

Ethan D. Minot

Promotion and Tenure Vita

A. Education and Employment Information

Education

Ph.D. (2004) in Physics, Cornell University, USA. GPA 4.0/4.0
Thesis "Tuning the Bandstructure of Carbon Nanotubes"
PhD. Advisor: Paul McEuen

Diploma, BSc Hons (1999) in Physics, Massey University, New Zealand, GPA 4.0/4.0
Thesis Advisor: Paul Callaghan

Professional Appointments

2012 – Present Associate Professor – Department of Physics, Oregon State University, USA
2007 – 2012 Assistant Professor – Department of Physics, Oregon State University, USA
2005 – 2006 Postdoctoral Researcher – Department of Applied Physics, Delft University, The Netherlands, **Postdoctoral Advisor: Cees Dekker**

2004 – 2005 Postdoctoral Researcher – Department of Applied Physics, Delft University, The Netherlands, **Postdoctoral Advisor: Leo Kouwenhoven**

2000 – 2004 Graduate Research Assistant – Cornell University, USA
1999 – 2000 Teaching Assistant – University of California, Berkeley, USA
1998 – 1999 Research Assisant, Department of Physics, Massey University, NZ

B. Teaching, advising and other assignments

1. Instructional Summary

Credit Courses

Course	Term	Year	# students
PH 671 Solid State Physics I	Winter	2007	9
PH 601 Graduate research	Spring	2007	ML
(teaching release time)			
PH 601 Graduate research	Summer	2007	TD
PH 603 Thesis	Summer	2007	ML
PH 672 Solid State Physics II: Electron Transport	Fall	2007	5
PH 601 Graduate research	Fall	2007	TD, LP
PH 603 Thesis	Fall	2007	ML
PH 673 Solid State Physics III: Optical Properties	Winter	2008	4
PH 601 Graduate research	Winter	2008	JB
PH 603 Thesis	Winter	2008	ML, TD, LP
PH 429 Paradigms in Physics: Reference Frames	Spring	2008	15
PH 601 Graduate research	Spring	2008	JB
PH 603 Thesis	Spring	2008	ML, TD, LP

PH 601 Graduate research	Summer	2008	JB
PH 603 Thesis	Summer	2008	ML, TD, LP
PH 671 Solid State Physics I	Fall	2008	9
PH 601 Graduate research	Fall	2008	-
PH 603 Thesis	Fall	2008	ML, TD, LP
PH 672 Solid State Physics II: Electron Transport	Winter	2009	8
PH 601 Graduate research	Winter	2009	-
PH 603 Thesis	Winter	2009	ML, TD, LP
PH 673 Solid State Physics III: Optical Properties	Spring	2009	6
PH 601 Graduate research	Spring	2009	-
PH 603 Thesis	Spring	2009	ML, TD, LP
PH 601 Graduate research	Summer	2009	-
PH 603 Thesis	Summer	2009	ML, TD, LP
PH 671 Solid State Physics: Electron transport	Fall	2009	6
PH 603 Thesis	Fall	2009	ML, TD, LP
PH 682 Optical Physics: Optical Prop. of Semicond.	Winter	2010	10
PH 603 Thesis	Winter	2010	ML, TD, LP
PH 427 Paradigms in Physics: Periodic Systems	Spring	2010	19
PH 603 Thesis	Spring	2010	ML, TD, LP
PH 401 Undergrad research	Summer	2010	RB
PH 603 Thesis	Summer	2010	ML, TD, LP
PH 461/561 Math Methods for Physics	Fall	2010	14+13
PH 505 Math Methods for Physics (Graduate Level)	Fall	2010	12
PH 601 Graduate research	Fall	2010	AA
PH 603 Thesis	Fall	2010	ML, TD, LP
PH 426 Paradigms in Physics: Central Forces	Winter	2011	29
PH 607 Physics Research Seminar	Winter	2011	9
PH 601 Graduate research	Winter	2011	AA
PH 603 Thesis	Winter	2011	ML, TD, LP, TS
PH 427 Paradigms in Physics: Periodic Systems	Spring	2011	23
PH 601 Graduate research	Spring	2011	GS, JS, RJ
PH 603 Thesis	Spring	2011	ML, TD, LP, TS
PH 601 Research	Summer	2011	DR
PH 603 Thesis	Summer	2011	TD, LP, GS, TS
PH 671 Solid State Physics: Electron transport	Fall	2011	9
PH 603 Thesis	Fall	2011	TD, LP, GS, TS
PH 682 Optical Physics: Optical Prop. of Semicond.	Winter	2012	9
PH 607 Physics Research Seminar	Winter	2012	6

PH 603 Thesis	Winter	2012	TD, TS, LA, MB, GS
PH 427 Periodic Systems	Spring	2012	34
PH 603 Thesis	Spring	2012	TD, TS, LA, MB, GS
PH 603 Thesis	Summer	2012	TD, TS, LA, MB
PH 561 Mathematical Physics	Fall	2012	12
PH 401 Undergraduate Research	Fall	2012	JW, HW
PH 601 Graduate Research	Fall	2012	LA, MB, HP
PH 603 Thesis	Fall	2012	TD, TS
PH 424 Paradigms: 1d Waves	Winter	2013	33
PH 607 Physics Research Seminar	Winter	2013	8
PH 401 Undergraduate Research	Winter	2013	HW
PH 603 Thesis	Winter	2013	TD, TS, LA, MB
PH 427 Periodic Systems	Spring	2013	28
PH 607 Physics Communication Seminar	Spring	2013	6
PH 401 Undergraduate Research	Spring	2013	HW
PH 603 Thesis	Spring	2013	TD, TS, LA, MB
PH 401 Undergraduate Research	Summer	2013	HW
PH 603 Thesis	Summer	2013	TD, TS, LA, MB
PH 671 Solid State Physics: Electron Transport	Fall	2013	10
PH 401 Undergraduate Research	Fall	2013	HW
PH 603 Thesis	Fall	2013	TD, TS, LA, MB
Sabbatical leave	Winter	2014	
PH 401 Undergraduate Research	Winter	2014	HW
PH 603 Thesis	Winter	2014	TD, TS, LA, MB
Sabbatical leave	Spring	2014	
PH 401 Undergraduate Research	Winter	2014	HW
PH 603 Thesis	Winter	2014	TS, LA, MB
PH 401 Undergraduate Research	Summer	2014	HW
PH 603 Thesis	Summer	2014	TS, LA, MB
PH 631 Electromagnetic Theory I	Fall	2014	11
PH 601 Graduate Research	Fall	2014	RH, RS, JH
PH 603 Thesis	Fall	2014	LA, MB
PH 632 Electromagnetic Theory I	Winter	2015	10
PH 601 Graduate Research	Winter	2015	RH, RS, JH, JP
PH 603 Thesis	Winter	2015	LA, MB
PH 575 Solid State Physics	Spring	2015	16
PH 607 Communications Seminar	Spring	2015	8
PH 601 Graduate Research	Spring	2015	JH
PH 603 Thesis	Spring	2015	LA, MB

