

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.

A90-44018 A 1-kpps transversely excited atmospheric CO₂ laser excited by an all-solid-state exciter with a magnetic pulse compressor. HIDEKAZU HATANAKA, HIROSHI TANAKA, MINORU OBARA, KATSUMI MIDORIKAWA, and HIDEO TASHIRO, *Journal of Applied Physics* (ISSN 0021-8979), Vol. 68, Aug. 15, 1990, pp. 1456-1459. 19 Refs.

The high-repetition-rate operation of a transversely excited atmospheric CO₂ laser pumped by an all-solid-state exciter consisting of a two-stage magnetic pulse compressor has been tested. At a repetition rate frequency of 1 kpps, an average laser power of 250 W was obtained. A maximum repetition rate of 1.1 kpps was limited by either the capability of the switching power supply (20 kW) or the turn-off time of the silicon controlled rectifier used (400 microsec). The energy transfer efficiency of the exciter was 75 percent and the overall laser efficiency was 3.2 percent. By changing the amount of the available magnetic flux swing of the cores used, 30-percent regulation on the input energy was also achieved with a constant energy transfer efficiency of 78 percent.

A90-28385 Picosecond laser diode pulse amplification up to 12 W by laser diode pumped erbium-doped fiber. ATSUSHI TAKADA, KATSUMI IWATSUKI, and MASATOSHI SARUWATARI, *IEEE Photonics Technology Letters* (ISSN 1041-1135), Vol. 2, Feb. 1990, pp. 122-124. 14 Refs.

Intense picosecond optical pulse generation from a gain-switched laser diode (LD) was demonstrated using a 1.48-micron LD-pumped Er³⁺-doped fiber laser amplifier. Saturation characteristics of the amplifier output power were also measured as a function of input repetition frequency. An amplified peak power of 12 W and 105-pJ pulse energy were obtained for 9-ps pulses at a 33-GHz repetition frequency. This is the highest peak power yet demonstrated in pulse generation employing all-laser diodes as active devices.

A90-32366 Development of laser inducing technique for fast propagating cracks in PMMA. S. SUZUKI, and T. NAKAJIMA, *Proceedings of the Dynamic Fracture Mechanics for the 1990's ASME/JSME Pressure Vessels and Piping Conference*, Honolulu, HI, July 23-27, 1989 (A90-32362 13-39). New York, American Society of Mechanical Engineers, 1989, pp. 79-84. 11 Refs.

A laser inducing technique for fast propagating cracks in PMMA is described. A defect is instantly generated in a PMMA specimen with focusing a pulsed laser light. A fast propagating crack at a speed of several hundred meters per second starts propagation from the defect if tensile force is applied to the specimen a laser induced fast propagating crack of the opening mode. The crack can be regarded as the one in an infinitely large specimen until the stress waves emitted at the defect outbreak are reflected back by specimen boundaries and impinge on the crack itself. Pulsed holographic microscopy with the laser inducing technique of fast propagating cracks makes it possible to take instantaneous microscopic photographs of the fast propagating cracks in infinitely large specimens. A new optical system is also described, which is qualified for holographic recording of a crack propagating through a transparent specimen.

A90-15827 Picosecond optical pulse generation from mode-locked phased laser diode array. H. MASUDA and A. TAKADA, *Electronics Letters* (ISSN 0013-5194), Vol. 25, Oct. 12, 1989, pp. 1418, 1419. 5 Refs.

Actively mode-locked 26 ps optical pulses are generated from a gain-guided, 10-stripe, phased laser GaAs diode array with an external cavity consisting of two cylindrical lenses and a corner reflector. To our knowledge, this is the shortest pulse width yet demonstrated from a mode-locked phased laser diode array. The detuning bandwidth of the mode-locking is measured as 2.5 MHz.

A90-13144 Multiterawatt excimer-laser system. S. WATANABE, A. ENDOH, M. WATANABE, N. SARUKURA, and K. HATA, *Optical Society of America Journal, B: Optical Physics* (ISSN 0740-3224), Vol. 6, Oct. 1989, pp. 1870-1876. 21 Refs.

A peak power of 4 TW has been obtained in KrF with an output energy of 1.5 J in 390 fsec from an electron-beam-pumped amplifier. The energy of the amplified spontaneous emission was as low as 1.8 percent. The pulse width was measured by the newly developed third-order autocorrelation technique based on the XeF C-A transition. Amplifiers increased the initial pulse width of 210 fsec to 390 fsec. The process of pulse-width broadening was investigated in detail. It was confirmed that the two-photon process contributes to small absorption in CaF₂ by the luminescence of self-trapped excitons. A terawatt-class KrF laser system with a moderate repetition rate was developed for applications to multiphoton processes.

