

**Yakov P. Shkolnikov, Ph.D., P.E.**  
**Managing Engineer**

**Professional Profile**

Dr. Yakov Shkolnikov has expertise in the development and analysis of high performance electronic devices and systems. With this expertise, he is able to advise clients on matters related to reliability and intellectual property issues.

Dr. Shkolnikov has extensive experience in algorithm design and has developed methods and software in such diverse areas as analysis of radiological imaging data, mechanical testing of medical implants, instrumentation of diagnostic systems, and ground penetrating radar systems. He has performed software review and design for medical and testing and control applications, and has experience with C, LabVIEW, MATLAB, and several other script, and controller languages.

His medical-devices project and research experience include the technical analysis of implantable cardioverter defibrillators (ICD), pacemakers, implantable pulse generators (IPGs), orthopedic implants, blood flow meters, electrosurgical and robotic equipment used in electro stimulation, and electro pathology. He also has experience in electromagnetic finite element analysis (AC/DC and RF), low electrical noise systems, cryogenic and high magnetic field measurements, data acquisition analysis and visualization, fiber optic systems, and electronic-device packaging.

Dr. Shkolnikov has assisted clients in technical analyses supporting complex litigation cases such as class action lawsuits, and patent and trade secret litigation. He has performed infringement, obviousness, and validity analysis of patents for consumer electronic devices and software; assisted clients in locating prior art and prior use examples; and overseen large document reviews inherent to such cases.

Dr. Shkolnikov has published over 25 peer-reviewed papers on electrical engineering topics such as semiconductor physics and electrical-safety and has participated in numerous technical conferences on medical device analysis and semiconductors. He has a patent pending on security of RFID cards, and has filed several provisional patents filings on cell phone power management, RFID technology, and mechanical strain sensing. Dr. Shkolnikov holds a research faculty appointment at School of Biomedical Engineering, Science and Health Systems at Drexel University, and is a guest lecturer at Princeton University, Department of Mechanical & Aerospace Engineering. He is also a referee for *Physical Review Letters*.

**Academic Credentials and Professional Honors**

Ph.D., Electrical Engineering (minor in Mechanical Engineering), Princeton University, 2005

M.A., Electrical Engineering, Princeton University, 2004

B.S., Engineering Physics, Cornell University (*summa cum laude*), 1999

Graduated ranked 1st in School of Engineering, Summa Cum Laude, Cornell University;  
Gordon Wu Fellow, Princeton University; Merrill Presidential Scholar, Cornell University; Tau  
Beta Pi

### **Licenses and Registrations**

Licensed Professional Engineer, New Jersey, #GE47825

### **Patents**

Patent Application No. US20080055093: Shield for Radio Frequency ID Tag or Contactless  
Smart Card, filed August 30, 2007 (with Y. Du and B. McGoran).

### **Publications**

Kurtz SM, Ochoa JA, Lau E, Shkolnikov Y, Pavri BB, Frisch D, Greenspon AJ. Implantation  
trends and patient profiles for pacemakers and implantable cardioverter defibrillators in the  
United States: 1993–2006. *PACE* 2009. doi: 10.1111/j.1540-8159.2009.02670.

Gokmen T, Padmanabhan M, Gunawan O, Shkolnikov YP, Vakili K, De Poortere EP, Shayegan  
M. Parallel magnetic-field tuning of valley splitting in AIs two-dimensional electrons. *Phys  
Rev B* 2008; 78(23):233306.

Bishop NC, Padmanabhan M, Gunawan O, Gokmen T, De Poortere EP, Shkolnikov YP, Tutuc  
E, Vakili K, Shayegan M. Valley susceptibility of interacting electrons and composite fermions.  
*Physica E-Low-Dimensional Systems and Nanostructures* 2008; 4(5):986–989.

McGowan JC, Shkolnikov YP, Sala JB, Ray RM. Diffuse electrical injury: A questionable  
phenomenon. *Biomedical Engineering Recent Developments*, Nazeran H, Goldman M,  
Schoepfoerster R (eds), Medical and Engineering Publishers, Inc., ISBN 978-1-930636-06-4,  
2008.

McGowan JC, Shkolnikov YP, Sala JB, Ray RM. Diffuse electrical injury: Questioning the  
scientific basis. *Proceedings, IEEE CCECE Conference, Niagara Falls, Ontario, Canada, 2008.*

Gunawan O, Gokmen T, Shkolnikov YP, De Poortere EP, Shayegan M. Anomalous giant  
piezoresistance in AIs 2D electron systems with antidot lattices. *Phys Rev Lett* 2008;  
100:036602.

