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GENERAL INFORMATION

On January 17, 1955 the Institute of Physics and Mathematics of the Academy of Sciences of the BSSR – the first in Belarus scientific-research center of physical-mathematical specialization – was founded. In 1959 it was reorganized into independent institutions: the Institute of Physics and the Institute of Mathematics and Computer Engineering. The key role in the establishment and development of the Institute of Physics was played by prominent scientists A.N. Sevchenko (the first Director of the Institute), B.I. Stepanov (the Director of the Institute from 1957 to 1985), and M.A. El'yashevich, who came to Minsk from the State Optical Institute (Leningrad), as well as by Belarusian physicists N.A. Borisevich and F.I. Fedorov. Under their supervision investigations were launched on spectroscopy and luminescence of complex molecules, optics of anisotropic and scattering media, spectroscopy and diagnostics of low-temperature plasma, and physics of elementary particles. Since 1961 one of the major directions of scientific investigations has been the laser physics, nonlinear optics, and laser spectroscopy.

■ **Stepanov Boris Ivanovich (1913–1987)** – a prominent scientist in the field of general spectroscopy, molecular spectral analysis, luminescence, laser physics, and nonlinear optics; a founder of the Institute of Physics and its Director from 1957 to 1985, Hero of the Socialist Labor, Honored Scientist of the BSSR, Laureate of the USSR and BSSR State Prizes, Academician, Doctor of Physical and Mathematical Sciences, Professor.

The Institute was growing and developing rapidly. In the 1960s a design-technological department was formed at the Institute. In 1992 this department became a legally independent establishment – the Pilot-Production Design Company "AXICON". In this year, on the basis of ten laboratories of the Institute of Physics specialized mainly in the field of spectroscopy and physics of plasma, the Institute of Molecular and Atomic Physics was established.

In the Institute of Physics, a number of generally recognized important results have been obtained for the time of its work:

– the theory of luminescence and absorption of light by solutions of complex molecules and semiconductors has been developed; a universal relation between the luminescence and absorption spectra, called the "Stepanov relation" in the scientific literature, has been derived (B.I. Stepanov, P.A. Apanasevich, V.P. Gribkovskii, A.M. Samson et al.);
– the covariant theory of electromagnetic and acoustic waves in anisotropic media has been developed; the phenomenon of lateral displacement of a light beam in the case of total internal reflection has been discovered (F.I. Fedorov, B.V. Bokut', A.G. Khatkevich, V.V. Filippov et al.);
– the spectroscopy of free complex molecules has been developed; the phenomenon of stabilization-labilization of electron excitation of complex molecules, discovered by N.A. Borisevich and B.S. Neporent, has been investigated in detail (N.A. Borisevich, V.V. Gruzinskii, V.A. Tolkachev et al.);
– the spectral-luminescent properties of chlorophyll molecules and related compounds have been investigated in detail; the role of singlet oxygen in the photooxidation and photodestruction processes has been considered (A.N. Sevchenko, G.P. Gurinovich, K.N. Solov'ev, B.M. Dzhagarov et al.);
– a number of methods and apparatus for investigating a plasma under laboratory and natural conditions and the travel of cosmic objects as well as apparatus for aero-space remote spectrometric investigations of natural objects have been developed (M.A. El'yashevich, V.S. Burakov, L.I. Kiselevskii, L.Ya. Min'ko, V.N. Snopko, V.D. Shimanovich, B.E. Plyuta, B.I. Belyaev, A.A. Kovalev et al.);
– the features of optical waveguides with anisotropic fillers and of the propagation of Gaussian beams in anisotropic media have been investigated; methods of obtaining planar integral optical elements have been developed (A.M. Goncharenko, V.A. Karpenko, V.P. Red'ko et al.);
– a lasing on the basis of dye solutions has been predicted and obtained; the principles of designing of tunable lasers, including distribute-feedback ones, have been developed and realized; a number of laser devices generating in the visible, near-ultraviolet, and near-infrared regions of the spectrum have been developed (B.I. Stepanov, A.N. Rubinov, V.A. Mostovnikov, T.Sh. Efendiev et al.);
– theoretical approaches, methods, and high-efficiency devices for nonlinear optical transformation of a laser radiation frequency, which, in combination with solid, semiconductor, liquid, or other lasers, make it possible to obtain a radiation with a gradually controllable frequency in the infrared, visible, and ultraviolet regions of the spectrum, have been developed (P.A. Apanasevich, B.V. Bokut', A.G. Khatkevich, N.S. Kazak, V.A. Orlovich, V.N. Belyi, S.A. Batishche et al.);
– the physical bases of dynamic holography have been developed; the phenomenon of phase conjugation of light beams in four-photon interactions has been discovered; the principles of the multiwave interaction of laser radiation in nonlinear media have been considered (E.V. Ivakin, A.S. Rubanov, B.I. Stepanov, P.A. Apanasevich, V.V. Kabanov, A.M. Lazaruk et al.);
– a large-scale introduction of methods of atomic and molecular spectral analysis into technological processes conducted at enterprises of the Republic of Belarus has been realized; new methods of determining the properties of carboxydrates and proteins, polymer materials, flax fibres, and other materials have been developed. (N.A. Borisevich, V.S. Burakov, R.G. Zhbankov, L.G. Pikulik, A.A. Yankovskii et al.);

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– changes in the spectral-optical characteristics of resonance media under the action of a powerful radiation and their manifestations in the processes of propagation of classical and quantum light beams have been investigated (P.A. Apanasevich, A.A. Afanas'ev, S.Ya. Kilin et al.);
– the coherent light fields influence on biological objects and microparticles has been investigated. Techniques of influence on biological microobjects by means of gradient fields such as cellular massage, regulation of processes occurring with blood cells etc. have been developed (A.N. Rubinov, A.A. Afana'sev, T.Sh. Efendiev et al.);
– a number of methods and apparatus based on laser and light-emitting diode (LED) sources have been developed for applications in physiotherapy and ophthalmology; the phenomenon of protective property of pigments of the human and animal organs of sight against the damaging action of laser and X radiation have been discovered (V.A. Mostovnikov, G.R. Mostovnikova, V.Yu. Plavskii, G.I. Zheltov, V.A. Lapina et al.);
– methods and apparatus for determining the characteristics of the atmosphere, water basins, and other natural and artificial media have been developed on the basis of many-sided investigations of the light scattering by different media (A.P. Ivanov, V.A. Loiko, A.P. Chaikovskii, A.P. Prishivalko, K.G. Predko, E.P. Zege, I.L. Katsev et al.);
– the physical bases of semiconductor lasers and the nonlinear optics of semiconductors have been investigated; new types of injection and streamer lasers as well as diode-pumped, optically pumped, and electron-beam-pumped lasers based on semiconductor crystals and quantum-dimensional heterostructures have been developed (V.P. Gribkovskii, V.A. Samoilyukovich, V.K. Kononenko, G.P. Yablonskii, G.I. Ryabtsev, S.V. Gaponenko, A.L. Gurskii, V.V. Parashchuk, E.V. Lutsenko);
– original effective approaches to the theory of field and particles have been developed on the basis of the vector parametrization of the Lorentz group and the method of universal equations proposed by F.I. Fedorov; new polarization, topological, and nonlinear effects in the dynamics of micro- and macrosystems, including experimentally detected effects, have been predicted (A.A. Bogush, L.M. Tomil'chik, E.V. Doktorov, O.S. Ivanitskaya, V.I. Kuvshinov, Yu.A. Kul'chitskii, Yu.A. Kurochkin, M.I. Levchuk, V.I. Strazhev, E.A. Tolkachev, A.Z. Gazizov, V.V. Kudryashov, A.F. Radyuk, L.G. Moroz, I.S. Satsunkevich et al.);
– a number of new apparatus and methods of nuclear spectroscopy have been developed and used for solving the problems on overcoming the consequences of the accident at the Chernobyl' Atomic Power Plant (E.A. Rudak, A.V. Berestov, A.M. Khil'manovich et al.).

