Ph. D., Dr. Sc., Prof. Leonid I. Goray

Strong background in the electromagnetic theory of diffraction and scattering by diffraction gratings, rough mirrors and nanocrystals; Helmholtz equation, Schrodinger equation, non-linear continuum equation, neuromorphic computing, machine learning: 100+ publications, 6 patents

Born November 3, 1963, Nizhniy Novgorod (Gorki in the former USSR).

Education

2011 Dr. in Science, thesis *Analysis of intensity of X-ray scattering on multilayer diffraction elements by an integral equation method* earned in the ***Institute for Analytical Instrumentation*** (***IAI***), ***Russian Academy of Science*** (***RAS***).

2004 Dr. in *Physics and Mathematics*, thesis *Numerical analysis of diffraction properties of reflection gratings in X-rays* earned in the ***Institute for Analytical Instrumentation*** (***IAI***), ***RAS***.

1987-1990 Post-Graduated School, ***S.I. Vavilov State Optical Institute***, St. Petersburg. Ph.D. thesis: *The rigorous integral method applied to the calculation of the diffraction efficiency of X-ray and EUV gratings.*

1981-1987 The ***St Petersburg Electrotechnical University***, M.S. (with honours) in *Optoelectronics.*

Job History

2008-present Principal Researcher & Professor, **Alferov University**, Russia.

2004- present Principal Researcher, **Institute for Analytical Instrumentation**, RAS, Russia

1996- present Director and President. ***I. I.G., Inc.***, US-based small private company

Development and distribution of new scientific and engineering software with applications in optics, physics, discrete mathematics and computer science. Development and selling worldwide *PCGrate™ for Windows 16/32/64-bit* software for rigorous efficiency calculations of multilayer diffraction gratings and rough mirrors working from *hard X-ray* to *meter* ranges (more than 500 packages to recognized governmental and military laboratories, private companies, universities and research centers – many of them have several *PCGrate* licenses). Efficiency modeling of flight gratings and Fresnel zone plates for different space missions: the *SOFIA* Airborne Infra-Red Echelle Spectrometer (*AIRES*), the *SKYLAB* spectrograph, the *J-PEX* sounding rocket spectrometer, the *Cosmic Origins Spectrograph* for the Hubble Space Telescope, the Extreme Ultraviolet Imaging Spectrometer (*EIS*) of the Solar-B project (*Hinode*), the Reflection Grating Spectrometer (*RGS*) for the Constellation-X (*IXO*) project, the Solar Imaging Suite for *GOES-R* satellites, the NASA *Ultra-Stable Extreme Ultraviolet Solar Monitor*, EUV spectroheliographs for the *Kortes* instrument of the International Space Station, *etc*.

The issue of online *Efficiency Testing Laboratory* (*ETL*) together with ***NASA Goddard Space Flight Center***, ***NRL Space Science Division***, ***Richardson Gratings of Newport Corp.*** and ***Laurence Berkeley National Laboratory*** which is the world's first comprehensive demonstration of the results of grating efficiency tests obtained using modern technologies.

1993-1997 ***Integrate, Inc.*** Director and physicist-expert in *Theory of Diffraction*.

Design, producing, and exclusive exporting worldwide holographic and ruled diffraction gratings of different types. Development (by the integral and modal methods) and selling through the US company Optometrics, Inc. the software package *PCGrate® for Windows 16-bit* for rigorous calculation of the efficiency of diffraction gratings with arbitrary groove profiles working from *soft X-ray* to *millimeter* ranges.

1991-1998 ***Holograte, Inc.*** Director, president (since 1993), computer scientist, and physicist in *Theory of Diffraction*.

Development of the new non-organic-based material technology for recording of holographic diffraction gratings. Producing and selling holographic diffraction gratings and rainbow holograms of different types.
Idea and creation of the software package *PCGrate® for DOS* for rigorous calculation of the efficiency of diffraction gratings working from *VUV* to *microwave* ranges, which is based on the developed modified integral method and the personal computing philosophy.

1987-1988 ***The State Optical Institute ("S.I. Vavilov GOI").*** Research scientist on the theoretical investigation of diffraction of electromagnetic waves on relief and phase holograms and gratings.

Development of theoretical approaches for calculations of diffraction efficiency of relief gratings and phase gratings (holograms), i.e., the boundary integral equation method.

Awards

1988 The winner of the young scientist work competition, ***Vavilov State Optical Institute***.
1987 The winner of the master thesis competition, ***Vavilov State Optical Institute***.

Membership in Scientific Committees

Member of the Programme Committee and the Editing Committee of IEEE Proceedings of the Annual International Conference "Days on Diffraction". http://www.pdmi.ras.ru/~dd/committee.php

Reviews and Chapters in English

1. Leonid I. Goray, "Diffraction Grating Groove Metrology Using AFM & STM", in *Atomic Force Microscopy - Basic Principles to Advanced Applications*, ed. C.S. Pathak (IntechOpen, 2021). ISBN 978-1-83968-230-8. DOI: http://dx.doi.org/10.5772/intechopen.97257
2. Leonid I. Goray and Gunther Schmidt, "Boundary Integral Equation Methods for Conical Diffraction and Short Waves," in *Gratings: Theory and Numerical Applications*; ed. E. Popov. 2nd rev. ed. (Institut Fresnel, AMU, 2014), Ch. 12 (pp. 447–536). ISBN 2-85399-943-4. http://www.fresnel.fr/numerical-grating-book-2
3. D.L. Voronov, L.I. Goray, T. Warwick, V.V. Yashchuk and H.A. Padmore, "High-order multilayer coated blazed gratings for high resolution soft x-ray spectroscopy," Opt. Express 23(4), 4771–4790 (2015). https://www.osapublishing.org/oe/abstract.cfm?uri=oe-23-4-4771
4. L.I. Goray, "Diffraction Gratings for Short-Wave Radiation: Modern Requirements and Achievements," Bulletin of the Russian Academy of Sciences. Physics, 2013, Vol. 77, No. 1, pp. 10–14 (2013). https://link.springer.com/article/10.3103/S1062873813010103