

Preface

The VIII International Conference on Atomic and Molecular Pulsed Lasers – AMPL-07) was held in September 10–14, 2007. The conference is a traditional scientific forum held every two years in the Akademgorodok of the ancient Siberian city of Tomsk. The AMPL conference is very popular among laser conferences, which is demonstrated by a large number of presented reports, as well as publication of the presented papers in thirteen issues of the journal “Atmospheric and Oceanic Optics” (1993, V. 6, Nos. 3, 6; 1995, V. 8, No. 11; 1997, V. 10, No. 11; 1998, V. 11, Nos. 2–3; 1999, V. 12, No. 11; 2000, V. 13, No. 3; 2001, V. 14, No. 11; 2002, V. 15, No. 3; 2004, V. 17, Nos. 2–3; 2006, V. 19, Nos. 2–3) and in six topical issues of SPIE Proceedings, USA (Proc. SPIE, 1995, V. 2619; 1997, V. 3403; 1999, V. 4071; 2001, V. 4747; 2003, V. 5483; 2005, V. 6263).

The scientific program of AMPL-07, as a whole, was traditional and included the following sections:

- **plenary section;**
- **gas and plasma lasers (Section A);**
- **metal-vapor lasers (B);**
- **dye lasers and photoprocesses in complex organic molecules (C);**
- **physical processes in gas lasers (D);**
- **laser systems and new laser-optical technologies of laser applications (E);**
- **incoherent sources of UV- and VUV-radiation (F);**
- **laser radiation transformation, optoelectronic devices (G).**

The conference was supported by the Russian Academy of Sciences, the Siberian Branch of RAS, the Russian Branch of SPIE, Laser Association, the Surgut State University; the Scientific-incorporated enterprise “Topaz”; the Administration of Tomsk and the Tomsk city Council. The information support was provided by the journal “Atmospheric and Oceanic Optics” (Tomsk, Russia), the edition “Advances of Optical Technologies” (New York, USA), and Internet-edition “Tomsk Review” (Tomsk, Russia).

186 scientists from Russia, Germany, France, Italy, USA, Serbia, Gzech Republic, Japan, Kazakhstan, Estonia, and Byelorussia were among the participants of the Conference; 223 papers were presented; 35 invited papers and 98 oral presentations were reported. The students of Tomsk institutes (about 50) took part in the Conference as the audience.

During the conference, the excursions were made to the laboratories of the Institute of High-Current Electronics SB RAS and of the Institute of Atmospheric Optics SB RAS.

The conference was dedicated to the memory of scientists: Vladimir Mikhailovich Klimkin and Sergei Inanovich Yakovlenko, died last year, who were the members of the Organizing Committee of all AMPL conferences. During the Conference, a great contribution of these scientists in the development of laser was highlighted repeatedly.

In 2008, some papers of the Conference will be published in the SPIE collected articles. The other papers, prepared by the authors in Russian, will be published in the journal “Atmospheric and Oceanic Optics” and in the journal “Tomsk State University Bulletin.”

As to the contents of papers presented at the Conference, we can say that in the program of Plenary meeting on September 10, the papers were devoted to the urgent problems of the development of pulse lasers, physics of gas discharge, sources of UV and VUV radiation, the interaction of laser radiation with the substance, the creation and the use of laser systems. Totally, 14 papers were presented. The first lecture at the plenary meeting was delivered by Prof. A. Ulrich from the Munich Technological University (Germany). The lecture informed about the first production of generation on KrF* molecules at pumping by a beam of heavy ions. In his report Dr. A.M. Boichenko presented briefly the most important scientific results of S.I. Yakovlenko, and Prof. G.S. Evtushenko presented in his report the most important results of Prof. V.M. Klimkin. Prof. K. Kolaček from the Institute of Plasma Physics (Praha, Gzech Republic) reviewed the papers devoted to the electric discharge lasers generating soft x-rays, including the results obtained at the Institute of Plasma Physics. The lecture delivered by S. Bosle and H. Pike “A new concept of a power supply for excilamps of barrier discharge” (Toulouse, France) was devoted to the development of generators of excilamps excitation with high efficiency of power transfer into load. Prof. A.N. Soldatov from the Tomsk State University (Tomsk, Russia) told about new results in producing a Sr-IR-laser and its application. The paper “Surface modification of biomaterials by nanosecond and picosecond pulses” was reported by Dr. M. Trtitsa from the Institute of Nuclear Sciences (Belgrad, Serbia). Dr. B. Lakur from the University Paris-Sud (France) presented the report “Generation of singlet oxygen in microdischarges.” The singlet oxygen is used when creating the chemical lasers with high mean radiation power.