Bishop NC, Padmanabhan M, Vakili K, Shkolnikov YP, De Poortere EP, Shayegan M. Valley  
polarization and susceptibility of composite fermions around a filling factor  $\nu=3/2$ . *Phys Rev  
Lett* 2007; 98:266–404.

Shayegan M, De Poortere EP, Gunawan O, Shkolnikov YP, Tutuc E, Vakili K. Quantum Hall  
effect in a multi-valley two-dimensional electron system. *IJMPB* 2007; 21:1388–1397.

Shayegan M, De Poortere EP, Gunawan O, Shkolnikov YP, Tutuc E, Vakili K. Two-dimensional electrons occupying multiple valleys. *AIAs Physica Status Solidi (b)* 2006; 243(14):3629–3642, November.

Gunawan O, Shkolnikov YP, Vakili K, Gokmen T, De Poortere EP, Shayegan M. Valley susceptibility of an interacting two-dimensional electron system. *Physical Review Letters* 2006; 97:186404.

Vakili K, Shkolnikov YP, Tutuc E, De Poortere EP, Padmanabhan M, Shayegan M. High-aobility AIAs quantum wells with out-of-plane valley occupation. *Applied Physics Letters* 2006; 89:172118.

Vakili K, Shkolnikov YP, Tutuc E, Bishop NC, De Poortere EP, Shayegan M. Spin-dependent resistivity and quantum Hall ferromagnetism in two-dimensional electrons confined to AIAs quantum wells. *Physica E* 2006; 34:89.

Vakili K, Gokmen T, Gunawan O, Shkolnikov YP, De Poortere EP, Shayegan M. Dependence of persistent gaps at Landau level crossings on relative spin. *Physical Review Letter* 2006; 97:116803.

Shkolnikov YP, Misra S, Bishop NC, De Poortere EP, Shayegan M. Observation of quantum Hall valley skyrmions. *Physical Review Letters* 2005; 95:066809.

Vakili K, Shkolnikov YP, Tutuc E, Bishop NC, De Poortere EP, Shayegan M. Spin-dependent resistivity at transitions between integer quantum Hall states. *Physical Review Letters* 2005; 94:176402.

Gunawan O, Shkolnikov YP, De Poortere EP, Tutuc E, Shayegan M. Ballistic electron transport in AIAs quantum wells. *Physical Review Letters* 2004; 93:246603.

Shkolnikov YP, Vakili K, De Poortere EP, Shayegan M. Giant low-temperature piezoresistance effect in AIAs two-dimensional electrons. *Applied Physics Letters* 2004; 85:3766.

Shkolnikov YP, Vakili K, De Poortere EP, Shayegan M. Dependence of spin susceptibility of a two-dimensional electron system on the valley degree of freedom. *Physical Review Letters* 2004; 92:246804.

Vakili K, Shkolnikov YP, Tutuc E, De Poortere EP, Shayegan M. Spin susceptibility of two-dimensional electrons in narrow AIAs quantum wells. *Physical Review Letters* 2004; 92:226401.

Vakili K, Shkolnikov YP, Tutuc E, De Poortere EP, Shayegan M. Realization of an interacting two-valley AIAs bilayer system. *Physical Review Letters* 2004; 92:186404.

Shayegan M, Karrai K, Shkolnikov YP, Vakili K, De Poortere EP, Manus S. Low-temperature, in situ tunable, uniaxial stress measurements in semiconductors using a piezoelectric actuator. *Applied Physics Letters* 2003; 83:5235.

De Poortere EP, Shkolnikov YP, Shayegan M. Field-effect persistent photoconductivity in AlAs and GaAs quantum wells with AlGaAs barriers. *Physical Review B* 2003; 67:153303.

Shkolnikov YP, De Poortere EP, Tutuc E, Shayegan M. Valley splitting of AlAs two-dimensional electrons in a perpendicular magnetic field. *Physical Review Letters* 2002; 89:226805.

De Poortere EP, Tutuc E, Shkolnikov YP, Vakili K, Shayegan M. Magnetic-field-induced spin polarization of AlAs two-dimensional electrons. *Physical Review* 2002; B 66:161308.

De Poortere EP, Shkolnikov YP, Shayegan M. High-mobility electrons in modulation-doped AlAs quantum wells. *Physica E* 2002; 13:646.

