Mark I. Stockman, Ph. D., D. Sc., is a Professor of Physics and a Director of Center for Nano-Optics (CeNO) at Georgia State University at Atlanta, GA.

Personal: Born in Kharkov (Ukraine), US citizen. MS (Honors) in Theoretical Physics from Novosibirsk State University (Russia), 1970. Diploma in Physics (with Honors) and MS in Physics from Novosibirsk State University, Russia, 1970. Ph. D. in Theoretical Physics from Institute of Nuclear Physics (Novosibirsk), Russian Academy of Sciences, 1975. D.Sc. in Theoretical and Optical Physics from Institute of Automation and Electrometry (Novosibirsk), Russian Academy of Sciences, 1989. Recent research focuses on electronic and optical properties of plasmonic metal and metal-semiconductor nanostructures. Published approx. 180 major research articles. **American Physical Society (APS), Fellow; Optical Society of America (OSA), Fellow; SPIE – The International Society for Optical Engineering (Fellow).**

Invited/Keynote Talks and Lectures: Presented numerous plenary, keynote and invited talks and lectures at major Conferences in the field of optics and nanoplasmonics. Chairman of SPIE *Metal Nanoplasmonics* Conference 2005-2011 at San Diego (CA), co-Chair of OSA Nanoplasmonics and Metamaterials Conference (META) 2008 and 2010. Presented invited lecturers at various international scientific schools, including *International Winter College on Nanophotonics* (2005; the next lecture course is scheduled in 2012) at the Abdus Salam International Center for Theoretical Physics at Trieste, Italy, *Erasmus Mundus School*, Porquerolles Islands (France, 2008), International Summer School *New Frontiers in Optical Technologies*, Tampere University of Technology (2008 and 2009, Tampere, Finland), APS March Meeting 2009, Korean Nanooptics Society Winter Workshop (2007-2010), Instrument Technology Research Center (ITRC), Hsinchu, Taiwan (2009), IEEE International Conference COMCAS 2009, Tel Aviv, Israel (2009), International Summer School *Dissipation at Surfaces*, University of Duisburg-Essen, Germany (2009), the International Conference on Micro/Nano Optical Engineering (ICOME) at Changchun, China (2011), Zhong-Guan-Cun Forum on Condensed Matter Physics – the 232th Lecture at Beijing Institute of Physics, Chinese Academy of Sciences, Beijing, 2011.

Taught short courses *Nanoplasmonics* at 2005-2012 SPIE *Photonics West* Meetings and 2005-2012 SPIE *Optics and Photonics* Meetings, ETOPIM International Conference at Sidney (Australia); Ecole Normale Supérieure de Cachan (France) (2006); University of Stuttgart (2008), Max Planck Institute for Quantum Optics (Garching at Munich, Germany, 2009), Enrico Fermi School at Varenna (Italy) 2010, Ettore Majorana International School at Erice, Sicily 2008 and 2011, Abdus Salam International Center for Theoretical Physics(ITCP) (Trieste, Italy), 2005 and 2012.

Visiting Positions: Distinguished Visiting Professor at Ecole Normale Supérieure de Cachan (France) (March, 2006 and July, 2008); Invited Professor at Ecole Supérieure de Physique et de Chimie Industrielle, Paris, France, May-June, 2008; Guest Professor at the University of Stuttgart (September-November, 2008); a Visiting Professor for Senior International Scientists of the Chinese Academy of Sciences at Changchun Institute of Optics, Fine Mechanics, and Physics, 2012-Present; Guest Professor at Ludwig Maximilian University (Munich, Germany) and Max Plank Institute for Quantum Optics (Garching at Munich, Germany) at the Munich Advanced Photonics (MAP) Center of Excellence, and Center for Advanced Studies at Ludwig Maximilian University (Munich, Germany), 2008-2009, 2013; a Visiting Professor for Senior International Scientists of the Chinese Academy of Sciences at Changchun Institute of Optics, Fine Mechanics, and Physics (2012); an Academic Icon Professor at University of Malaysia, Kuala Lumpur (2014).

Expertise: Nanoplasmonics and nanooptics, physical optics, theoretical condensed matter and optical physics, and strong field and ultrafast optics and nanoplasmonics.

Major Scientific Results:

Mark I. Stockman is a pioneer of nanoplasmonics publishing his first results in this area in 1988, setting the foundations of the field and later having obtained groundbreaking results in it. His pioneering research in this area began with the introduction of the giant optical enhancement in fractal nanoclusters of plasmonic metals. He was one of the co-authors in a fundamental paper (1992) that correctly predicted the spectrum of surface enhanced Raman scattering (SERS) with a dramatic enhancement in the red/near-ir spectral region, which was instrumental in the discovery by K. Kneipp et al. (1999) of the single-molecule SERS, as acknowledged by the corresponding reference. Today SERS is a thriving field with many new phenomena and applications.