The authors of these and other results were awarded two Lenin Prizes, seven State Prizes of the USSR, 15 State Prizes of the BSSR and the Republic of Belarus, ten Prizes of Lenin Komsomol. Four researchers of the Institute of Physics of the National Academy of Sciences of Belarus were given the title of a Hero of Socialist Labour, two researchers were awarded the Frantsisk Skorina Order, and one researcher was awarded the Honour Order. The Institute was repeatedly a winner of the All-Union Socialist Emulation among the academic institutions of the USSR. In 1967 it was awarded the Order of the Red Banner of Labor for the successes achieved in the development of physical science and in the training of highly skilled scientific personnel. For the achievement, in 2005, the best results in the fulfillment of the main purpose parameters of the prognosis of the socio-economic development of the Republic of Belarus, the Institute of Physics was put up on the Republican Board of Honour.

At present the Institute of Physics works in the following main directions:
– laser physics, development and fabrication of new laser sources and devices for different applications;
– physical, nonlinear, and quantum optics; laser spectroscopy;
– nonlinear dynamics of complex systems;
– physics of nanodimensional structures;
– transfer of optical radiation and optics of scattering media, optical methods of investigation and diagnostics of natural objects and biological media;
– physics of elementary particles and nuclear reactions.

At the Institute of Physics of the NASB, an Academic Council, scientific councils on the problems of laser physics, physical optics, and nuclear physics, and two special councils considering candidate's and doctor's theses works act.

The Institute participates actively in the fulfillment of state programs of scientific investigations and state scientific and technical programs (SSTP), is a head organization-executor of the State Complex Program of Scientific Investigations "Fotonika", the State Program of Basic Research "Fields and Particles", the subprogram "Optotex-1" of the SSTP "Optotex", and the SSTP "Protection of Documents".

Researchers of the Institute publish about 300 scientific works in home and foreign journals, make more than 350 reports at republican and international conferences, file 20 applications for invention every year.

At present the Institute is staffed with 300 workers, including 200 research workers, among which are five academicians and four members of the Academy of Sciences of Belarus, 44 doctors of sciences, and 107 candidates of sciences. At the Institute, 25 post-graduate students and seven persons working for doctor's degree are trained.

The Institute of Physics of the NASB is a founder of two international scientific journals: "Journal of Applied Spectroscopy" (jointly with the IMAP of the NASB) and "Nonlinear Phenomena in Complex Systems" (jointly with Belarusian State University).

The main achievements of the Institute of Physics of the NASB are the obtaining of scientific results corresponding to the world level, the development of scientific bases of a number of laser-optical technologies in the Republic of Belarus, the introduction of laser-optical technologies into the national economy, and the provision of the high authority of the home science and the high level of development of physics in Belarus.

SCIENTIFIC SUBDIVISIONS

LABORATORY OF WAVE OPTICS
– Parametric multiwave mixing;
– Optical solitons, interaction of ultrashort laser pulses with photon crystals;
– Formation and nonlinear frequency conversion of Bessel and other nontraditional light beams in crystals;
– Acousto-electrooptical interactions in crystals with a complex anisotropy;
– Laser formation of microcappilary and submicron structures.

LABORATORY OF HETEROGENEOUS ORGANIC MEDIA
– Distributed-feedback laser emitters based on thin films doped with dyes and nanoparticles;
– Laser-optical technologies of control of the gas-exchange processes in biological tissues;
– Investigation of physicochemical processes in organic systems by methods of kinetic laser spectroscopy.

LABORATORY OF QUANTUM OPTICS
– Quantum optics (squeezed and other nonclassical states of light, individual atoms and molecules in different media, quantum fluctuations of laser radiation and their detection);
– Quantum informatics and quantum cryptography;
– Quantum computers;
– Control of stochastic processes in laser systems.

LABORATORY OF LASER DYNAMICS
– Laser control of physicochemical processes by selective excitation of atoms and molecules into definite states by powerful picosecond laser pulses for the development of laser-chemical technologies of obtaining new substances;
– Investigation of the processes of formation of spatial-temporal radiation structures in lasers and resonance nonlinear media for the development of scientific principles of development of systems for protection, coding, and transfer of optical information.

LABORATORY OF LASER SYSTEMS AND DEVICES
– Determination of the regularities and mechanisms of interaction of the radiation of laser and LED sources with biological objects of different structure-organization level;
– Investigation of the regularities and mechanisms of action of a powerful pulsed-periodic laser radiation on different materials for the purpose of solving technological problems;
– Development of powerful pulsed-periodic laser systems on the basis of solid-state active media with parameters required for technological applications of such systems and development of laser technological facilities on their basis;
– Development of phototherapeutic apparatus on the basis of laser and LED sources, laser surgical apparatus, and light-therapeutic technologies;
– Use of laser and LED radiation in agricultural technologies.

LABORATORY OF MOLECULAR SIMULATION AND SPECTROSCOPY
– Vibrational spectra and structure of carbohydrates and proteins, theoretical and experimental bases of molecular spectral analysis, spectroscopy of high-molecular compounds;
– Structure and properties of polymers used for technological and medical purposes; development of objective highly selective methods of analysis of flax, flax fibres, and products of them; investigation of the molecular structure and the binding ability of the main transport systems of the blood plasma in norm and in the case of different pathologies; development of the methods of obtaining highly efficient sugar substitutes.

LABORATORY OF NONLINEAR OPTICS
– Physics of the processes of stimulated Raman scattering (SRS) of pulsed, nonstationary, stationary, and continuous radiation, generation of SRS solitons, static properties of fields transformed as a result of the SRS;
– Development and fabrication of SRS converters of the radiation frequency of different-type lasers;
– Physical bases of the functioning and designing of diode-pumped microchip- and mini-lasers with SRS conversion of radiation frequency;
– Spectroscopy of the four-wave mixing; coherent and spontaneous Raman scattering with time resolution and its application for investigating the properties of crystals, complex organic molecules, biological molecules;
– Development and fabrication of laser radiation sources (including the lasers with tuning the lasing wavelength in the deep UV, UV and near IR regions of the spectrum) for applications in scientific investigations, biology, photochemistry, environment protection.

LABORATORY OF OPTICAL HOLOGRAPHY
– Dynamic holography, optical processing of information;
– Multiwave interactions and self-action of laser radiation in nonlinear media;
– Nonlinear-optical methods of control of laser-radiation parameters;
– Nonlinear-optical properties of micro- and nanodimensional particles and composites and methods of their investigation;
– Physical bases of use of laser radiation in biology and medicine.

LABORATORY OF OPTICAL PROBLEMS OF INFORMATICS
– Investigation of optical nonlinearities in semiconductors and other condensed media;
– Development of nonlinear-optical methods of transformation and processing of information signals, development and investigation of new architectural concepts and algorithms of parallel optical processing of information;
– Modeling of nonlinear-optical devices of digital processing of data flows.

