

**Name:** Dr. Gennady Smolyakov

**Address:** Center for High Technology Materials  
University of New Mexico  
1313 Goddard SE  
Albuquerque, New Mexico 87106  
Tel. (505) 272-7852  
E-mail: gen@chtm.unm.edu

**Present Position (since April 2015):** Research Associate Professor, Dept. of Electrical & Computer Engineering (ECE) & Center for High Technology Materials (CHTM), University of New Mexico

**Education:**

- Candidate of Sciences Degree (Ph.D.) in Physics and Mathematics (specialty - laser physics), Saratov State University, Russia, 1997.  
Dissertation title: *The Study of Spatial Characteristics of Semiconductor Injection Laser Emission.*
- M.Sc., Physics, Moscow Engineering-Physics Institute, Special Faculty of Physics, Moscow, USSR, 1987.  
Thesis title: *Reconstruction of Waveguide Holograms by Modulated Emission of Semiconductor Injection Laser.*

**Professional Experience:**

- April 2015 – present: Research Associate Professor, Dept. of Electrical & Computer Engineering (ECE), University of New Mexico
- November 2004 – April 2015: Research Assistant Professor, Dept. of Electrical & Computer Engineering (ECE), University of New Mexico
- June 2001 – November 2004: Senior Research Scientist, Center for High Technology Materials (CHTM), University of New Mexico
- Feb. 1998 - March 1998: Visiting Post Doctoral Fellow, Satellite Venture Business Laboratory, University of Tokushima, Japan
- 1998 - 2001: Post Doctoral Fellow, Center for High Technology Materials, University of New Mexico
- 1997 - 1998: Research Assistant, Center for High Technology Materials, University of New Mexico
- 1990 – 1997: Scientific Fellow, Junior Scientific Fellow, and Laser Engineer, Center for Mechanics and Physics, Saratov State University, Russia
- 1987 – 1989: Laser Engineer, Saratov Branch of the Institute of Radiotechnics and Electronics of the Academy of Sciences of USSR, Saratov

**Citizenship:** USA, Russia

**Areas of Current Research Interest:**

Optoelectronic devices; optics of waveguides; design and simulation of VCSELs and edge-emitting semiconductor injection lasers; physics and simulation of

semiconductor quantum well and quantum dot devices; colloidal quantum dots for applications in biomedicine, radiation detection, and plasmonic solar water splitting.

#### **Honors, Awards, and Society Offices:**

- 2002 - *Award of the Minister of National Education and Sport, Poland* for joint work on computer simulation of operation and optimization of semiconductor lasers.

#### **Professional Societies:**

SPIE – The International Society for Optical Engineering

#### **Principal Accomplishments:**

- Design and implementation of a device for ultra-high-frequency (UHF) impedance matching of semiconductor injection lasers with UHF oscillators
- Experimental demonstration of complex spatial dynamics in DFB lasers due to mode switching induced by injection current modulation
- First demonstration of the role of thermal effects in above-threshold laser pattern formation in semiconductor edge-emitting lasers
- Generalization of the effective frequency method (EFM) to laterally inhomogeneous VCSEL structures

#### **Publications and Patents:**

Over 100 publications, including 1 book chapter and 7 awarded patents.

#### **Selected Publications:**

1. Bogoroditskaya R. A., Rabinovich E. M., **Smolyakov G. A.**, “*Effect of mode switching on space-modulation characteristics of the radiation from distributed-feedback injection lasers ( $\lambda=1.58 \mu\text{m}$ )*”, *Sov. Tech. Phys. Lett. (USA)* **17**(2), pp. 87-91 (1991).
2. Sinichkin Yu. P., Bogoroditsky A. G., Mavlutov A. H., **Smolyakov G. A.**, Tuchin V. V., Yaroslavsky I. V., “*Functional monitoring of tissues using frequency-domain laser light scattering*”, *Proc. SPIE* **2082**, pp. 161-166 (1994).
3. **Smolyakov G. A.**, Ovchinnikov S. V., “*The influence of thermal effects on spatial characteristics of radiation of injection stripe lasers*”, *Laser Physics* **7**(2), pp. 418 - 425 (1997).
4. Smagley V. A., **Smolyakov G. A.**, Eliseev P. G., Osinski M., and Przekwas A. J., “*Current self-distribution effect in vertical-cavity surface-emitting semiconductor lasers*”, *Physics and Simulation of Optoelectronic Devices VI* (M. Osinski, P. Blood, and A. Ishibashi, Eds.), *Proc. SPIE* **3283**, pp.171-182 (1998).
6. M. Osinski, V. A. Smagley, **G. A. Smolyakov**, T. Svimonishvili, P. G. Eliseev, and G. Simonis, “*Three-dimensional simulation of oxide-confined vertical-cavity surface-emitting semiconductor lasers*”, *Optoelectronic Materials and Devices* (M. Osinski and Y.-K. Su, Eds.), *Proc. SPIE* **3419**, pp. 196-207 (1998).
7. P. G. Eliseev, **G. A. Smolyakov**, and M. Osinski, “*Ghost modes and resonant effects in AlGaIn-InGaIn-GaN lasers*”, *IEEE J. Selected Topics Quant. Electron.* **5**(3), pp.