A brief survey of investigations, made at the Laboratory of Optical Radiation of the Institute of High-Current Electronics SB RAS (Tomsk) over a period of two years between the conferences AMPL-05 and AMPL-07, was presented by Prof. V.F. Tarasenko. Dr. A.B. Treshchalov from the Tartu University (Tartu, Estonia)

delivered a lecture "VUV and the visible radiation from a high-pressure discharge in argon." Prof. A.A. Ionin from the Physical Institute RAS (Moscow) delivered a lecture on creation of a high-power femtosecond laser system. At the plenary section the lectures were delivered by Prof. P.A. Bokhan (Institute of Semiconductor Physics SB RAS), Dr. Yu.M. Andreev (Institute of Monitoring of Climatic and Ecological Systems SB RAS), and Prof. M.M. Makogon (Institute of Atmospheric Optics SB RAS).

Prof. G.G. Matvienko, Director of the Institute of Atmospheric Optics SB RAS, who opened the Conference, made a report and presented the results of investigations of the Institute.

Section A. Gas and Plasma Lasers

The Section was opened by the report by Prof. A.M. Razhev (Institute of Laser Physics, Novosibirsk), who told about the latest results on the study of lasers excited by an induction transverse discharge. The greatest radiation energy about 300 mJ was obtained for CO₂ laser. Dr. M.Yu. Yakimov from the Institute of Mechanics Problems RAS (Moscow) gave the latest results on the study of CO₂ laser pumped by a combined discharge at high gas flow velocity. Prof. V.F. Losev from the Institute of High-Current Electronics SB RAS (Tomsk) reported on generation of high-power short pulses in active media of excimer lasers. The reports of B.V. Lazhintsev (Federal Nuclear Centre – Scientific Research Institute of Experimental Physics, Sarov) were devoted to CO₂ investigations and excimer lasers with the pulse repetition rate up to 5 kHz.

Prof. P.A. Bokhan presented a paper devoted to generation of an electron beam in the wide-aperture discharge and to its use for laser pumping. Prof. A.N. Panchenko (Institute of High-Current Electronics SB RAS, Tomsk) reported on the latest results on laser excitation by generators with inductive energy accumulators and semiconductor current choppers. At this section, 25 papers were presented, including 13 oral reports, from which the following conclusion can be made – the investigations in the field of gas and plasma lasers are still in progress, and in the problem of obtaining of the short-wave UV and VUV radiation, the other types of lasers cannot compete with gas lasers up to now.

Section B. Metal Vapor Lasers

At this section 27 papers were presented. Spectral, time, frequency, coherent, energy characteristics of metal vapor lasers were under discussion; as well as the metal vapor lasers with injecting vapors to a discharge due to the dissociation of compounds; the present-day power supplies and active elements of MVL; lasers with complex composition of active media; systems amplifier-oscillator; new elements and laser transitions. Much attention was given to the prospects of the development and application of MVL.

Prof. P.A. Bokhan from Novosibirsk reported the generation in He-Cd-laser. The paper by V.A. Gerasimov about the correctness of traditional models of laser operation on self-limited transitions caused a hot debates. Dr. V.G. Sokovikov (Institute of Atmospheric Optics SB RAS, Tomsk) informed the audience about the observed high-effective process of optical excitation of resonance states of Eu ions from the basic state of atom.

Dr. G.D. Chebotarev (Southern Federal University, Rostov-on-Don) presented the results of optimization of self-heating He⁻Sr⁺(Ca⁺) recombination lasers; the author has shown a possibility of 30% increasing of the mean generation power when exciting active medium by pulse bursts with short interpulse interval.