A89-38001 Frequency chirped short pulse amplification in inhomogeneously broadened XeCl gain media. FUMIHIKO KANNARI and MINORU OBARA, *Applied Physics Letters* (ISSN 0003-6951), Vol. 54, April 24, 1989, pp. 1610-1612. 17 Refs.

The coherent amplification of frequency chirped ultrashort pulses in a XeCl gain medium was studied numerically. The coherent interaction between a short pulse and an inhomogeneously broadened excimer medium was studied by solving the multilevel Maxwell-Bloch equations which included the XeCl gain structure and the multilaser transitions. Data are presented for the energy gain data and pulse shapes calculated for a 7-ps chirped pulse and a 220-fs nonchirped pulse. It was found that the effective saturation energies calculated for nonchirped laser pulses were significantly higher than the values obtained experimentally. The implications of this finding for the XeCl lasers are discussed.

A90-11189 Theoretical high-efficiency extraction study of a short-pulse electron-beam-pumped ArF laser amplifier with atmospheric pressure Ar-rich mixtures. YOUNGWOON LEE, EIICHI MATSUI, FUMIHIKO KANNARI, and MINORU OBARA, *IEEE Journal of Quantum Electronics* (ISSN 0018-9197), Vol. 25, Sept. 1989, pp. 2053-2066. Research supported by the TEPCO Research Foundation. 78 Refs.

The single-pass (50 cm) amplifier performance of an atmospheric-pressure ArF laser pumped by a 65-nsec FWHM short-pulse electron beam was investigated theoretically for a wide range of excitation rates (0.1-2.0 MW/cm²). Atmospheric mixtures of Ne, Ar, and F₂ percent were studied. A kinetic numerical model of the ArF amplifier with a Ne buffer system was constructed. A one-dimensional propagation treatment considered the gain depletion and saturation absorption spatially and temporally along the optical axis. In this model the rate constants for electron quenching of metastable ArF of (1.6, 1.9, and 2.4) × 10 to the -7th/cm² sec were used for Ar concentrations of 40 percent, 70 percent, and Ar/F₂ mixture, respectively. Good agreement was obtained between theory and experiment. For the three mixtures, the extracted intensity was calculated using the optimum input intensities at each excitation rate. As a result, power efficiencies of over 10 percent were predicted.

A90-10739 Multi-frame pulse holography system. YOSHITAKA YAMAMOTO, *Proceedings of the 18th International Congress on High Speed Photography and Photonics, Part 2*, Xian, People's Republic of China, Aug. 28-Sept. 2, 1988, (A90-10726 01-35). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, pp. 587-594. 5 Refs.

Two methods for recording images with a framing holography system are proposed. In the first method, each pulse generated from multiple laser resonators is divided into two parts. Part of the beams illuminate the hologram from different directions as reference beams and the other beams illuminate the object as an object beam. In the other method, a pulse train-generated from a single laser resonator is divided into two parts so that some of the beams illuminate the object as an object beam while the others are used as reference beams. The incident angles of these reference beams are changes with pulses by electrooptical devices. Comparisons show that the first method is better if the number of recorded images is two or four.

A89-43158 High-order solitons and the modulational instability. MASATAKA NAKAZAWA, KAZUNORI SUZUKI, HIROKAZU KUBOTA, HAUS, and A. HERMANN, *Physical Review—A General Physics, 3rd Series* (ISSN 0556-7791), Vol. 39, June 1, 1989, pp. 5768-5776. 8 Refs.

It is shown that the amplitude ripple which appears on a higher-order soliton can be regarded as a modulational instability (MI) process as long as the ripple duration is much shorter than the pulse duration of the pump. The ripple frequency generated in a higher-order soliton at shorter propagation distances is in good agreement with the MI frequency. It is also found that the self-induced Raman effect can enhance the growth rate of the MI ripples; this is because an asymmetric amplitude change occurs on the wing of the pump pulse and resultant phase change initiates the MI ripple.

A89-42131 Quasi-steady operation characteristics of laser-propulsion using liquid H₂O fuel. TAKASHI ABE and SHUNICHI SATO, 20th AIAA Fluid Dynamics, Plasma Dynamics and Lasers Conference, Buffalo, NY, June 12-14, 1989. 8 pp. 6 Refs. (AIAA Paper 89-1913).