FOR NOTES

SETUP FOR MEASURING THE ENERGY OF A PULSED LASER RADIATION AND CALIBRATION TESTING OF INSTRUMENTATION FOR MEASURING THE LASER-RADIATION POWER

The setup represents a complex including lasers, measuring devices, optical elements, and a personal computer. It is designed for measuring the energy of laser-radiation pulses, certification of different-type lasers by the radiation-energy level, calibration, and calibration testing of instrumentation for measuring the laser-radiation energy.

Development and production:
– Institute of Physics of the NASB.

TECHNICAL DATA:
Dynamic range of reproduction of the energy unit: $5 \cdot 10^{-3}$–1 J;
Dynamic range of the measuring energy: $5 \cdot 10^{-3}$–100 J;
Spectral range in the energy-measurement regime: 0.4–10.6 μm;
Constant wavelengths in the regime of energy-unit reproduction: 0.532; 0.69 and 1.064 μm;
Relative standard uncertainty in measuring the laser-radiation energy: 1.6–4.3 %;
Relative standard uncertainty in reproducing the laser-radiation energy unit: 1.7–2.7 %.

PORTABLE MOBILE SECONDARY STANDARD FOR PRESERVATION OF THE SIZE OF THE LASER-RADIATION AVERAGE-POWER UNIT

The standard is designed to provide the uniformity of measurements of the average power of a continuous laser radiation, storage of the size of the laser-radiation average-power unit (SLRAPU), transfer of the SLRAPU to calibrated instrumentation for measuring the laser-radiation average-power at wavelengths of 0.532 μm and 0.96–0.98 μm and measuring the outer power of external laser-radiation sources in the spectral range 0–12.0 μm.

MOBILE STANDARD TO TRANSFER OF THE SIZE OF THE LASER-RADIATION ENERGY UNIT

The standard is designed to provide the uniformity of measurements of the energy of a pulsed laser radiation, the storage of the size of the laser-radiation energy unit, the transfer of the size of this unit to calibrated instrumentation and measuring the radiation energy in the process of metrological calibration of different-type pulsed lasers.

■ LABORATORY OF SEMICONDUCTOR PHYSICS AND ENGINEERING

– Injection semiconductor lasers, diode-pumped solid-state lasers;
– Quantum-well lasers and structures based on composite and doped superlattices;
– Lasers and light-emitting diodes based on broad-band semiconductors and semiconductor heterostructures with quantum wells.

■ DEPARTMENT OF LASER-OPTICAL TECHNOLOGIES

– Development of laser-optical instrument making at the Institute of Physics of the NASB; development, perfection, and introduction of new laser-optical technologies into technological processes used in machine building and medicine;
– Development of technologies of precession machining of materials and alloys;
– Scientific and applied directions of optical monitoring.

■ LABORATORY OF OPTICS OF SCATTERING MEDIA

– Theory of radiation transfer in light-scattering media;
– Scattering of light on individual particles;
– Propagation of radiation in dense media;
– Optics and laser probing of the atmosphere and ocean;
– Optical methods in material science, biology and medicine.

■ LABORATORY OF PHYSICAL OPTICS

– Physics of gas lasers and development of methods of control of their radiation parameters;
– Conversion of the radiation frequency of lasers of middle IR range in nonlinear crystals;
– Interaction of electromagnetic radiation with dispersive media;
– Laser methods of control of the optical properties of materials and determination of distances;
– Development of methods of optical diagnostics and prediction of optical properties of dispersive media of complex composition;
– Mathematical simulation in problems on control of the state of the air basin;
– Local and remote analysis of gases, including with the use of lasers.

■ SCIENTIFIC-TESTING LABORATORY OF LASER EQUIPMENT AND POLARIMETRY

– Development of scientific bases of the metrological provision of laser equipment;
– Preparation of normative documentation on the problems of testing, development of state standards for laser equipment on the basis of international standards;
– Metrological provision of laser equipment in the Republic of Belarus;
– Development of testing and measuring equipment for testing of laser facilities and calibration testing;
– Investigation of the polarization characteristics of visible and near-IR laser radiation reflected, scattered, or passed through structurally inhomogeneous materials;
– Investigation of the spectral reflection characteristics of materials and coatings of aerocosmic equipment in the visible and IR regions of the spectrum;
– Investigation of the structural (conformational) transformations in high-molecular polymers under the action of radiation of a continuous-wave CO_2 laser.

■ LABORATORY OF PHYSICS OF FUNDAMENTAL INTERACTIONS

– Theory of nonlinear and topologically nontrivial effects in classical and quantum systems (solitons, monopoles, instantons);
– Development of theoretical-group, algebraic, and geometric methods of defining and calculating processes of fundamental interactions and the covariant Fedorov approach in the field theory of elementary particles;
– Development of new methods of calculating quantum-mechanical systems;
– Relativistic kinematics, electromagnetic structure of nucleons;
– Electroweak interactions;
– Neutrino astrophysics of high energies;
– Experimental physics of high energies.

■ LABORATORY OF NUCLEAR SPECTROSCOPY

– Nuclear spectroscopy, including the applied one;
– Nuclear reactions at low and middle energies;
– Ecological applications of nuclear spectroscopy.

■ FRAUNHOFER-STEPANOV INTERNATIONAL SCIENTIFIC LABORATORY OF OPTICAL DIAGNOSTICS

– Interaction of optical radiation with a substance;
– Development and application of lasers and laser methods;
– Development and fabrication of optical components and devices;
– Acoustic and radiation diagnostics;
– Development of methods and devices for nondestructive control of the characteristics of materials, nondestructive control integrated into a technological process, monitoring of plants and production processes.

■ PILOT-PRODUCTION DESIGN UNITARY ENTERPRISE "AXICON" OF THE NATIONAL ACADEMY OF SCIENCES OF BELARUS

– Scientific-research and design works on the development of devices, apparatus, facilities, and nonstandard equipment;
– Participation in the testing of products and improvement of them for the purpose of their commercial production, production of small series of products;
– Production of optical, mechanical and electronic elements, units, and devices.

SCIENTIFIC-TECHNICAL DEVELOPMENTS

1. MEDICINE

PHOTOTERAPEUTIC APPARATUS "MALYSH"

The apparatus is designed on the basis of LED sources operating in the blue-green spectral range. It has no analogs in the efficiency of treatment of jaundice (hyperbilirubinemia) in newborn babies. The apparatus makes it possible to increase the time of phototherapy by approximately three times and to completely exclude the side adverse effects given by the traditionally used lamp light sources because of the presence of the ultraviolet and infrared components in their emission spectrum (the intensity of these components increases with increase in the time of use of the lamps). The use of the apparatus "Malysh" for the treatment of heavy forms of hemolytic jaundice makes it possible, in the majority of cases (97–98%), to refuse from the blood transfusion in a newborn baby – the procedure that can lead to the fatal outcome (1%).

TECHNICAL DATA:
Size of the light spot: 200x500 mm;
Time of continuous work: 24 h;
Mean guaranteed life of the apparatus: 10 000 h;
Mass: 4 kg;
Overall dimensions: 240x200x120 mm.

Phototerapeutic apparatus "Malysh"

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company;
– Lyuzar Company.

Participating medical organization:
Mother and Baby Center.

