

Professor and iCORE Chair of Nanoscale Information and Communications Technologies
Department of Physics
University of Alberta
Edmonton, Alberta T6G 2J1
Canada

Principal Research Officer and Director of Nano-Electronics Program
National Institute for Nanotechnology
Edmonton, Alberta
Canada

Academic Qualifications

B.Sc. Honours Applied Chemistry, Coop Program, University of Waterloo, Canada 1982
Ph.D. Chemistry, University of Toronto, Canada 1987

Career History

- Postdoctoral Fellow, IBM T.J. Watson Research Center, Yorktown Heights, USA, 1987
- Member of Technical Staff, AT&T Bell Laboratories, Murray Hill, NJ, USA, 1988
- Senior Research Officer, Leader Scanning Tunneling Microscopy Group, National Research Council, Steacie Institute for Molecular Sciences, Ottawa, 1994
- Adjunct Professor, Chemistry, University of Ottawa, 1999
- Appointed National Research Council Principal Research Officer, 2000
- Adjunct Professor, Physics, McGill University, 2000
- Leader, Molecular Interfaces Program, National Research Council, Steacie Institute for Molecular Sciences, 2001
- Professor, Department of Physics, University of Alberta, and simultaneously, Principal Research Officer and Molecular Scale Devices Program Leader, National Institute for Nanotechnology, Edmonton, 2003
- iCORE Chair in Nanoscale Information and Communications Technology, 2003
- Adjunct Professor, Dept. of Chemistry, University of Alberta, 2004
- Director, HEMIC (Hitachi Electron Microscopy Product Development Centre), 2009
- Program Coordinator, Hybrid Nano-Electronic Systems, National Institute for Nanotechnology, 2011
- AITF Industrial Chair in Atom Scale Fabrication, 2011
- CTO Quantum Silicon Inc. 2014

Awards and Distinctions

- National Science and Engineering Research Council Undergraduate Award 1982
 - National Science and Engineering Research Council Postgraduate Scholarship 1982-1986
 - University of Toronto Lash Miller Award 1982-1986
 - T.J. Watson IBM Outstanding Achievement Award 1989
 - Steacie Institute For Molecular Sciences Outstanding Achievement Award 1998
 - National Research Council of Canada Outstanding Achievement Award 1999
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- Royal Society of Canada Rutherford Memorial Medal - Physics 1999
- Noranda Award of the Canadian Society for Chemistry, 2000
- Fellow, Academy of Science of the Royal Society of Canada, 2000
- National Research Council of Canada Outstanding Achievement Award 2001
- Associate, Canadian Institute for Advanced Research, Nanoelectronics Program, 2002
- iCORE Chair of Nanoscale Information and Communications Technologies, 2003
- Fellow, Canadian Institute for Advanced Research, Nanoelectronics Program, 2006
- iCORE Chair of Nanoscale Information and Communications Technologies, 2008
- AITF Tier 1 Industrial Chair in Atom Scale Fabrication, 2012
- American Physics Society Fellowship, Division of Condensed Matter Physics, 2012
- ASTech Outstanding Leadership in Alberta Technology, 2015
- Innovation Makes Sense Patent Award, 2015
- Innovation Makes Sense Spin Off Award, 2015
- Innovation Makes Sense Patent Award, 2016
- National Research Council's NINT Research Award, 2017
- Innovation Patent Award, 2017

General Description of Research

Working in the general areas of condensed matter physics and surface chemical physics I primarily use scanned probe microscopy and quantum mechanical computation to gain a detailed understanding of and atom-scale control over atomically defined surface silicon structures. New instrument and technique development – experimental and computational - is a theme running throughout my work. Recent work is split between fundamental studies and commercialization.

Scientific Biography available in
[“Wolkow Sci Bio.pdf”](#)*

Refereeing

Active referee for premier journals Physical Review Letters, Nature, Science, ACS Nano and Nano Letters as well as for Journal of Chemical Physics, Journal of Physical Chemistry, Journal of American Chemical Society, Surface Science and Physical Review B. Also reviewer of NSF, various European, Asian and NSERC grants, for US and Canadian tenure appointments, and of academic awards.

* Follow hyperlink or request the document.

Contributions to the Training of Highly Qualified Personnel

The group has 15±3 members, including NINT staff, Postdocs, Research Associates, Graduate Students, Undergraduates and a Chief Executive Officer of a spin-off company.

Staff at NRC-NANO

Gino DiLabio	Research Council Officer	1993-2015	Professor and Dept. Head at UBC Okanogan
Jason Pitters	Research Council Officer	1993-present	
Martin Cloutier	Technical Officer	1994-present	
Mark Salomons	Research Council Officer	1994-present	

PDFs and Research Associates

David McComb	RA (1994), became faculty member at the University of Glasgow
Charles MacPherson	RA (1995) Nortel in Ottawa, then Uniax, Santa Barbara
David Brown	RA (1996) now Principle Staff, Field Applications Engineer at GLOBALFOUNDRIES
Gregory Lopinski	RA (1998) now a staff scientist at NRC Steacie Institute
Steven Patitsas	RA (1999) Professor, University of Lethbridge, Physics department
Oleksa Hulko	PDF (2000) became a research associate at Cambridge University
Gin Gu	postdoc in Germany
Peter Kruse	PDF (2002) Professor at McMaster University, Chemistry
Xiao Tong	PDF (2002) research associate, Santa Barbara, staff scientist Brookhaven National Labs
Jason Pitters	PDF (2002) jointly supervised with Dan Wayner, staff scientist NRC, NINT
Paul Piva	PDF (2003) became RA at NRC standards Institute, IP Lawyer
Mohamed Rezeq	PDF (2003) Professor Saudi Arabia
Iana Dogel	PDF (2004-6) assistant director, Nano Alberta, gov Alberta agency
Luca Ramoino	PDF (2006-7) Senior Process Engineer at Oerlikon Solar AG Switzerland
Adam Dickie	PDF (2003-5) science writer and vintner
Stanislav Dogel	PDF (2004-8) became staff scientist at NINT
M. Baseer Haider	PDF (2006-9), Professor, King Fahd University of Petroleum and Minerals, Saudi Arabia
Mustafa Muhamad	PDF (2008-9) now RA at University Alberta, engineering dept
Radovan Urban	PDF (2006-10) RA (2010-present)
Lucian Livadaru	PDF (2006-10) RA (2013-13), QSi Inc., staff scientist
Peter Ryan	PDF (2010-12)
Bruno Martins	PDF (2011-15) Data Scientist, Bluemetrix, Ireland
Hatem Labidi	PDF (2012-16) Staff scientist QSi Inc
Isil Ozfidan	PDF (2015-16) RA with Prof Richard Bernt, Germany
Moe Rashidi	PDF (2013-18) RA (2018), now a research analyst at ATB financial
Mohammed Koleini	PDF (2014-17) RA 2017
Thomas Dienel	RA (2017-present)
Jo Onoda	RA (2017-present)

Students in Ottawa

Michael Woodside	Summer student (1997), from U. of Toronto Engineering Physics, PhD at UC Berkeley Physics, postdoc Stanford, now U of A Physics Professor and cross appointee to NRC-NANO
Tara Fortier	Summer student (1998), from Concordia Physics, entered graduate school, Bolder
Katherine DeJong	Summer student (1999), from U. of Western Ont., entered graduate school there, became a manager at Sandia Nat Labs.
Clarrise Mark	Summer student (1999)
Vincenzo Palermo	Grad student from Italy (6 months 2001), became Staff Scientist CNR, Italy