De Poortere EP, Tutuc E, Shkolnikov YP, Vakili K, Shayegan M, Palm E, Murphy T. Quantum Hall effect in AlAs 2D electron system. *International Journal of Modern Physics B* 2002; 16:2917.

De Poortere EP, Shkolnikov YP, Tutuc E, Papadakis SJ, Shayegan M, Palm E, Murphy T. Enhanced electron mobility and high order fractional quantum Hall states in AlAs quantum wells. *Applied Physics Letters* 2002; 80:1583.

### **Selected Conference Presentations**

Shkolnikov Y, Restrepo C, Parvizi J, Hozack W, Garino J, Suggs J, Kurtz S. Clinical validation of a squeakometer for characterization of acoustic emissions in arthroplasty patients. ORS 55th Annual Meeting, Las Vegas, NV, February 23, 2009.

McGowan JC, Shkolnikov YP, Sala JB, Ray RM. Diffuse electrical injury: Questioning the scientific basis. IEEE Canadian Conference on Electrical and Computer Engineering, Niagara Falls, Ontario, Canada, May 6, 2008.

McGowan JC, Shkolnikov YP, Sala JB, Ray RM. Diffuse electrical injury: A questionable phenomenon. 24th Southern Biomedical Engineering Conference, El Paso, TX, April 19, 2008.

Bowden AE, Shkolnikov YP, MacDonald D, Kurtz SM. Automated microCT-based damage maps of explanted polymeric TDR components. North American Spine Society 22<sup>nd</sup> Annual Meeting, Austin, TX, October 22–27, 2007.

Bowden AE, Shkolnikov YP, MacDonald D, Kurtz S. Development and validation of an automated MicroCT-based technique for mapping damage of explanted polymeric components for TDR. Spine Arthroplasty Society, Berlin, Germany, 2007.

Padmanabhan M, Bishop N, Shkolnikov YP, De Poortere EP, Shayegan M. Gap and mass measurements of composite fermions at  $\nu=5/3$  in a 2D electron system with tunable valley occupation. APS March Meeting, Denver, CO, 2007.

Bishop N, Padmanabhan M, Vakili K, Shkolnikov YP, De Poortere EP, Shayegan M. Valley susceptibility measurements of composite fermions around filling factor  $\nu = 3/2$ . APS March Meeting, Denver, CO, 2007.

Shkolnikov YP, Gunawan O, Vakili K, Gokmen T, De Poortere E, Shayegan M. Valley susceptibility of an interacting two-dimensional electron system. APS March Meeting, Baltimore, MD, 2006.

Padmanabhan M, Vakili K, Shkolnikov YP, Gunawan O, Gokmen T, Tutuc E, De Poortere EP, Shayegan M. Selective occupation of conduction band valleys in AlAs quantum wells. APS March Meeting, Baltimore, MD, 2006.

Gunawan O, Shkolnikov YP, Vakili K, De Poortere EP, Shayegan M. Giant piezoresistance in AlAs 2D electron systems with antidot lattice. APS March Meeting, Baltimore, MD, 2006.

Vakili K, Gokmen T, Padmanabhan M, Gunawan O, Shkolnikov YP, Tutuc E, Shayegan M. Landau level crossings in imbalanced, two-valley two-dimensional electron systems. APS March Meeting, Baltimore, MD, 2006.

Gunawan O, Shkolnikov YP, Tutuc E, Vakili K, Shayegan M. Antidot lattice in AlAs 2D electron system: Electron pinball with elliptical Fermi contours. APS March Meeting, Los Angeles, CA, 2006.

Vakili K, Y. Shkolnikov, Tutuc E, Bishop N, De Poortere EP, Shayegan M. Spin-dependent resistivity at transitions between integer quantum Hall states. APS March Meeting, Los Angeles, CA, 2006.

Vakili K, De Poortere EP, Shayegan M. Spin susceptibility of two-dimensional electrons in AlAs. PCCM Workshop on Correlated Electronic Materials, Princeton, NJ, 2005.

Shkolnikov YP, Vakili K, De Poortere EP, Shayegan M. Dependence of spin susceptibility of a two-dimensional electron system on valley degree of freedom. 16<sup>th</sup> International Conference on High Magnetic Fields in Semiconductor Physics, Tallahassee, FL, 2004.