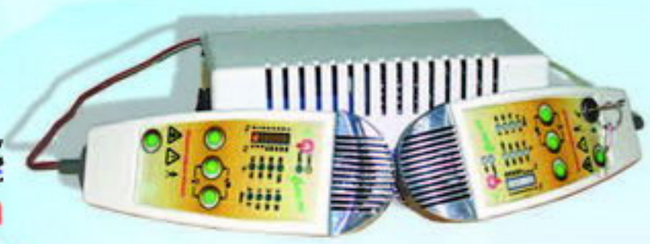
MAGNETOLASER THERAPEUTIC APPARATUS "SENS"

The apparatus is designed in three modifications for treatment of diseases with a deeply localized pathology focus and cupping of a pain syndrome of different etiology on the basis of modern semiconductor lasers and superbright light-emitting diodes. It makes it possible to exert a combined action by blue and IR radiation in the presence of a constant or a variable magnetic field, which enhances the therapeutic effect.
Field of application: treatment of traumas, including sports ones; diseases of joints, internal organs, and others.

TECHNICAL DATA:
Wavelength of a laser diode: 0.81±0.02; 0.98±0.02; 1.06±0.02 μm (depending on the modification);
Wavelength of an LED: 0.45±0.02 μm;
Induction of a constant magnetic field: 20 mTl;
Mean-rectified induction of a variable magnetic field: 2 mTl.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company;
– Lyuzar Company.

Participating medical organization:
BelMAPO.



Magnetolaser therapeutic apparatus "Sens"

SETUP FOR MEASURING THE AVERAGE POWER OF A CONTINUOUS LASER RADIATION AND CALIBRATION TESTING OF INSTRUMENTATION FOR MEASURING THE LASER-RADIATION AVERAGE POWER

The setup represents a complex consisting of lasers, measuring devices, optical elements, and a personal computer. It is designed for measuring the average power of a continuous and a pulsed-periodic laser radiation, certification of different-type lasers by the continuous-radiation power level, calibration and calibration testing of instrumentation for measuring the laser-radiation average power.

TECHNICAL DATA:
Dynamic range in the regime of reproduction of the average-power unit: $1 \cdot 10^{-3}$–5 W;
Dynamic range in the regime of measuring the laser-radiation average power: $1 \cdot 10^{-4}$–100 W;
Spectral range in the regime of measuring the laser-radiation average power: 0.4–12.0 μm;
Constant wavelengths in the regime of reproduction of the average power unit: 0.532; 0.975 and 10.6 μm;
Relative standard uncertainty in measuring the average laser-radiation power: 1.4–3.0 %;
Relative standard uncertainty in reproducing the laser-radiation average-power unit: 1.5–3.0 %.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company.

SETUP FOR MEASURING THE STABILITY OF THE POWER OF A CONTINUOUS LASER RADIATION

The setup is designed for measuring the stability of the power of a laser radiation in the process of certification of different-type continuous-wave lasers in accordance with the requirements of the STB ICO 11554–2004 standard. The data obtained are processed on a personal computer.

TECHNICAL DATA:
Dynamic range of the controlled laser-radiation average-power level: 10^{-3}–0.5 W;
Spectral range: 0.4–1.1 μm;
Threshold response in measuring the laser-radiation power stability:
– mean-time (measurement period 1 min): 0.04 %;
– long-time (measurement period 1h): 0.08 %;
Increased relative uncertainty in measuring the laser-radiation power stability (k=2, P=0.95): no more than 10 %.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company.

SETUP FOR DETERMINING THE SPATIAL CHARACTERISTICS OF LASER RADIATION

The setup is designed for measuring the spatial characteristics of a laser radiation and certification of different-type lasers by the spatial characteristics of their radiation on the basis of recording the spatial distribution of the radiation intensity in a laser beam by a matrix radiation detector and processing the data obtained by a personal computer.

TECHNICAL DATA:
Spectral range: 19–1800 nm;
Diameter of a laser-radiation beam: 0.4–6 mm;
Angular divergence of a laser-radiation beam: up to 0.03 rad;
Spatial resolution: 10 μm;
Coefficient of diffraction-limit overhoot M^2: 1–10;
Dynamic range of measuring the spatial distribution of the laser-radiation intensity: no less than 900:1;
Relative standard uncertainty in measuring the parameters of a laser-radiation beam: no more than 5 %.

Development and production:
– Institute of Physics of the NASB.

SETUP FOR MEASURING THE STABILITY OF LASER-RADIATION PULSES

The setup is designed for measuring the stability of the energy of laser-radiation pulses in the process of certification of different-type pulsed lasers in accordance with the requirements of the STB ISO 11554–2004 standard. The data obtained are processed on a personal computer.

TECHNICAL DATA:
Dynamic range of the controlled pulse-energy level: 10^{-2}–0.5 J;
Spectral range: 0.4–1.1 μm;
Threshold response in measuring the laser- radiation energy: 0.086 %;
Increased relative uncertainty in measuring the stability of the laser-radiation power (k=2, P=0.95): no more than 10 %.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company.

LASER THERAPEUTIC APPARATUS "AIBOLIT"

The apparatus is designed in four modifications differing by the wavelength and the regime of laser-radiation action (pulsed, continuous, or modulated) and represents a portable magnetic-laser therapeutic device. It provides an action of a low-intensity laser radiation on foci of affection of outer and intracavity localization, on biologically active points and reflexogenic zones as well as an internal laser irradiation of blood with the use of nonpermanent sterile light guides. The apparatus can be used not only for treatment of human diseases, but also in veterinary medicine (treatment of diseases of agricultural and furry animals).

TECHNICAL DATA (BY THE EXAMPLE OF THE AIBOLIT-KN15 MODIFICATION):
Laser radiation wavelength: 0.67 μm;
Regime of operation: continuous or modulated;
Mean-power range: 0–15 mW.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company;
– Lyuzar Company.

Participating medical organization:
BelMAPO.

Laser therapeutic apparatus "Aibolit"

LASER THERAPEUTIC APPARATUS "SNAG"

The apparatus is designed in eight modifications differing by the wavelength and the laser-radiation power and represents a compact magnetic laser therapeutic device based on modern high-intensity semiconductor lasers. The spectral range of its radiation corresponds to the maximum light transmission of biological tissues. The apparatus provides a laser-radiation action on foci of affection of outer and intracavity localization as well as a supravenous action on the blood through the skin. The intensity of the high-power radiation of these apparatus is optimum for the activation of the most important metabolic enzymes, the stimulation of the synthesis of proteins, DNA, and RNA, the division of cells, the regeneration of tissues, and the modulation of the activity of the immune system in the process of localization of a pathologic focus at a depth of up to 2–4 cm.

TECHNICAL DATA:
Wavelengh of a laser diode: 0.81±0.02; 0.85±0.02; 0.98±0.02; 1.06±0.02 μm (depending on the modification);
Induction of a constant magnetic field: 20 mTl;
Mass: 1.2 kg.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company;
– Lyuzar Company.

Participating medical organization:
BelMAPO.

Laser therapeutic apparatus "Snag"

LASER THERAPEUTIC APPARATUS "RODNIK-1"

The apparatus represents a new-generation universal multifunctional device designed with account for the latest achievements of the laser and fiber-optical engineering and medical practice. It can provide a laser or a magnetic-laser action in all phototherapy procedures used at present, including the local and zonal laser therapy using an external action, and the intracavitary laser therapy, as well as the intravascular (intravenous) action on the blood with the use of permanent sterile light-guide nozzles with a needle, a supravascular (supravenous) action on the blood, and an action on the biologically active points of a zone (laser reflexotherapy).