Undergraduate Students in Edmonton

Tony Tadic	UofA Physics undergraduate, NSERC award (2003-04) and summer (2004), entered Med Phys grad school, UofA
Brian Olsen	UofA Eng Phys undergraduate, Summer student (2004)
Josh Mutus	UofA Physics undergraduate, Coop student, fall (2005), became grad student with me, finishing early (2012), postdoc U Santa Barbara
Josh Krabbe	UofA Eng Physics undergraduate, Summer student (2006), now grad student UofA
Jonathon Backs	UofA Eng Physics undergraduate, Summer Student (2008), became Electrical Engineer with McMillan-McGee
Chad Dierdrichs	UofA Eng Physics undergraduate, NSERC Summer Student (2011), currently undergraduate
John Wood	UofA Eng Physics undergraduate, Summer Student (2012 & 2013)
Erika Lloyd	UofA Eng Physics undergraduate, summer student (2013)
Kyle Nova	U Waterloo coop student, Physics, (Jan-Apr 2016)
Christopher Mannes	UofA Physics undergraduate, 499 projects, (2017-18)
Kieran Mastel	UofA Physics undergraduate summer student, NSERC scholarship (2018)
Brad Hesson	UofA Physics undergraduate (May 2018 – present)
Marcus Tamara	UofA Physics undergraduate (May 2018 – present)
Stephanie Yong	UofA Physics undergraduate, QEII Scholarship (September 2018 – present)
Sophie Taylor	UofA Physics undergraduate, 499 projects, (2017-18)

Current Graduate Students

Roshan Achal	PhD, NSERC CGSD scholarship , started as MSc (Sept 2012)
Taleana Huff	PhD, started as MSc student (January 2013)
Jeremy Croshaw	MSc, QEII graduate scholarship (September 2016)

Graduated Students

Amsalu Anagaw	MSc (2007), became PhD student Physics UofA
Manuel Smeu	MSc (2005-2007), became PhD student at McGill

Janik Zikovsky	PhD (2004-2009), became staff Scientist at Oak Ridge National Laboratory
Shoma Sinha	PhD (2006-11), became staff Scientist at Quantiam Technologies, Canada
Cristian Vesa	MSc (2009-11), became teacher
Josh Mutus	PhD (2006-12), Postdoc U Santa Barbara, currently Staff Scientist, Google quantum Computer Facility, Santa Barbara, CA, USA
Manuel Smeu	PhD student at McGill (2007-12) co-supervised Wolkow (McGill adjunct) and Hong Guo, Postdoc Northwestern U, now Professor SUNY Binghamton, USA
Peter Legg	MSc (2010-12)
Marco Taucer	MSc/PhD (2009-15), Dissertation Award , currently postdoc with Paul Corkum, U Ottawa
John Wood	MSc (2014-17), Engineer at Mycralyne
Erika Lloyd	MSc (2015-17), MASt at University of Edinburgh
Wyatt Vine	MSc (2016-18), PhD student in electrical engineering at New South Wales University

Student Achievements

- Roshan Achal (PhD)
- 2013 Faculty of Science Graduate Award
 - 2013 NSERC CGSM
 - 2013 Walter H Johns Graduate Fellowship
 - 2014 1st Place Alberta Nano Research Symposium Oral Presentations
 - 2014 2nd Place Nanotechcom Business pitch competition
 - 2014 1st Place Department of Physics Graduate Student Symposium Oral Presentations
 - 2015 1st Place Best Student Oral Presentation Division of Condensed Matter Physics CAP(2015)
 - 2015 2nd Place Nanotechcom Business pitch competition
 - 2015 2nd Place NanoNexus Business pitch competition
 - 2015 Doctoral Recruitment Scholarship

 - 2016 Faculty of Science Graduate Scholarship
 - 2016 President's Doctoral Award
 - 2016 NSERC CGSD3
 - 2016 AITF Doctoral (NSERC Top-up)
 - 2016 1st Place Department of Physics Graduate Student Symposium Oral Presentations
 - 2016 Three Minute Thesis (3MT) Finalist
 - 2017 1st Place Department of Physics Graduate Student Symposium Oral Presentations
- Taleana Huff (PhD)
- 2014 Poster Presentation – Gordon Research Conference

- 2015 Best Talk – University of Alberta Research Symposium
- 2016 Best Poster – University of Alberta Research Symposium
- 2016 3 Minute Thesis Semi-Finalist – University of Alberta
- 2017 NC-AFM Conference Talk - Suzhou, China
- 2018 NC-AFM Poster Award – Porvoo, Finland
- Jeremy Croshaw (MSc)
- 2017 Queen Elizabeth II Graduate Scholarship
- Wyatt Vine (MSc)
- 2016 Dean’s Excellence Recruitment Scholarship
- 2016 University of Alberta Recruitment Scholarship
- 2016 NSERC CGS-M
- 2016 U of A Walter H. Johns Fellowship
- 2017 Queen Elizabeth II Graduate Scholarship

Membership on committees, boards, or policy-making bodies

- 1997 Organizer of the Semiconductor section of the Surface Canada Meeting
- 1999 Member of the Organizing Committee of the Sixth International Conference on the Structure of Surfaces, Vancouver
- 1999 Organizer of Semiconductor section of the Surface Canada Meeting
- 2001 Program committee member for the Sixth International Conference on Nanometer-Scale Science and Technology and the 47th Symposium of the American Vacuum Society
- 2001 Conference Chair for the International STM meeting (620 participants)
- 2001 Elected Member at Large of the Nanoscale Science and Technology Division of the American Vacuum Society
- 2001 Member of the Nanoscale Science and Technology Division Awards Committee of the American Vacuum Society
- 2002 Participated in foundational meetings to discuss nanoscience initiatives in Canada. Aided Dan Wayner prepare a white paper describing a new nanoscience institute – which became NINT
- 2003 Member organizing committee, International STM meeting
- 2004 Program committee member for the 1st Canada NanoForum in Edmonton, Alberta
- 2004- Physics Department Graduate student affairs committee
- ongoing
- 2005 Program committee member for the 2nd NanoForum Canada, Montreal
- 2005 Program committee, International Scanning Tunneling Microscopy conference, Japan
- 2006- Member of President’s Advisory Committee for Senior Academic Appointments
- ongoing (PACSAA). Review all Canada Research Chair, Canada Excellence Research Chairs, and other high-level appointments and awards
- 2003- Member of several University of Alberta and National Institute for nanotechnology
- ongoing hiring committees
- 2004- Member of Physics Department condensed matter physics faculty hiring
- ongoing committees
- 2005- Member of National Institute for Nanotechnology committee for strategic planning

- ongoing
2005- Member of National Institute for Nanotechnology committee for budget allocation
ongoing
2005- IBM / UofA Centre for Advanced Studies Board member
2010
2006 Organizing Committee – International Conference on Nanoscience and Technology
2006 Program committee, 3rd NanoForum Canada, Edmonton
2006 Presented and joined panel discussion at ARTS DIALOGUE: "Converging Technologies - Shaping the Future and Reflecting on the Past". Leading speaker was Dr. Kristine Bruland who chaired the European Commission's High Level Expert Group "Foresighting the New Technology" which considered the economic and ethical effects of the developing fields of nanotechnology, bio-tech, and cognitive sciences. March 6, Edmonton
- 2010 Co-chair of Gordon Research Conference, "Nanostructure Fabrication"
2010- Board member of the journal "Surface Science"
2016
2012- Department of Physics Technical Services Committee
2016
2012- Biophysics professor recruiting committee
2013
2006- International Conference on Nanoscience and Technology organizing committee
ongoing
2017 Served on department panel to select Killam postdoctoral fellowship recipient
2016 & Member of the program advisory board for the 8th International Symposium on
2019 Surface Science in Japan

