CURRICULUM VITAE

Igor PESHKO

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DEGREES

Doctor of Sciences (*Optics and Laser Physics*), Institute of Physics, National Academy of Sciences, Kiev, Ukraine (2003). Thesis: "Self-effecting processes in the solid-state lasers".

Honorary Diploma of Senior Scientific Fellow (1991), for the cycle of pioneering works "High power single-frequency lasers with nano-selector".

Ph.D. (*Quantum Electronics and Physics of Solids*), Institute of Physics, National Academy of Sciences, Kiev, Ukraine (1983). Thesis: "Picosecond Nd:glass lasers and fast phenomena in optically excited semiconductors".

M.Sc. (*Molecular and Radio Spectroscopy*), Department of the Radiophysics, Kiev State University, Kiev, Ukraine (1971). Thesis: "Stimulated Raman scattering in organic liquids".

POSITIONS HELD (last 10 years)

Adjunct Professor – Physics and Computer Science, Wilfrid Laurier University, Waterloo, ON, Canada	2010 – present
Senior Scientist, Laser & Sensory Technologies – P&P Optica, Inc., Waterloo, ON, Canada	2012 - 2013
Consultant, Photonic devices for robots – CrossWing, Inc., Markham, ON	2012
Research Associate – Mechanical and Industrial Engineering, University of Toronto (UofT), ON, Canada	2009 – 2011
Consultant, Photonics Technologies – Engineering Services, Inc., Toronto	2004 – present
Research Associate – Chemical & Physical Sciences, Biophysics Lab, University of Toronto Mississauga (UTM), ON, Canada	2006 – 2010
Senior Scientist – Intelligent Optical Systems, Inc. Torrance, CA, USA	2008 – 2009
Senior Research Associate – Institute for Optical Sciences, UofT, ON	2004 – 2006
Senior Staff Scientist – Photonics Research Ontario (Centre of Excellence, PRO), Toronto, ON	2001 – 2004

LANGUAGE SKILLS

English (fluent), Ukrainian (native), Polish (fluent), Russian (native), French (basic)

MAIN ACHIEVEMENTS IN SCIENCE AND TECHNOLOGIES

In Technologies

Dr. I. Peshko has a long-standing, widely recognized experience in optical/laser/sensory technologies. He was leading multiple projects for industrial, military and health-care applications. Dr. I. Peshko developed a multilaser deposition technique for the high temperature super-conducting films for Brookhaven National Lab, USA; a visualization system for monitoring the chemical reaction with granulation inside the reactors in poor visibility conditions; special fiber diffusers for heart surgery (with University of California, Los-Angeles, USA and Intelligent Optical Systems, Torrance, CA, USA); oxygen sensors for the diving equipment (together with Engineering Services, Inc.). Dr. I. Peshko designed and built the fiber blue-green laser for biomedical applications (with Intelligent Optical Systems, Torrance, CA, USA). Lately, he worked within several projects, developing the low repetition rate compact fs-laser and another devices for the non-linear multimodal scanning microscope (UTM) and gas sensory networks (UofT and Engineering Services, Inc.). He developed the mid-IR lasers for ultrasound material diagnostics technologies, for medical surgery and military applications. One of the most valuable works was a grant of the US Air Force Lab for development of a High Power Lasers Simulator: SoliSim. Recently Dr. I. Peshko was developing a general concept, operational algorithms, and hardware for a multifunctional scientific instruments, working from robotic movable platforms. Among them: Robotic Nurse and Reconnaissance Robotic Platform systems.

In theory:

1. New concept of the absorption spectroscopy is under development. Innovative data processing algorithms have been realized. With this technology the remote gas concentration measurement accuracy of 99% has been achieved.
2. A new branch of Spectroscopy has been developed: Phase Laser Spectroscopy, which is able to monitor surface conductivity (real and imaginary parts) at optical frequencies.
3. Optical noise theory has been developed and applied to the ultrafast laser pulses formation analysis. Theory has explained all "paradoxes" of the picosecond lasers and predicted new regimes of operation.
4. Multi-component laser plasma plume has been analyzed for specific conditions of the superconducting films deposition process.
5. It has been shown experimentally and explained theoretically that high power laser beam product of parameters is not invariant in the linear transformations.
6. Theory of the "absorbing" interferometer that does not introduce losses into the laser cavity has been developed and applied to the single-frequency laser mini-systems.

In experiment, for the first time:

1. Non-stationary index of refraction (on the "hot" electrons) in Si (at 1 μm) has been measured by the transient picosecond holography method.
2. Self-starting, mode-locked Nd:glass laser with high repetition rate (500GHz) has been developed and demonstrated (without any modulator in the cavity).
3. A method of "black" pulses generation (named "Anti-mode-locking with optical lever") has been proposed and shown experimentally.
4. Multi-laser film deposition technology has been developed. A correlation between superconducting film properties and laser beam intensity distribution has been found. Y-Ba-Cu-O superconducting thin films of high quality were deposited routinely.
5. It has been found that the presence of thermal lenses in the gain media results in a complex amplitude-phase distribution of the laser beam. Effective beam parameters product of 330W-laser has been decreased 1.5 times. With this transformation it was possible to build 1.2-kW CW Nd:YAG four-laser system with single power delivery fiber.
6. For the first time single- and double-frequency, diode pumped mini-lasers have been built with Nd:YAG, Nd:YVO_4 and Nd:YLF gain crystals with output power up to 0.6W. The pulsed laser with auto-modulation of several seconds duration has been experimentally demonstrated (named "entropy waves generator").
7. Multifunctional multigas sensor, operating according to the inhomogeneous network principles, has been designed and demonstrated.