PH 603 Thesis	Summer	2015	LA, MB, DM
PH 631 Electromagnetic Theory I	Fall	2015	8
PH 601 Graduate Research	Fall	2015	JH
PH 603 Thesis	Fall	2015	LA, MB, DM
PH 632 Electromagnetic Theory II	Winter	2016	8
PH 601 Graduate Research	Winter	2016	JH, MS
PH 603 Thesis	Winter	2016	LA, MB, DM
PH 575 Solid State Physics	Spring	2016	9
PH 607 Communications Seminar	Spring	2015	8
PH 601 Graduate Research	Spring	2016	JH, MS
PH 603 Thesis	Spring	2016	LA, MB, DM
PH 603 Thesis	Summer	2016	JH, MS, LA, DM, MB
PH 603 Thesis	Fall	2016	MS, LA, DM, MB
PH 315 Physics of Contemporary Challenges	Winter	2017	35
PH 603 Thesis	Winter	2017	MS, LA, DM, MB
PH 575 Solid State Physics	Spring	2017	21
PH 607 Communications Seminar	Spring	2017	6
PH 407 GRE Physic Preparation Seminar	Spring	2017	6
PH 603 Thesis	Spring	2017	MS, LA, DM, MB

Key: Undergraduate Students who participated in PH401 (Research)

HW – Heather Wilson

Key: Graduate Students who participated in PH601 (Research)

JB – Jorg Bocterle

AA – Ali Almaqwashi

RH – Robert Harrison

JP – Jordan Pommerenck

RJ – Robert Jacobs

JS – Jeff Schulte

RS – Ryan Scheirer

DM – Dan McCulley

HP – Hiral Patel

DR – Daniel Roth

JH – Jay Howard

MS – Mitchell Singer

Key: Graduate Students who participated in PH603 (Thesis)

ML – Matthew Leyden

TD – Tristan DeBorde

LP – Landon Prsbrey

TS – Tal Sharf

GS – Grant Saltzgaber

LA – Lee Aspitarte

MB – Morgan Brown

Non-Credit Courses and Workshops

Spring 2011: One-hour workshop with Junior Physics Majors: Miniaturizing Electronic Circuits – Hands-on activity and lecture teaching photolithography and modern circuit fabrication.

Spring 2016: One-hour workshop with Junior Physics Majors: Miniaturizing Electronic Circuits

Curriculum Development

- Development of the PH671 and PH682 modules in Solid State Physics (Electron Transport and Optical Properties of Semiconductors), 2009-2010
- PH211 (Introductory Physics with Calculus) Curriculum Reform Focus Group, Spring 2009
- Lead the design of a Nanoscience Lab for PH 213 (Introductory Physics with Calculus), Spring 2009
- Development of new small group activities for PH429 and PH427 (Paradigms in Physics courses).

Professional Development of Teaching Skills

- I was a participant in the American Association of Physics Teachers (AAPT) New Faculty Workshop in College Park, Maryland in Fall 2007.
- I attended the Oregon Chapter of the American Association of Physics Teachers (ORAAPT) Annual Meeting in Fall 2008.
- Video tapes were made of all my lectures in Winter 2011 and are being used for teaching development.
- I regularly attend lectures by experts in Physics Education Research that are hosted by the OSU Department of Physics (one or two lectures per quarter). I also meet with these visiting experts to discuss developments in Physics Education Research.
- I have been trained as an OMSI Science Communication Fellow (2016)

Graduate and Undergraduate Student Trainees and Postdoctoral Trainees

Postdoctoral advisor for		Dates	
1. Landon Prisbrey		Fall 2011 – Summer 2013	<i>Main project</i> “Watching single enzymes at work using nanoelectronic biosensors”

PhD thesis advisor for		Graduation	Thesis
2. Matthew Leyden	Physics Ph.D.	Spring 2011	“Label-free Biosensing with Carbon Nanotube Transistors”
3. Landon Prisbrey	Physics Ph.D.	Fall 2011	“Carbon Nanotube Devices Engineered by Atomic Force Microscopy”
4. Tristan DeBorde	Physics Ph.D.	Fall 2013	Photocurrent generation in carbon nanotubes
5. Tal Sharf	Physics Ph.D.	Fall 2014	<i>Project:</i> Electrostatic noise in biological environments
6. Lee Aspitarte	Physics Ph.D.	Spring 2017	<i>Project:</i> Electron-electron interactions in carbon nanotubes
7. Morgan Brown	MatSci Ph.D.	Summer 2017	<i>Project:</i> Biosensing applications of graphene
8. Daniel McCulley	Physics Ph.D.	Expected 2019	<i>Project:</i> Electron-electron interactions in nanomaterials
9. Mitchell Singer	Physics Ph.D.	Expected 2020	<i>Project:</i> Electron-electron interactions in nanomaterials
10. Carly Fengel	Physics Ph.D.	Expected 2021	<i>Project:</i> Biosensing applications of graphene

Masters thesis advisor for		Graduation	Thesis
1. Grant Saltzgaber	Physics M.S.	Summer 2012	<i>Project:</i> Signal-to-noise ratio and detection time of nanoelectronic biosensors
2. Peter Wojcik	Physics M.S.	Summer 2012	<i>Project:</i> Fabrication of nanoelectronic biosensors from large-area graphene.
3. Jay Howard	Physics M.S.	Summer 2016	<i>Project:</i> Neural recordings – comparing graphene devices to sharp electrodes