An experimental study of steady operation of repetitively-pulsed laser thruster using a liquid H₂O fuel was conducted by using the TEA CO₂ laser of 10 pps (pulse per second) repetition rate. The thrust produced and the flow velocity, the density, and temperature of the plume are measured. The measured impulse coupling coefficient and the plume velocity show that the additional absorption by the inverse bremsstrahlung accelerates the plume and the higher specific impulse is attained in comparison with the one predicted by the transparent vapor model.

A89-39140 Possibility of a high-efficiency pulsed vibrational overtone HF chemical laser. SHUICHI ASHIDATE and MINORU OBARA, *Japanese Journal of Applied Physics, Part 2* (ISSN 0021-4922), Vol. 28, March 1989, pp. L470-L472. 11 Refs.

The possibility of high-efficiency frequency conversion using first vibrational overtone transitions in a discharge-initiated nonchain (H₂/SF₆)HF chemical laser is theoretically analyzed. By totally suppressing fundamental transitions, vibrational overtone HF laser energy can be obtained, in pulsed operation, with a conversion efficiency of 67 percent of the fundamental output energy. A multiline oscillation of 1.3-1.5 microns is expected in the first vibrational overtone transitions. An overtone laser energy density of 0.87 mJ per cubic cm is found to be achievable from a discharge initiated He diluted gas mixture of SF₆/H₂/He = 84/12/404-664 Torr.

A89-22906 14 GHz single-mode picosecond optical pulse train generation in Zn-doped distributed-feedback lasers. K. KAMITE, H. SUDO, M. SUGANO, H. SODA, T. KUSUNOKI et al., *Applied Physics Letters* (ISSN 0003-6951), Vol. 54, Jan. 16, 1989, pp. 208, 209. 5 Refs.

To generate ultrashort pulse train at a high repetition rate, Zn was doped to the active region of distributed-feedback lasers. Increase in the differential gain and reduction of the carrier lifetime have been confirmed. The 3 dB bandwidth was increased to 16 GHz. The 14 ps single longitudinal mode optical pulse train at a repetition rate of 14 GHz was generated by gain-switched operation.

A89-45440 Femtosecond 1.4–1.6 micron infrared pulse generation at a high repetition rate by difference frequency generation. KENJI KUROKAWA and MASATAKA NAKAZAWA, *Applied Physics Letters* (ISSN 0003-6951), Vol. 55, July 3, 1989, pp. 7–9. 12 Refs.

Tunable subpicosecond infrared pulses have been generated in the 1.4–1.6 micron region by mixing a 1.064-micron Nd:YAG laser pulse and a visible subpicosecond pulse from a cavity dumped, synchronously pumped dye laser. Pulses as short as 94 fs with a peak power of 8.4 kW have been obtained with a KTP crystal at a rate of 3.8 MHz.

A89-36110 Multiterawatt subpicosecond KrF laser. A. ENDOH, M. WATANABE, N. SARUKURA, and S. WATANABE, *Optics Letters* (ISSN 0146-9592), Vol. 14, April 1, 1989, pp. 353–355. 11 Refs.

A 390-fsec pulse with a peak power of 4 TW has been obtained in KrF, yielding an output energy of 1.5 J from an electron beam-pumped amplifier with an active cross section of 320 sq cm. The amplified spontaneous emission is as low as 1.8 percent in energy. An initial pulse width of 210 fsec is increased to 390 fsec in the amplifier, mainly as a result of linear dispersion in the thick windows and lenses used throughout the system. Nonlinear absorption and self-phase modulation are not significant in the 2.5-cm-thick CaF₂ output window at an intensity of 13 GW/sq cm.

A89-33288 Generation of 5 THz repetition optical-pulses by modulation instability in optical fibers. S. SUDO, H. ITOH, K. OKAMOTO, and K. KUBODERA, *Applied Physics Letters* (ISSN 0003-6951), Vol. 54, March 13, 1989, pp. 993, 994. 6 Refs.

The generation of 5 THz repetition optical pulses with modulation instability is reported in an optical fiber. The single-mode fibers used in the experiment have a SiO₂-GeO₂ glass core and a SiO₂ glass cladding. The experimental results clarify that a small anomalous dispersion fiber can provide an extremely high repetition rate optical pulse train through a modulation instability process. Results also show that optical pulse trains with a repetition rate range from a few hundred GHz to a few THz can be obtained by controlling the fiber dispersion characteristics.