- 771-779 (1999).
8. **G. A. Smolyakov**, V. A. Smagley, W. Nakwaski, P. G. Eliseev, and M. Osinski, “*Design of InGaN/GaN/AlGaN VCSELs using the effective frequency method*”, Physics and Simulation of Optoelectronic Devices VII, (P. Blood, A. Ishibashi and M. Osinski, Eds.), *Proc. SPIE* **3625**, pp. 324-335 (1999).
  9. M. Osinski, and **G. A. Smolyakov**, “*Integrated thermal-electrical-optical simulator of vertical-cavity surface-emitting lasers*”, Design, Fabrication, and Characterization of Photonic Devices (M Osinski, S.J. Chua, S.F. Chichibu, Eds.), *Proc. SPIE* **3896**, pp. 143-154 (1999).
  10. M. Osinski, V. A. Smagley, C. -S. Fu, **G. A. Smolyakov**, and P. G. Eliseev, “*Design of InGaN/GaN/AlGaN vertical-cavity surface-emitting lasers using electrical-thermal-optical simulation*”, Physics and Simulation of Optoelectronic Devices VIII (R.H. Binder, P. Blood, and M. Osinski, Eds.), *SPIE Proceedings* **3944**, pp. 40-55 (2000).
  11. **G. A. Smolyakov**, P. G. Eliseev, and M. Osinski, “*Analysis of vector LP modes in VCSELs using the effective frequency method*”, Physics and Simulation of Optoelectronic Devices IX (Y. Arakawa, P. Blood, and M. Osinski, Eds.), *SPIE Proceedings* **4283**, pp. 113-128 (2001).
  12. M. Osinski, T. Svimonishvili, **G. A. Smolyakov**, V. A. Smagley, P. Mackowiak, W. Nakwaski, “*Temperature and thickness dependence of steam oxidation of AlAs in cylindrical mesa structures*”, *IEEE Photon. Tech. Lett.* **13**(7), pp. 687 – 689 (2001).
  13. Osinski M., Smagley V. A., **Smolyakov G. A.**, Eliseev P. G., “*Design of InGaN-GaN-AlGaN vertical-cavity surface-emitting lasers using electrical-thermal-optical simulation*”, *IEEE J. Selected Topics Quant. Electron.* **7**(2), pp. 270 - 279 (2001).
  14. **G. A. Smolyakov**, P. G. Eliseev, and M. Osinski, “*Effects of resonant mode coupling on near- and far-field characteristics of InGaN-based lasers*”, Physics and Simulation of Optoelectronic Devices X (P. Blood, M. Osinski, and Y. Arakawa, Eds.), *Proc. SPIE* **4646**, pp. 563 - 573 (2002).
  15. Osinski M., Smagley V. A., Lu M., **Smolyakov G. A.**, Eliseev P. G., Riely B. P., Shen P. H., Simonis G. J., “*Self-consistent calculation of current self-redistribution effect in GaAs/AlGaAs oxide-confined VCSELs*”, *IEEE J. Selected Topics Quant. Electron.* **9**(5), pp. 1422-1430 (Sep/Oct 2003).
  16. Y. -R. Zhao, **Gennady A. Smolyakov**, M. Osinski, “*High-performance InGaAs/GaAs/AlGaAs broad-area diode lasers with impurity-free intermixed active region*”, *IEEE J. Selected Topics Quant. Electron.* **9**(3), pp. 1333-1339 (Sep/Oct 2003).
  17. **Gennady A. Smolyakov**, Vladimir A. Smagley, Weiliang Chen, Marek Osinski, “*Resonant coupled-cavity effects in VCSELs with annular ring contacts*”, Physics and Simulation of Optoelectronic Devices XII (M. Osinski, H. Amano, and F. Henneberger, Eds.), *Proc. SPIE* **5349**, pp. 385-396 (2004).
  18. H. Cao, H. Ling, C. Liu, H. Deng, M. Benavidez, V. A. Smagley, R. B. Caldwell, G. M. Peake, **G. A. Smolyakov**, P. G. Eliseev, and Marek Osinski, “*Large S-section-ring-cavity diode lasers: directional switching, electrical diagnostics, and mode beating spectra*”, *IEEE Photon. Technol. Lett.* **17**, pp. 282-284 (2005).
  19. H. Cao, C. Liu, H. Ling, H. Deng, M. Benavidez, V. A. Smagley, R. B. Caldwell, G. M. Peake, **G. A. Smolyakov**, P. G. Eliseev, and M. Osinski, “*Frequency beating*