Shkolnikov YP, Tutuc E, Vakili K, Gunawan O, Shayegan M. Physics and technology of AlAs semiconductor devices. Corporate Affiliates Program Meeting, Princeton NJ, 2004.

Shkolnikov YP, Vakili K, Shayegan M. Strain dependence of spin and valley polarization in AlAs 2D electrons. APS March Meeting, Montreal, Canada, 2004.

Gunawan O, Shkolnikov YP, Tutuc E, Shayegan M, De Poortere EP. Valley-resolved ballistic transport in a two-dimensional electron system. APS March Meeting, Montreal, Canada, 2004.

Vakili K, Shkolnikov YP, De Poortere EP, Tutuc E, Shayegan M. Spin polarization of 2D electrons in Narrow AlAs quantum wells. APS March Meeting, Montreal, Canada, 2004.

Shkolnikov YP, De Poortere EP, Vakili K, Tutuc E, Shayegan M, Karrai K, Palm E, Murphy T. stress-induced modification of electronic properties in AlAs 2D electrons. Corporate Affiliates Program Meeting, Princeton, NJ, 2003.

De Poortere EP, Shkolnikov YP, Shayegan M. Field-effect persistent photoconductivity in GaAs/AlAs-based structures. APS March Meeting, Austin, TX, 2003.

Gunawan O, De Poortere EP, Shkolnikov YP, Vakili K, Tutuc E, Shayegan M, Yau JB. Ballistic transport in AlAs 2D electrons. APS March Meeting, Austin, TX, 2003.

Vakili K, Shkolnikov YP, De Poortere EP, Tutuc E, Shayegan M. Magnetoresistance measurements in wide and narrow AlAs quantum wells. APS March Meeting, Austin, TX, 2003.

Shkolnikov YP, De Poortere EP, Vakili K, Tutuc E, Shayegan M. Lifting of the valley degeneracy in AlAs 2D electrons. APS March Meeting, Austin, TX, 2003.

Shkolnikov YP, De Poortere EP, Tutuc E, Shayegan M, Palm E, Murphy T. Magnetic field dependence of valley splitting in AlAs 2D electrons. 15<sup>th</sup> International Conference on High Magnetic Fields in Semiconductor Physics, Oxford, UK, 2002.

Shkolnikov YP, De Poortere EP, Tutuc E, Shayegan M. Evidence of multi-valley fermi surface in AlAs 2D electrons. APS March meeting, Seattle, WA, 2001.

Skinner CH, Stotler DP, Bell RE, Pitcher CS, Terry JL, Shkolnikov Y. High resolution spectroscopy at Alcatraz C-mod using a Fabry Perot interferometer. APS, 41<sup>st</sup> Annual Meeting of the Division of Plasma Physics, Seattle, WA, 1999.

### **Guest Lectures**

Shkolnikov YP. Got risk? Managing risk and reliability in modern technology. Cornell Club of Central New Jersey, Princeton, NJ, December 4, 2009.

Villarraga M, Shkolnikov YP. Medical device failure analysis during the design process. Department of Biomedical Engineering, Drexel University, Philadelphia, PA, May 6, 2009.

Shkolnikov YP. Electricity and the human body. Mechanical Engineering, Princeton University, Princeton, NJ, April 9, 2009.

Shkolnikov YP. Medical device design. North Jersey Section Engineering in Medicine and Biology IEEE Chapter, Clifton, NJ, August 4, 2008.

Villarraga M, Shkolnikov M. FMEA: Risk management and prioritization in medical device design. Thompson Interactive, July 17, 2008.

Shkolnikov YP. Failure analysis during the design process of medical devices. Department of Biomedical Engineering, Drexel University, Philadelphia, PA, 2008.

Shkolnikov YP, Villarraga M. Introduction to electrophysiology. Mechanical Engineering, Princeton University, Princeton, NJ, 2007.

Shkolnikov YP, Villarraga M. Failure analysis during the design process of medical devices. Compliance Online, 2007.

Shkolnikov YP. Electricity and the human body. Mechanical Engineering, Princeton University, Princeton, NJ, 2007.

Shkolnikov YP, Villarraga M. Medical device failure analysis during the design process. Department of Biomedical Engineering, Drexel University, Philadelphia, PA, 2007.

### **Current Academic Appointments**

Visiting Research Professor, School of Biomedical Engineering, Drexel University

### **Peer Review**

- Referee for *Physical Review Letters*

### **Professional Affiliations**

- Institute of Electrical and Electronics Engineers
- American Physical Society