

Soviet Aerospace Literature

This month: *Lasers*

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A86-39669 A high-power CO₂ laser pumped by a self-maintained volume discharge initiated by an electron beam (Moshchnyi CO₂-lazer s nachachukoi ob'emnym samostoitel'nym razriadom, initsiiiruemyym puchkom elektronov). V. V. APOLLONOV, I. G. KONONOV, A. M. PROKHOROV, K. N. FIRSOV, and V. A. IASHCHIKOV, (AN SSSR, Institut Obshchei Fiziki, Moscow, USSR) *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0016), Vol. 12, April 12, 1986, pp. 401-405. 10 Refs.

The characteristics of a self-maintained volume discharge with electron beam preionization are investigated, as are the characteristics of a CO₂ laser in this pumping mode, with discharge volumes reaching 60 l. A study is also made of the possibility of increasing the stability of a self-maintained volume discharge by using highly ionizable compounds which effect the electron energy in the discharge.

A87-31945 Instability of the homogeneous form of a self-maintained discharge in excimer lasers (O neustoiichivosti odnorodnoi formy samostoitel'nogo razriada v eksimernykh lazerakh). V. M. BORISOV, V. P. NOVIKOV, and O. B. KHRISTOFOROV, *Teplofizika Vysokikh Temperatur* (ISSN 0040-3644), Vol. 24, Nov.-Dec. 1986, pp. 1072-1078. 14 Refs.

A study is made of the instability of the homogeneous form of combustion of a volume discharge used for the pumping of lasers based on the halides of inert gases (e.g., XeCl, KrF, and ZrF). Qualitative experimental results on the ignition of a discharge in mixtures of various compositions are presented. The problem of the instability of the spatially homogeneous state of the discharge relative to electron density perturbations, which do not change its impedance, is investigated theoretically. Stability conditions are obtained analytically for the case of the stabilization of the full discharge current by an electric circuit.

A87-12744 Nonlinear-optic deformation of acoustic subsystems and ultrafast melting of semiconductor surfaces by short laser pulses (Nelineino-opticheskaya deformatsiya akusticheskoi pod-sistemy i sverkhbystroe plavlenie poverkhnosti poluprovodnikov korotkimi lazernymi impul'sami). V. I. EMELIANOV, I. F. UVAROVA, (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) (Vsesoiuznaia Konferentsiia po Kogerentnoi i Nelineinoi Optike, 12th, Moscow, USSR, Aug. 26-29, 1985) *Akademiia Nauk SSSR, Izvestiia, Seria Fizicheskaiia* (ISSN 0367-6755), Vol. 50, June 1986, pp. 1214-1219. 12 Refs.

Two laser-induced instabilities (deformation-concentration and deformation-thermal) are discussed which make it possible to explain cer-

tain experimental results on the interaction of high-power laser radiation with semiconductors and metals: the formation of spatially periodic surface structures with different lattice morphologies in the form of concentric rings; strong nonlinear-optic absorption in semiconductors; and ultrafast (of the order of 10 to the -13th sec) laser melting of semiconductor surfaces. Numerical estimates are given, and a comparison is made with experimental data.

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A87-12765 Stabilization of the composition of the gas medium of a repetitively pulsed CO₂ laser by means of hopcalite (Stabilizatsiia sostava gazovoi sredy impul'sno-periodicheskogo CO₂-lazera s pomoshch'iu gopkalita). V. I. BARANOV, G. F. DROKOV, V. A. KUZMENKO, V. S. MEZHEVOV, and V. V. PIGULSKAIA, (AN SSSR, Institut Atomnoi Energii, Moscow, USSR) *Kvantovaiia Elektronika* (ISSN 0368-7155), Vol. 13, May 1986, pp. 989-992. 11 Refs.

Results of experiments in which hopcalite was used to stabilize the composition of the gas medium of repetitively pulsed and monopulse CO₂ lasers are reported. In particular, the mechanisms of the decrease in the catalyst activity with time under conditions for catalyst regeneration are determined. It is shown that the use of hopcalite has made it possible to achieve long-term operation of a high-power repetitively pulsed CO₂ laser without changing the gas mixture in a closed circuit. Some details related to the use of hopcalite are discussed.