A89-16873 Single-shot measurement of subpicosecond KrF pulse width by three-photon fluorescence of the XeF visible transition. N. SARUKURA, M. WATANABE, A. ENDOH, and S. WATANABE, *Optics Letters* (ISSN 0146-9592), Vol. 13, Nov. 1988, pp. 996–998. 10 Refs.

The intensity of the XeF CA transition induced by a subpicosecond KrF laser is shown to have a cubic dependence on KrF laser intensity. A third-order autocorrelation technique for measuring the duration of a single KrF subpicosecond pulse has been developed utilizing this visible transition. A pulse width of 220 fsec was successfully measured with a high contrast of about 10. The visible fluorescence is more useful to researchers than vacuum-UV fluorescences. Furthermore, this simple technique may be applied over a wide UV wavelength region from 204 to 306 nm.

A89-16008 Saturation characteristics of UV dyes for ps XeCl laser pulses. M. WATANABE, A. ENDOH, and S. WATANABE, *Lasers '87 Proceedings of the Tenth International Conference on Lasers and Applications*, Lake Tahoe, NV, Dec. 7–11, 1987 (A89-15976 04–36). McLean, VA, STS Press, 1988, pp. 349–355. 9 Refs.

Experiments with an XeCl excimer laser are reported in which a peak power of 1 TW was obtained with a pulse width of 310 fs and an amplified spontaneous emission (ASE) background of less than 3 percent. An analysis of the ASE shows that the ASE coupling between stages is completely suppressed by an appropriate spatial filter, with relatively low gain operation. The saturation characteristics of UV dyes are examined for the case of subpicosecond pulses.

A89-15988 High power and efficient X-ray preionization XECL laser with a pulse transmission line. TOSHIFUMI HASAMA, KENZO MIYAZAKI, KAWAKATSU YAMADA, and TAKUZO SATO, *Lasers '87 Proceedings of the Tenth International Conference on Lasers and Applications*, Lake Tahoe, NV, Dec. 7–11, 1987 (A89-15976 04–36). McLean, VA, STS Press, 1988, pp. 150–154. 7 Refs.

A high power and efficient X-ray preionized discharge pumped-eximer laser has been developed. The electrical circuit of the laser system is composed of a pulse-forming line (PFL), a rail-gap switch and a pulse transmission line (PTL) to transform the PFL impedance. In order to investigate the effects of the impedance transformation of the PTL, two types of the PTL with the output impedances of 0.26 and 0.48 ohm have been employed. The system with a lower output impedance has produced the large laser energies by 13–15 percent in the range of the PFL-charging voltage from 228 to 400 kV at HCl/Xe/Ne = 4/20/4476 Torr. The maximum energy obtained is 50 J in an 85-ns pulse (FWHM), corresponding to the peak power of 0.59 GW. The highest efficiency, of 3.1, has been achieved with an energy of 17.6 J.

A88-52968 29-fsec pulse generation from a linear-cavity synchronously pumped dye laser. HIROKAZU KUBOTA, KENJI KUROKAWA, and MASATAKA NAKAZAWA, *Optics Letters* (ISSN 0146-9592), Vol. 13, Sept. 1988, pp. 749–751. 10 Refs.

29-fsec optical pulses at a center wavelength of 615 nm have been generated from a linear-cavity synchronously pumped dye laser without using the colliding-pulse mode-locking technique. The laser consists of two dye jets (a gain jet and a saturable absorber jet) and a sequence of four Brewster-angled prisms. Kiton Red S is used as the laser dye instead of the conventional Rhodamine 6G.

A89-23419 Property of amplified spontaneous emission and saturable absorber for terawatt XeCl laser system. M. WATANABE, A. ENDOH, N. SARUKURA, and S. WATANABE, *Journal of Applied Physics* (ISSN 0021-8979), Vol. 65, Jan. 15, 1989, pp. 428–432. 13 Refs.

A peak power of 1 TW has been obtained in XeCl with a pulse width of 310 fs and the amplified spontaneous emission (ASE) less than 3 percent in energy. The property of ASE was analyzed for different gains. Based on this analysis, the ASE coupling between stages was suppressed by using an appropriate spatial filter along with operating at a low-gain level. The saturation characteristics of UV dyes were investigated and analyzed for subpicosecond pulses. BBQ (4,4'-di(2-butyl-octyloxy-1-p-quinque-phenyl)in cyclohexane showed the satisfactory performance for a saturable absorber in contrast and transmission.

A88-49117 Optical pulse compression in 1.5 micron wavelength region using large-positive-dispersion fibre and grating pair. H. ITOH, S. SUDO, K. OKAMOTO, and T. HOSAKA, *Electronics Letters* (ISSN 0013-5194), Vol. 24, June 23, 1988, pp. 785, 786. 8 Refs.