- between monolithically integrated semiconductor ring lasers”, *Appl. Phys. Lett.* **86**, 041101 (2005).
20. **G. A. Smolyakov**, P. G. Eliseev, and M. Osinski, “Effects of resonant mode coupling on optical characteristics of InGaN/GaN/AlGaN lasers”, *IEEE Journal of Quantum Electron.* **41**(4), pp. 517-524 (2005).
  21. Hongjun Cao, Hui Deng, Hai Ling, Chiyu Liu, Vladimir A. Smagley, Robert B. Caldwell, **Gennady A. Smolyakov**, Allen L. Gray, Luke F. Lester, Petr G. Eliseev, and Marek Osinski, “Highly unidirectional InAs/InGaAs/GaAs quantum-dot ring lasers”, *Appl. Phys. Lett.* **86**, 203117 (2005).
  22. **Gennady A. Smolyakov** and Marek Osinski, “Analysis of lateral mode confinement in VCSELs with ring metal apertures”, *J. Lightwave Technol.* **23**(12), pp. 4278-4286 (2005).
  23. C. Liu, H. Cao, **G. A. Smolyakov**, P. G. Eliseev and M. Osinski, “Anomalous splitting in microwave mode-beating spectra of semiconductor ring lasers”, *Electron. Lett.* **41**(17), pp. 963-964 (2005).
  24. Peter G. Eliseev, Hongjun Cao, Chiyu Liu, **Gennady A. Smolyakov**, and Marek Osinski, “Nonlinear mode interaction as a mechanism to obtain slow/fast light in diode lasers”, Physics and Simulation of Optoelectronic Devices XIV (M. Osinski, F. Henneberger, and Y. Arakawa, Eds.), *Proc. SPIE* **6115**, pp. 87-96 (2006).
  25. Melisa R. Greenberg, **Gennady A. Smolyakov**, Ying-Bing Jiang, Timothy J. Boyle, and Marek Osinski, “Synthesis and characterization of In-containing colloidal quantum dots”, *Colloidal Quantum Dots for Biomedical Applications* (Marek Osinski, Kenji Yamamoto, and Thomas M. Jovin M.D., Eds.), *Proc. SPIE* **6096**, pp. 35-47 (2006).
  26. Nathan J. Withers, **Gennady A. Smolyakov**, Hongjun Cao, Ron Kaspi, Marek Osinski, “Small footprint InGaSb/AlGaAsSb multiple-quantum-well light-emitting diodes”, Physics and Simulation of Optoelectronic Devices XV (M. Osinski, F. Henneberger, Y. Arakawa, Eds.), *Proc. SPIE* **6468**, 646802 (2007).
  27. Melisa R. Greenberg, **Gennady A. Smolyakov**, Timothy J. Boyle, Marek Osinski, “Synthesis and characterization of ZnO and ZnO/ZnS colloidal nanocrystals”, *Colloidal Quantum Dots for Biomedical Applications II* (M. Osinski, T. M. Jovin, K. Yamamoto, Eds.), *Proc. SPIE* **6448**, 644806 (2007).
  28. **Gennady A. Smolyakov** and Marek Osinski, “Resonant internal transverse-mode coupling in InGaN/GaN/AlGaN lasers”, Chapter 17 in book "Nitride Semiconductor Devices: Principles and Simulation", (edited by Joachim Piprek), pp. 381-404, Wiley-VCH, Weinheim, 2007. ISBN: 978-3-527-40667-8.
  29. H. J. Cao, N. J. Withers, **G. A. Smolyakov**, M. Osinski, “Microwave frequency beating between monolithically integrated quantum-dot ring lasers”, *Electron. Lett.* **43**(25), pp.1456-1458 (2007).
  30. J. Chen, **G. A. Smolyakov**, S. R. J. Brueck, K. J. Malloy, “Surface plasmon modes of finite, planar, metal-insulator-metal plasmonic waveguides”, *Optics Express* **16**(19), pp.14902-14909 (2008).
  31. N. J. Withers, K. Sankar, B. A. Akins, T. A. Memon, T. Gu, J. Gu, **G. A. Smolyakov**, M. R. Greenberg, T. J. Boyle, M. Osinski, “Rapid degradation of CdSe/ZnS colloidal quantum dots exposed to gamma irradiation”, *Appl. Phys. Lett.* **93**(17), 173101 (3 pp.) (2008).

