

# 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 Semiconductors from the USSR and Japan.

Support for assembling and publishing the selected abstracts has been provided by the Innovative Science and Technology Directorate of the Strategic Defense Initiative Organization (SDIO), with the sponsorship and technical management of the abstract service by the Office of Naval Research (ONR) under ONR Grant N0014-87-6-0137.

Abstracts in this listing have been taken from the semimonthly abstract journal International Aerospace Abstracts (IAA), published by the American Institute of Aeronautics and Astronautics (AIAA) in cooperation with the National Aeronautics and Space Administration (NASA) under Contract No. NASW-4373. Additional material can be obtained through searching the Aerospace Database—available online via DIALOG or NASA RECON.

Paper copies and microfiche of the original documents cited are available from AIAA Library, Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., 555 W. 57th St., New York, NY 10019 (212) 247-6500, ext. 231. Use the "A" number to identify material you want. Please be advised that most of the original documents are in the original language. Direct questions concerning this abstract section of the *AIAA Journal* to John Newbauer, AIAA Administrator, Technical Publications.

## Soviet Aerospace Literature This month: *Semiconductors*

**A90-52392** Investigation of the characteristics of an In-p-InP contact (Issledovanie kharakteristik kontakta In-p-InP). A. P. BALASHOVA and A. E. SHABEL'NIKOVA, *Radiotekhnika i Elektronika* (ISSN 0033-8494), vol. 35, Aug. 1990, pp. 1715-1719. 6 Refs.

The characteristics of a contact formed by the deposition of In on an atomically pure p-InP surface were investigated at room temperature as well as under cooling at voltages up to 20 V. It is shown that the contact exhibits good rectifying properties at room temperature, whereas under cooling down to -90 C the rectification disappears; it is restored after a relatively long period of time after a return to room temperature.

**A91-15450** Physical properties of microregions with a high density of defects in wideband single crystals (Osobennosti fizicheskikh svoystv mikrooblastei s vysokoi plotnost'iu defektov v shirokazonnykh monokristallakh). V. I. TREFILOV, E. A. CHERNINA, M. D. GLINCHUK, L. A. LITVINOV, and V. I. BERZHATYI, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 314, no. 2, 1990, pp. 362, 363. 9 Refs.

The possibility of using the effect of shock-ionization wave excitation in semiconductors as a method of fast plasma generation is investigated. It is shown experimentally that the process of plasma generation by a shock-ionization wave in GaAs can be homogeneous and can produce a plasma with an inverse concentration. Under such conditions, stimulated emission has been obtained at room temperature. The creation of picosecond semiconductor lasers based on shock-ionization waves with an output of tens and hundreds of kilowatts is thought to be possible.

**A90-46638** Experiments on crystallization of semiconductor materials, eutectic alloys and crystal growth from water solution in microgravity. L. L. REGEL, O. V. SHUMAEV, I. V. VIDENSKII, I. M. SAFONOVA, A. A. VEDERNIKOV et al., (39th IAF International Astronautical Congress, Bangalore, India, Oct. 8-15, 1988) *Acta Astronautica* (ISSN 0094-5765), Vol. 21, May 1990, pp. 331-348. 29 Refs. (IAF Paper 88-363).

The crystallization of Al-Ni eutectic alloys, GaSb, and hydroxyapatite and calcium sulphate from aqueous solutions under microgravity is examined. The materials and procedures for the space- and ground-based experiments are described. The effects of microgravity on the microstructure of these materials are investigated. The space-flight data are compared with ground-based experimental results. It is detected that it is possible to obtain eutectic alloys with perfect microstructure and highly perfect GaSb crystals by direct crystallization in microgravity. The crystallization of hydroxyapatite and calcium sulphate reveals that it is possible, under microgravity, to produce complicated spatially organized crystalline textures and to control their properties.

**A91-15367** Optimization of the geometry of interdigital Schottky-barrier photodiode structures (Optimizatsiia geometrii vstrechno-shchyrevykhfotodiodnykh struktur s bar'erami Shotki). S. V. AVERIN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 35, Sept. 1990, pp. 1995-1999. 12 Refs.

The paper examines the response speed of photodiode structures realized in the form of interdigital Schottky-barrier contacts to the active layer of a semiconductor material. The optimal value of the interelectrode gap assuring realization of a maximum response speed of the photodetector is determined. An analysis is then made of the potential capabilities of various semiconductor materials from the viewpoint of developing high-speed visible-range and IR photodetectors.