A87-24351 Operation of a high-power industrial CO₂ laser under conditions of repetitively-pulsed radiation amplification (Rabota moshchnogo tekhnologicheskogo CO₂-lazera v rezhime usileniia impul'sno-periodicheskogo izlucheniia). A. M. BELENKII, V. V. VASILTSOV, V. S. GOLUBEV, A. M. ZABELIN, and F. V. LEBEDEV, (AN SSSR, Nauchno-Issledovatel'skii Tsentr po Tekhnologicheskim Lazeram, Troitsk, USSR); et al. *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Aug. 1986, pp. 1720-1722. 8 Refs.

Experiments conducted in a system consisting of a master oscillator and an amplifier are described. A diffusion-cooled CO₂ laser was used as the oscillator while a fast-flow CO₂ laser with self-sustaining lateral discharge served as the amplifier. Upon modulation of the input radiation, repetitively pulsed radiation with a mean power of 4.5 kW and a maximum peak power reaching 36 kW was obtained at the amplifier output. In the continuous mode, the amplifier radiation power reached 6.5 kW.

A87-24354 An electron-beam ArF laser (Elektronno-puchkovyi ArF-lazer). A. D. KLEMENTOV, N. V. MOROZOV, and P. B. SERGEEV, (AN SSSR, Fizicheskii Institut, Moscow, USSR) *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Aug. 1986, pp. 1730-1733. 9 Refs.

The performance of an electron-beam ArF laser is investigated experimentally. Optimization of the composition of the working gas mixture is carried out and spectra of the emission and luminescence of the active medium are obtained. A Ne-Ar-F₂ working gas mixture at 6 atm yields a lasing energy of 3.5 J, the efficiency being 3.5 percent. On the basis of a proposed scheme of plasma-chemical processes in the electron-beam ArF laser active medium, the results obtained are analyzed and conclusions are drawn which pertain to the potential of this laser.

A87-12780 A study of the possibility of obtaining short emission pulses in an atmospheric-pressure chemical H₂-F₂ laser (Issledovanie vozmozhnosti polucheniia korotkikh impul'sov izlucheniia v khimicheskoi H₂-F₂-lazeze atmosfornogo davleniia). A. S. BASHKIN, V. A. ZOLOTAREV, L. V. KULAKOV, and M. P. FROLOV, (AN SSSR, Fizicheskii Institut, Moscow, USSR) *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7155), Vol. 13, May 1986, pp. 1065-1068. 8 Refs.

The duration of the emission from an atmospheric-pressure H₂-F₂ laser is investigated experimentally as a function of the mixture composition and its initial excitation level. The excitation source used in the experiments is a neodymium glass laser with harmonic generation in which the energies of the third and fourth harmonics are 5 and 2 J, respectively, for a pulse length of 10 ns. The duration of the emission of the H₂-F₂ laser is shown to be 45 ns for an initial fluorine atom concentration of 3×10 to the 17th per cu cm with the mixture F₂:O₂:H₂:He = 300:30:100:320 mm Hg. The divergence of the chemical laser is 1.1 mrad for a specific energy output of 40 J/l, which is only a factor of 1.6 worse than the diffraction limit.

A87-12781 The effect of water vapor on the energy of a pulsed oxygen-iodine laser (Vlianie parov vody na energiiu generatsii impul'snogo kislородno-iodnogo lazera). N. P. VAGIN, P. G. KRIUKOV, V. S. PAZIUK, and N. N. IURYSHEV, (AN SSSR, Fizicheskii Institut, Moscow, USSR) *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7155), Vol. 13, May 1986, pp. 1068, 1069.

The output energy of a pulsed chemical oxygen-iodine laser is investigated experimentally as a function of the partial water vapor pressure in the gas flow leaving the chemical singlet oxygen generator. It is found that only slight changes in the output energy are observed as the partial water vapor pressure varies over a wide range up to pressures three times the oxygen pressure. For a partial oxygen pressure of 0.35 mm Hg and a maximum water content of 1.2 mm Hg, the specific output energy is about 2 kcal/mol, which is close to the values typically obtained for CW chemical oxygen-iodine lasers with the water vapor completely frozen out.

A87-12896 A 2.5-kW industrial CO₂ laser (Tekhnologicheskii CO₂-lazer moshchnost'iu 2,5 kVt). V. K. GOLOV, A. I. IVANCHENKO, V. V. KRASHENINNIKOV, A. G. PONOMARENKO, and A. A. SHEPELENKO, (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR); et al. *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seria Tekhnicheskii Nauki* (ISSN 0002-3434), June 1986, pp. 87-91. 9 Refs.