32. Krishnaprasad Sankar, John B. Plumley, Brian A. Akins, Tosifa A. Memon, Nathan J. Withers, **Gennady A. Smolyakov**, Marek Osinski, “*Synthesis and characterization of scintillating cerium-doped lanthanum fluoride nanocrystals*”, Colloidal Quantum Dots for Biomedical Applications IV (M. Osinski, T. M. Jovin, K. Yamamoto, Eds.), *Proc. SPIE* **7189**, 718909 (2009).
33. N. J. Withers, J. B. Plumley, B. A. Akins, A. C. Rivera, G. Medina, **G. A. Smolyakov**, G. S. Timmins, and M. Osinski, “*Radiation sensitivity enhancement in cells using high-Z nanoparticles*”, Colloidal Quantum Dots for Biomedical Applications V (M. Osinski, W. J. Parak, T. M. Jovin, and K. Yamamoto, Eds.), *Proc. SPIE* **7575**, 75750Z (2010).
34. J. M. Vargas, A. A. McBride, J. B. Plumley, Y. Fichou, T. A. Memon, V. Shah, N. Cook, B. A. Akins, A. C. Rivera, **G. A. Smolyakov**, J. R. O’Brien, N. L. Adolphi, H. D. C. Smyth, and M. Osinski, “*Synthesis and characterization of core/shell Fe<sub>3</sub>O<sub>4</sub>/ZnSe fluorescent magnetic nanoparticles*”, *J. Appl. Phys.* **109**(7), 07B536, (2011).
35. **G. A. Smolyakov** and M. Osinski, “*High-speed modulation analysis of strongly injection-locked semiconductor ring lasers*”, *IEEE J. Quantum Electron.* **47**(11), pp.1463 - 1471 (2011).
36. L. M. Armijo, Y. I. Brandt, D. Mathew, S. Yadav, S. Maestas, A. C. Rivera, N. C. Cook, N. J. Withers, **G. A. Smolyakov**, N. L. Adolphi, T. C. Monson, D. L. Huber, H. D. C. Smyth, and Marek Osinski, “*Iron oxide nanocrystals for magnetic hyperthermia applications*”, *Nanomaterials* **2**(2), pp. 134-146 (2012).
37. **G. A. Smolyakov**, Y. Fichou, and M. Osinski, “*Analysis of high-frequency modulation response of strongly injection-locked cascaded semiconductor ring lasers*”, *IEEE J. Quantum Electron.* **48**(12), pp. 1568-1577 (2012).
38. A. C. Rivera, N. Glazener, N. C. Cook, B. A. Akins, L. M. Armijo, J. B. Plumley, N. J. Withers, K. Carpenter, **G. A. Smolyakov**, R. D. Busch, M. Osinski, “*Characterization of potassium bromide loaded with dysprosium fluoride nanocrystals for neutron detection*”, *Int. J. Nanotechnol.* **11**(5-8), pp. 529-538 (2014).
39. Y. I. Brandt, T. Mitchell, **G. A. Smolyakov**, M. Osinski, R. S. Hartley, “*Quantum dot assisted tracking of the intracellular protein Cyclin E in Xenopus laevis embryos*”, *J. Nanobitechnol.* **13**, Article Number 31 (2015).