**A90-50792** Possible realization of high-temperature superconductivity in semiconductors (Vozmozhnaia realizatsiia vysokotemperaturnoi sverkhprovodimosti v poluprovodnikakh). I. U. A. BUMAI, I. G. GOROL'CHUK, D. S. DOMANEVSKII, A. V. STEPANENKO, A. B. TIMOFEEV et al., *Fizika Nizkikh Temperatur* (ISSN 0132-6414), Vol. 16, June 1990, pp. 707-711. 32 Refs.

The concept of superconductivity involving electron (hole) pairs is discussed. Estimates are presented which indicate the possibility of the realization of Bose-Einstein condensation in a system of two-electron centers in semiconductors, where a high concentration of such centers can be achieved through laser annealing. It is shown that structures exhibiting the Meissner effect at 20-50 K can be synthesized by high-dose ion implantation, producing centers with a pair of localized electrons in silicon or silicon carbide.

**A90-24184** Quantum detection of submillimeter or millimeter wave radiation using the resonance tunneling effect (Kvantovyi priem /sub/millimetrovogo izlucheniia s ispol'zovaniem effekta rezonansnogo tunnelirovaniia). A. V. KAMENEV and V. V. KISLOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Dec. 26, 1989, pp. 24-28. 10 Refs.

A mechanism for the detection of submillimeter or millimeter wave radiation is proposed which is based on quantum-well and resonance tunneling phenomena. Crucial to this mechanism is the reduction of the resonance section on the volt-ampere curve of the tunnel device as well as a reduction in the negative differential resistance during irradiation of a double-well structure. This phenomenon is connected with the fact that stimulated transitions between resonance levels primarily lead to the reflection of tunneling electrons, whereas, in the absence of irradiation, the structure is transparent to resonant electrons.

**A91-16192 Microwave conductivity of optically excited gap in a semiconductor microstrip.** S. S. GEVORGIAN, *Electronics Letters* (ISSN 0013-5194), Vol. 26, Oct. 25, 1990, pp. 1921, 1922. 10 Refs.

A simple expression for the microwave conductance of an optically excited gap in a semiconductor microstrip is presented. For small gap widths the performance of photo-conductive detectors or optical control microwave switches is limited by the contact resistance.

**A90-50870 Effect of the fast nonisothermicity of charge carriers on the self-modulation of two-component heterostructure lasers (Vliianie bystrogo neizotermichnosti nositelei zariada na avtomodulatsiiu dvukhkompontnykh geterolazeroi).** A. G. PLIAVENEK, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, July 1990, pp. 885-887. 15 Refs.

The self-modulation regime of radiation from two-component heterostructure lasers is investigated theoretically. It is shown that radiation intensity pulsations lead to pulsations of electron temperature which in turn smooth the self-modulation instability. Nonisothermicity of the carriers is shown to have an effect on the shape of the light spikes, which is manifested most markedly in a pulse-fall delay.

**A90-48215 An optical analog-digital converter based on MOS-liquid crystal structures (Opticheskii analogo-tsifrovii preobrazovatel' na osnove struktury MDP-ZhK).** E. M. DIANOV, A. A. KUZNETSOV, and S. M. NEFEDOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 16, March 12, 1990, pp. 26-30. 6 Refs.

An implementation of an analog-digital converter using an optically controlled liquid-crystal modulator with an optical feedback is described. It is estimated that the analog-digital converter described here is potentially capable of converting 3 million analog signals to a five-bit code in 1 s. With further improvement in modulator technology, the converter can be used as a component of an optical computer. An optical scheme of the analog-digital converter is presented.

**A90-42308 Self-focusing effects in a bistable semiconductor interferometer.** I. I. BALKAREI, M. G. EVTIKHOV, J. V. MOLONEY, and YU. A. RZHANOV, *Optical Society of America Journal, B: Optical Physics* (ISSN 0740-3224), Vol. 7, July 1990, pp. 1298-1302. 16 Refs.

Transverse effects are discussed that are related to optical diffraction and carrier diffusion in a bistable semiconductor Fabry-Perot interferometer with optical nonlinearity arising from variations in carrier concentrations. The system instability with respect to the homogeneous self-oscillations and self-focusing stratification is considered. The formation and pulsation of the structures are investigated in the numerical simulation.

**A90-39502 Changes in the surface morphology of InP, GaAs, and InAs under laser irradiation of threshold current density (Izmenenie morfologii poverkhnosti InP, GaAs i InAs pod deistviem lazernogo izlucheniia porogovoi plotnosti potoka).** K. K. DZHAMANBALIN, A. G. DMITRIEV, E. N. SOKOL-NOMOKONOV, and I. I. UKHANOV, *Fizika i Khimiia Obrabotki Materialov* (ISSN 0015-3214), Mar-Apr. 1990, pp. 20-23. 7 Refs.