Recent Public Awareness/Education Activities

- 2001 The original variable temperature cryogenic STM designed and built at Bell Labs and further developed at NRC has been donated to the Science and Technology Museum in Ottawa to aid establishing a future scanned probe microscope exhibit
- 2001 APEC CTF Nanotechnology Experts Meeting, international experts technology foresight exercise, Nov 4 to 7
- 2002 Invited article for McGraw-Hill Science Encyclopedia, describing molecule-silicon science and the potential for hybrid devices
- 2001- Physical Review letter received coverage, Physical Review Focus – "STMs Make
2002 Mountains out of Molehills" (November 21, 2001), Materials Today (Feb, 2002), Scientific American, various e-journals (2002)
- 2002 Arranged a visit by a local (Ottawa) high school science class (from Holy Trinity Catholic High School). They attended a lecture by inspirational scientist Don Eigler
- 2002 Aided Ottawa high school teacher (Christine Adam-Carr) who was writing a new textbook and sought advice on an introduction to nanotech,
- 2003 Assisted high school students (Colonel By Secondary School) with projects on nanotechnology

- 2003 Headed successful effort to establish ethicist position at National Institute for Nanotechnology
- 2004 Continued effort to establish awareness and a suitable institute stance related to societal concerns about nanotechnology. Helped establish a relationship with the UA Health Law institute's director, Tim Caulfield and his associate Lori Sheremeta, to ensure that NINT was aware of, appropriately involved in, and to a degree protected from emerging issues related to societal implications of nanotechnology. Wrote article entitled "The ruse and the reality of nanotechnology" for a special issue of the Health Law review. Helped establish a fellowship, administered by the Health law group that will support visiting scholars who wish to study societal issues related to nanotech
- 2005 Condensed Matter Physics lecture series organizer – a forum that encourages free discussion during and after presentations by physics department graduate students, postdocs and faculty as well as by visiting scientists. The CMP series continues to this day, organized now by junior colleagues, I provide funds to purchase pizza for all in attendance
- 2005 Invited article, perspectives on nano-scale science for the Canadian Foundation for Innovation, appeared in a book entitled "Why We Need to Know: Essays by Leading Canadian Researchers", April
- 2004-2005 Twice judged CBC/Netera Alliance science essay contest for children in grades 6,7,8 in the province of Alberta
- 2005 Lectured to finalists in Canadian Physics Olympiad
- 2005 Spoke to local high school science class
- 2005 Deployed group members to speak at local high schools several times
- 2005 Within a local lecture series called "philosopher's café", spoke and fielded questions, together with Lori Sheremeta of University of Alberta Health Law Institute, on nanoscience and societal concerns
- 2006 Seminar on Ethics and Academic Integrity, Department of Physics, fall 2006. This and several other presentations help physics graduate students to grasp ethics issues that are relevant to the physical sciences
- 2006-ongoing Responded to media about nanoscience and/or ethics in science – on approximately 50 occasions
- 2011 HYRS Career Panel, with 4 other local profs and business people talked about career issues for 2 hours to this exceptional group of grade 11 students who have been placed by a gov Alberta program known as "HYRS" in summer research positions on campus
- 2012 Science 100 class. Demonstration of broad ranging solid state physical principles through recent atom scale experimental results. 2012 and each subsequent year
- 2013 Lecture, Let's Talk NanoScience, an event for grade 11 and 12 students
- 2016 Initiated a Physics-Industry "mixer" event to enable new funding opportunities, to identify new research objectives and to provide mentoring for physics department members interested in commercialization opportunities. Raised funds for the event. Numerous industrial participants engaged. Interested Physics Profs. The Dean of Science and TEC Edmonton (University of Alberta's commercialization entity) participated. Students and postdocs were included also. The event was called "Industrial Strength Physics" and was held in Jan 2016

- 2014 Collaboration with Lockheed Martin Canada (and USA) solidifies a relationship that is important - not only for spin-off company QSi, but also for NINT, UofA and the province of Alberta. Lockheed now has a long term intention of furthering its relationships with others in Alberta
- 2018 Participated in 'Profile of an Expert' for InSciTE students
- 2018 Volunteered as an interviewee with USchool – a program run by U of A that aims to introduce and connect students from socially vulnerable, Aboriginal and rural communities to the University.

Recent Grants

Grant Holder	Title of proposal, funding source	Amount per year (fraction applied to Wolkow)	Years of tenure
Molecular Interfaces Group	Operating, SIMS, NRC	160,000 (20%)	2002
Molecular Interfaces Group	Major capital, SIMS, NRC	400,000 (80%)	2002
Molecular Interfaces Group	Toward Hybrid Silicon Molecular Devices NSC-NRC Joint Research Program	100,000 (100%) 100,000 (100%)	2002 2003
R.A. Wolkow	Organic Modification of Semiconductors, NRC-BC Science and Technology Fund	10,000 (100%)	2002
R.A. Wolkow	Member support, Canadian Institute for Advanced Research, Nanoelectronics program	30,000 (100%)	2002- 2011
R.A. Wolkow	Start-up funds, University of Alberta	250,000 (100%)	2003
R.A. Wolkow	Beyond the Roadmap: A Path to Nanoscale Information and Communication Technologies iCORE Chair	750,000 (95%) 750,000 (95%) 750,000 (95%) 750,000 (95%) 750,000 (95%)	2003 2004 2005 2006 2007
R.A. Wolkow	Operating NINT, NRC	500,000 (100%) 500,000 (100%) 500,000 (100%) Approx 700,000	2003 2004 2005 2006

		(100%)	
R.A. Wolkow	Capital	100,000 (80%)	2003
		500,000 (80%)	2004
	NINT, NRC	500,000 (80%)	2005
		0	2006
Frank Hegmann	Terahertz conductivity of free-standing molecular wires on silicon, NanoIP, NSERC	100,000 (20%)	2004
		100,000 (20%)	2005
David Lynch	Integrated Nanosystems Research Facility	912,139 (5%)	2004
	Canadian Foundation for Innovation, Innovation Fund	3,860,499 (5%)	2005
		1,117,793 (5%)	2006
R.A. Wolkow	A foundation for molecular devices	78,900 (100%)	2004
		78,900 (100%)	2005
	NSERC, Discovery grant	78,900 (100%)	2006
		78,900 (100%)	2007
		78,900 (100%)	2008
R.A. Wolkow	Combined high resolution electron energy loss spectrometer and scanning tunneling microscope project, CFI, New Opportunities Fund	235,000 (100%)	2005
R.A. Wolkow	Combined high resolution electron energy loss spectrometer and scanning tunneling microscope project, ASRIP, Innovation Fund	181,500 (100%)	2005
Frank Hegmann	“Ultrafast Nanotools”, chemists and physicists, experimentalists and theorists combine fast lasers with scanned probes to understand time-dependent electrical transport through molecules. Funded by CFI, ASRIP	\$3.4M (11%)	2006
R.A. Wolkow	iCORE Chair renewal	\$3M (100%)	2008-12
	Hemic – Hitachi electron microscopy centre, funded by Hitachi (Canada and Japan) / nanoWorks (AB) / WD (Fed) / NRC (Fed and Local) Wolkow is Scientific Director and director of several product development projects, Marek Malec is manager of the facility	\$14M (~5%) all new microscopes available to entire campus.	2009-12
R.A. Wolkow	iCORE Chair renewal	\$2350000 (100%)	2012-17
R.A. Wolkow	Scanning Probe and Point Projection Microscopes for Fundamental Nano Science Studies	\$99,000	2014
		\$99,000	2015
		\$99,000	2016
	NSERC, Discovery Grant	\$99,000	2017