Senior project mentor for		Graduation	Thesis
1. Daniel Harada	B.S. (Physics)	2008	“1/f noise in liquid gated carbon nanotube devices”
2. Michael Paul	B.S. (Physics)	2009	“Scanning laser microscopy for nanometrology”
3. Ramsi Hawkins	B.S. (Physics)	2009	“Development of nanophysics activities for introductory physics”
4. Colin Podelnyk	B.S. (Physics)	2009	“Single molecule fluorescence techniques for studying biological systems”
5. Nathan Howell	B.Eng. (Chem. Eng.)	2009	“Chemical vapor deposition of aligned carbon nanotubes on quartz”
6. Brian Maloney	B.Eng. (Chem. Eng.)	2009	“Chemical vapor deposition of aligned carbon nanotubes on quartz”
7. Thomas Fitzgerald	B.Eng. (Chem. Eng.)	2009	“Chemical vapor deposition of aligned carbon nanotubes on quartz”
8. Reed Coffman	B.S. (Physics)	2014	Optical characterization of single-layer graphene
9. Jenna Wardini	B.S. (Physics)	2014	URISC “Graphene synthesis and characterization”
10. Dustin Swanson	B.S. (Physics)	2014	Electrical characteristics of graphene field effect transistors
11. Heather Wilson	B.S. (Physics)	2014	URISC: Nanoelectronic sensing of single enzyme dynamics
12. David Froman	B.S. (Physics)	2015	Investigating the origins of hysteresis in CNT FET devices
13. Abigail Merkel	B.S. (Physics)	2015	Portable instrumentation for monitoring

			nanoelectronic biosensors
14. Gregg Stevens	B.S. (Physics)	2016	Designing optical I/O for electronic neurosensor
15. Zachary McKay	B.S. (Physics)	2017	Van-der Waals heterostructures
16. Ryan Bailley-Crandel	B.S. (Physics)	2017	URISC: van der Waals heterostructures for biosensing applications
17. Daniel Still	B.S. (Physics)	Expected 2018	Graphene super capacitors

Research experience mentor for	Dates	Project	
1. Caleb Joiner	B.S. (Physics)	2007	URISC: Carbon nanotube antennas
2. Jorg Bochterle	B.S. (Physics)	2008	Creation of point defects and line cuts in graphene using conducting-tip atomic force microscopy
3. Rachel Burton	B.S. (Physics)	2010	Chemical vapor deposition of aligned carbon nanotubes on quartz
4. William Gibson	B.S. (Biology)	2011	Covalent attachment of proteins to carbon nanotubes and other surfaces
5. Michael Goldtrap	B.S. (Physics)	2011	Set up of probe station and Labview coding.
6. Canan Schuman	Pharmacy	2011-2012	Non-covalent attachment of proteins to carbon nanotubes and other surfaces
7. Josh Kevek	Moved on to lab tech position at Cornell University, 2009 – 2012		Instrumentation for carbon nanotube and graphene synthesis. Fabrication of carbon nanotube and graphene electronic devices. Design and refurbishment of two thin-film deposition systems. Machining of specialty parts for a variety of experiments. Maintenance of an atomic force microscope and probe station.
8. Ali Almaqwashi	PhD candidate (Physics)	2010	Variable-force microscopy for characterization of horizontally-aligned carbon nanotubes
9. Jeff Schulte	PhD candidate (Physics)	2012	Data analysis of single molecule events recorded by a nanoelectronic sensor
10. Daniel Roth	PhD candidate (Physics)	2012	Optics experiments with nanomaterials
11. Robert Jacobs	PhD candidate (Physics)	2012	Characterizing the radius of curvature of atomic force microscope tips
12. Hiral Patel	PhD candidate (Physics)	2013	Measurement of SAR1 enzyme kinetics
13. Jay Howard	PhD candidate (Physics)	2014	Graphene biosensors interfaced with bacteria
14. Ryan Shierer	PhD candidate (Physics)	2014	Four-probe measurements of sheet resistance
15. Robert Harrison	PhD candidate (Physics)	2014	Measuring the dielectric constant of liquids
16. Jared Cayton	B.S. (Physics)	2015	Building a Nuclear Magnetic Resonance lab for undergraduate education
17. Tanner Grenz	B.S. (Biochem)	2017	Electrophysiology of neurons

Honor College Thesis Advisor for

Heather Wilson

Tanner Grenz

Graduate committee Member for		Graduation
1. Jonathan Shanks	PSM (Appl. Phys.)	2007
2. Matthew Ryder*	M.S. (Chem. Eng.)	2009
3. Stephen Meliza	M.S. (EECS)	2009
4. Daniel Harada	M.S. (Physics)	2010
5. Joshua Russell	M.S. (Physics)	2010
6. Joseph Tomaino	Ph.D. (Physics)	2011
7. Tosapol Maluangnont	Ph.D. (Chemistry)	2011
8. Santosh Murali	M.S. (EECE)	2011
9. Denny Jackson	Ph.D. (Physics)	2011
10. James Eilertsen	Ph.D. (Chemistry)	2011
11. Bill Cowell	Ph.D. (EECE)	2012
12. Andy Jameson	Ph.D. (Physics)	2012
13. Ali Almaqwashi	M.S. (Physics)	2012
14. Mark Kendrick	Ph.D. (Physics)	2012
15. Seongweon Park	Ph.D. (Physics)	2012
16. Whitney Shepherd	Ph.D. (Physics)	2012
17. Michael Paul	Ph.D. (Physics)	2014
18. Eric Krebs	Ph.D. (Physics)	2015
19. Brian Johnson	Ph.D. (Physics)	2015
20. Matthew Ryder	Ph.D. (Chemical Eng)	2013
21. Logan Strid*	M.S. (Mech. Eng.)	2013
22. Louis Maizy	M.S. (Physics)	2013
23. Camden Driggers*	Ph.D. (Biophysics)	2014
24. Bao-Sung Yeh*	Ph.D. (EECE)	2015
25. Jeff Schulte	Ph.D. (Physics)	2015
26. Somdev Banerjee*	Ph.D. (Chemistry)	2017
27. Maureen Caupp*	Ph.D. (Chemistry)	Current student
28. Robert Jacobs	Ph.D. (Physics)	Current student
29. Hiral Patel	Ph.D. (Physics)	2017
30. Chris Heist*	Ph.D. (Chemistry)	Current student
31. Chris Jones	Ph.D. (Physics)	2017
32. James Haggerty	Ph.D. (Physics)	Current student
33. Byounghwak Lee	Ph.D. (Physics)	Current student
34. Kyle Vogt	Ph.D. (Physics)	Current student
35. Andrew Ferreira*	Ph.D. (Chemistry)	2017
36. Alison Gicking	Ph.D. (Physics)	Current student
37. Garrett Potter	Ph.D. (Physics)	2017
38. Amani Alobaidi,	Ph.D. (Physics)	Current student
39. Ryan Scheirer	MS (Physics)	2017
40. Lei Zheng*	Ph.D. (EECE)	Current student
41.		
42.		