A fast-flow laser is reported in which the active medium is excited by a self-sustained dc discharge produced by an electric-discharge device with nonsectioned electrodes. In the laser, two discharge gaps are formed by a flat anode and two cathodes, one on each side of the anode. A gas mixture is driven through the gasdynamic channel by a centrifugal fan rotating at 6000 rpm/min. With a mixture of CO₂:N₂:He = 2.5:7.5:5 mm Hg, the rated power is 2.5 kW; the maximum power is 4 kW with the mixture 2.5:7.5:10 mm Hg. The general design of the laser is described, and its principal performance characteristics are given.

A87-15356 A study of a hypersonic WFR mirror operating in accordance with the oscillator-amplifier scheme (Issledovaniie OVF-

zerkala na giperzvuke, rabotaiushchego po skheme generator-usilitel'). N. G. BASOV, A. P. VASIN, V. F. EFIMKOV, I. G. ZUBAREV, and M. G. SMIRNOV, (AN SSSR, Fizicheskii Institut, Moscow, USSR); et al. *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, June 1986, pp. 1201-1206. 5 Refs.

A study is made of the operation of a hypersonic WFR mirror based on the oscillator-amplifier scheme with strong signal and weak reference waves. The preferred amplification of the Stokes reference wave is demonstrated in the case of large gain increments in the interaction region. It is shown that by using the method of the spatial separation of interaction regions, saturated amplification, and polarization decoupling, it is possible to reduce signal energy transfer to the Stokes reference wave and to increase the signal reflection coefficient by 50 percent or more.

A87-21774 Theory of a relativistic synchro-Cerenkov amplifier with a helical electron beam (Teoriia relativistskogo sinkhro-Cherenkovskogo usilitelia so spiral'nym elektronnyim potokom). M. G. KURKIN and V. A. CHEREPENIN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 31, Sept. 1986, pp. 1873-1876. 6 Refs.

A modified synchro-Cerenkov system with improved power characteristics is examined with reference to the development of free-electron lasers. Consideration is given to a multiwave synchro-Cerenkov amplifier in which relativistic electrons interact with whispering gallery modes propagating along the ideally conducting surface of a helical trough. The efficiency characteristics of the device are analyzed, and the radiation power directivity pattern in the H-plane is presented for an electron energy of 1.5 MeV and a beam current of 0.5 kA.

A87-24334 The theory of parametric free-electron lasers (K teorii parametricheskikh lazerov na svobodnykh elektronakh). E. G. BESSONOV, (AN SSSR, Fizicheskii Institut, Moscow, USSR) *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Aug. 1986, pp. 1617-1628. 20 Refs.

A theory of parametric free-electron lasers is developed which is applicable to the general case of a beam density-modulated both in coordinate and pulse space so that the beam becomes 'unfrozen' during interaction with the undulator. The angular and energy spread of the beam is taken into account. The potential of such lasers in the far vacuum of the UV spectrum is examined.

A86-30863 Using an intracavity spatial filter for reducing the beam divergence of excimer lasers (Ispol'zovanie vnutrizonatornogo prostranstvennogo fil'tra dlia umen'sheniia raskhodimosti izlucheniia eksimernykh lazerov). M. S. DZHIDZHOEV, I. A. KUDINOV, V. T. PLATONENKO, and V. K. POPOV, (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Jan. 1986, pp. 224, 225. 8 Refs.

A combination of an intracavity spatial filter and a diffraction grating is used in an attempt to reduce the beam divergence of an XeCl laser. It is shown that the use of a cavity with a spatial filter makes it possible to reduce, by more than an order of magnitude, the beam divergence of the electric-discharge Xe-Cl laser and to narrow its emission spectrum, with a decrease in output power from 50 to 20 mJ. A further improvement of the lasing characteristics is possible through an optimization of the diaphragm size and an adjustment of the optical scheme.

A87-31926 Selection of gasdynamic channel parameters for electric-discharge fast-flow lasers (Vybore parametrov gazodinamicheskogo kanala dlia elektrorazriadnykh bystroprotochnykh lazerov). A. I. IVANCHENKO, V. V. KRASHENINNIKOV, A. G. PONOMARENKO, and A. A. SHEPELENKO, *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Nov.-Dec. 1986, pp. 3-8. 18 Refs.