		\$99,000	2018
R.A. Wolkow	Scanning Probe and Point Projection Microscopes for Fundamental Nano Science Studies NSERC, Discovery Grant	\$40,000 \$40,000 \$40,000	2014 2015 2016
R.A. Wolkow	Industrial Strength Physics	\$5120	2015-16
R.A. Wolkow	Nano-Enabled Electronic and Ultra Sharp Tip Technology Alberta Innovates	\$1.5M	2017-20

Invited Talks

183. *Atomic Computational Elements Composed of Silicon Dangling Bonds*, WINDS18, Kohala Coast, HI, November 28th, 2018
182. *Well Beyond Moore: Silicon Chapter 2*, Transcending Incrementalism, Houston, TX, June 28th, 2018
181. *Supercharging Si*, 2018 T-30 McKinsey and Company Disruption 2.0, Pebble Beach, CA, June 8th, 2018
180. *Binary Silicon Atomic Logic*, WINDS17, Kohala Coast, HI, November 28th, 2017
179. *Toward Atom Scale Ultra Low Power Classical Circuitry and Quantum Circuitry*, TANN'17, Toronto, ON, August 24, 2017
178. *Toward Atom Scale Ultra Low Power Classical Circuitry and Quantum Circuitry*, Alberta Nano Research Symposium, Calgary, AB, May 5, 2017
177. *Toward Atom Scale Ultra Low Power Classical Circuitry and Quantum Circuitry*, SFU Data Centre Launch, Burnaby, BC, April 20, 2017
176. *Properties of multiple silicon atom artificial molecules on a silicon surface*, ACS National Meeting and Exposition, San Francisco, USA, April 2-6, 2017
175. *Toward Atom Scale Ultra Low Power Classical Circuitry and Quantum Circuitry*, Workshop on Simulation and Modeling of Emerging Electronics, Hong Kong, China, January 11, 2017
174. *The Role of Multi-Probe Transport Measurements in Building Atom Scale Circuitry*, Charge Transport at Surfaces and Nanostructures with Multi-probe Techniques, Julich, Germany, September 21-23, 2016
173. *Building Atom Scale Circuitry*, TNT2016, Fribourg, Switzerland, September 5-9, 2016
172. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, University of Regensburg, Germany, 2015
171. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, Danish Technical University, Denmark, 2015
170. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, Theory Meets Experiment: Molecular Nanoscience and Applications, University College London, United Kingdom, June 1-2, 2015
169. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, Canadian Association of Physicists meeting, University of Alberta, Canada 2015
168. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, ISANN 2015, Waikoloa, Hawaii, November 29 – December 5, 2015

167. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, University of Ottawa Physics Department, Canada, 2015
166. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, Presentation to NINT International review committee, University of Alberta, Canada, 2015
165. *Toward Atom Scale Ultra Low Power Electronic Circuitry*, Advanced Materials Workshop: Transcending Incrementalism, Texas A&M University Campus, Texas, June 23-24, 2015
164. *Building Atom Scale Circuitry*, University of Leiden, Netherlands, 2014
163. *Building Atom Scale Circuitry*, IEEE ASAP, Zurich, Switzerland, June 18-20, 2014
162. *Building Atom Scale Circuitry*, Space Exploration Symposium, Edmonton, Canada, Sept 25-26, 2014
161. *Building Atom Scale Circuitry*, ICN+T, Vail, USA, July 20-25, 2014
160. *Building Atom Scale Circuitry*, Workshop on Atomic Wires, Poland, Sept 10-12, 2014
159. *Building Atom Scale Circuitry*, AVS61, Baltimore, USA, Nov 9-14, 2014
158. *Building Atom Scale Circuitry*, Deutsches Elektronen-Synchrotron, Germany, 2014
157. *Building Atom Scale Circuitry*, CSC, Quebec, Canada, 2014
156. *Building Atom Scale Circuitry*, CMOS Emerging Technology, Whistler, Canada, 2014
155. *Building Atom Scale Circuitry*, Field-Coupled Nanocomputing Conference, Tampa, USA, Feb 7-8, 2013
154. *Building Atom Scale Circuitry*, Canada-India Summer School of Nanofabrication and Characterization, Toronto, Canada, 2013
153. *Building Atom Scale Circuitry*, Foresight Institute Conference, Palo Alto, USA, Jan 11-13, 2013
152. *Building Atom Scale Circuitry*, Wave Conference, Lake Louise, Canada, May 5-8, 2013
151. *Building with Atoms*, Theory meets Experiment: Organic Molecules on Inorganic Surfaces, London, UK, June 24, 2013
150. *Silicon Atomic Quantum Dots: A Basis for Electronic Circuitry*, CIFAR Quantum Information, Edmonton 2013
149. *Future Trends in Microelectronics: Into the Cross Currents*, Corsica, France June 25-29, 2012
148. *Beyond the Roadmap: A Route to Ultra-Low Power Electronics*, DARPA Unconventional Computing Systems for Real-Time Sensor Data Analysis Workshop, Arlington, 14 Mar 2012
147. *New Technologies through Atom-Scale Crafting: New Microscopes and a Route Beyond the Semiconductor Roadmap to Ultra-Low Power Silicon Electronics*, University of Waterloo Physics Department Colloquium, Waterloo, 16 Feb 2012
146. *Introduction of Quantum Silicon Incorporated* to iNovia Capital, Edmonton, 9 Feb 2012
145. *Introduction to Quantum Silicon Incorporated*, Breamer Investments, NY, NY, 30 Jan 2012
144. *Quantum Silicon Incorporated Product Development*, Texas Instruments, Dallas, Texas, 26 Jan 2012
143. *Introduction to Quantum Silicon Incorporated*, Texas Instruments, Dallas, Texas, 14 Dec 2011
142. *New Technologies through Atom-Scale Crafting: New Microscopes and a Route Beyond the Semiconductor Roadmap to Ultra-Low Power Silicon Electronics*, Materials Research Society Meeting, Boston MA, USA, Nov 2011

141. *New Technologies Through Atom-Scale Crafting: New Microscopes and a Route Beyond the Semiconductor Roadmap to Ultra-Low Power Silicon Electronics*, Colloquium, Department of Physics, University of British Columbia, 28 Sep 2011
140. *Toward Commercial Applications of Atom Scale Science*, Tech Futures Summit, Banff, AB, 28-30 Aug 2011
139. *Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature*, Plenary Speaker, 16th International Symposium on Silicon Chemistry (ISOS-XVI), Hamilton ON, 14-18 Aug 2011
138. *Silicon atomic quantum dots, qubits, artificial molecules and surface state conductors, new theory and experimental results*, International Workshop on Atomic Scale Interconnection Machines, Institute of Materials Research and Engineering, A*STAR, Singapore, 29 June 2011
137. *Beyond the Roadmap: A Route to Ultra-Low Power Electronics*, Chrysalix Energy Venture Capital, Vancouver, BC, 30 May 2011
136. *Beyond the Roadmap: A Route to Ultra-Low Power Electronics*, Braemar Energy Ventures, Boston, MA, USA, 3 May 2011
135. *Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature*, Pacifichem meeting, Honolulu Hawaii, USA, 18 Dec 2010
134. *Making Nanotips*, CIFAR Nanoelectronics meeting, Banff Alberta, 18 Nov 2010
133. *Toward Commercial Applications of Atom Scale Science*, Tyndall National Institute at University College Cork, Cork, Ireland, 21 Oct 2010
132. *Toward Commercial Applications of Atom Scale Science*, Trinity College, Dublin, Ireland, 18 Oct 2010
131. *Nano-tips: fabrication of needles that terminate in a single atom*, Condensed Matter Physics Seminar, Department of Physics, University of Alberta, 7 Oct 2010
130. *Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature*, Colloquium, Physics Department, Simon Fraser University, Burnaby, BC, 24 Sept 2010
129. *Some Recent Considerations of and Progress Toward Working Nano-Electronic Devices*, Alberta Innovates Technology Futures Research and Capacity Summit, Banff Alberta, 20 Aug 2010
128. *A new Beginning for QCA: Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature*, 2010 CMOS Emerging Technologies Workshop, Whistler, BC, Canada, 19-21 May 2010
127. *Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature*, Yale Institute for Nanoscience and Quantum Engineering Seminar, Yale University, New Haven, CT, USA, 22 April 2010
126. *Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature*, Department of Electrical Engineering, University of Notre Dame, Notre Dame, IN, USA, 28 April 2010
125. *Applying lessons from atom-scale science to develop new charged particle sources*, Workshop on Heavy Particle and Charged Particle Interferometry, at Institute for Theoretical Atomic, Molecular, and Optical Physics (ITAMP), Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA April 19–21, 2010
124. *Controlled coupling & Occupation of Si atomic quantum dots at room temperature, Quantum Coherent Properties of Spins II*, Pacific Institute of Theoretical Physics,