*GCR

Team efforts in teaching

- I pioneered the use of the DokuWiki platform for managing class websites. This platform is now used to disseminate material developed by the NSF-funded “Paradigms in Physics” project.
- I participate in Undergraduate Physics Curriculum group. We meet once every 3 weeks to ensure consistency across the undergraduate curriculum and develop new course material.
- I participate in Graduate Physics Curriculum group. We meet once every 3 weeks to ensure consistency across the graduate curriculum and develop new course material.
- Invited guest lecturer for
 - Electronic Sensors ECE499, instructor Pallavi Dhagat (Spring 2008, Winter 2009, Spring 2015, Spring 2016)
 - Science of Nanotechnology ECE499/599, instructor John Conley (Spring 2009, Spring 2010, Spring 2011)
 - The Science, Engineering and Social Impact of Nanotechnology ENGR221, Instructor Stacey Harper. (Winter 2009)
 - Physics for K-8 Teachers PH111, instructor Emily van Zee (Fall 2009)

International Teaching

N/A

2. Student and Participant Evaluation

Summary of Student Evaluations

Course #	Year - Term	# Evaluations	Course Overall Rating	Instructor Contribution Rating
PH 315	2017 - Winter	22	4.7	4.9
PH 424	2013 - Winter		5.6	N/A
PH 426	2011 - Winter	22	4.4	4.2
PH 427	2010 – Spring		*	*
	2011 - Spring		5.0	5.0
	2012 - Spring	17	5.3	5.4
	2013 - Spring	10	5.8	5.8
PH 429	2008 - Spring	10	5.1	5.0
PH 461/561	2010 - Fall		4.6	4.7
PH 505	2010 - Fall	11	4.9	4.8
PH 575	2015 - Spring	9	5.4	5.6
	2016 - Spring	8	5.7	5.7
	2017 - Spring	15	5.5	5.6
PH 607	2016 - Spring	6	5.3	5.7
PH 631	2014 - Fall	5	5.7	5.7
	2015 - Fall	7	5.5	5.8
PH 632	2015 - Winter	6	5.5	5.5
	2016 - Winter	5	5.9	5.7
PH 671	2007 - Winter	8	3.8	4.2
	2008 - Fall	9	4.4	4.6
	2009 - Fall	6	5.0	5.3
	2011 - Fall	7	5.1	5.0
	2013 - Fall	5	5.9	5.9
PH 672	2007 - Fall	5	4.8	5.0
	2009 - Winter	7	4.7	5.0
PH 673	2008 - Winter	4	4.5	4.5
	2009 - Spring	5	5.5	5.5
PH 682	2010 - Winter	7	5.1	5.2
	2012 - Winter	8	5.5	5.5

* In Spring 2010 our department participated in a test of electronic student evaluations of teaching. The results cannot be compared to the traditional student evaluations. Prof. Henri Jansen will address this missing data in his letter

3. Peer Teaching Evaluations

To be completed by the Department Promotion and Tenure Committee.

4. Advising

I work closely with my undergraduate and graduate student advisees on various aspects of professional development including the skills of

1. planning, organizing and undertaking lab research
2. preparing and delivering oral presentations and posters
3. writing scientific manuscripts and proposals
4. critiquing existing literature (for graduate students this includes refereeing journal papers)
5. developing and carrying out outreach activities

I help students choose their future career paths and provide help with the job search process (identifying job opportunities, preparing job-specific resumes, and preparing for interviews). My first Ph.D. student, Matthew Leyden, just accepted a job with NT Bio, a Santa Barbara-based start-up company aiming to commercialize nanoelectronic biosensors. Four undergraduate researchers from my group have gone onto graduate programs (Daniel Harada, Michael Paul, Jorg Bochterle and Canan Schuman). Another former undergraduate researcher, Josh Kevek, has taken a position at Cornell University as "Research Support Specialist" for one of the world's top condensed matter physics groups (led by Prof. Paul McEuen). Josh gained valuable experience and training for this Cornell position by working both as an undergraduate researcher (2008 – 2009) and as a Scientific Instrument Technician in my group (2009 – 2011). Other undergraduate researchers have moved onto positions in industry. Daniel Harada is now a process engineer at WaferTech and Brian Maloney has accepted a biotech engineering position at Bend Research.

I strive to maintain a healthy lab atmosphere that is welcoming, supportive and intellectually stimulating. Informal student-faculty interactions occur at weekly group lunches. I hold weekly group meetings that focus on developing students' scientific communication/presentation skills, and I involve group members in outreach activities that build appreciation for their research field. I aim to communicate with graduate students on a daily basis and meet one-on-one with undergraduate students on a weekly basis. Within this supportive group environment, I focus on the specific needs of each group member, giving guidance on developing successful research and career paths.

I participate as an advisor in the Science Experience in Science and Engineering for Youth program (<http://cbee.oregonstate.edu/sesey>). I have been continuously involved in the program since 2010. Each year my lab supervises week-long mini-research projects for two high school students.