An analysis is made of the effect of the geometrical characteristics of the principal elements of the gasdynamic path and of the gas flow parameters in the pumping zone on the characteristics of the pumping device in a fast-flow laser with a closed gas-flow loop. Stability regions are determined for a laser with a self-maintained glow discharge normal to the gas flow, which makes it possible to select gas flow parameters ahead of the pumping zone and electrode configurations and dimensions. Expressions are also obtained for estimating the unavoidable pumping losses.

A87-29718 A numerical and experimental investigation of the energy potentialities of an OD(OH)-CO₂ chemical laser (Chislennoe i eksperimental'noe issledovaniie energeticheskikh vozmozhnostei khimicheskogo OD[OH]-CO₂-lazera). A. S. BASHKIN, N. M. GAMZATOV, I. U. PODMARKOV, O. E. PORODINKOV, and A. N. ORAEVSKII, (AN SSSR, Fizicheskii Institut, Moscow) *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Oct. 1986, pp. 1999-2008. 23 Refs.

A calculation model of a pulsed OD-CO₂ chemical laser is developed. A complex experimental assessment reveals that the model satisfactorily describes the laser's fundamental time and energy characteristics. Under conditions of instantaneous D atom generation, a numerical optimization of the mixture composition is carried out for all of the basic

components, and the effect of temperature on the laser's energy characteristics is studied. In the approximation of instantaneous flow mixing, it is shown that high power output (150 J/g) and chemical efficiency (10 percent) can be expected in a CW OD-CO₂ chemical laser.

A87-29728 A study of the active medium of an H₂-HCl GDL in the anharmonic approximation (Issledovanie aktivnoi sredy H₂-HCl-GDL v angarnicheskome priblizhenii). V. M. AKULINTSEV, V. M. GLAZENKOV, N. M. GORSHUNOV, A. I. U. MIASNIKOV, and I. U. P. NESHCHIMENKO, (Moskovskii Inzhenerno-Fizicheskii Institut, Moscow, USSR); et al. *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Oct. 1986, pp. 2102-2108. 16 Refs.

The feasibility of gasdynamically pumping HCl molecules in a hydrogen-containing supersonic one-dimensional inviscid flow for different atom concentrations is studied. The anharmonic oscillator model is used to calculate H₂-HCl GDL active medium characteristics. Operating conditions are found under which optical gains of about 1/m are achieved at a supersonic flow length of 12-60 cm.

A87-25238 Nonlinear conversion of continuous-wave emission in waveguide lasers based on stimulated light scattering (Nelineinoe preobrazovanie nepreryvnogo izlucheniia v svetovodnykh lazerakh na vyzhdenii rasseyaniia sveta). E. M. DIANOV, A. N. PILIPETSKII, A. M. PROKHOROV, and V. N. SERKIN, (AN SSSR, Institut Obshchei Fiziki, Moscow, USSR) *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0044-4510), Vol. 91, Oct. 1986, pp. 1249-1261. 14 Refs.

A method is developed for the nonlinear conversion of continuous-wave laser emission to a periodic sequence of high-power and short pulses in lasers based on stimulated Mandelstam-Brillouin scattering (SMBS) and stimulated Raman scattering (SRS) of light. A study is made of the dynamics of the formation of a stationary sequence of giant pulses of Stokes radiation in a SMBS waveguide laser. Attention is also given to the principal characteristics of the nonlinear transformation of continuous-wave laser emission in a cascade (SMBS-SRS) waveguide laser in which giant SMBS pulses formed in the cavity initiate the generation of high-power and short SRS pulses.

A87-28464 A study of an XeF-asterisk UV laser with pumping by excimer radiation (Issledovanie UF lasera na molekule XeF-asterisk s nakachkoi eksimernym izlucheniem). N. G. BASOV, V. A. DANILYCHEV, V. A. DOLGIKH, O. M. KERIMOV, and A. I. U. SAMARIN, (AN SSSR, Fizicheskii Institut, Moscow, USSR); et al. *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Sept. 1986, pp. 1808-1814. 29 Refs.