In his paper Dr. N.A. Judin (University of Innovation Technologies and Enterprise, Tomsk) considers the reasons of appearance of phantom currents in active medium of self-limiting transition lasers. It is shown that the phantom current is due to the characteristics of a charge of a capacity component of impedance of a laser gas-discharge tube.

Interesting results were presented in reports of young Russian scientists F.A. Gubarev, V.V. Gerasimov, D.V. Shiyarov. A profound paper by Prof. A.N. Soldatov was devoted to the history of the development of metal vapor lasers in Siberian region. Dr. V.O. Troitskii in his paper considered the MVL application for technological problems using a copper bromide vapor laser.

Section C. Dye Lasers and Photoprocesses in Complex Organic Molecules

At this section 12 oral papers and 19 posters were presented. The participants presented the results of latest investigations of photoprocesses in complex organic compounds, as well as the results of producing of new materials on their base for quantum electronics, in particular, active media of tunable lasers.

Thus, the results of complex (theoretical and experimental) studies of photoprocesses in complex organic molecules were given in the papers by V.Ya. Artukhov, G.V. Mayer; R.M. Gadirov and coauthors; O.M. Zharkova and coauthors (Tomsk State University). An original theoretical approach to the investigation of photoprocesses in aromatic molecules, captured by polymers, was considered in the paper by Dr. V.A. Pomogayev and coauthors (Kyusyu University, Japan).

Experimental investigation of peculiarities of two-photon absorption by new dyes synthesized at the Institute of Organic Chemistry NAS Ukraine was given in the paper of V.A. Svetlichnyi and coauthors (Tomsk

State University). The role of energy transfer processes in extinguishing bioluminescence with addition of xanthene dyes was considered in the paper by M.A. Gerasimova and coauthors (Siberian Federal University, Krasnoyarsk).

The results of creation of solid-state active media of retuned lasers were presented in the papers of T.N. Kopylova, G.V. Mayer, Kuznetsova and coauthors (TSU). The paper by E.N. Telminov and coauthors presented the results on the development of a solid-state tuned laser for diagnostic complexes.

In the work of the Section the following students participated: E.R. Kashapova, L.O. Khasanova, E.V. Shamonaeva (and O.K. Bazyl').

19 posters, described the results of detailed investigations on the Section topics (papers by N.E. Koval'skaya, N.G. Bryantseva, N.S. Eremina, A.D. Tsyganov, O.V. Dolgova, A.G. Sizykh, S.S. Anufrik, G.G. Samsonova, I.V. Reimer, I.V. Mastushkina, O.N. Chaikovskaya, et al.), were presented.

Section D. Physical Processes in Gas Lasers

At the Section D Dr. K.N. Firsov from General Physics Institute RAS (Moscow) reported the results of studies of a discharge in SF₆ and in mixtures with SF₆. To excite vibrational levels in SF₆, the radiation of the pulsed CO₂ laser was used. In his paper Prof. V.F. Tarasenko presented the latest results of the experiments on generation of a supershort avalanche electron beam in different gases at high pressures and on formation of a volumetric discharge without a source of additional pre-ionization. In his paper Dr. S.A. Yampol'skaya (Institute of High-Current Electronics SB RAS, Tomsk) presented the results of computer simulation of the effect of pumping parameters on the kinetic processes in a XeCl laser. Prof. A.A. Zhupikov (Institute of Laser Physics SB RAS, Novosibirsk) presented the experimental data on the effect of pumping, composition, and pressure of mixture on the energy characteristics of KrCl laser. At this section 27 papers were presented including 11 oral ones.

Section E. Laser Systems and New Laser-optical Technologies of Laser Applications

This Section was one of the most numerous: 27 oral reports and 38 posters were presented there. The plenary session was opened by the report of K.N. Firsov (General Physics Institute RAS, Moscow) "Balloelectric effect at explosive boiling up of water under the action of the pulse laser radiation." A new physical effect – generation of an electric signal (ES) under the effect of IR-laser radiation at the flow density below the threshold of plasma formation on the water surface was its topic.