- University of British Columbia, Vancouver, BC, Canada, 4-6 Dec 2009
123. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, Canada-Japan-Poland Workshop on Quantum Dots, Wroclaw, Poland, 5-7 Oct 2009
 122. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, International Workshop on Quantum Cellular Automata, Vancouver, BC, Canada, 7-9 Aug 2009
 121. *Some highlights from NINT and Controlled Coupling and Occupation of Silicon Atomic Quantum Dots*, Canadian Association of Physicists Annual Meeting, Moncton NB, 7 June 2009
 120. *Applying Lessons from Atom-Scale Science to Develop New Charged Particle Sources, Plenary lecture*, 53rd International Conference on Electron, Ion, and Photon Beams Conference, Marco Island, FL, 26-9 May, 2009
 119. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, National Institute for Materials Science, Columbia University, New York, 25 Mar 2009
 118. *Advanced Microscopy Development at NINT*, Hitachi, Naka, Japan, 19 Feb 2009
 117. *Advanced Microscopy Development at NINT*, JEOL, Akishima, Japan, 18 Feb 2009
 116. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, National Institute for Materials Science, Tsukuba, Japan, 17 Feb 2009
 115. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, Molecular Electronics IX Conference, Kauai, Hawaii, USA, 12-15 December, 2008
 114. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, Cornell University, 20 Nov 2008
 113. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, Colloquium, University of Victoria, Victoria, 15 Oct 2008
 112. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, Institute for Quantum Information Science, University of Calgary, 21 Oct 2008
 111. *Controlled coupling and occupation of silicon atomic quantum dots at room temperature*, condensed matter physics seminar, University of Alberta, 9 Oct 2008
 110. *Plenary talk, The ruse and the reality of nanotechnology*, AAPT 2008 summer meeting, meeting of ~1500 science teachers from across N America, Edmonton, 22 July 2008
 109. *Electronic processes of organic molecules on semiconductor surfaces*, LEEMI-EIPAM'08 International Conference on low-energy electron interactions, Roscoff, France 7-11 May, 2008
 108. *What we can do today, expect to do in the future and what we will never do with nanotechnology*, Keynote speaker, Undergraduate Nanotechnology Conference, Toronto, 8 Mar 2008
 107. *Hybrid silicon-molecule device concepts*, Innovations in energy conversion materials workshop Banff Alberta, 19 Nov 2007
 106. *Hybrid silicon-molecule device concepts*, Nanotechnology Research Institute (AIST, Japan) – National Institute for Nanotechnology 2nd Joint Scientific Workshop, Edmonton, Alberta, Canada, July 18-20, 2007
 105. *The Ruse and the Reality of Nanotechnology*, Talk to Alberta Ingenuity, Edmonton,

- Alberta, 17 July 2007
104. *Hybrid silicon-molecule device concepts*, 4th International Conference on Materials for Advanced Technologies, Singapore, 1-6 July 2007
 103. *"Bacon and Eggheads"* Parliamentary lecture, West Block, Ottawa, 7 June, 2007
 102. *Toward hybrid silicon-organic technologies*, plenary lecture, 40th Silicon Symposium, University of Victoria, 31 May 2 June, 2007
 101. *The Ruse and the Reality of Nanotechnology*, keynote speech, Pharmaceutical Sciences Group 35th Annual Symposium, Toronto, 8 May, 2007
 100. *What we can do today, expect to do in the future and what we will never do with nanotechnology*, Keynote speaker, Canadian Society of Nuclear Medicine annual meeting, St John's, Newfoundland, 3 -5 May 2007
 99. *Field regulation of single-molecule conductivity by a charged atom*, 13th Brazilian Workshop on Semiconductor Physics, São Paulo, Brazil, 1-5 April, 2007
 98. *Hybrid silicon-molecule device concepts*, The NINT-CeNS Winter School on Nanotechnology Convergence, a gathering of scientists and students from Munich Germany and Edmonton, Edmonton 14-21 Mar 2007
 97. *Field regulation of single-molecule conductivity by a charged atom*, College of Nanoscale Science and Engineering, University at Albany, State University of New York, 18-19 January 2007
 96. *Field regulation of single-molecule conductivity by a charged atom*, Schloss Ringberg Discussion meeting on one-dimensional materials, hosted by Max Plank Institutes, Tegernsee, Germany, 15-18 Oct. 2006
 95. *Field regulation of single-molecule conductivity by a charged atom*, ACS meeting, San Francisco CA, Sept. 2006
 94. *Field regulation of single-molecule conductivity by a charged atom*, Gordon Research Conference on Nanostructure Fabrication, July 16 – 21, 2006, New Hampshire, USA
 93. *Field regulation of single-molecule conductivity by a charged atom*, CREST workshop on physics of single molecules, 16-18 May 2006, Shonnan international village, Kanagawa, Japan
 92. *Field regulation of single-molecule conductivity by a charged atom*, University of Pittsburgh, Feb 2 2006
 91. *Field regulation of single-molecule conductivity by a charged atom*, Pacifichem, Dec 2005, Hawaii
 90. *Field regulation of single-molecule conductivity by a charged atom*, MRS meeting, Boston, Nov 2005
 89. *Field regulation of single-molecule conductivity by a charged atom*, CIAR nanoelectronics meeting, Santa Barabara CA, Nov 2005
 88. *An Intro to Nanoscience: what we can do, likely will do, and won't ever do*, Alberta Cancer Board Annual Research Meeting, Banff Alberta, Nov 2005
 87. *Field regulation of single-molecule conductivity by a charged atom*, TNT2005, Oviedo, Spain, 29 July 2005
 86. *Field regulation of single-molecule conductivity by a charged atom*, Nanoforum, Montreal
 85. *Field regulation of single-molecule conductivity by a charged atom*, Molecular Conduction Workshop, Purdue University, 27 July, 2005
 84. *The Coming Nano-World*, Canadian Science Writers' Association, Jasper National