Lasing is obtained at 22 electron-vibrational transitions in an XeF-asterisk molecule in the near UV during excitation of XeF₂ by Xe-asterisk excimer radiation. The dependence of the lasing energy at different electron-vibrational transitions on the pressure of He, N₂, and Ar is studied. Estimates are made of the depopulation constants corresponding to vibrational levels with v-double-prime = 3, 6, 7 of the X state. The lasing efficiency is 2.3 percent when the efficiency of pump radiation utilization is taken into account.

A87-28523 The dynamics of a surface plasma generated by an independent source in the field of laser emission (Dinamika pri-poverkhnostnoi plazmy, soddavaemoi nezavisimym istochnikom, v pole lazernogo izlucheniia). A. S. KOVALEV, A. M. POPOV, B. V. SELEZNEV, and V. A. FEOKTISTOV, (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *Fizika Plazmy* (ISSN 0367-2921), Vol. 12, Sept. 1986, pp. 1120-1126. 12 Refs.

A study is made of the evolution of a plasma formation generated by a high-power short pulse of an Nd laser on a metal surface, with the relatively weak emission of a CO₂ laser focused on the surface. The thresholds of a sustained breakdown plasma are measured as a function of the plasma-generating pulse energy. The dynamics of plasma front propagation along the target surface and in the direction opposite to the laser beam direction is investigated. It is shown that the use of an additional laser with an energy less than that of the CO₂ laser by 2-3 orders of magnitude makes it possible to generate a surface plasma capable of absorbing and transferring to the target a significantly greater fraction of the CO₂ laser energy.

A87-29711 The generation and amplification of subpicosecond UV radiation pulses through the use of excimer lasers (Generatsiia i usilenie subpikosekundnykh impul'sov UF izlucheniia s pomoshch'iu eksimernykh lazerov). S. A. AKHMANOV, V. M. GORDIENKO, M. S. DZHIDZHOEV, S. V. KRAIUSHKIN, and I. A. KUDINOV, (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR); et al. *Kvantovaya Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Oct. 1986, pp. 1957, 1958.

Subpicosecond (350 fs) high-power (6 GW) pulses were obtained in the UV (308 nm) spectral region. Particular attention is given to their efficient amplification in an XeCl excimer amplifier. It is shown that the energy removed from the excimer amplifier under saturation conditions in-

creases due to the broadening of the amplified signal spectrum upon transition to femtosecond pulses.

A87-31945 Instability of the homogeneous form of a self-maintained discharge in excimer lasers (O neustoiichivosti odnorodnoi formy samostoiatei'nogo razriada v eksimernykh lazerakh). V. M. BORISOV, V. P. NOVIKOV, and O. B. KHRISTOFOROV, *Teplofizika Vysokikh Temperatur* (ISSN 0040-3644), Vol. 24, Nov.-Dec. 1986, pp. 1072-1078. 14 Refs.

A study is made of the instability of the homogeneous form of combustion of a volume discharge used for the pumping of lasers based on the halides of inert gases (e.g., XeCl, KrF, and ZrF). Qualitative experimental results on the ignition of a discharge in mixtures of various compositions are presented. The problem of the instability of the spatially homogeneous state of the discharge relative to electron density perturbations, which do not change its impedance, is investigated theoretically. Stability conditions are obtained analytically for the case of the stabilization of the full discharge current by an electric circuit.

A86-32685 High-altitude airborne and satellite-borne laser sounding of humidity and temperature profiles (Vysotnoe lazernoe zondirovanie profilei vlazhnosti i temperatury s borta samoleta i ISZ). V. V. ZUEV and O. A. ROMANOVSKII, (AN SSSR, Institut Optiki Atmosfery, Tomsk, USSR) *Issledovanie Zemli iz Kosmosa* (ISSN 0205-9614), Jan.-Feb. 1986, pp. 79-83. 19 Refs.

The paper analyzes the feasibility of using specific lidar systems for the airborne and spaceborne sounding of humidity and temperature profiles by the differential absorption method. Airborne downward sounding is shown to be more effective for the same lidar systems than upward sounding from the ground. Spaceborne lidar sounding makes it possible to use strong H₂O absorption lines and to recover humidity profiles of atmospheric layers with a low water-vapor content.