C. Scholarship and Creative Activity

1. Publications

- * corresponding author
UG undergraduate student
___ (underlined) members of my OSU research group

Submitted

M. J. Senger, D. R. McCulley, N. Lotfizadeh, V. V. Deshpande & **E. D. Minot***, “Universal interaction driven gap in metallic carbon nanotubes”, *submitted to Physical Review B* (2017)

J. O. Island, M. Ostermann, L. Aspirtarte, **E. D. Minot**, D. Varsano, E. Molinari, M. Rontani, & G. A. Steele* “Interaction driven giant orbital magnetic moments in carbon nanotubes” *submitted to Nature Physics* (2017)

S. Ripp, P. Turunen, E. D. Minot, A. E. Rowan, K. G. Blank “Deciphering design principles of FRET-based protease substrates: thermolysin-like protease from *Geobacillus stearothermophilus* as a test case” *submitted to ACS Omega* (2017)

Peer-reviewed articles

1. L. Aspirtarte, D. R. McCulley & **E. D. Minot***, “A nanoscale pn junction in series with tunable Schottky barriers”, *Journal of Applied Physics* **122**, 134304 (2017)
2. L. Aspirtarte, D. R. McCulley, A. Bertoni, J. Island, M. Osterman, M. Rontani, G.A. Steele & **E. D. Minot***, “Giant modulation of the electronic band gap of carbon nanotubes by dielectric screening”, *Scientific Reports* **7**, 8828 (2017)
3. L. Aspirtarte, D. R. McCulley & **E. D. Minot***, “Photocurrent quantum yield of suspended carbon nanotube photodiodes”, *Nano Letters* **16** 5589 (2016)
4. M. A. Brown, M. S. Crosser, M. Leyden, Y. Qi & **E. D. Minot***, “Measurement of high carrier mobility in graphene in an aqueous electrolyte environment” *Applied Physics Letters* **109**, 093104 (2016)
5. H. Wilson^{UG}, S. Ripp, L. Prisbrey, M. A. Brown, T. Sharf, D. J. T. Myles, K. G. Blank & **E. D. Minot*** “Electrical Monitoring of sp³ Defect Formation in Individual Carbon Nanotubes” *J. Phys. Chem. C* **120** 1971 (2016)
6. M. S. Crosser, M. A. Brown, P. L. McEuen & **E. D. Minot*** “Determination of the Thermal Noise Limit of Graphene Biotransistors” *Nano Letters*, **15** 5404 (2015)
7. M. A. Brown, L. Barker, L. Semprini, & **E. D. Minot*** “Graphene Biotransistor Interfaced with a Nitrifying Biofilm”, *Environmental Science and Technology Letters*, **2** 118 (2015)
8. M. J. Paul, B. Lee, J. Wardini, Z. J. Thompson, A. Stickel, A. Mousavian, H. Choi, **E. D. Minot**, and Yun-Shik Lee* “Terahertz induced transparency in single-layer graphene”, *Applied Physics Letters* **105**, 221107 (2014)
9. T. Sharf, Neng-Ping Wang, J. W. Kevek, M. A. Brown, H. Wilson, S. Heinze, & **E. D. Minot*** “Single Electron Charge Sensitivity of Liquid-Gated Carbon Nanotube Transistors”, *Nano Letters* **14**, 4925 (2014)
10. T. DeBorde, L. Aspirtarte, T. Sharf, J. W. Kevek & **E. D. Minot*** “Determining the Chiral Index of Semiconducting Carbon Nanotubes Using Photoconductivity Resonances”, *Journal of Physical Chemistry C*, **118**, 9946 (2014)

11. T. DeBorde, L. Aspitarte, T. Sharf, J. W. Kevek & **E. D. Minot*** "Photothermoelectric Effect in Suspended Semiconducting Carbon Nanotubes", *ACS Nano* **8** 216-221 (2014)
12. M. J. Paul, Y. C. Chang, Z. J. Thompson, A. Stickel, J. Wardini^{UG}, H. Choi, **E. D. Minot**, T. B. Norris and Yun-Shik Lee*, "High-field terahertz response of graphene" *New Journal of Physics* **15** 085019 (2013)
13. G. Saltzgaber, P. Wojcik, T. Sharf, M. R. Leyden, J. L. Wardini^{UG}, C. A. Heist, A. A. Adenuga, V. T. Remcho & **E. D. Minot***, "Scalable graphene field-effect sensors for specific protein detection" *Nanotechnology* **24** 355502 (2013)
14. T. Sharf, J. W. Kevek, T. DeBorde, J. L. Wardini^{UG}, & **E. D. Minot*** "Origins of Charge Noise in Carbon Nanotube Field-Effect Transistor Biosensors" *Nano Letters* **12**, 6380 (2012)
15. M. J. Paul, J. L. Tomaino, J. W. Kevek, T. DeBorde, Z. J. Thompson, **E. D. Minot** & Yun-Shik Lee* "Terahertz imaging of inhomogeneous electrodynamic in single-layer graphene embedded in dielectrics" *Applied Physics Letters* **101**, 091109 (2012)
16. M. J. Paul, N. A. Kuhta, J. L. Tomaino, A. D. Jameson, L. P. Maizy, T. Sharf, N. L. Rupesinghe, K. B. K. Teo, S. Inampudi, V. A. Podolskiy, **E. D. Minot** & Yun-Shik Lee*, "Terahertz transmission ellipsometry of vertically aligned multi-walled carbon nanotubes" *Applied Physics Letters* **101**, 111107 (2012)
17. J. L. Tomaino, A. D. Jameson, M. J. Paul, J. W. Kevek, A. M. van der Zande, R. A. Barton, H. Choi, P. L. McEuen, **E. D. Minot**, Yun-Shik Lee*, "High-Contrast Imaging of Graphene via Time-Domain Terahertz Spectroscopy" *J. Infrared Millimeter and Terahertz Waves* **33**, 839 (2012)
18. Q.N. Thanh, H. Jeong, J. Kim, J.W. Kevek, Y.H. Ahn, S. Lee, **E.D. Minot**, J.Y. Park*, "Transfer-Printing of As-Fabricated Carbon Nanotube Devices onto Various Substrates" *Advanced Materials* **24** 4499 (2012)
19. M. R. Leyden, C. Schuman^{UG}, R.J. Messinger, T. Sharf, V. T. Remcho, T. M. Squires, **E. D. Minot***, "Increasing the detection speed of a real-time all-electronic biosensor" *Lab on a Chip* **12**, 954 - 959 (2012)

All experimental work was performed in my lab. Dr. Squires' lab was responsible for mass transport modeling and contributed to discussions and editing. Dr. Remcho gave advice on microfluidic design, surface functionalization, fluorescence microscopy and contributed to editing.