The threshold current densities of laser irradiation corresponding to fusion-like surface changes in InP, GaAs, and InAs crystals are determined. It is shown that the surface morphology changes observed in the crystals are not actually related to surface fusion. The most probable cause of the observed surface changes is crystal decay due to heating below the melting point.

**A90-34662 High-output LED based on p-n Al(x)Ga(1-x)As(Si) structures of varying composition (Svetodiody povyshennoi moshchnosti izlucheniia na osnove p-nstruktury Al(x)Ga(1-x)As(Si) peremennogo sostava).** V. V. BEDNARSKII, A. E. GAFT, V. F. KOVALENKO, V. D. LISOVENKO, A. A. LITVIN et al., *Optoelektronika i Poluprovodnikovaia Tekhnika* (ISSN 0233-7577), no. 16, 1989, pp. 60-63. 10 Refs.

Factors affecting the emission output of p-n GaAs(Si) structures are investigated. It is found that increasing the p-layer thickness, doping with isovalent indium impurity, and decreasing the GaAs substrate thickness and electron concentration result in increased emission intensity. It is demonstrated that a further increase in the emission power of pn Al(x)Ga(1-x)As(Si, In) structures (up to 7.8 mW for a LED current of 100 mA) can be achieved by creating a surface microrelief and applying an antireflection anodic oxide coating to the mesa structures.

**A90-19195 Coherent effects in generation of ultrashort light pulses by a semiconductor injection laser (Kogerentnye efekty pri generatsii ul'trakorotkikh impul'sov sveta poluprovodnikovym inzhetskionnym lazerom).** E. M. BELENKO and P. P. VASIL'EV, *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0044-4510), Vol. 96, Nov. 1989, pp. 1629-1637. 14 Refs.

The generation of ultrashort pulses by a Q-switched semiconductor laser is studied theoretically and experimentally. A regular substructure of the pulse envelope and stimulated Raman scattering of the pulse train within the active region of laser are observed. These effects can be explained by coherent interaction between the light pulse and laser population inversion, the intraband relaxation of the carriers being suppressed by the strong electromagnetic field. The theoretical treatment of laser dynamics is based on the Maxwell-Bloch equations, allowance being made for dependence of the intraband relaxation time on the amplitude of the electromagnetic field, an inhomogeneous broadening mechanism, and possible Raman scattering within the laser cavity.

**A90-34655 Tunneling transistors (Tunnel'nye tranzistory).** I. U. K. POZHELA, *Optoelektronika i Poluprovodnikovaia Tekhnika* (ISSN 0233-7577), no. 15, 1989, pp. 8-16. 33 Refs.

Devices based on the transmission of electrons through various thin potential barriers and wells are reviewed. Attention is given to both experimentally implemented devices and new concepts and ideas concerning the use of tunneling effects in developing new high-frequency devices. Examples of specific solid state devices based on the tunneling effect are discussed.

**A90-34612 Emission linewidth of a single-mode injection laser with optoelectric feedback (Shirina linii izlucheniia odnomodovogo inzhetskionnogo lazera s optoelektricheskoi obratnoi svyaz'iu).** I. V. KORUKIN and I. U. M. MIRONOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, Jan. 1990, pp. 53-55. 11 Refs.

The paper considers the possibility of the narrowing of the linewidth of a single-mode semiconductor laser through the suppression of the part of frequency noise associated with nonisochronism. A method is proposed whereby the suppression is achieved by means of optoelectric feedback using the signal of the fluctuation amplitude detecting photodiode for pump current modulation. It is shown that this approach makes it possible to substantially vary the levels of amplitude and frequency fluctuations and the linewidth.

**A90-34610 A study of the characteristics of a single-frequency semiconductor laser with an external cavity (Issledovanie kharakteristik odnochastotnogo poluprovodnikovogo lazera s vneshnim rezonatorom).** N. N. GAVRILENKO, A. N. KOLBASNIKOV, V. D. KURNOSOV, O. F. SEMENOV, S. KH. TAKTASHOV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, Jan. 1990, pp. 40-42. 11 Refs.

Results of an experimental study of an external-cavity InP/InGaAsP oscillator lasing at a wavelength of 1.3 micron are reported. The external resonator was used in order to achieve single-frequency operation. Watt-ampere and spectral characteristics are presented for the external-cavity laser, with and without an external cavity. A correlation between the behavior of the spectral and noise characteristics of the external-cavity laser is established experimentally.

**A90-32705 Reflection of far-IR emission from a hot semiconductor plasma (Otrazhenie izlucheniia dal'nego IR diapazona ot gorachei plazmy poluprovodnikov).** E. A. ANDRIUSHIN, R. I. EKZHANOV, I. N. SISAKIAN, A. B. SHVARTSBERG, and A. V. SHEPELEV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, Feb. 1990, pp. 247-249. 13 Refs.