The field of application: treatment of long-term green wounds and ulcers, burns, fractures of bones, strained tendons and muscles, sports traumata, diseases of the locomotor system, gynaecological diseases, cardiovascular diseases, gastric ulcer, neurological diseases, etc.).

TECHNICAL DATA:
Number of independent channels: 4;
Induction of a magnetic field: 50 mTl;
Mass of the apparatus: no more than: 5 kg.

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company;
– Lyuzar Company.

Participating medical organization:
BelMAPO.

Laser therapeutic apparatus "Rodnik-1"

THREE-COLOR RETINAL STIMULATOR

The apparatus is designed for treatment of ophthalmological diseases and removal of visual fatigue. It exerts a medical effect by combined action of radiation of three wavelengths, corresponding to the maxima of spectral sensitivity of the eye, on the eye retina. It can be fabricated in two modifications: a laser modification and a LED one. It has a higher efficiency than analogous apparatus based on helium-neon lasers. Tests have shown that the stimulator makes it possible to improve the visual acuity in 75% of the cases; this index of a helium-neon laser is 47%.

TECHNICAL DATA:
Dimensions of the power unit: 210x160x125 mm;
Dimensions of the optical head: 138x135 mm;
Mass of the power unit: 1.7 kg;
Mass of the optical head: 0.18 kg.

Development and joint production:
– Institute of Physics of the NASB;
– LOTIS TII Company.

Participating medical organization:
MTZ Medservice Company.

Three-color retinal stimulator

6. CONTROL-MEASURING EQUIPMENT

Unique control-measuring equipment have been developed for control, calibration, and certification of the radiation parameters of laser facilities used in the Republic of Belarus.

SETUP FOR MEASURING THE PARAMETERS OF LASER-RADIATION ATTENUATORS

The setup is designed for measuring the attenuation coefficients of measuring attenuators of laser radiation by two methods: the dynamic method (mechanical attenuators with a rotating sector) and the static method (absorption attenuators). It can be used for calibration of attenuators forming a part of equipment for measuring the power of a laser radiation.

TECHNICAL DATA:
Attenuation-coefficient dynamic range: 1.0–100;
Spectral range: 0.4–1.1 μm;
Critical angle of incidence: 1.5 deg;
Main relative error in measuring
the attenuation coefficient: no more than 3.0 %.

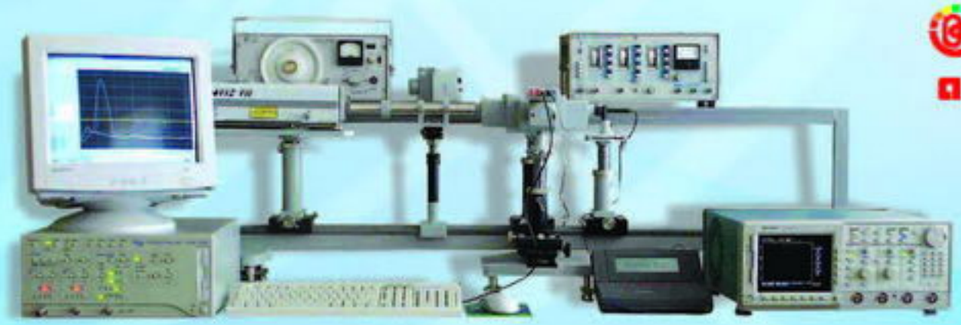
Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company.

SETUP FOR MEASURING THE TIME ENERGY CHARACTERISTICS OF PULSED LASER RADIATION

The setup is designed for measuring the shape, duration, and peak power of pulses and their repetition rate in the process of certification of different types of pulsed lasers in accordance with the requirements of the STB ISO 11554-2004 standard.

TECHNICAL DATA:
Pulse-energy dynamic range: $1 \cdot 10^{-3}$–0.1 J;
Spectral range: 0.4–1.1 μm;
Time resolution: $2 \cdot 10^{-9}$ sec;
Pulse-duration range: 10^{-8}–10^{-3} sec;
Relative total standard uncertainty in measuring the laser-pulse peak power: 2.6–4.6 %;
Relative total standard uncertainty in measuring the laser-pulse duration: 1.2–4.4 %;

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company.



SET "AXICON" OF UNIFIED MECHANICAL UNITS FOR CONSTRUCTION OF OPTICAL-ELECTRONIC AND LASER SYSTEMS

The set "Axicon" can be used in scientific-research institutions, instrument-making plants, and in higher educational establishments for development of optoelectronic systems and fulfillment of research works. By the requirement of a customer, nonstandard elements analogous in functions and different in characteristics, dimensions, and shape can be fabricated.

ELEMENTS:

- Optical plates of mark KA-1PO 4;
- Optical rails of mark KA-2RO;
- Bases of mark KA-2O;
- Angle pieces of mark KA-2U;
- Platforms of mark KA-3P;
- Rods of mark KA-3Sh;
- Rings of mark KA-3K;
- Holders of mark KA-3DS;
- Fixed members of mark KA-3S;
- Screw fixed members of mark KA-3SV;
- Holders of mark KA-4O;
- Mounts of light filters of mark KA-1ODS;
- Mounts of diaphragms of mark KA-1ODD;
- Mounts of round optics of mark KA-5DKO;
- Vertically movable mounts of mark KA-5DVP;
- Mounts of polarization elements of mark KA-5DPE;
- Crystal mounts of mark KA-5K;
- Thermostated crystal mounts of mark KA-5KT;
- Adjustment platforms of mark KA-6PYu;
- Microscopic stages of mark KA-7SP;
- Rotational tables of mark KA-7SP;
- Fine adjustment screw of mark KA-9VM.

Producer:
– Axicon Company.

АКСИКОН

INDICATOR OF THE POWER LEVEL OF A LOW-INTENSITY LASER RADIATION "NILI-TEST"

The apparatus is designed for estimating the average power of a low-intensity laser radiation and an individual laser-radiation pulses of all laser therapeutic apparatus used in medical organizations of the Republic of Belarus. It can be also used for estimating the radiation power of laser sources used in different fields of science and technology. The average power of laser radiation is controlled in the apparatus with the use of a thermal detector of original design.
The advantages of the apparatus: compactness, off-line operation, use of a nonselective photodetector.

TECHNICAL DATA:
Spectral range: 0.44-1.08 μm;
Range of estimating laser-radiation power in the continuous or modulated regimes: 0.5–500 mW;
Range of estimating average power of a laser-radiation pulse with a wavelength of 0.89 μm at a pulse duration of 50–150 nsec and a pulse repetition rate of 0–5 kHz: 0–20 W;
Maximum error: no more than ±10 %.

Indicator of the power level of a low-intensity laser radiation "NILI-test"

Development and joint production:
– Institute of Physics of the NASB;
– Axicon Company;
– Lyuzar Company.

B.I.Stepanov Institute of Physics
АКСИКОН
ЛЮЗАР

Participating medical organization:
BelMAPO.

LASER EQUIPMENT FOR WELDING AND TREATMENT OF METAL DENTURES

The equipment is designed for different types of laser treatment (welding, cutting, and perforation) of thin and miniature pieces and thermal-treatment surfaces of metal dentures and other products of metal alloys, used in the health protection and metal-working industry. Dentures made with the use of this equipment do not contain expensive silver solders, which decreases their cost as well as the allergic and galvanic action on the human organism, significantly improves the elastic properties of the springing clamps and orthodontical parts, and makes it possible to fabricate metal-ceramic dentures of large length.