20. L. Prisbrey, D. Roundy, K. Blank, L.S. Fifield, **E. D. Minot***, "Electrical characteristics of carbon nanotube devices prepared with single oxidative point defects" *J. Phys. Chem. C* **116**, 1961 (2012)

All experimental work was performed by my student. Dr. Roundy was responsible for numerical modeling of transport properties. Dr. Blank and Dr. Fifield contributed to discussions, editing and planning experiments.

21. T. DeBorde, J.W. Kevek, T. Sharf, J.L. Wardini^{UG} & **E. D. Minot***, "A Spectrally-Tunable Photocurrent Microscope for Characterizing Nanoelectronic Devices" *Proc. IEEE Nano* **11**, 382-386 (2011)
22. T. Sharf, J.W. Kevek & **E. D. Minot***, "Fabrication of low-noise carbon nanotube field-effect transistor biosensors" *Proc. IEEE Nano* **11**, 122-125 (2011)
23. L. Prisbrey, T. DeBorde, J.Y. Park & **E. D. Minot***, "Controlling the Function of Carbon Nanotube Devices with Re-writable Charge Patterns" *Applied Physics Letters* **99**, 053125 (2011)

All experimental work was performed in my lab. Dr. Park participated in discussions, planning experiments and editing the manuscript.

24. A. D. Jameson, J. W. Kevek, J. L. Tomaino, M. J. Paul, M. Hemphill-Johnston^{UG}, M. Koretsky, **E. D. Minot** & Yun-Shik Lee*, "Terahertz Spectroscopy of Ni-Ti Alloy Thin Films", *Applied Physics Letters* **98**, 221111 (2011)

My lab was responsible for lithographic patterning of thin films, AFM measurements of step height and dc sheet resistance measurements by 4-probe technique. Dr. Koretsky's lab was responsible for depositing Ni-Ti thin films and determining alloy composition. Dr. Lee's lab performed THz imaging and spectroscopy. Dr. Lee wrote the first draft of the manuscript and I contributed editorial comments.

25. J. L. Tomaino, A. D. Jameson, J. W. Kevek, M. J. Paul, A. M. van der Zande, R. A. Barton, P. L. McEuen, **E. D. Minot** & Y.S. Lee*, "Terahertz Imaging and Spectroscopy of Large-Area Single-Layer Graphene" *Optics Express* **19**, 141-146 (2011)

My lab was responsible for device fabrication, Raman spectroscopy and electrical characterization measurements using facilities at OSU and Cornell. Dr. McEuen's lab provided training on graphene growth and transfer techniques and comments on the manuscript. Dr. Lee's lab performed THz imaging and spectroscopy. Dr. Lee wrote the first draft of the manuscript and I contributed significant editing.

26. A. A. Almagwashi, J. W. Kevek^{UG}, R. M. Burton^{UG}, T. DeBorde & **E. D. Minot***, "Variable-Force Microscopy for Advanced Characterization of Horizontally-Aligned Carbon Nanotubes", *Nanotechnology* **22**, 275717 (2011)
27. L. Prisbrey, G. Schneider & **E. D. Minot***, "Modeling the Electrostatic Signature of Single Enzyme Activity", *Journal of Physical Chemistry B* **114**, 3330–3333 (2010).

All numerical calculations were performed by my student. I made decisions regarding research directions and wrote the manuscript. Dr. Schneider participated in discussions, gave advice on computational approaches and participated in editing the manuscript.

28. T. DeBorde, M. R. Leyden, J. C. Joiner^{UG} & **E. D. Minot***, "Identifying individual single-walled and double-walled carbon nanotubes by atomic force microscopy", *Nano Letters* **8**, 3568-3571 (2008).

With postdoctoral advisors C. Dekker and L. P. Kouwenhoven:

29. I. Heller, A. M. Janssens, J. Mannik, **E. D. Minot**, S. G. Lemay & C. Dekker*, "Identifying the mechanism of biosensing with carbon nanotube transistors", *Nano Letters* **8**, 591-595 (2008).
30. **E. D. Minot***, A. M. Janssens, I. Heller, H. A. Heering, C. Dekker & S. G. Lemay, "Carbon nanotube biosensors: the critical role of the reference electrode", *Applied Physics Letters* **91**, 093507 (3 pages) (2007).
31. **E. D. Minot**, F. Kelkensberg, M. van Kouwen, J. A. van Dam, L. P. Kouwenhoven, V. Zwiller*, M. T. Borgström, O. Wunnicke, M. A. Verheijen & E. P. A. M. Bakkers "Single quantum dot nanowire LEDs", *Nano Letters* **7**, 367-370 (2007).

With PhD supervisor P. L. McEuen:

32. J. D. Whittaker, **E. D. Minot**, D. M. Tanenbaum, P. L. McEuen, & R. C. Davis*, "Measurement of the Adhesion Force between Carbon Nanotubes and a Silicon Substrate", *Nano Letters* **6**, 953-957 (2006).
33. **E. D. Minot**, Yuval Yaish, Vera Sazonova & P. L. McEuen*, "Determination of electron orbital magnetic moments in carbon nanotubes", *Nature* **428**, 536-539 (2004).
34. **E. D. Minot**, Yuval Yaish, Vera Sazonova, Ji-Yong Park, Markus Brink, & P. L. McEuen*, "Tuning carbon nanotube band gaps with strain", *Physical Review Letters* **90**, 156401 (2003).

With undergraduate supervisor P. T. Callaghan:

35. **E. D. Minot**, P. T. Callaghan* & N. Kaplan, "Multiple Echoes, Multiple Quantum Coherence and the Dipolar Field", *Journal of Magnetic Resonance* **140**, 200-205 (1999).