An analysis is made of the optical properties of semiconductor plasma in the far-IR and submillimeter bands. The behavior of the nonlinear optical characteristics of semiconductor in this band are examined. Estimates are made of the limiting switching times in the case where radiation is controlled by the heating of the semiconductor plasma.

**A90-32145 Deep blue and ultraviolet e-beam pumped semiconductor lasers.** A. NASIBOV, V. KOZLOVSKII, and I. A. SKAZIARSKII, *Proceedings of the Metal vapor, deep blue, and ultraviolet lasers Meeting*, Los Angeles, CA, Jan. 17-20, 1989 (A90-32126 13-36). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, pp. 242-245. 6 Refs.

The use of ZnS(x)Se(1-x) and ZnO semiconductor compounds as active media for e-beam-pumped semiconductor lasers is reported. Plates of the compounds, 2-3 cm in diameter and 20-30 cm thick, with mirror-covered surfaces, form the optical cavity of a two-dimensional scannable laser. The e-beam energy being 75 keV, the maximum power reached 5 Watts at 375 nm. The compounds have been used to generate in the 330-400 nm range.

**A90-29163 Carrier concentration autowaves in PbS(1-x)Se(x) injection lasers (Avtovolny kontsentratsii nositelei v inzhetskionnykh lazerakh na osnove PbS(1-x)Se(x)).** M. S. MURASHOV and A. P. SHOTOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Dec. 1989, pp. 2426-2432. 7 Refs.

Time variations were investigated in the spectral-spatial distribution of radiation from pulsed broad-contact PbS(1-x)Se(x) injection lasers. Autowaves of the concentration of free charge carriers with two closely spaced frequencies were found to be excited in these structures. The autowaves lead to the generation of two types of laser emission channels associated with the modulation of the refractive index and the optical gain.

**A90-24176 Spatial restructuring of the character of optical switching in a bistable semiconductor interferometer (Prostranstvennaia perestroika kharaktera opticheskogo perekliucheniia v bistabil'nom poluprovodnikovom interferometre).** A. V. GRIGOR'YANTS and I. N. DIUZHNIKOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Dec. 12, 1989, pp. 4-9. 16 Refs.

Firth and Galbraith (1985) showed theoretically that, owing to diffusion in a nonlinear semiconductor interferometer, the character of optical hysteresis in various parts of the laserbeam cross section can vary in a qualitative manner to the point of switching-direction reversal. The present work reports an experimental observation of this effect in the case of bistable switching in different interference orders as well as in the case of McCall oscillations. The observed reversal of the switching direction makes possible the simultaneous execution of 'yes' and 'no' logic operations on two optical signals in different parts of the beam.

**A90-19262** Energy and time characteristics of the emission of a longitudinal-output streamer laser (Energeticheskie i vremennye kharakteristiki izlucheniia strimernogo lazera s prodol'nym vykhodom izlucheniia). A. N. PECHENOV, I. M. POPOV, and V. A. FROLOV, *Kvantovaya Elektronika* (Moscow) (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1790-1792. 13 Refs.

Field distributions and transverse mode excitation thresholds in semiconductor lasers with longitudinal electron beam pumping are calculated in the quasi-classical approximation. The calculations allow for effects related to the thermal lens and to the nonuniformity of gain factor distribution. It is shown that the field localization mechanism changes with pumping intensity. The results are compared with experimental data.

**A90-18115** Optical reversible bitwisedata recording in VO<sub>2</sub> films (Opticheskaia reversivnaia pobitovaya zapis'informatsii na plenkakh VO<sub>2</sub>). D. Z. GARBUZOV, S. V. ZAITSEV, I. S. TARASOV, F. A. CHUDNOVSKII, and V. B. PTASHNIK, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Oct. 1989, pp. 174-177. 8 Refs.

The possibility of data recording in vanadium dioxide films using a semiconductor heterolaser was investigated experimentally. The method is based on the physical phenomenon of the semiconductor-metal phase transition in the VO<sub>2</sub> film at about 65°C. In the experiments, data were recorded in the temperature range 60-70°C with a resolution of 2000 lines/min and a contrast of 0.6. The reversibility of the recording is unlimited (not less than 10 to the 8th cycles); the minimal threshold energy of the transition is 0.0005 J/cm.

**A90-18111** Using the semiconductor-metal phase transition in vanadium dioxide for the intracavity control of CO<sub>2</sub> laser emission (Ispol'zovanie fazovogo perekhoda poluprovodnik-metal v dvuokisi vanadiia dlia vnutrizonatornogo upravleniia izlucheniem CO<sub>2</sub> lazera). N. F. BOCHORISHVILI, V. D. VVEDENSKII, I. M. GERBSHTEIN, O. B. DANILOV, V. A. KLIMOV et al., *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Oct. 1989, pp. 83-87. 11 Refs.