A86-32741 The possibility of implementing a free-electron laser using the effect of stimulated Cerenkov emission (O vozmozhnosti realizatsii lazera na svobodnykh elektronakh na effekte vyzhden-nogo Cherenkovskogo izlucheniia). V. A. BAZYLEV and V. V. GOLOVIZNIN, (AN SSSR, Institut Atomnoi Energii, Moscow, USSR) *Fizika Plazmy* (ISSN 0367-2921), Vol. 12, Feb. 1986, pp. 178-183. 16 Refs.

A study is made of the amplification of a transverse electromagnetic wave by a relativistic electron beam in a refracting medium in the presence of an external magnetic field parallel to the magnetic component of the field of the amplified wave. An expression is obtained for the conversion efficiency of electron energy to the energy of coherent electromagnetic radiation in the essentially nonlinear case. The effect of multiple electron scattering is analyzed, and the advantages of the scheme proposed here over other free-electron laser implementations are examined.

A87-34290 The possibility of producing a supercooled plasma in a high-power pulsed microwave discharge (O vozmozhnosti polucheniia pereokhlazhdennoi plazmy v moshchnom impul'snom SVCh-razriade). A. N. DIDENKO, V. M. PETROV, V. N. SLINKO, S. S. SULAKSHIN, and I. U. G. IUSHKOV, (Tomskii Politehnicheskii Institut, Tomsk, USSR) *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 292, no. 3, 1987, pp. 601-604. 9 Refs.

Experiments are reported in which a quasi-stationary recombination plasma was obtained in a high-power (1.3 MW) pulsed microwave discharge in an inert gas (xenon) at atmospheric pressure. This indicates that a high-power pulsed microwave discharge can be used for exciting the active medium of plasma lasers. The efficiency of this excitation method is determined for an Ne-Xe-CCl₄ (1000:50:1) mixture used in excimer XeCl lasers.

A87-34407 A repetitively pulsed excimer laser system consisting of a master oscillator and a regenerating amplifier (Impul'sno-periodicheskaiia eksimernaia lazernaia sistema 'zadaiushchii generator-regenerativnyi usilitel'). V. P. AGEEV, V. V. ATEZHEV, V. S. BUKREEV, S. K. VARTAPETOV and A. I. ZHUKOV, (AN SSSR, Institut Obshchei Fiziki, Moscow, USSR); et al. *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0016), Vol. 13, Jan. 12, 1987, pp. 19-22.

A laser system consisting of a master oscillator and a regenerating amplifier is proposed in which two discharge circuits based on magnetic switches with a common high-voltage commutator are used for discharge excitation in both components. The use of magnetic switches makes it possible to simultaneously optimize the energy parameters of the two lasers and the time interval between amplification in each laser. It is shown that the energy efficiency of the system is close to that of the regenerating amplifier in the case when it operates in the oscillator mode.

A87-34411 Directional stimulated emission of a Ge hot-hole laser (Napravlennoe stimulirovanoe izluchenie lazera na goriachikh dyrkakh Ge). A. V. MURAVEV, I. N. NOZDRIN, S. A. PAVLOV, and V.

N. SHASTIN, (AN SSSR, Institut Prikladnoi Fiziki, Gorki, USSR) *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0016), Vol. 13, Jan. 26, 1987, pp. 65-68, 6 Refs.

Stimulated infrared (80-200 microns) emission at hot-hole transitions in p-Ge in crossed electric and magnetic fields has been previously demonstrated using rectangular parallelepiped specimens representing an active medium combined with a total-internal-reflection resonator. The practical application of such a system, however, is limited by the unsatisfactory directionality of the emission. In the present study, directional stimulated emission at hot-hole transitions in p-Ge is demonstrated experimentally using a system with a nearly semiconfocal resonator with external mirrors. Such a system is of practical interest as a long-wave IR emission source.

A87-35943 High-power laser systems with phase conjugation (O moshchnykh lazernykh sistemakh s obrashcheniem volnovogo fronta). N. G. BASOV, V. F. EFIMKOV, I. G. ZUBAREV, and SOBOLEV, V. B. (AN SSSR, Fizicheskii Institut, Moscow, USSR) (*Vsesoiuznaia Konferentsiia po Obrashcheniiu Volnovogo Fronta Lazernogo Izlucheniia v Nelineinykh Sredakh*, Minsk, Belorussian SSR, Feb. 20-22, 1986) *Akademiia Nauk SSSR, Izvestiia, Seriya Fizicheskaiia* (ISSN 0367-6765), Vol. 51, Feb. 1987, pp. 323-329, 8 Refs.