Optical pulse compression at 1.5 micron has been conducted. Optical pulses of duration 20 psec (FWHM) from a T1:KCl-color-center laser were compressed into pedestal-free 1.2-psec pulses using a large-positive-dispersion fiber and a grating pair. In addition, 280-fsec pulses were obtained from the resultant 1.2-psec pulses through the soliton compression effect in a negative-dispersion fiber.

A88-47917 Single-longitudinal-mode operation of DFB lasers in gain-switched operating conditions. K. KAMITE, H. ISHIKAWA, and H. IMAI, *Electronics Letters* (ISSN 0013-5194), Vol. 24, July 21, 1988, pp. 933, 934. 8 Refs.

Single-longitudinal-mode operation under a gain-switched condition, generating 20 ps optical pulses, has been attained in DFB lasers emitting at 1.3 micron wavelength. It has been clarified that Delta lambda, which is the difference between the DFB wavelength and the gain peak wavelength, plays an important role in stable single-mode operation. The optimum range of Delta lambda was found to be in the range from -15 nm to 0 nm.

A88-45241 Terawatt XeCl discharge laser system. S. WATANABE, A. ENDOH, M. WATANABE, and N. SARUKURA, *Optics Letters* (ISSN 0146-9592), Vol. 13, July 1988, pp. 580–582. 13 Refs.

A peak power of 1 TW has been obtained in a XeCl laser with a pulse width of 310 fsec. Amplified spontaneous emission was investigated extensively by changing the gain of wide-aperture discharge amplifiers. As a result, the amplified spontaneous emission content was suppressed to less than 3 percent in energy through the use of an appropriate spatial filter before the final amplifier and by operating at a low gain level of 4.8 percent/cm.

A88-42160 Y-Ba-Cu oxide films formed with pulsed-laser induced fragments. OSAMU ERYU, KOUICHI MURAKAMI, KOKI TAKITA, KOHZOH MASUDA, HIROMOTO UWE et al., *Japanese Journal of Applied Physics, Part 2* (ISSN 0021-4922), Vol. 27, April 1988, pp. L628–L631. 11 Refs.

For the formation of Y-Ba-Cu oxide films by pulsed-laser sputtering, the dependence on laser energy density was first investigated over a wide range from 0.6 to 3 J/sq cm at 1.064 micron. Rutherford backscattering spectrometry proved that the composition of deposited films strongly depends on the energy density. Films formed at a narrow window of laser energy density from the sputtering threshold of 0.6 J/sq cm to 0.8 J/sq cm showed superconductivity with a T_c onset at 81 K and zero resistance at 79 K in spite of an excess of Cu and Ba atoms after annealing in oxygen. The X-ray diffraction patterns showed that these films have highly preferred orientation of the c-axis, and scanning electron microscopy exhibited the texture of highly dense grains with large sizes of about 5 microns at the surface.

A88-41463 Formation and processing of high T_c superconductor films with pulsed excimer laser. TOMOJI KAWAI, MASAKI KANAI, and MAKI KAWAI, *High-temperature superconductors Proceedings of the Symposium*, Boston, MA, Nov. 30Dec. 4, 1987 (A88-41426 17–76). Pittsburgh, PA, Materials Research Society, 1988, pp. 327–330.

High T_c YBa₂Cu₃O(y) and GdBa₂Cu₃O(y) thin films can be made by a laser sputtering method using LnBa₂Cu₃O(y) (Ln = Y and Gd) ceramics as targets and cubic zirconia as a substrate in a high vacuum system. The superconducting onset temperature and the zero resistance temperature of the film are 95 and 80K, respectively. The surfaces of these films were subjected to an irradiation with a focused pulsed excimer laser. Scanning of the beam led to the etching of the surface to form a groove. Photochemical processes on these superconductor films were studied using dynamic mass-spectroscopic method.

A88-41016 Pulsed laser processing of ceramics in water. NOBORU MORITA, SHUICHI ISHIDA, YASUTOMO FUJIMORI, and KEN ISHIKAWA, *Applied Physics Letters* (ISSN 0003-6951), Vol. 52, June 6, 1988, pp. 1965, 1966.

The processing of ceramics in water using a Q-switched YAG laser is investigated. It is found that the recast layer and cracks which usually form in ceramics parts machined by laser do not form when the present method is used. This method can be used to successfully scribe, cut, and drill without damaging the inherent characteristics of ceramics.