The paper is concerned with the possibility of using the semiconductor-metal transition in vanadium dioxide for creating a laser mirror with electron-beam addressing. A multilayer mirror has been constructed which has a reflection coefficient gradient from 0.14 to 0.92 at a wavelength of 10.6 microns for the metal and semiconducting states of the vanadium dioxide film, respectively. The mirror has been mounted inside the cavity of a CO<sub>2</sub> laser, and the generation of 1-ms laser pulses has been observed during the local pulsed heating of the mirror by an electron beam.

**A90-15544** System of parameters and results of measurements of planar GaAs diodes (Sistema parametrov i rezul'taty izmereniia planarnykh GaAs-diodov). N. V. BUDILOVICH, V. G. NECHAEV, D. G. PAVEL'EV, and I. A. STRUKOV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 34, Oct. 1989, pp. 2190-2196. 6 Refs.

The system of parameters for planar GaAs Schottky barrier diodes is calculated. Experimental data are presented on the nominal noise temperature at 1.7 GHz, dc resistance, sum capacitance at 100 KHz, and impedance characteristics at 68 GHz. The design considered is suitable for the development of millimeter-wave mixers; mixers operating in the 20-100 GHz range were fabricated.

**A90-15521** Theory of photoconductivity and photoluminescence of amorphous semiconductors at low temperatures (Teoriia foto-provodimosti i fotoluminitsentsii amorfnykh poluprovodnikov pri nizkikh temperaturakh). S. D. BARANOVSKII, E. I. LEVIN, I. M. RUZIN, B. I. SHKLOVSKII, and H. FRITZSCHE, *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0044-4510), Vol. 96, Oct. 1989, pp. 1362-1380. 9 Refs.

A theory of tunnel radiative recombination of nonequilibrium carriers in an amorphous semiconductor at low temperatures is developed, accounting for energy relaxation and spatial diffusion of carriers via hops between localized states of the band tails. The problem of the fate of a solitary electron-hole pair is solved by calculating the probability,  $\eta_a(R)$ , that a diffusing electron will move away from the hole over a distance  $R$ , avoiding recombination with the hole. A theory of the stationary state of the system is developed using the  $\eta_a(R)$  function, and the photoconductivity and photoluminescence of an amorphous semiconductor at low temperatures are calculated.

**A89-40541** Effect of shockwaves excited by a laser plasma on the electrical conductivity of semiconductors and polymers (Vlianie udarnykh voln, vzbuzhdaemykh lazernoi plazmoi, na elektroprovodnost' poluprovodnikov i polimerov). A. V. POLIANINOV and V. A. IANUSHKEVICH, (7th Vsesoiuznaia Konferentsiia po Vzaimodeistviu Opticheskogo Izlucheniia s Veshchestvom, Leningrad, USSR, Mar. 1988) *Akademiia Nauk SSSR, Izvestiia, Seriya Fizicheskaiia* (ISSN 0367-6765), Vol. 53, April 1989, pp. 733-739. 16 Refs.

Results of an experimental study of short-front shock waves excited by nanosecond laser pulses on the defect structure, electrical conductivity, and charge carrier lifetimes of semiconductors are reported. Measurements of residual electrical conductivity and carrier lifetimes in laser-irradiated Ge and Si are used to determine the defect multiplication coefficient and the concentration of charged point defects. It is shown that the transmission of even weak short-front shock waves produces a drop of a factor of 10 to the 9th - 10 to the 10th in the electrical resistance of polymer insulation.

**A90-26426** A new class of semiconductor materials - Quasi-one-dimensional complex compounds (Novyi klass poluprovodnikovykh materialov - Kvaziodnomernnye kompleksnye soedineniia). N. I. TRIFONOV, *Akademiia Nauk BSSR, Doklady* (ISSN 0002-354X), Vol. 34, Jan. 1990, pp. 41-43. 6 Refs.

Complex compounds with mixed-valence platinum and halide bridges are described which exhibit semiconductor properties along one direction and dielectric properties along the normal directions. The values of the electron-phonon interaction constant are determined for four compounds of this class using resonance Raman spectroscopy.

**A90-14548** Effective matching of a microwave modulator with a laserdiode in a prescribed band of the GHz region (Effektivnoe soglasovanie SVCh modulirovannogo lazernogo dioda v zadannoi poloze chastot gigagertsevykh diapazonov). A. A. BLISKAVITSKII, I. U. K. VLADIMIROV, I. U. A. TAMBIEV, and N. V. SHELKOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Aug. 1989, pp. 1751-1754. 8 Refs.