Conference Proceedings (not peer reviewed) and Invited Review Articles

36. S. Bertolazzi, J. Brivio, A. Radenovic, A. Kis, H. Wilson^{UG}, L. Prisbrey, **E. D. Minot**, A. Tselev, M. Philips, M. Viani, D. Walters & R. Proksch*, "Exploring flatland: AFM of mechanical and electrical

properties of graphene, MoS2 and other low-dimensional materials” *Microscopy and Analysis*, **27** (April 2013)

37. L. Prisbrey, Ji-Yong Park, K. Blank, A. Moshar, **E. D. Minot***, “Scanning Probe Techniques for Engineering Nanoelectronic Devices”, *Microscopy and Analysis*, April Issue (2012).

Images and data were collected in my lab by my student. Dr. Park helped us implement a new imaging mode in our scanning probe microscope. Dr. Blank helped my student design and carry out the single molecule sensing experiment. Dr. Moshar generated 3d visualization of our images. My student and I wrote the manuscript. Other authors gave editorial suggestions.

38. M. R. Leyden, C. Schuman^{UG}, T. Sharf, J.W. Kevek^{UG}, V.T. Remcho & **E.D. Minot***, "Fabrication and Characterization of Carbon Nanotube Field-Effect Transistor Biosensors", *Proc. SPIE 7779*, 77790H (2010).

Dr. Remcho gave advice and material assistance for the design and fabrication of microfluidic channels that were used in this work. My student and I wrote the manuscript. Other authors gave editorial suggestions.

2. Meeting participation

1. **(invited)** European Physical Society Condensed Matter Meeting, Groningen, Netherlands, presented the talk “Electron-electron interaction driven phenomena in carbon nanotubes” (Sept 2016)
2. APS March Meeting: Condensed Matter Physics, Baltimore, MD, Co-author of the talk “Photocurrent Generation Efficiency in Carbon Nanotube PN Junctions” presented by my student L. Aspirtarte (March 2016)
3. APS March Meeting: Condensed Matter Physics, Baltimore, MD, Co-author of the talk “Using Dielectric Environment to Tune Carbon Nanotube Properties” presented by my student D. McCulley (March 2016)
4. APS March Meeting: Condensed Matter Physics, Baltimore, MD, Co-author of the talk “Kirigami Graphene Transistors for Biological Sensing” presented by my collaborator M. Reynolds (March 2016)
5. Brain Initiative Investigators Meeting, Bethesda, MD, Co-author of the poster “Wrapping Cells with Stretchable Transistors”, presented by my student Morgan Brown (December 2015)
6. **(invited)** Conference on Nanomaterials: Computation, Theory, and Experiment, Telluride, CO, Presented the talk “Quantum efficiency of CNT photodiodes” (July 2015)
7. Advanced Materials and Nanotechnology Conference, Nelson, New Zealand, presented the talk “Scanning Photocurrent Microscopy of Carbon Nanotube Devices” (Feb 2015)
8. **(invited)** Material Research Society Fall Meeting, Boston, MA, presented the talk “Electron Transport Past Point Defects in Carbon Nanotubes” (Dec 2014).
9. Science and Technology of Carbon Nanotubes (NT14), Los Angeles, CA, co-author of the poster “Photocurrent microscopy reveals chiral index fingerprint and thermoelectric power of CNT FETs” presented by my student L. Aspirtarte (June 2014).
10. APS March Meeting: Condensed Matter Physics, Denver, CO, Co-author of the talk “Single charge sensitivity of liquid gated carbon nanotube transistors” presented by my student T. Sharf (March 2014)

11. APS March Meeting: Condensed Matter Physics, Denver, CO, Co-author of the talk "Photothermoelectric effect in semiconducting carbon nanotubes" presented by my student L. Aspitarte (March 2014)
12. Material Research Society Fall Meeting, Boston, MA, co-author of the poster "Photothermoelectric Effect in Individual Suspended Carbon Nanotubes" presented by my student L. Aspitarte (Dec 2013)
13. **(invited)** Workshop on Defects in Carbon Nanotubes, Telluride, CO, Co-author of the talk "Electron transport across point defects in carbon nanotubes" presented by my student T. Sharf (July 2013)
14. **(invited)** Human Frontiers Science Program Annual Meeting, Strasbourg, France, Co-author of the talk "Nanoelectronic biosensors: novel tools to watch single enzymes at work" presented by my collaborator Kerstin Blank (July 2013)
15. Biophysical Society Meeting, Boston, MA, Co-author of the Poster presented by my student T. Sharf (Feb 2013)
16. Gordon Research Conference, Mt. Snow, VT, Presented the poster "Single enzyme activity detected by a nanoelectronic sensor" (July 2012).
17. APS March Meeting: Condensed Matter Physics, Boston, MA, Co-author of the talk "Environmental Charge Noise in Suspended Carbon Nanotube Biosensors" presented by my student T. Sharf (March 2012)
18. APS March Meeting: Condensed Matter Physics, Boston, MA, Co-author of the talk "Scanning Photocurrent Characterization of Absorption Resonances and Photocarrier Generation in Single-Walled Carbon Nanotubes" presented by my student T. DeBorde (March 2012)
19. NW-APS Annual Conference, Corvallis, Oregon; Co-author of the talk "Large-Scale Large Area Graphene Growth and Characterization" presented by my undergraduate student J. Wardini (Oct 2011)
20. IEEE Nano, Portland, Oregon; Co-author of the talk "A Spectrally-Tunable Photocurrent Microscope for Characterizing Nanoelectronic Devices" presented by my student T. DeBorde (August 2011)
21. IEEE Nano, Portland, Oregon; Co-author of the talk "Fabrication of low-noise carbon nanotube field-effect transistor biosensors" presented by my student T. Sharf (August 2011)
22. The Science and Technology of Carbon Nanotubes, Cambridge, England; Co-author of the poster "Controlling the Function of Carbon Nanotube Devices with Re-writable Charge Patterns" presented by my student L. Prisbrey (July 2011)
23. Graphene 2011, Bilbao, Spain; Co-author of the poster "Terahertz Imaging and Spectroscopy of Large-Area Single-Layer Graphene", presented by student Josh Kevek (April 2011)
24. APS March Meeting: Condensed Matter Physics, Dallas, TX, Presented the talk "Terahertz Imaging and Spectroscopy of Large-Area Single-Layer Graphene" (March 2011)
25. Advanced Materials and Nanotechnology, Wellington, New Zealand, Present the talk "Point-Functionalized Carbon Nanotubes for Electrical Detection of Single Molecules" (Feb 2011)
26. **(invited)** SPIE Optics and Photonics, San Diego, CA; Presented the talk "Carbon nanotube transistors for protein sensing applications" (Aug 2010).