Experiments have been conducted which demonstrate that, in order to increase the hypersound reflection coefficient of a phase-conjugation (PC) mirror according to a four-wave mixing scheme with an intense signal wave, it is necessary to use gain discrimination of the Stokes reference wave. An increase in the reflection coefficient by 20-50 percent and more can be achieved through the spacing of regions of four-wave interaction and saturated gain, as well as through polarization decoupling. Specifically, a single-channel neodymium-laser setup with a PC mirror and spatial filters was investigated.

A86-35960 A study of specific energy characteristics of industrial gasdynamic CO₂ lasers (Issledovanie udel'nykh energeticheskikh kharakteristik tekhnologicheskikh CO₂-GDL). B. V. ABAKUMOV, S. N. MININ, B. A. TIKHONOV, and L. N. IUDINA, (AN SSSR, Institut Atomnoi Energii, Moscow, USSR) *Kvantovaiia Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, Feb. 1986, pp. 345-350, 6 Refs.

The principal factors affecting the specific energy characteristics of industrial gasdynamic lasers are examined. In particular, attention is given to homogeneous gasdynamic CO₂ lasers using active media based on pure components (e.g., N₂-CO₂-H₂O) and combustion products of three types of fuels (fine carbon powder, a mixture of carbon and boron, and toluene). It is shown that for an optimal three-component mixture, the specific output energy can be as high as 50-70 J/g.

A86-39643 Inertial nonlinear processes in laser media and their effect on high-power laser beams (Inertsionnye nelineinye protsessy v lazernykh sredakh i ikh vliianie na moshchnye lazernye puchki). V. S. ZUEV, K. S. KOROLKOV, O. I. NOSACH, and E. P. ORLOV, (AN SSSR, Fizicheskii Institut, Moscow, USSR) (*Vsesoiuznaia Konferentsiia po Kogerentnoi i Nelineinai Optike*, 12th, Moscow, USSR, Aug. 26-29, 1985) *Akademiia Nauk SSSR, Izvestiia, Seriya Fizicheskaiia* (ISSN 0367-6765), Vol. 50, April 1986, pp. 765-772, 32 Refs.

The paper determines the increments and times of development of the emission wavefront instability of high-power lasers due to the inertial nonlinearity of the active medium under the effect of coherent radiation on the rate of processes in the medium. Particular attention is given to the role of enthalpic stimulated scattering (ESS). Calculations are presented for photodissociative iodine and excimer type KrF-lasers. It is concluded that, in designing high-power laser systems, it is necessary to account for the effect of nonlinear inertial self-defocusing (leading to ESS) on the formation of the laser-beam structure.

A86-46278 Using low-power ionizers for exciting the active media of excimer lasers (Ispol'zovanie ionizatorov maloi moshchnosti dlia vzbuzhdeniia aktivnykh sred eksimernykh lazerv). A. I. ALEKSANDROV, N. G. BASOV, V. N. VOLKOV, and V. A. DANILYCHEV, (AN SSSR, Fizicheskii Institut, Moscow, USSR); MATVEEV, I. N.; et al. *Kvantovaiia Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, April 1986, pp. 704-711, 18 Refs.

The characteristics of XeF and XeCl lasers stabilized by an external low-power ionizer are examined in two operating modes, one involving negative ion accumulation and the other involving a discharge stabilized by the external low-power ionizer. The temporal, spectral, and energy characteristics of the lasers are discussed. In the negative ion accumulation mode, the minimal ion concentration is found to be 10 to the 11th and 10 to the 12th per cu cm for F- and Cl-, respectively. The use of a discharge stabilized by a low-density electron beam makes it possible to reduce the electron beam current density to 0.1 mA/sq cm in the case of the XeCl laser; the maximum specific output power of the XeCl laser is 10 J/l.

A86-46281 Dynamics of discharge development and limiting energy characteristics of lasers using a mixture of He-Xe-HCl (Dinamika razvitiia razriada i predel'nye energeticheskie kharakteristiki lazerv na smesi He-Xe-HCl). V. M. BAGINSKII, P. M. GOLOVINSKII, V. A. DANILYCHEV, A. I. MILANICH, and A. M. SOROKA, (AN USSR, Institut Fiziki, Kiev, Ukrainian SSR; AN SSSR, Fizicheskii Institut, Moscow, USSR); et al. *Kvantovaiia Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, April 1986, pp. 751-758, 16 Refs.