Aspects of the broadband low-loss matching of an InGaAsP heterostructure laser and a microwave modulator in the GHz region were studied theoretically and experimentally. Results of panoramic measurements of the laser SWR are used to estimate elements of its equivalent circuit and to synthesize a passive microstrip matching circuit. This circuit makes it possible to raise the efficiency of the laser-radiation-intensity modulation by more than 10 dB in the modulating frequency band from 2 to 3.4 GHz.

**A90-14547** The use of a photothermoplastic disk in memories with the recording of one-dimensional holograms (Primenenie fototermoplasticheskogo diska v ZU s zapis'iu odnomernnykh gologramm). E. KH. GULANIAN, A. L. MIKHAELIAN, L. V. MOLCHANOVA, V. A. SIDOROV, and I. V. FEDEROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Aug. 1989, pp. 1747-1750. 10 Refs.

The paper examines results of studies on the multichannel recording of one-dimensional holograms on a reversible photothermoplastic carrier, in particular, on a disk. It is shown experimentally that heating by YAG:Nd (1.06 micron) and semiconductor (0.82 micron) laser radiation can be used together with electric-current heating for the developing and erasure of optical information recorded on the photothermoplastic carrier.

**A90-14520** Adaptive image reconstruction by means of a controlled phase transparency utilizing an MOS-LC structure (Adaptivnoe vosstanovlenie izobrazhenii s pomoshch'iu upravliaemogo fazovogo transparenta na osnove MDP-ZhK-struktury). A. L. VOL'POV, I. U. A. ZIMIN, V. N. LOPATKIN, and A. I. TOLMACHEV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, July 1989, pp. 1459-1462. 6 Refs.

The adaptive reconstruction of images in incoherent light is described and studied experimentally. A phase transparency utilizing an MOS-LC structure and controlled by an LED array is used as the adaptive element. The use of an algorithm based on the maximization of the modulus of the spatial image Fourier spectrum at a certain frequency permitted the high-quality reconstruction of images of small-sized objects observed through a phase-distorting medium.

**A90-14489** Stabilization of the emission amplitude of semiconductor laser diodes (Stabilizatsiia amplitudy izlucheniia poluprovodnikovykh lazernykh diodov). V. N. KOROLEV, A. V. MARUGIN, A. V. KHARACHEV, and V. B. TSAREGRADSKII, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Aug. 1989, pp. 38-44. 7 Refs.

Two methods for stabilizing the emission intensity of injection lasers, one using an external electrooptic element and the other using directly the emitter power supply circuit, are examined. Stabilization of the emission amplitude of commercial laser diodes, with a 25-30 dB decrease in the low-frequency amplitude fluctuations, has been achieved experimentally using an external modulator based on a lithium metaniobate crystal. This stabilization scheme is shown to be effective in the case of the linear polarization of the laser diode emission over a wide emission intensity range at frequencies up to 100 kHz.

**A90-12439** Streamer excitation of laser action in the high-frequency regime (Strimernoe vzbuzhdenie generatsii v vysokochastotnom rezhime). V. P. GRIBKOVSKII, V. V. PARASHCHUK, and G. P. IABLONSKII, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, June 1989, pp. 1145-1148. 10 Refs.

Packet-pulse operation of a semiconductor streamer laser was realized at a pulse repetition rate of up to 10 MHz. A mean radiation power of 10 mW (CdS) was achieved which exceeds published data by 2-3 times. A powerful small-size laser with these parameters was developed.

**A90-12431** The generation of ultrashort light pulses in a semiconductor laser with dual feedback (Generatsiia ul'trakorotkikh svetovykh impul'sov v poluprovodnikovom lazere s dvoimoi obratnoi svyaz'iu). K. B. DEDUSHENKO and S. A. EGOROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, June 1989, pp. 1116-1121. 15 Refs.

A semiconductor injection laser with optical and optoelectronic (dual) feedback is studied. It is shown that, under active mode locking, this laser can emit picosecond light pulses whose repetition rate depends on the relationship between signal transmission times in the optical and optoelectronic feedback loops. The feasibility of a small self-contained ultrashort light pulse source which does not need sophisticated electronic equipment is demonstrated.



**A90-10867** Anisotropic semiconductor-dielectric strip waveguide (Anizotropnyi poloskovyi poluprovodnikovo-dielektricheskii volnovod). G. S. MAKEEVA, O. A. GOLOVANOV, and S. N. BARYSHEV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 34, Sept. 1989, pp. 1976-1979. 5 Refs.