TECHNICAL CHARACTERISTICS:
Laser-radiation wavelength: 1.06 μm;
Laser-pulse duration: 6 msec;
Pulse energy: 8 J;
Pulse repetition rate: 10 Hz;
Parameters of a weld:
– width: 0.5–1mm;
– melting depth: 0.2–1 mm.

Development and production:
– Institute of Physics of the NASB;
– Axicon Company.

B.I.Stepanov Institute of Physics
АКСИКОН

Participating medical organization:
Belarusian State Medical University.

Some works done with the use of the laser welding equipment.

Fabrication of metal-ceramic dentures of large length.

Restoration and fabrication of clasp and bridge dentures.

ULTRAVIOLET RADIATION SOURCE "GEMOKVANT 04"

The apparatus is designed for treatment of a number of diseases associated with hemorheological disturbances: chronic arterial incompetence of extremities, myocardial ischemia, primary and secondary pulmonary hypertension. The apparatus provides an action of an ultraviolet radiation on the blood of a patient. In this case, a cascade of photochemical processes, causing changes in the proteins, plasma lipids, antioxidant system. The molecules of the photomodified and newly synthesized plasma proteins play the role of antigens and cause corresponding immune reactions in a human organism. One of the links of the blood-irradiation treatment action is the stimulation of hemopoieses processes, which can be considered as an enhancement of the adaptation-protection activity of the organism.

TECHNICAL DATA:
Rate of blood pumping: 1–10 ml/min;
Error in the rate of blood pumping: no more than ±20 %;
Time of continuous work: no less than 8 h;
Mass of the apparatus: no more than 9 kg.

Development and joint production:
– Axicon Company;
– Institut of Physics of the NASB.

АКСИКОН

B.I.Stepanov Institute of Physics

Participating medical organization:
Belarusian State Medical University.

Ultraviolet radiation source "Gemokvant 04"

DIODE-PUMPED PULSED MICROCHIP LASERS WITH INTRACAVITY SRS CONVERSION

The lasers are designed for use in distance-measuring devices, spectroscopy apparatus, and other systems and represent miniature completely solid-state lasers generating short light pulses with a high repetition rate (of duration less than 10^{-8} sec.). At the output of such lasers, additional nonlinear elements can be installed for obtaining a radiation with a frequency falling within the range 300–600 nm. These lasers are pumped by a standard diode laser with an output power of up to 1 W.
Field of application: precise distance measurements, ecology, medicine, spectroscopy, photochemistry.

TECHNICAL DATA:
Wavelength: 1.06 and 1.18 μm;
Peak output power: no less than 25 kW;
Pulse duration: 200 nsec;
Pulse repetition rate: 5–10 kHz;
Length of an emitter: 1 cm.

Development and production:
– Institute of Physics of the NASB.

B.I.Stepanov Institute of Physics

LASER OPTICAL ELEMENTS AND COATINGS

The Axicon Company produces precise optical products in small series, including those with nonstandard optical characteristics, sizes, and shapes in accordance with the requirements of customers. Optical elements – lenses, prisms, polarizers, interference filters, laser mirrors, interferometers, etc. – are made from optical and quartz glasses and certain crystals and can be used in the spectral range 250–300 nm.

ELEMENTS AND COATINGS:

OPTICAL WINDOWS:
Diameter: 6–200 m;
Surface quality: λ/10 & 20–10 Scratch/dig;
Nonparallelism: up to ±5".

DIELECTRIC MIRRORS AND AR COATINGS:
Diameter: 6–100 mm;
Spectral range: 250–3000 nm;
Refl. coef.: 0.01–99.8%.

INTERFERENCE FILTERS:
Diameter: 10–50 mm;
Spectral range: 250–3000 nm;
Half-width: 0.003–0.25 λ_{max};
Max. transmission: 30–65%;
background: 0.1–0.001 %

Producer:
– Axicon Company.

АКСИКОН

FABRY-PEROT INTERFEROMETER:
Diameter: 10–80 mm;
Base: 0.005–50 mm;
Surface quality: λ/70 & 20–10 Scratch/dig;
Nonparallelism: ±0.5".

LENSES:
Plano-convex, plano-concave, meniscus, hemispherical (diameter: 6–200 mm, surface quality: λ/10 & 20–10 Scratch/dig).

POLARIZATION OPTICS:
– Fresnel Rhombs;
– Thin-film Polarizers (dia. up to 60 mm, Rs99.5%, Tp>93%);
– Multiple & Zero-order Waveplates (phase tolerance of ±1 degree);
– Optical rotators.

PRISMS:
– Calcite prisms: Glan-Taylor, Glan (laser), Glan-Thompson, Wollaston (spectral range: 250–2300 nm).
– Right-angle, dispersing, and penta prisms, Dove prisms,
– Retroreflection prisms (dev. of angles: up to ±1").

DEEP-OPTICAL-CONTACT ELEMENTS:
Optical cells, resonant reflectors, optical delay lines – nonseparable joints of precise optical elements (size: 0.05–200 mm, surface quality: λ/10 & 20–10 Scratch/dig).

5. LASER SOURCES, ELEMENTS AND DEVICES

COMPACT LASER SOURCES OF EYE-SAFE RADIATION

The compact laser sources generate a 1.5–1.6 μm radiation that is considered as a conditionally safe for human organs of vision. They can be used for control of the environment, distance measurements, target indication. Advantages: compactness and safety for the vision.
Field of application: geology, ecology, and others.

TECHNICAL DATA:
Lasing wavelength: 1.58 μm;
Excitation energy: 7 J;
Lasing energy: no more than: 25 mJ;
Pulse duration: 3–4 nsec;
Repetition rate of pulse trains: 20 Hz;
Working temperature range: –50 ч + 70°C;
Dimensions:
– emmiter: 150x30x40 mm;
– power-supply unit (PSU): 250x180x70 mm;
Mass without the PSU: no more than 2 kg.

Development and production:
– Institute of Physics of the NASB;
– Peleng Company.

B.I.Stepanov Institute of Physics
PELENG

LASER DIODES & LASER DIODE ARRAYS

A technology of fabrication and testing of powerful single laser diodes (LDs) and laser diode arrays (LDAs) has been developed. Single LDs were used in an IR laser projector developed at the JSC "Peleng" together with the IP NASB. The projector allows one to observe objects at night at distances of up to 1300 m. All previous models had a range of night supervision of no more than 800 m. LDs and LDAs are used in blocks for diode pumping of longitudinal and transverse excitation geometries, respectively. LDs are used in systems of control of mobile objects in micromarking with the use of a laser beam.

TECHNICAL DATA:
Single LDs:
Lasing wavelength: 0,8–1,06 μm (depending on the heterostructure type);
Output power: up to 3 W in the continuous mode of generation;
Working temperature ranges: –50 ч +60 °C.

Laser diode arrays:
Lasing wavelength: 0,98 μm;
Output power: up to 100 W in the pulsed mode (pulse duration up to 7 ms).

Development and production:
– Institute of Physics of the NASB;
– Peleng Company.