AREAS OF EXPERTISE

- **High Power Laser Systems**

High power solid-state lasers with fiber delivery, simulation of the thermo-mechanical processes in high power lasers, high power beam quality control.

- **Femtosecond Systems**

Femtosecond lasers of high repetition rate (>1 GHz) and low repetition rate (<10MHz), femtosecond lasers with tunable parameters, dispersion compensated systems, radiation with controllable parameters in spectral and time domains.

- **Single-Frequency Lasers**

Single-frequency mini-lasers, optical radars, nano-selectors, optical standards, tunable and chirped single-frequency systems, phase laser spectroscopy, optical properties of thin films.

- **Fiber Lasers**

High energy pulsed fiber lasers and combiners, middle-IR fiber lasers, principles of coherent combining, multi-wavelength fiber lasers.

- **Sensors**

Fiber sensors, spectroscopy based sensors, sensors for life-supporting systems, simulation of long period gratings, unmanned sensory platforms, security networks, lasers for multi-component detection, synergistic IP-sensors, remote sensing.

- **High Temperature Superconductivity**

Laser deposition of the high temperature superconductors; properties of laser plasma; laser beam shaping for the crystal film deposition.

- **Laser Ultrasonic Diagnostic**

Lasers of near and middle IR for ultrasound diagnostics, algorithms of the ultrasound data processing, ultrasound diagnostics in composite materials, new architectures of the laser/ultrasound devices.

- **Inhomogeneous Networks and Data Processing**

The network of different sensors and devices located on movable platform; data cross-processing and imaging.

INTERNATIONAL COOPERATION

Dr. I. Peshko worked in/for Universities and National Labs (Canada, USA, Ukraine, Germany, and Poland), in Government Agencies (Canada, Ukraine), and in private industrial companies (Canada, USA, Poland, Ukraine). In the USA he prepared proposals, worked as PI and co-researcher in the grants and contracts of NIH, DoD (DARPA, AF, Navy, Army), NASA, NSF, DOT, DOE, NOAA, etc.

SCHOLARLY ACTIVITY (after 2000)

Books, brochures, invited papers and reviews

1. I. Peshko, R.Pawluczyk, D.Wick. Synergistic Sensory Platform: Robotic Nurse. *J. Low Power Electron. Appl.* 2013, v.3, pp.114-158.
2. I.Peshko. A chapter "Time and Light" in book "Laser Pulses - Theory, Technology, and Applications", ISBN 978-953-51-0796-5, edited by Igor Peshko, InTech, Rijeka, Croatia, 2012, p.3-32.

3. I.Matharoo, I.Peshko, A.Goldenberg, Robotic reconnaissance platform. I. Spectroscopic instruments with rangefinders, Review of Scientific Instruments, 2011, v.82, 113107:1–113107:15.
4. I.Peshko. A chapter “Smart Synergistic Security Sensory Network for Harsh Environment: Net4S in book "Nuclear Power: Control, Reliability and Human Factors", ISBN: 978-953-307-599-0. Editor P.Tsvetkov, InTech, Rijeka, Croatia, p.85 - 100, 2011.
5. I.Peshko. A chapter 4.2. “Photonic Therapies” in Handbook of Biophotonics, v.2: “Photonics for Health care”, Wiley-VCH, p.457-462, 2011.
6. V.S.Flis, V.M.Pan, V.A.Komashko, V.O.Moskaliuk, I.I.Peshko. Physical-technical basis of the $YBa_2Cu_3O_{7-\delta}$ high-T_c superconducting thin films deposition. Usp.Fiz.Met. (Advances in Metal Physics, in Ukrainian) 2006, v.7, p.189-241 (53 pages).
7. I.Peshko, Z.Jankiewicz. Coherent light sources of the eye-safe spectral range. Opto-electronics Review, 1998, v.6, #2, p.111-119.

Publications in peer-reviewed journals (after 2000)

8. I.Matharoo, I.Peshko, Smart Spectroscopy Sensors: II.Narrow-Band Laser Systems Optics and Lasers in Engineering, 2013, v.51, pp.270-277.
9. I.Peshko, V.Rubtsov, L.Vesselov, G.Sigal, H.Laks. Fiber photo-catheters for laser treatment of atrial fibrillation. Optics and Lasers in Engineering, 2007, v.45, p.495-502.
10. I.Peshko, B.Hockley, E.Nikolaev, A.Prudnikov. New garnet crystal potentially suited for mini-laser devices of 1.5-μm spectral range. J.Non-crystalline solids. 2006, v.352, p.2380-2384.
11. I.Peshko, O.Cherry, T.Rutkievich, B.Hockley, V.Rubtsov. Long Period Bragg Grating Design for Chemical Sensors Application. 2005, Metrology Science & Technology, 2005, v.16, p.2221-2228.
12. M.Lopiitchouk, I.Peshko. Solid-state laser with self-stabilized or linearly chirped output frequency. Semiconductor Physics, Quantum Electronics & Optoelectronics. 2002, v.5, #2, p.197-200.
13. I.Peshko. Phase Laser Intracavity Spectroscopy. J.Phys.D: Appl. Phys., 2002, v.35, #3, p.181-185.
14. I.Peshko, V.Flis, V.Matsui. High-temperature super-conducting YBCO films deposited by the YAG double-laser system J.Phys.D:Appl. Phys., 2001, v.34, #5, p.732-739.
15. V.M.Pan, I.Peshko, V.S.Flis & al. Effect of Growth-Induced Linear Defects on High Frequency Properties of Pulse-Laser Deposited $YBa_2Cu_3O_{7-\delta}$ Films. J.Superconductivity Inc.Novel Magn. 2001, v.14, #1, p.105-114.

Conference presentations – 12 (after 2000)