The paper presents the results of the mathematical modeling of a semiconductor-dielectric waveguide of strip design, in which the properties of the waveguiding semiconductor strip can change under the effect of such factors as negative differential resistance (NDR) and its anisotropy in strong electric fields. Calculation results are presented for the 10-25 GHz range, and it is shown that amplification can be achieved in a semiconductor-dielectric strip waveguide in the presence of an n-GaAs film under NDR conditions when a constant electric field of superthreshold level is applied to the strip.

**A89-54599** The instability of longitudinal oscillations in a limited semiconductor plasma (Neustoiichivost' prodol'nykh kolebaniy v ogranichennoi plazme poluprovodnikov). O. V. GLUKHOV and V. M. IAKOVENKO, *Radiofizika* (ISSN 0021-3462), Vol. 32, July 1989, pp. 905-911. 18 Refs.

Pierce instability in a limited semiconductor sample is investigated. The effects of the external circuit, thermal spread, and electron collision frequency on this instability are studied. Analytical expressions for growth rates are found. The possibility of using this phenomenon for microwave oscillation is shown.

**A89-52769** Strain effect in acoustoelectronic devices based on single-crystal gallium arsenide (Tenzoeffekt v akustoelektronnykh priborakh na osnovemonokristallicheskogo arsenida galliia). V. M. KOLESKO and V. V. BARKALIN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 34, July 1989, pp. 1541-1543. 5 Refs.

In order to investigate the development of single-crystal GaAs SAW transducers, the strain effect (i.e., the change in the SAW propagation characteristics as the acoustic line is strained) in GaAs single crystals was studied for the main crystallographic planes and different SAW propagation directions. The results indicate that the strain effect in single-crystal GaAs is more pronounced than in structures based on single-crystal silicon.

**A89-51042** A silicon-on-sapphire photodetector for an optical logic element (Fotopriemnik na KNS-strukture dlia opticheskogo logicheskogo elementa). V. I. BLYNSKII, S. A. MALYSHEV, S. I. RAKHLEI, and V. D. CHUMAK, *Avtometriia* (ISSN 0320-7102), May-June 1989, pp. 133-135. 7 Refs.

The objective of the study was to investigate the spectral characteristics of photodetectors consisting of 500x1000-micron p-n transitions formed in 0.8- and 1.9-micron epitaxial layers grown on a sapphire substrate. It is found that the spectral sensitivity of the silicon-on-sapphire photodetectors in the visible range is 0.1 A/w or better. Some specific characteristics of the spectral sensitivity of the photodetectors associated with the small length of secondary charge carriers in the thin epitaxial film and the transparency of the sapphire substrate in silicon's proper absorption range are discussed.

**A89-51030** Light modulation in quantum well superconductor structures (Modulatsiia sveta v poluprovodnikovykh strukturakh s kvantovymi lamami). V. V. SHASHKIN, *Avtometriia* (ISSN 0320-7102), May-June 1989, pp. 19-30. 37 Refs.

The physical mechanisms underlying optical emission modulation in quantum well structures and the parameters of devices implementing these effects are reviewed. In particular, attention is given to the band structure and optical properties, nonlinear optical phenomena in quantum well structures, electrooptical modulation in quantum well structures, and implementations and applications of light modulators using quantum well structures. It is shown that the use of quantum well effects makes it possible to construct devices with switching speeds ranging from 1 picosecond to 100 seconds for incident emission intensities from 10 to the 6th to 10 to the -5th W/sq cm.

**A90-14456** Spectral characteristics of InGaAsP/GaAs 111-line liquid-phase-epitaxy lasers ( $\lambda = 0.8$  micron) intended for the pumping of YAG:Nd(3+) (Spektral'nye kharakteristiki InGaAsP/GaAs 111-line ZhFe-lazero / $\lambda = 0.8$  mkm/, prednaznachennykh dlia nakachki IAG:Nd(3+)). I. N. ARSENT'EV, G. R. BEZHANISHVILI, P. P. BUINOV, L. S. VAVILOVA, N. A. STRUGOV et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Aug. 12, 1989, pp. 45-49. 9 Refs.

It is demonstrated experimentally that ultrasonic treatment primarily affects the Np heteroboundary of GaAs-AlGaAs light-emitting double heterostructures in contrast to heat treatment, which primarily affects the pP heteroboundary. The ultrasonic treatment acts on specific types of defects situated on or near the Np heteroboundary, thus improving the electrical and optical properties of the heterostructure. It is concluded that ultrasonic treatment can be used to suppress the nonlinearities on the watt-ampere characteristics of such structures.

**A89-53711** A new model of the small-dose effect in semiconductors (Novaia model' effekta malykh doz v poluprovodnikakh). V. T. MAK, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, June 26, 1989, pp. 17-19. 9 Refs.