Many papers, presented at the Section, were dedicated to the problem of the laser radiation interaction with materials. The resonance light absorption by gases, liquids, and biotissues is the base of processes of isotope separation in the nuclear and pharmaceutical industry, processes of catalysis, laser medicine, diagnostics, therapeutics, some types of surgery, as well as in biology and biometry.

Laser torch dynamics and thermal processes in the target under the action of a pulse-periodic CO₂ laser as well as the evaporation process of a fast-moving target under the effect of high-power laser radiation were the topic of reports made by specialists from the Institute of Electrophysics UrB RAS (Ekaterinburg).

The report by Yu.N. Panchenko and coauthors (Institute of High-Current Electronics SB RAS) has confirmed that the development of nanotechnologies is closely connected with the development of lasers. Their report analyzes the efficiency of production of nanopowder under the impact of XeCl laser radiation on the material CeO₂/Gd₂O₃. It was shown that at the pumping energy density higher than the optimal one, the efficiency of nanopowder formation decreased at the cost of the increase of screening characteristics of the laser plasma.

At present of special interest are the investigations of processes of interaction of femto- and picosecond laser radiation with materials, as well as the development of high-power femtosecond laser systems. This problem was considered in the paper by V.I. Cheremiskin (Laboratory of lasers, plasma and photon processes, Marseilles, France) "Femtosecond XEF(C–A) laser amplifier with pumping by the radiation of multichannel surface discharges." The paper presented the latest results on the amplification of femtosecond optical pulses in a gas active medium of the photodissociation XeF(C–A) amplifier. The goal of the investigation was the development of laser systems of the super-high peak power ($\sim 10^{15}$ W) based on the hybrid (solid state/gas) laser technology.

Apart from the above-mentioned facts, there was a great section of nonresonance interaction of laser radiation with materials, including the force action of laser radiation mainly on the structural materials – metals, semiconductors, and dielectrics. The problem of laser technological application was discussed in some papers by the authors from the Institute of Atmospheric Optics SB RAS (Tomsk), TOO "Nauka-L" (Almaty, Kazakhstan), Samara Division of the Physical Institute RAS (Samara), et al.

A great amount of results on the use of lasers, and, first of all, metal-vapor lasers in the oncology was given in the papers of scientific workers of the Scientific-Research Institute of Oncology SB RAMS and the Tomsk State University: Prof. V.A. Evtushenko "Medical treatment of basalcellular cancer of skin by the

method of photodynamic therapy and heavy attendant diseases using a "LITT-PDT" dye laser," O.V. Cheremesina "Condition of the system of peroxide oxidation of lipoids in the treatment of pre-cancer of bronchi by low-intensity laser radiation," M.V. Vusik "The application of local spectrophotometry of urologic tumors of patients with muscular-invasion cancer of urinary bladder on the background of cytostatic therapy." In the presented studies the laser equipment was used, developed at the Tomsk State University and OOO "LITT."

The scientific results, presented at the section, make possible the future development of applied investigations in the fields, interdisciplinary with the laser physics. It should be noted that the market of laser processing of materials is the most powerful, mobile, and fast developing.

Section F. Incoherent Sources of UV- and VUV-radiation

This Section traditionally considered the problems of production and application of incoherent radiation sources. Here 15 posters and 8 oral papers were presented. Among oral papers, of interest were the following.

In the paper by A.M. Boichenko (GPIAS, Moscow) theoretically were outlined the ways for producing Xe₂ laser and excilamps of VUV-range at the cost of pumping in the afterglow of wave of background electron multiplication. In the paper of Dr. I. Wiezer (OOO "Coherent," Munich, Germany), an attempt was made to evaluate the VUV-radiation source efficiency based on the small-size electron gun, constructed and distributed by the firm "Coherent," capable of producing an electron beam with a power of up to 12 keV. Although the work was not completed, the device was already claimed as a promising European innovation.

In the paper by Dr. M.I. Lomaev "VUV-radiation of inert gases at excitation by a volume nanosecond discharge" (Institute of High-Current Electronics SB RAS, Tomsk, Russia) the first results were reported on generation of a volume discharge in helium at a pressure of up to 12 atm, and in other inert gases at lower pressures. The discharge volume was achieved at the cost of the effect of electron runaway. Probably, in the immediate future the described excitation technique will result in a new class of gas-discharge equipment for different applications.

