence of the output energy was measured.

A89-49344 A pulsed CO₂ laser with a self-pumping mirror using four-wave mixing in the laser active medium (Impul'snyi CO₂-lazer s samonakachivaiushchimsia zerkalom na chetyrekhvolnovom smeshenii v aktivnoi srede lazera). A. A. DENISOV, O. L. KULIKOV, and N. F. PILIPETSKII, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 658-662. 8 Refs.

A ring laser with parametric feedback due to four-wave mixing in the active medium of a pulsed CO₂ laser is studied. Dependences of lasing energy on the gain in the gas mixture CO₂:N₂ = 1:1 under pressures between 0.1 and 0.4 atm and on the pulse shape are presented. Output radiation power reached 1 MW. The correction of phase distortions inside the laser resonator was observed.

A89-49342 Tunable picosecond and femtosecond sources of quasi-CW laser radiation based on fiber-optic converters (Perestraivaemye piko- i femtosekundnye istochniki kvazinepreryvnogo lazernogo izlucheniia na baze volokonno-opticheskikh konvertorov). S. A. AKHMANOV, D. N. DOVCHENKO, N. I. ZHELUDEV, and A. V. SIMONOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 649-651. 5 Refs.

Results are presented on the development of a new family of completely solid-state frequency-tunable CW laser sources that emit in the picosecond and femtosecond bands. The laser sources are based on the principle of nonlinear frequency conversion and dispersive compression of the spectral continuum radiation.

Japanese Aerospace Literature This month: Pulsed Lasers

A89-46317 Picosecond VUV anti-Stokes Raman laser pumped by a KrF laser. AKIHIKOTAKAHASHI, MITSUO MAEDA, KATSUNORI MURAKAWA, and MASANORI AKAZAKI, *Japanese Journal of Applied Physics, Part 2* (ISSN 0021-4922), Vol. 28, Feb. 1989, pp. L 252-L 255. 8 Refs.

Generation of picosecond vacuum ultraviolet pulses by anti-Stokes stimulated Raman Scattering (ASRS) in hydrogen gas is reported. A tunable picosecond KrF excimer laser (30 ps FWHM, 12 mJ) is used as a pump source, and a series of anti-Stokes lines up to the 9th order (128.8 nm) is efficiently generated. The transient effects due to the finite decay time of the Raman medium are discussed for the present picosecond ASRS experiment.

A89-35781 Silent discharge excited TEM₀₀ 2.5 kW CO₂ laser. KOJI YASUI, MASAKI KUZUMOTO, MASAOKI TANAKA, SHIGENORI YAGI, and SHUJI OGAWA, *IEEE Journal of Quantum Electronics* (ISSN 0018-9197), Vol. 25, April 1989, pp. 836-840. 12 Refs.

The performance characteristics of the TEM₀₀ 2.5-kW silent-discharge-excited, transverse-flow CO₂ laser are presented. The silent-discharge excitation is advantageous for a high-quality beam pattern and for pulsed operation and sealed-off operation. Furthermore, the discharge power can be easily increased without limitation due to the instability of the discharge itself.

A90-51613 Numerical simulation of elongating the pulse duration of a TEA CO₂ laser. KOICHI SASAKI and TAKASHIGE TSUKISHIMA, *Japanese Journal of Applied Physics, Part 1* (ISSN 0021-4922), Vol. 29, Feb. 1990, pp. 277-283. Research supported by MOESC. 16 Refs.

The results of numerical simulations of elongating the pulse duration of a TEA CO₂ laser are reported. It is shown that neither relative increase of N₂ gas in the N₂:He:CO₂ gas mixture nor elongation of the pulse duration of the discharge current is very effective. A significant result is obtained with the pulse-injection locking method, when two conditions are satisfied: (1) the detuning angle is less than 0.1π, and (2) the initiation of discharge of the main laser is synchronized with the injected laser pulse within about 200 nsec.

A90-42320 All solid-state CW passively modelocked Ti:sapphire laser using a colored glass filter. NOBUHIKO SARUKURA, YUZO ISHIDA, TSUTOMU YANAGAWA, and HIDETOSHI NAKANO, *Applied Physics Letters* (ISSN 0003-6935), Vol. 57, July 16, 1990, pp. 229, 230. 8 Refs.

All solid-state CW passive mode locking of a Ti:sapphire laser is accomplished using a colored glass filter, instead of an organic dye, as a saturable absorber. The tuning range is remarkably wide (785-855 nm), and 2.7 ps pulses are obtained directly from the cavity.