- Park, 20 June 2005
83. *Scanning Tunneling Microscopy and Nanotechnology*, Grade 10 science class at Strathcona High School, Edmonton, 27 May 2005
 82. *Intoduction to nanoscience*, Canadian Physics Olympiad (for high school students), University of Alberta, Edmonton, 30 April 2005
 81. *A lay accessible description of nanotechnology*, Medical Physics section of the Grand Oncology Rounds, Cross Cancer Institute, Edmonton, 19 April 2005
 80. *Philosophers' Café, Topic: Nanotechnology: The Ruse and Reality*. A public discussion at the Stanley A. Milner Library with co-presenter Lori Sheremeta of the University of Alberta Health Law Institute, Edmonton, 26 Feb, 2005, Bob Wolkow and Lori Sheremeta of the U of Alberta Health Law Institute
 79. *Hybrid Molecule-Silicon Nanoscience: Laying a foundation for Molecular Devices*, Pacific Centre for Advanced Materials and Microstructures annual meeting, Vancouver, 4 Dec 2004
 78. *Hybrid Molecule-Silicon Nanoscience: Laying a foundation for Molecular Devices*, Physics Department, McGill University, 9 Sept. 2004
 77. *Hybrid Molecule-Silicon Nanoscience: Laying a foundation for Molecular Devices*, NASA Institute for Nanoelectronics and Computing, 2nd Annual Workshop on Molecular Conduction, Northwestern University on July 8-10, 2004
 76. *Hybrid Molecule-Silicon Nanoscience: Laying a foundation for Molecular Devices*, Electronic Structure and Simulations of Nanostructures, towards an understanding of physical, chemical and biological processes, Jyvaskyla, Finland, June 2004
 75. *3 Lecture Series*, ICTP Spring College on Science at the Nanoscale, Trieste, Italy, May 2004
 74. Keynote Speaker, 29th annual APICS/CIC Student Chemistry Conference, St Mary's University, Halifax, May 13-15, 2004
 73. *Hybrid Molecule-Silicon Nanoscience: Laying a foundation for Molecular Devices*, Seminar, Dalhousie University, 14 May, 2004
 72. Talk at Sigma Xi Annual Banquet, Edmonton, March 31 2004
 71. Talk to Edmonton Rotary club, Mar 2004
 70. *Distinguished Lecture series*, Department of Chem. Eng. and Applied Chem., University of Toronto, March 2004
 69. *iCORE Distinguished Lecturer series*, University of Calgary, Jan 2004
 68. Physics Seminar, Simon Fraser University, Jan 2004
 67. International Conference on Materials for Advanced Technologies, Singapore, Dec 2003
 66. Condensed Matter Physics Seminar at the University of Rochester, New York, Dec 2003
 65. *Ethical implications of nanotechnology*, Health Law Institute, University of Alberta, , Nov. 2003
 64. Edmonton Council for Advanced Technology lecture, Nov, 2003
 63. International Conference on Atomically Controlled Surfaces, Nara, Japan, Nov. 2003
 62. Nanotechnology Seminar at Purdue, Oct 2003
 61. CIAR Nanoelectronics Molecular Electronics student school, July, 2003
 60. *Molecules and Nanoscience*, Montpellier, April 2003
 59. March meeting, Austin Texas, 2003

58. Convergence across scales meeting, Edmonton, October 2002
57. Plenary lecture, Asia SPM 4 & Taipei Symposium on Nanotechnology, Aug 12, 2002
56. *Enabling Complex Science Through Multidisciplinary Teams*, Symposium on Microelectronics Research & Development in Canada, , June 2002, Ottawa
55. 9th International Conference on Desorption Induced by Electronic Transitions (DIET9), Centre Paul Langevin, Aussois (France), June 4-7, 2002
54. *Molecular Nanosystems : From Single Molecules to Supramolecular Assemblies* in Ascona, Switzerland, 14 April 2002
53. Chemical Conference in Taipei, 23 Feb. 2002
52. Canadian Eminent Lecturer tour of Taiwan, March 2002
51. Brian Bent Memorial Lecture, Columbia University, New York, Jan 2002
50. Canadian Society for Chemistry, Montreal, May 30 2001
49. UK surface Science conference, London, April 2001
48. University of Alberta, Dept Physics, March 9, 2001
47. Gordon Conference, Reactions at Surfaces, California, Feb 2001
46. Institute for Chemical Process and Environmental Technology, Ottawa, 26 Jan 2001
45. 10th International Workshop on Computational Material Science: Total Energy And Force Methods, Trieste, Italy, 11 - 13 January 2001
44. 8th International Colloquium on SPM (ICSPM-8). December 7-9, 2000 in Atagawa, Shizuoka, Japan
43. Series of student lectures and departmental seminar at Princeton, Nov. 2000.
Noranda Award Lecture, CIC Meeting, Calgary, May 2000
42. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, Department of Chemistry, University of California at Berkeley, CA, March 2000
41. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, IBM Almaden Research Center, California, March 2000
40. *Controlled Breaking of Benzene-Si bonds with STM via a Sharp Adsorbate Resonance*, Department of Chemistry, Stanford University, CA, March 2000
39. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, Symposium "Surface Chemistry of Polymers and Organic Monolayers" at the ACS National Meeting in San Francisco, CA on March 26-30, 2000
38. *Absolute Chirality Determination and Asymmetric Induction at a Silicon Surface*, Symposium on the "Physical Chemistry of Chirality." at the ACS National Meeting in San Francisco, CA on March 26-30, 2000
37. *Exploring and Controlling Matter at the Atomic-level*, McMaster undergraduate tour of Sci and Tech in Ottawa, Jan 2000
36. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, Department of Chemistry, University of Ottawa, October 1999
35. *Controlled Breaking of Benzene-Si bonds with STM via a Sharp Adsorbate Resonance*, Department of Materials, Oxford University, England, October 1999
34. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, Dept. of Chemistry, Cambridge University, October 1999
33. *Controlled Breaking of Benzene-Si bonds with STM via a Sharp Adsorbate Resonance*, Dept. of Physics, University College London, London, England, October 1999
32. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, JRCAT-NAIR, Tsukuba, Japan, Sept. 1999

31. *Structural Determination of Individual Adsorbed Molecules*, Dept. of Condensed Matter Physics, Univ. of Tokyo, Japan, Sept. 1999
30. *Structural Determination of Individual Adsorbed Molecules*, Hitachi Advanced Research Laboratory, Hatoyama, Japan, Sept. 1999
29. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, 12th International Conference on Fourier Transform Spectroscopy, Tokyo Japan, Aug 1999
28. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, STM99, Seoul South Korea, July 1999
27. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, 82nd CSC Meeting - Toronto, Surface Chemistry Perspectives on the Design of Materials Properties, May 1999
26. *Controlled Breaking of Benzene-Si bonds with STM via a Sharp Adsorbate Resonance*, Laval University, April 1999
25. *Controlled Molecular Adsorption on Si: Laying a Foundation for Molecular Devices*, Department of Chemistry, Carleton University, February 1999
24. *Understanding Molecular Adsorption on Silicon*, Brockhouse Lecture, McMaster University, Hamilton, Oct. 1998
23. *Organic Modification of semiconductors*, University of Waterloo, Department of Chemistry, July 1998
22. *Organic Modification of Silicon*, University of Ottawa, Department of Chemistry, Jan. 1998
21. *Organic Modification of Silicon*, Laval University, Department of Chemistry, Sept. 1997
20. *Direct Observation of Precursors to Chemisorption*, Canadian Association of Physics meeting (CAP97) Calgary, June 1997
19. *Capturing Precursors to Chemisorption*, Surface Canada 97, Sherbrooke, May 1997
18. *AA Low Temperature Scanning Tunneling Microscopy Study of Silicon Homoepitaxy*, Distinguished lecturer at the 4th International Colloquium on Scanning Tunneling Microscopy, 12 Dec 1996, Kanazawa, Japan
17. *Overview of Nanostructures Research at SIMS*, JRCAT, Tskuba, Japan, 12 Dec 1996
16. *Non-Thermal Transient Motion of Adsorbates*, NATO Advanced Studies Institute, Surface Diffusion: Atomistic and Collective Processes, Rhodes Greece, 26 Aug 1996
15. *Some new Applications of Scanning Tunneling Microscopy*, CIC Meeting, St. Johns Newfoundland, 25 June 1996
14. *Order-Disorder Transition on the Si(100) Surface*, Gordon Conference, Order and Disorder in Solids, 21 July 1996
13. *Atomic-level Processes Underlying Silicon Homoepitaxial Growth*, McGill University, Physics Department, 11 April 1996
12. *Scanning Probe Microscopies: Principles and Applications*, ASM International local meeting, Ottawa, 9 Jan 1996
11. *Silicon Epitaxy Studied With Scanning Tunneling Microscopy*, NRC Seventh Canadian Semiconductor Technology Conference, Ottawa, 14-18 Aug. 1995
10. *An Atom-Resolved View of Silicon Nanoclusters*, Gordon Research Conference on Metal and semiconductor Clusters, New Hampshire, Aug 6-11, 1995
9. *Silicon Epitaxy Studied With Scanning Tunneling Microscopy*, University of Illinois Beckman Institute, Champagne Illinois, 30 June 1995
8. *A Low Temperature Scanning Tunneling Microscopy Study of Silicon Homoepitaxy*,