B.I.Stepanov Institute of Physics
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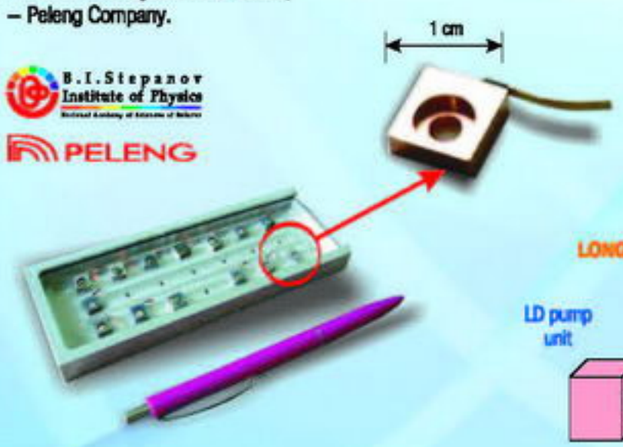
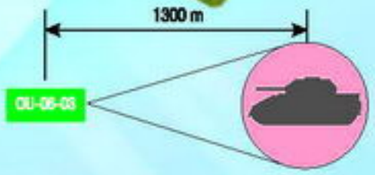
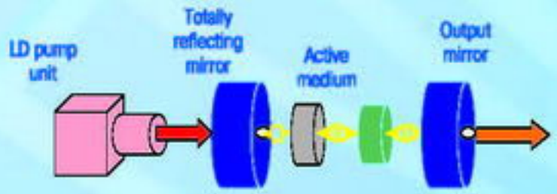
IR laser floodlight OU-06-03.





SOLID-STATE LASERS WITH LONGITUDINAL LD (ARRAYS) PUMP UNIT



2. ECOLOGY

COMPLEX OF LIDAR APPARATUS

The lidar complex is designed for investigating the processes and composition of the atmosphere, probing its aerosol and gas components, and monitoring the transfer of contaminations. The complex includes a panoramic lidar, a lidar station for probing the stratospheric aerosol, a lidar station for probing the atmospheric ozone, a mobile lidar station for control of the contamination of the lower atmospheric layer, and a mobile lidar. This complex is a part of the European lidar network EARLINET, the International photometric network AERONET, and the CIS lidar network CIS Li-Net (the formation of which was coordinated by the Institute of Physics of the NASB).

TECHNICAL DATA:
Height of measurements: 0–40 km;
Radius of action along the horizontal: 0–15 km;
Spatial resolution: up to 10 m;
Time resolution: fractions of a second;
Detected contaminants:
– aerosol particles;
– gases NH_3, C_2H_2, O_3, CO, NO, NO_2 and others.

Developmet and joint production:
– Institute of Physics of the NASB;
– Axicon Company.

B.I.Stepanov Institute of Physics
АНСИОН

Mobile lidar station.

Lidar station for probing the atmospheric ozone.

LASER TRACE GAS ANALYZER

The analyzer is designed for automated highly sensitive detection of several tens of gases (including H_2O, NH_3, C_2H_4, O_3, SO_2, OCS, ClO, C_2H_5, HNO_3, NO_2, CO_2, CO, NO, HI, N_2O, CH_4, COF_2, freons) in the atmosphere of cities, industrial zones, transport highways, open pits, production buildings, etc. The gas analyzer provides a rapid measurement of the background and increased concentrations of detected gases in the atmosphere, control of the contamination of the air basin as a result of the transport and industrial emissions, and identification of the results of the action of some thermal, electro-physical, and radiation processes.

Advantages: service of large areas of probing from one point of the space, a high sensitivity to small concentrations, possibility to perform measurements for 24 hours in a day, a high rate of measurements, automation of measurements, possibility of connection to information networks.

TECHNICAL DATA:
Laser used: a TEA CO_2-laser with automated frequency tuning;
Lasing wavelength range: 9.1–11.3 μm; 4.5–5.5 μm;
Length of a trace: up to 5 km;
Sensitivity (for NH_3): several mTorr;
Power supply: 220 V, 50 Hz, 200 W;
Sizes: 1400x650x1250 mm;
Mass: 170 kg.

Developmet and production:
– Institute of Physics of the NASB.

B.I.Stepanov Institute of Physics

MULTIDETECTOR GAMMA SPECTROMETERS

The gamma spectrometers "Pripyat'" and "ARGUS" are designed for control of the content of radionuclides in foods and water, investigating radioactive wastes, biological investigations with the use of radioactive marks, control of the content of radionuclides in building materials, investigating the transfer of radionuclides (determining the radon content, monitoring the environment), and investigations in the field of nuclear physics, including by the coincidence method (in particular for construction of radioactive-decay schemes, and determination of the nuclear-process cross section, including the angular and correlation characteristics).

TECHNICAL DATA:
Volume: up to 5 liter ("Pripyat'-2"), up to 50 liter (Argus);
Minimum detectable activity: 0.2 Bq/kg;
Range of detectable energies: 0.1–3 MeV;

Developmet and joint production:
– Institute of Physics of the NASB;
– Axicon Company.

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Gamma spectrometer "ARGUS".

Gamma spectrometer "Pripyat'-2".

LASER-OPTICAL SYSTEM FOR HIGH-ACCURACY DETERMINING THE POSITION OF AN OBJECT IN A COUNTRY INACCESSIBLE FOR DIRECT OBSERVATION

Possible fields of application:
– topographic survey and map-making of buildings, communications, and public service objects in town-planning;
– designing and building of gas and oil pipe-lines, electric-power lines, etc.;
– geodesic survey of a country inaccessible for man, including because of a radioactive contamination;
– development of automated systems for pilot steering of ships in ports, straits, and complex forvaters as well as in systems of warning of the danger of come-down of avalanches, glaciers, etc.

TECHNICAL DATA:
Radiation wavelength: 1.06 μm;
Accuracy of angular positioning: not worse than 4°;
Resolving power: 6";
Accuracy of determining the coordinates of an object: 10 cm;
Served area of a town massive: 0.5x0.5 km;
Mass of the system: 8 kg;
Mass of a laser searchlight: 5 kg.

Development and production:
– Institute of Physics of the NASB.

B.I.Stepanov Institute of Physics

METHODS AND EQUIPMENT FOR DIGITAL PROCESSING AND TRANSFER OF OPTICAL SIGNALS ON THE BASIS OF THE OPTICAL-BISTABILITY PHENOMENON

Fields of application:
– fiber-optic communication lines and networks – from the requiring-payment connections to the high-speed global optical communications;
– completely optical digital computational systems;
– methods and apparatus for control of geometric parameters of electronic products.

TECHNICAL DATA (for an EOL optical logic element):
Number of logic operations: 8;
Size of individual logic optical element (pixel): 3x3x2 μm^3;
Density of arrangement of parallel channels: no less than 1000 per cm^2;
Working wavelength: 488 nm (is changed by the requirement of a customer);
Working aperture: no less than 7.4 mm.

Development and production:
– Institute of Physics of the NASB;
– Axicon Company.

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АКСИКОН

EOL digital optical device.

PLANTS FOR LASER CLEANING

The plants "Bronza" and "Parfenon" are designed for laser cleaning of art products of ancient marble and other stones, paper, parchment, wood, paintings, and metals as well as for technological operations in microelectronics, power engineering, aircraft industry, and other industries. The plants provide a high quality of cleaning due to the simultaneous action of the fundamental frequency nanosecond radiation of a powerful YAG:Nd laser and the radiation of one of its harmonics. The plants are equipped with a special mechanism providing the obtaining of an optimum, for each type of art product, ratio between the intensities of the UV and IR components. The plants have a block design with a reliable vibration isolation of all blocks and units, which provides a high reliability in the process of transportation and work. These plants and their associated technologies developed have no analogs in the CIS and, by a number of parameters, excel foreign analogs.

Fields of application: restoration of art products and fulfillment of technological works on cleaning in microelectronics, power engineering, aircraft industry.