In 1995-1996 he introduced localization of plasmonic eigenmodes and such universally accepted phenomenon as *plasmonic near-field hot spots*. This direction of research was further developed when in 2001 he in collaboration with David Bergman showed that dark and bright plasmonic eigenmodes co-exist. He also showed that strongly-localized eigenmodes are necessarily dark. Thus it was established that the Anderson localization of surface plasmons does not play a role in far-field optics of nanoplasmonic systems but is very important and can be observed with near-field excitation, which is another fundamental result. These results form the fundamental basis of the contemporary nanoplasmonics.

Starting from 2000, Mark Stockman published a series of pioneering results that, to a significant degree, determined the modern development of the field of nanooptics and nanoplasmonics. In 2000 he pioneered the field of ultrafast nanoplasmonics with his Phys. Rev. Lett. article predicting giant ultrafast fluctuations (the "*Ninth Wave*

Effect") of nanoplasmonic local fields. In 2003 he with co-authors introduced *coherent control of ultrafast localization on nanoscale*, another milestone of the ultrafast nanoplasmonics. This development allowed for a very accurate control of optical energy with a nanometer resolution in space and with a femtosecond precision in time. This breakthrough work has initiated a significant field of scientific research; in particular it has stimulated Focus Program *"Ultrafast Nanooptics"* of German Science Foundation (2009).

In 2003, Mark Stockman in collaboration with David Bergman set foundation of quantum nanoplasmonics with a seminal article introducing the spaser [D. J. Bergman and M. I. Stockman, *Surface Plasmon Amplification by Stimulated Emission of Radiation: Quantum Generation of Coherent Surface Plasmons in Nanosystems*, Phys. Rev. Lett. **90**, 027402-1-4 (2003)]. Simultaneously, they filed a patent application for spaser; a *US patent No. 7,569,188* for spaser was issued to them in 2009. The spaser is a nanoscale quantum generator of local plasmonic fields, which are intense and ultrafast. The spaser is also a quantum amplifier: it is about the same size and with similar gain as the most common and most important microelectronic active element, MOSFET (metal-oxide-semiconductor field effect transistor). Importantly, the spaser is approximately 1000 times faster than the MOSFET The spaser is the previously "missing" active element of nanoplasmonics that possesses a potential to become the basis of active nanoplasmonic technologies. It will be possible to build ultrafast processors of information with spasers replacing MOSFETs. The spasers can also be used in nanosensing, nanoimaging, and nanolithography, and many other fields. Since initial introduction of spaser, Stockman was followed by many research groups from all over the world in developing the spaser both theoretically and experimentally. Recently there has been experimental confirmation and observation of spaser jointly by three groups published in *Nature.* An extensive wave of publications on the spaser and related nanolasers has followed. The spaser will potentially have a revolutionary effect on nanoplasmonics and generally on nanotechnologies. Also, reports and comments on the spaser and nanolasers have been published in Nature, Optics Express, et al. citing spaser as an original idea.

In 2004, Mark Stockman published two seminal results introducing *adiabatic concentration of optical energy on nanoscale* in plasmonic tapers and efficient *nanolenses of nanoparticle aggregates*. Both these works enjoyed wide experimental and theoretical following, accumulating hundreds references.

He is continuing to work very actively. In 2007, he pioneered attosecond nanoplasmonics and *attosecond nanoplasmonic-field microscopy* [in collaboration with a team from Max Plank Institute for Quantum Optics (MPQ, Garching, Germany) and Ludwig Maximilian University (LMU, Munich, Germany)]. Among recent novel results are plasmonic renormalization of Coulomb interactions (2008), time-reversal coherent control on the nanoscale (2008), nanoconcentration of terahertz radiation (2008), Giant Plasmon-Induced Drag Effect Rectification (SPIDER) (2009), spaser as a bistable (logical) nanoamplifier (2010), and coherent control of third harmonic generation in photonic-plasmonic systems [in collaboration with University of Stuttgart, Germany (2010)].

In 2010 he with his collaborators introduced a novel concept of adiabatic metallization of dielectrics in strong fields. In 2011, this concept was developed by him and the same collaborators to predict the dynamic ultrafast metallization of dielectrics. This development of the ultrafast/ultrastrong-field condensed-matter optical physics is promising to become a foundation of the new solid state technology of information processing that is three orders of magnitude faster than the existing technologies. In 2012, he predicted optical field effect in dielectrics where a strong optical field excites electrical currents with a ~1 fs rise and decay times. This effect was discovered experimentally at MPQ/LMU and published in Nature, 2013, Nature Photonics, 2014. Another breakthrough was the discovery of efficient generation of hot electrons in adiabatic compression and its application to chemical nano-vision, published in 2013 in Nature Nanotechnology.