The use of VUV excilamps on xenon dimmers was presented in the paper of V.M. Orlovskii (Institute of High-Current Electronics, public company "Vostokgasprom," Tomsk, Russia). Field tests of a block of high-power excilamps of a given type in the field conditions have shown that the process of the gas condensate obtaining from the by-product gas requires about 3–4 times less energy than the traditional process of mechanical compression. In the paper by I.V. Galakhov (All-Russian Scientific-Research Institute of Nuclear Physics, Sarov) a diagram was described for the pulse preionization of standard xenon excilamps and it was shown that a given technological process enabled one to increase the excilamp pulse power without damage for their resource. In the paper by M.B. Shpizel ("Hyperboloid," New-York, USA) the results were presented of the developments of component sources of the concentrated polychromatic radiation based on high-power light diodes, in which the radiation from several light diodes was turned to a beam with low divergence (up to 0.5 degrees).

In the reports and papers of the section, there were the works on kinetics of processes in an ultra-high frequency discharge, created by an electron beam, on the study of characteristics of gas-discharge lamps on the mixtures of cadmium diode with inert gases; on the mixtures of argon chloride, krypton and chlorine molecules; krypton and argon with bromine vapors; iodine vapors with krypton and xenon; modeling and development of excilamps and discharge cells, based on a barrier discharge.

Section G. Laser Radiation Transformation, Optoelectronic Devices

At this Section 9 oral papers and 25 posters were presented.

The Section was opened by Dr. Yu.M. Andreev (Institute of Monitoring of Climatic and Ecological Systems SB RAS, Tomsk), who elucidated the results of model and experimental investigations of physical characteristics of wide-range (visible–near and middle IR-terahertz ranges) nonlinear crystals of solid solutions, conditions and efficiency of frequency transformation in crystals. The developed information on a series of original crystals and crystals of solid solutions, parameters and characteristics of corresponding frequency converters were presented by G.V. Lansky. An original paper about a dynamic feature of phase self-synchronization in a two-cavity parametric light generator was presented by an assistant professor D.B. Kolker (State Technical University, Novosibirsk), as well as the paper on a possibility of creating a nonstationary wave guide channel based on elongated nanoparticles suspended in gas media was presented by Prof. N.P. Sadykov from the Federal Nuclear Center-Research Institute of Technical Physics (Snezhinsk). In the field of applied optics, specialists gave much attention to the classification of known algorithms and the comparative model estimates of parameters and characteristics of the frequency converters, based on a great amount of widely used crystals with regular domain structure presented by E.P. Kotsubinskaya (Institute of Monitoring of Climatic and Ecological Systems SB RAS, Tomsk). A series of interesting reports on crystals was presented by V.V. Atuchin (Institute of Semiconductor Physics SB RAS, Novosibirsk) and scientists of the Tomsk State

University. Special attention should be given to the paper by E.I. Lipatov (Institute of High-Current Electronics SB RAS, Tomsk) on the optoelectron switching in diamond and to the series of papers presented by the specialists of the Tomsk State University in the optoelectronics field.

At the final meeting of AMPL-2007 on September 14, the results of the Conference were summed up. A scientist from Novosibirsk D.I. Strokotov (Institute of Chemical Kinetics and Combustion SB RAS) was awarded the diploma for the best report among young scientists. The participants took into consideration a high level of organization of the conference, active participation of young scientists and aspirants in the conference work, and expressed their opinion about the organization of the next conference of AMPL in September, 2009 in Tomsk.

Additional information on the AMPL conference can be found on data line of the Institute of Atmospheric Optics SB RAS: <http://symp.iao.ru>.

Yu.M. Andreev, the Institute of Monitoring of Climatic and Ecological Systems SB RAS;

A.V. Klimkin, the Institute of Atmospheric Optics SB RAS;

A.V. Vasil'eva, A.N. Soldatov, Tomsk State University;

E.A. Sosnin, V.F. Tarasenko, the Institute of High-Current Electronics SB RAS;

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