TECHNICAL DATA ("Parfenon"):
Radiation energy (1064 nm): no more than 550 mJ;
Radiation energy (532 nm): no more than 800 mJ;
Radiation energy (355 nm): no more than 400 mJ;
Radiation energy (266 nm): no more than 300 mJ;
Radiation energy (213nm): no more than 100 mJ;
Radiation-pulse duration: 15–20 nsec;
Pulse repetition rate: 1–5 Hz.

Development and production:
– Institute of Physics of the NASB;
– Axicon Company.

Plant for laser cleaning "Parfenon".

Example of laser restoration of a bronze fragment of a marching altar.

4. INFORMATIONAL SYSTEMS

IDENTIFIER OF HOLOGRAPHIC PROTECTIVE ELEMENTS AND OTHER TYPES OF CONCEALED IMAGES

The identifier is designed for determining the authenticity of securities as well as excise and control marks.

Identifier provides:
– visualization of holographic images;
– visualization of luminescent protective marks and symbols;
– identification of microtext information;
– visualization of half-tone(watered) protective images;
– visualization of latent polarization images;

TECHNICAL DATA:
Power supply: 2 batteries of the type of $CR_{123}A$;
Dimensions: 170x50x35 mm;
Mass: 200 g.

Development and joint production:
– Institute of Physics of the NASB;
– S.I.Vavilov MMZ.

3. TECHNOLOGICAL EQUIPMENT

PLANT FOR LASER MACHINING

The plant is designed for cutting of materials of ferrous and non-ferrous metals and perforation of holes.

Fields of application: machine building, instrument making, metal working, and other industries.

TECHNICAL DATA:
Thickness of a material (for steel): no more than 5 mm;
Mass of treated parts: no more than 10 kg;
Laser radiation wavelength: 1.064 μm;
Laser radiation power: no more than 150 W;
Overall dimensions: 2400x1400x1600 mm;
Mass of the plant: 550 kg.

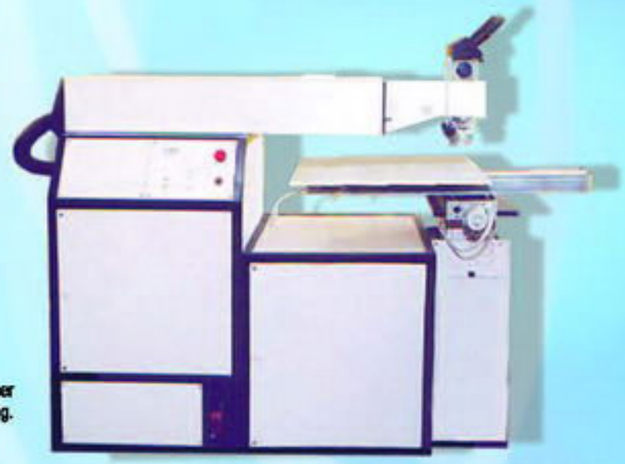
Joint development and production:
– Institute of Physics of the NASB;
– Axicon Company.

PLANTS FOR LASER SCANNING MARKING

The plants are designed for marking and engraving of products of metals, plastics, and ceramics as well products with paint coatings and other coatings under the production conditions of the machine-building, instrument-making, and metal-working industries, and for laser marking of gems and jewelries.

TECHNICAL DATA:
Height of engraved marks: no less than 0.6 mm;
Average width of lines: 0.05 mm;
Laser radiation wavelength: 1.064 μm;
Sizes: 1900x900x1200 mm;
Mass: 250 kg;

Joint development and production:
– Institute of Physics of the NASB;
– Axicon Company.



Plant for laser scanning marking.

TECHNICAL DATA:
Laser radiation wavelength: 1.064, 0.533, 0.266 μm;
Pulse repetition rate: up to 25 Hz;
Energy of a laser radiation pulse:
– for 1.064 μm – up to 200 mJ,
– for 0.533 μm – up to 100 mJ,
– for 0.266 μm – up to 20 mJ;
Height of marks: 30–150 μm;
Output of marking (average):10 products in an hour;
Magnification of the TV system of the apparatus table: 40–100*;
Overal dimensions of the apparatus:
– Control past: 850x650x1350 mm;
– Apparatus table: 750x1200x1350 mm;
Mass of the apparatus: 250 kg.

Developmet ad joint production:
– Institute of Physics of the NASB;
– Axicon Company.

Apparatus for laser marking of gems and jewelries

PLANT FOR LASER ENGRAVING "DUET"

The plant is designed for making of engravings on the surface of oxidized plates of aluminum alloys and plates with paint coatings for the purpose of fabrication of station-index plates and panels of devices as well as for marking of sheet materials under the production conditions of the machine-building, instrument-making, metal-working, and other industries.

TECHNICAL DATA:
Wavelength: 1.064 μm;
Working field of the coordinate table: 1000x700 mm;
Accuracy of positioning: 0.05 mm;
Width of engraved lines: 0.01-0.1 mm;
Depth of engraved lines: 0.1 mm;
Overall dimensions:
– coordinate table: 700x1700x1000 mm;
– power units (2 units): 600x800x900 mm;
– control bay: 700x700x1000 mm.

Developmet ad joint production:
– Institute of Physics of the NASB;
– Axicon Company.

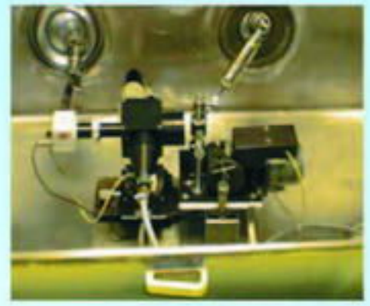
Plant for laser engraving "Duet".

EQUIPMENT FOR FABRICATION OF IONIZING-RADIATION SOURCES

The special laser equipment is designed for welding and hermetic sealing of radioactive containers and can be used as a part of a technological complex for fabrication of ionizing-radiation sources in closed radiative boxes for welding and hermetic sealing of radioactive containers of medical and technological application.
Field of application: industry (flaw detection, X-ray radiography, and others).

TECHNICAL DATA:
Laser-radiation wavelength: 1.06 μm;
Regime of operation: pulsed;
Laser-pulse duration: 10 msec;
Pulse energy: no more than 8 J;
Repetition rate: no more than 50 Hz;
Average power: 100 W;
Accuracy of positioning of a sample: 10 μm.

0,1 mm Sealed container.



Development and production:
– Institute of Physics of the NASB;
– Axicon Company.

LASER DIFFRACTIONAL RELAXOMETER FOR INVESTIGATING CONDENSED MEDIA

The relaxometer operates by the principle of dynamic gratings: a sample is exited by a pulsed laser, and a diffraction signal is recorded by a continuous beam of an other laser. It can be used for quantitative analysis of the kinetic and amplitude characteristics of different-nature light-induced effects (including effects that do not manifest themselves in luminescence) in volumetric materials and films, measuring the heat conduction, thermal certification of different media (including diamond-like materials, and films of submicron thickness), and investigating the properties of new types of laser crystals and mechanical properties of samples (velocity of sound, modulus of elasticity, and others).

TECHNICAL DATA:
Time resolution: 10 nsec;
Minimum detectable change in the refractive index: 10–6;
Minimum thickness of a sample: 1 μm;
Minimum transverse size of a sample: 0.8 mm;
Range of change in the heat conduction: 0.01–2500 W/m K;
Period of grating: 20–140 μm.

Development:
– Institute of Physics of the NASB.