- Surface Canada Conference, Univ. Waterloo, 25-27 May 1995
7. *Scanning Tunneling Microscopy of Silicon: Atoms, Nanoclusters, Bulk*, Ontario Laser and Lightwave Research Centre, Toronto, 18 April 1995
 6. *Evidence of Adsorbed Atom Pairing During Silicon Homoepitaxy*, 209th ACS National Meeting, Anaheim, CA, 2-6 April, 1995
 5. *Adsorption Phenomena studied with Scanning Tunneling Microscopy*, University of Manitoba, 10 Mar, 1995
 4. *Adsorption Phenomena studied with Scanning Tunneling Microscopy*, Queens University, 15 Feb. 1995
 3. *A Low Temperature STM Study of Silicon Homoepitaxy*, University of Ottawa, 19 Jan 1995
 2. *Scanning Tunneling Microscopy*, Ottawa Science Fiction Society, 30 Oct. 1994
 1. *Silicon Homoepitaxy at Low Temperature: Capturing Adsorbed Atoms and the Formation of Individual Bonds*, Interface Formation and Dynamics in Layered Structures conference, Toronto, April 1994

Published Papers

130. *Binary atomic silicon logic*, Huff, T., Labidi, H., Rashidi, M., Livadaru, L., Dienel, T., Achal, R., Vine, W., Pitter, J., Wolkow, R.A., *Nature Electronics*, **1**, 636-643 (December 13, 2018)
129. *Initiating and monitoring the evolution of single electrons within atom-defined structures*, Rashidi, M., Vine, W., Dienel, T., Livadaru, L., Retallick, J., Huff, T., Walus, K., Wolkow, R.A., *Phys. Rev. Lett.*, **121**, 166801 (October 14, 2018)
128. *SiQAD: A Design and Simulation Tool for Atomic Silicon Quantum Dot Circuits*, Ng, S., Retallick, J., Chiu, H.N., Lupoiu, R., Rashidi, M., Vine, W., Dienel, T., Livadaru, L., Wolkow, R.A., Walus, K., arXiv, 1808-04916, (August 14, 2018)
127. *Lithography for robust and editable atomic-scale silicon devices and memories*, Achal, R., Rashidi, M., Croshaw, J., Churchill, D., Taucer, M., Huff, T., Cloutier, M., Pitters, J.L., Wolkow, R.A., *Nature Communications*, **9**, 2778, (July 23, 2018)
126. *Autonomous Scanning Probe Microscopy in Situ Tip Conditioning through Machine Learning*, Rashidi, M., Wolkow, R.A., *ACS Nano*, **12(6)**, 5185-5189, (May 23, 2018)
125. *Selective production of hydrogen ion species at atomically designed nanotips*, Moritani, H., Urban, R., Nova, K., Salomons, M., Wolkow, R.A., Pitters, J. *Ultramicroscopy*, **186**, 42-48 (March 2018)
124. *All-electronic Nanosecond-resolved Scanning Tunneling Microscopy: Facilitating the Investigation of Single Dopant Charge Dynamics*, Rashidi, M., Vine, W., Burgess, J.A.J., Taucer, M., Achal, R., Pitters, J.L., Loth, S., Wolkow, R.A. *J. Vis. Exp*, **131**, e56861 (January 2018)
123. *Resolving and Tuning Carrier Capture Rates at a Single Silicon Atom Gap State*, Rashidi, M., Lloyd, Erika., Huff, Taleana. R., Achal, R., Taucer, M., Croshaw, Jeremiah, J.J., Wolkow, R.A., *ACS Nano*, **11(11)**, 11732-11738 (November 2017)
122. *Atomic White-Out: Enabling Atomic Circuitry through Mechanically Induced Bonding of Single Hydrogen Atoms to a Silicon Surface*, Huff, T., Labidi, H., Rashidi, M., Koleini, M., Achal, R., Salomons, M.H., Wolkow, R.A., *ACS Nano*, **11(9)**, 8636-8642 (July 2017)

121. *Indications of chemical bond contrast in AFM images of a hydrogen-terminated silicon surface*, Labidi H., Koleini, M., Huff, T., Salomons, M., Cloutier, M., Pitters, J.L., Wolkow, R.A., Nature Communications, **8**, 14222 (2017)
120. *Time-Resolved Single Dopant Charge Dynamics in Silicon*, Rashidi, M., Burgess, J., Taucer, M., Achal, R., Pitters, J.L., Loth, S., Wolkow, R.A., Nature Communications, **7**, 13258 (2016)
119. *Time-Resolved Imaging of Negative Differential Resistance on the Atomic Scale*, Taucer, M., Ozfidan, I., Lloyd, E., Koleini, M., Labidi, H., Pitters, J.L., Maciejko, J., Wolkow, R.A., Physical Review Letters, **117**, 276805 (December 2016)
118. *Quantum Transport in Gated Dangling-Bond Atomic Wires*, Bohloul, S., Shi, Q., Wolkow, R.A., Guo, H., Nano Letters, **17(1)**, 322-327 (December 2016)
117. *Reactive Gas Ion Beam Generation Using Single Atom W (111) Gas Field Ion Sources*, Urban, R., Moritani, H., Wolkow, R.A., Pitters, J.L., Microscopy and Microanalysis, **22**, 616-617 (July 2016)
116. *Multiple Silicon Atom Artificial Molecules*, Wood, J.A., Rashidi, M., Koleini, M., Pitters, J.L., Wolkow, R.A., arXiv, 1607.06050 (2016)
115. *Iridium single atom tips fabricated by field assisted reactive gas etching*, Wood, J.A., Urban, R., Salomons, M., Cloutier, M., Wolkow, R.A., Pitters, J.L., Applied Surface Science, **v.267**, 277-280 (2016)
114. *Hydrogen Ion Beams from Nanostructured Gas Field Ion Sources*, Moritani, H., Urban, R., Salomons, M., Wolkow, R.A., Pitters, J., Microscopy and Microanalysis, **v.22 (S3)**, 612-613 (2016)
113. *Understanding Charge Dynamics in Silicon Dangling Bond Structures for Nanoscale Devices*, Livadaru, L., Pitters, J.L., Taucer, M., Wolkow, R.A., NanoTechnology Conference and Expo: Advanced materials, CNTs, particles, films and composites, **v.1**, 35-37, (2016)
112. *Scanning tunneling spectroscopy reveals a silicon dangling bond charge state transition*, Labidi, H., Taucer, M., Rashidi, M., Koleini, M., Livadaru, L., Pitters, J., Cloutier, M., Salomons, M., Wolkow, R.A., New Journal of Physics, **v.17**, 073023 (2015)
111. *Consequences of Many-Cell Correlations in Clocked Quantum-Dot Cellular Automata*, Taucer, M., Karim, F., Walus, K., Wolkow, R.A., IEEE Transactions on Nanotechnology, **v.14**, 638-647 (2015)
110. *New fabrication technique for highly sensitive qPlus sensor with well-defined spring constant*, Labidi, H., Kupsta, M., Huff, T., Salomons, M., Vick, D., Taucer, M., Pitters, J., Wolkow, R.A., Ultramicroscopy, **v.158(01)**, 33-37, (2015)
109. *Evaluating Angular Ion Current Density for Atomically Defined Nanotips*, Urban, R., Wolkow, R.A., Pitters, J.L., Microscopy and Microanalysis, **v.20(5)**, 1514-1520, (2014)
108. *Atom-scale surface reactivity mediated by long-ranged equilibrium charge transfer*, Piva, P.G., DiLabio, G.A., Livadaru, L., Wolkow R.A., Physical Review B, **v.90**, 155422 (2014)
107. *Characterizing the rate and coherence of single-electron tunneling between two dangling bonds on the surface of silicon*, Shaterzadeh-Yazdi, Z., Livadaru, L., Taucer, M., Mutus, J., Pitters, J.L., Wolkow, R.A., Sanders, B.C., Physical Review B, **v.89(3)**, 035315 (2014)
106. *Robustness of tungsten single atom tips to thermal treatment and air exposure*, Vesa, C., Urban, R., Pitters, J.L., Wolkow, R.A., Applied Surface Science, **v.300**, 16-21, (2014)