The dynamics of the development of a self-sustained discharge in the mixture He:Xe:HCl = 100:1:0.2 (p = 2 atm) is modeled numerically, with allowance made for the various elementary processes occurring in the plasma of the excimer laser. In the case of a low photon density in the cavity, the duration of the emission is limited by the development of a stepped ionization instability with respect to the spatially inhomogeneous perturbations of the electron density across the current. For large photon fluxes, the duration of the emission is determined by the burnout time of the halogen carrier.

A86-44623 The possibility of constructing a chemical laser at the B-X electron transition of IF molecules (O vozmozhnosti sozdaniia khimicheskogo lazera na elektronnom perekhode B-X molekul IF). A. S. BASHKIN, M. S. KURDOGLIAN, and A. N. ORAEVSKII, (AN SSSR, Fizicheskii Institut, Moscow, USSR) *Kvantovaiia Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, March 1986, pp. 665-667, 19 Refs.

A model is proposed for the chemical pumping of the B₃Pi(0) electron state of IF molecules in an F-H₂-NF₂-IF mixture. On the basis of this model, numerical calculations of reaction kinetics are made. It is shown that at the B-X transition of IF molecules, high weak-signal gain factors are achieved which are sufficient to induce lasing. Processes which inhibit the pumping rate at a higher lasing level are defined, and methods designed to eliminate these constraints are outlined.

A86-46276 A laser using free electrons moving in transverse-gradient fields (Lazer na svobodnykh elektronakh, dvizhushchikhsia v poliakh s poperechnym gradientom). D. F. ZARETSKII, E. A. NERSESOV, K. B. OGANESIAN, and M. V. FEDOROV, (AN SSSR, Institut Obshchei Fiziki, Moscow, USSR) *Kvantovaiia Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, April 1986, pp. 685-692, 22 Refs.

Quantum-mechanical equations are obtained for the amplitudes of transition probabilities in a free-electron laser in which the transverse oscillations of the free electrons are induced by a static potential that is homogeneous in the beam direction but has a gradient in the transverse direction. The resonance frequency of the system and the linear gain factor at its odd harmonics are determined. Estimates are made of the maximum lasing frequency and of the corresponding gain factor.

A86-39671 A low-divergence laser and its use for the excitation of stimulated Raman scattering in compressed hydrogen (Lazer s maloi raskhodimost'iu i ego ispol'zovanie dlia vzbuzhdeniia VKR s szhatom vodorode). P. A. APANASEVICH, A. F. BOKHONOV, V. S. BURAKOV, A. S. GRABCHIKOV, and V. A. ORLOVICH, (AN BSSR, Institut Fiziki, Minsk, Belorussian SSR); et al. *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0016), Vol. 12, April 12, 1986, pp. 414-418, 10 Refs.

The development of an XeCl excimer laser with an unstable telescopic resonator and polarized emission output is reported, and its use for exciting four Stokes and two anti-Stokes components of stimulated Raman scattering in compressed hydrogen is examined. The laser, whose active volume is 55 x 2 x 0.8 cu cm, produces 2.5-mJ pulses (with an intracavity diaphragm of 0.25-mm diameter) with a total half-height divergence of not more than 0.15 mrad and a near-Gaussian transverse distribution.

A86-44611 A chemical laser at electron transitions of the IF molecule (Khimicheskii lazer na elektronnykh perekhodakh molekul IF). V. F. GAVRIKOV, N. A. KONOPLEV, I. V. MELNIKOV, and V. A. SCHEGLOV, (AN SSSR, Fizicheskii Institut, Moscow, USSR) *Kvantovaiia Elektronika (Moscow)* (ISSN 0368-7147), Vol. 13, March 1986, pp. 544-550, 22 Refs.

The visible-band NF-IF chemical laser is analyzed theoretically. Its gain properties are studied and its energy characteristics are calculated as functions of the system's parameters. It is shown that the specific power output of the CW IF laser can exceed 120 J/g when the total chemical efficiency is 5 percent. Practical recommendations are made based on the realization of the high energy parameters of the CW IF laser. A number of high-pressure pulsed IF laser schemes are suggested, and it is noted that the pulsed chemical laser energy density can exceed 60 J/liter (the efficiency being about 6.5 percent).