A model describing the behavior of semiconductors under low irradiation doses (up to 10 to the 8th rad) is presented. According to this model, low doses of nuclear radiation produce solid-phase process that in turn lead to a reduction in the density of energy states generated by microcrystallites and clusters. Such states are effective centers of recombination, leading to changes in all the properties of materials connected with recombination processes.

**A89-52739** Investigation of diffraction-coupled open resonators in the short-wave region of the millimeter-wave range (Issledovanie difraktsionno-sviazannykh otkrytykh rezonatorov v korotkovolnovoi oblasti millimetrovogo diapazona dlin voln). A. A. VERTII, I. V. IVANCHENKO, and N. A. POPENKO, *Radiofizika* (ISSN 0021-3462), Vol. 32, June 1989, pp. 788-792. 9 Refs.

The characteristics of diffraction-coupled short-focus open resonators (ORs) are investigated, and it is demonstrated that they can be used as high-Q loaded circuits in semiconductor oscillator-adders. It is shown that the OR near field can be viewed as the superposition of waves radiated by the mirror edges. It is noted that the present approach can be used for the diffraction locking of stabilizing resonators in oscillator-adders.

**A89-48072** The feasibility of the orbital gamma spectrometry of the moon and Mars using semiconductor detectors (O vozmozhnostiakh orbital'noi gamma-spektrometrii luny i Marsa s pomoshch'iu poluprovodnikovykh detektorov). I. A. SURKOV, L. P. MOSKALEVA, and O. S. MANVELIAN, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 27, May-June 1989, pp. 433-437. 8 Refs.

The paper evaluates the feasibility of using semiconductor gamma spectrometers on orbital spacecraft for the element mapping of the moon and Mars. Estimates are made of the minimum concentrations that can be determined with a gamma spectrometer employing ultrapure germanium at a volume of 200 cu cm. The efficiency of the detector according to the total absorption peak and its resolution are equal to 0.1 and 2 keV, respectively, for an energy of 1 MeV.

**A89-45014** Photoresponse peculiarities of variable-gap P(+)-N-N(+) diodes. V. M. ARUTIUNIAN and A. T. DARBASIAN, (4th Eidgenoesische Technische Hochschule Zuerich, International Conference on Infrared Physics, Zurich, Switzerland, Aug. 22-26, 1988) *Infrared Physics* (ISSN 0020-0891), Vol. 29, May 1989, pp. 689-692. 8 Refs.

Phenomena taking place in P(+)-N-N(+) variable-gap diodes at low injection levels are studied. They are believed to be important to the construction of new high-efficiency optoelectronic devices. Particular attention is given to the P(+)-N-N(+) structure with a band gap in the N-type base which varies linearly with the coordinate. It is found that the sign of the potential difference created by light in the base may be either positive or negative.

## Japanese Aerospace Literature This month: Semiconductors

**A90-33268** Noise characteristics of Er3+-doped fiber amplifiers pumped by 0.98 and 1.48 micron laser diodes. MAKOTO YAMADA, MAKOTO SHIMIZU, MASAHARU HORIGUCHI, MASANOBU OKAYASU, TATSUYA TAKESHITA et al., *IEEE Photonics Technology Letters* (ISSN 1041-1135), Vol. 2, March 1990, pp. 205-207. 10 Refs.

Measured noise characteristics of Er3+-doped optical fiber amplifiers pumped by 0.98- and 1.48-micron laser diodes (LDs) are reported. The noise figures estimated from the beat noise between signal and spontaneous emission are 3.2 dB for pumping by 0.98micron LD and 4.1 dB for pumping by 1.48-micron LD. The beat noise between spontaneous emission components and the spontaneous shot noise for the 0.98-micron pumping are lower than those for the 1.48-micron pumping.

**A90-34972** p-type conductivity control of ZnSe highly doped with nitrogen by metalorganic molecular beam epitaxy. A. TAIKE, M. MIGITA, and H. YAMAMOTO, *Applied Physics Letters* (ISSN 0003-6951), Vol. 56, May 14, 1990, pp. 1989-1991. 10 Refs.

p-type ZnSe with resistivity low enough for device application has been realized by metalorganic molecular beam epitaxy. This method has enabled growth of p-type ZnSe doped with nitrogen at concentrations as high as 10 to the 19th/cu cm by using ammonia as a dopant source. The dependence of photoluminescence and electrical properties on substrate temperatures has been investigated. Hall measurements show p-type conductivity with a resistivity of 0.57 ohm cm, a carrier concentration of 5.6 x 10 to the 17th/cu cm, and a Hall mobility of 20 sq cm/V s.