105. *Conductivity of Si (111)-(7×7): The Role of a Single Atomic Step*, Martins, B.V.V., Smeu, M., Livadaru, L., Guo, H., Wolkow, R.A., Physical Review Letters, **v.112(24)**, 246802 (2014)
104. *Single-Electron Dynamics of an Atomic Silicon Quantum Dot on the H-terminated Si (100)-(2×1) Surface*, Taucer, M., Livadaru, L., Piva, P.G., Achal, R., Labidi, H., Pitters, J.L., Wolkow, R.A., Physical review letters, **v.112(25)**, 256801 (2014)
103. *Four-probe measurements with a three-probe scanning tunneling microscope*, Salomons, M., Martins, B.V.C., Zikovskiy, J., Wolkow, R.A., Review of Scientific Instruments, **v.85(4)**, 045126 (2014)
102. *Silicon atomic quantum dots enable beyond-CMOS electronics*, Wolkow R, Livadaru L, Pitters J. L., Taucer M, Piva P, Salomons M, Cloutier M, Martins B, Field-Coupled Nanocomputing, 33-58, (2014)
101. *Tip apex shaping of gas field ion sources*, Pitters, J.L., Urban, R., Vesa, C., Wolkow, R.A., Ultramicroscopy, **v.131**, 56-60, (2013)
100. *Nanoscale structuring of tungsten tip yields most coherent electron point-source*, Mutus, J., Livadaru, L., Urban, R., Pitters, J.L., Legg, P., Salomons, M., Cloutier, M., Wolkow, R.A., New Journal of Physics, **v.15**, 103031(2013)
99. *Silicon surface conductance investigated using a multiple-probe scanning tunneling microscope*, Zikovskiy J, Salomons M, Dogel S, Wolkow R, Atomic Scale Interconnection Machines: Proceedings of the 1st AtMol European Workshop, 167-180, (2012)
98. *Gas field ion source current stability for trimer and single atom terminated W(111) tips*, Urban, R., Pitters, J.L., Wolkow, R.A., Applied Physics Letters, **v.100**, pp.263105-263108 (2012)
97. *Dopant depletion in the near surface region of thermally prepared silicon (100) in UHV*, Pitters, J.L., Piva, P.G., Wolkow, R.A., Journal of Vacuum Science and Technology B, **v.30**, 021806 (2012)
96. *Electronic properties of Si(111)-7×7 and related reconstructions: density functional theory calculations*, Smeu, M., Guo, H., Ji, W., Wolkow, R.A., Physical Review B, **v.85**, 195315(2012)
95. *Organic nanostructures on hydrogen-terminated silicon report on electric field modulation of dangling bond charge state*, Ryan, P.M., Livadaru, L., DiLabio, G.A., Wolkow, R.A., Journal of the American Chemical Society, **v.134(29)**, 12054-12063 (2012)
94. *Field ion microscope evaluation of tungsten nanotip shape using He and Ne imaging gases*, Urban, R., Wolkow, R.A., Pitters, J.L., Ultramicroscopy, **v.122**, 60-64, (2012)
93. *Creation and recovery of a W(111) singleatom gas field ion source*, Pitters, J.L., Urban, R., Wolkow, R.A., Journal of Chemical Physics, **v.136(15)**, 154704 (2012)
92. *Conduction modulation of π -stacked ethylbenzene wires on Si(100) with substituent groups*, Smeu, M., Wolkow, R.A., Guo, H., Theor Chem Acc, **131**, 1085-93 (2012) (published 9 Jan 2012)
91. *Theory of nonequilibrium single-electron dynamics in STM imaging of dangling bonds on a hydrogenated silicon surface*, Livadaru, L., Pitters, J.L., Taucer, M., Wolkow, R.A., Phys. Rev.B **84**, 205416-30 (2011), (published: 11Nov2011)
90. *Limits of elemental contrast by low energy electron point source holography*, Livadaru, L., Josh Mutus, Wolkow, R.A., J. Appl. Phys., **110**, 094305-13 (2011), (published online 3Nov2011)

89. *Low-energy electron point projection microscopy of suspended graphene, the ultimate 'microscope slide'*, Mutus J. Y.; Livadaru L.; Robinson J. T., *New J. Phys.*, **13**, 063011 (June 2011)
88. *Charge Control of Surface Dangling Bonds Using Nanoscale Schottky Contacts*, Pitters J.L.; Dogel I.A.; Wolkow R.A., *ACS NANO*, **5**, 1984-1989 (2011), (Published: Mar2011)
87. *Indications of field-directing and self-templating effects on the formation of organic lines on silicon*, Zikovskiy, J., Dogel S., Salomons M., Pitters J.L., DiLabio G.A., Wolkow R.A., *J. Chem.Phys.*, **134**, 114707-12 (2011), (Published: 21Mar2011)
86. *Tunnel coupled dangling bond structures on hydrogen terminated silicon surfaces*, Pitters J.L., Livadaru L., Haider M.B., Wolkow R.A., *J.Chem.Phys.*, **134**, 064712-18 (2011) (Published: 14Feb2011)
85. *Dangling-bond charge qubit on a silicon surface*, Livadaru, L., Xue, P., Shaterzadeh-Yazdi, Z., DiLabio, G.A., Mutus, J., Pitters, J.L., Sanders, B.B., Wolkow, R.A., *New J. Phys.* **12** 083018-32 (2010) (published 9Aug2010)
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81. *Reaction of a hydrogen-terminated Si(100) surface in UHV with ion-pump generated radicals*, Zikovskiy, S., Dogel, A., Dickie, A.J., Pitters, J.L., Wolkow, R.A., *J.Vac.Sci.Technol. A*, **27** 248-52 (2009)
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Patent

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