27. The Science and Technology of Carbon Nanotubes, Montreal, Canada; Presented the poster "Carbon nanotube point defects for electronic detection of single enzyme dynamics"(June 2010).
28. APS March Meeting: Condensed Matter Physics, Portland, OR; Co-author of the talk "Determining the Detection Speed Limits of Nanobiosensors", presented by my student M. R. Leyden. Co-author of the talk "Horizontally-aligned carbon nanotube films with nanotube diameter controlled by growth temperature", presented by A. Almaqwashi.
29. **(invited)** Materials Science Institute Conference, Gleneden Beach, OR; Presented the talk "Carbon nanotube transistors for biological applications" (Dec 2009).
30. ONAMI MicroNano Breakthrough Conference, Portland, OR; Presented the poster "Carbon nanotube electronics at Oregon State University" (September 2009).
31. **(invited)** Oregon AAPT: Presented the talk "Nanophysics lab activity for introductory physics lab" (Sept 2008).
32. Gordon Conference: Single molecule approaches to Biophysics, New London, CT; Presented the poster "Nanoelectronic detection of single molecule activity" (July 2008).
33. APS March Meeting: Condensed Matter Physics, Pittsburg PA; Co-author of the talk "Modeling the electrostatic signature of single molecule activity", presented by my student L. Prsbrey (March 2009).
34. APS March Meeting: Condensed Matter Physics, New Orleans LA; Co-author of the talk "Identifying individual single walled and double walled CNTs by AFM", presented by my student T. DeBorde (March 2008).
35. AAPT New faculty workshop, College Park, MD, participant (Oct 2007).
36. APS March Meeting: Condensed Matter Physics, Baltimore LA; Presented the talk "CNT biosensors, the critical role of the reference electrode", (March 2007).
37. Gordon Conference: Quantum computing, Long Beach, CA, participant (Jan 2006)
38. **(invited)** APS March Meeting: Condensed Matter Physics; Presented the talk "Tuning the bandgap of CNTs" (March, 2004).
39. **(invited)** International Conference on Advanced Materials and Nanotechnology, Wellington, NZ; Presented the talk "Tuning the bandgap of CNTs with strain" (Feb 2003).
40. **(invited)** ASME International Mechanical Engineering Congress, New Orleans, LA; Presented the talk "Tuning the bandgap of CNTs with strain" (April 2002).

3. Funding

Current/Past awarded grants

PI: Minot

National Science Foundation

Beyond the Shockley-Queisser Limit: Understanding and Controlling Carrier Multiplication in Carbon Nanotube PN Junctions

7/1/17-6/31/20

\$399,858

PI: Dhagat, co-PIs: Minot, Jander, Tate, Dolgos 9/1/15 - 2/1/17
National Science Foundation \$544,000
MRI: Acquisition of a High Field, Wide Temperature Range Electrical, Magnetic and Thermal Properties Measurement System

PI: Minot, Co-PIs Goldberg, McEuen 9/1/14 – 8/31/16
National Science Foundation \$300,000
EAGER: Stretchable graphene transistors for high signal, high channel count neural recording

PI: Minot 1/15/12-1/14/17
National Science Foundation \$598,000
CAREER: Modifying Electron-Electron Interactions to Control the Optical and Electronic Properties of Carbon Nanotubes

PI: Parthasarathy, co-PI: Minot 1/1/11 - 12/31/11
Office of Naval Research \$179,000
ONAMI: Engineering proteins to probe and perturb nano-scale structure formation and molecular conformation
(Minot lab component \$43,000)

PI: Minot, co-PIs: Jander, Dhagat, Solanki, Fifield 1/1/11 - 12/31/11
Office of Naval Research \$91,000
ONAMI: Acquisition of wafer-scale growth capabilities for carbon-based nanoelectronics
(Minot lab component \$91,000)

PI: Lee, co-PIs: Minot, Schneider 1/1/11 - 12/31/11
Office of Naval Research \$181,000
ONAMI: Nonlinear Terahertz Electrodynamics in Graphene
(Minot lab component ~\$80,000)

PI: Minot, co-PIs: Remcho, A. Indra, G. Indra 1/1/11 - 12/31/11
Office of Naval Research \$172,000
ONAMI: Nanobiosensors for early detection of head and neck squamous cell cancer
(Minot lab component \$73,000)

Joint-PIs: Minot, Blank 9/1/10 - 8/30/13
Human Frontier Science Program \$750,000
Nanoelectronic biosensors: novel tools to watch individual enzymes at work
(Minot lab component \$375,000)

PI: Minot 6/1/10 - 5/30/11
OSU Research Office Research Equipment Reserve Fund \$23,000
Acquisition of a Probe Station for Nanoelectronic Biosensor Research

PI: Minot, co-PI: Remcho 6/1/09 - 5/30/10
Army Research Laboratories \$135,000
ONAMI: Individual suspended carbon nanotubes for high performance sensing
(Minot lab component \$81,000)

PI: Lee, co-PIs: Minot, Podolskiy 1/1/10 - 12/31/10
Office of Naval Research \$200,000
ONAMI: THz nanoantenna array based on carbon nanotubes
(Minot lab component \$90,000)

PI: Minot, co-PI: Conley 1/1/10 - 12/31/10
Office of Naval Research \$182,000

ONAMI: Tuning exciton binding in carbon nanotubes for energy harvesting
(Minot lab component \$91,000)

PI: Rorrer, co-PIs; Minot, McIntyre, Ostroverkhova, Tate, Dhagat, Jander
Office of Naval Research 1/1/10 - 12/31/10
\$290,000
ONAMI: Acquisition of microRaman/photoluminescence imaging system

PI: Minot 9/1/09 - 8/31/11
American Chemical Society PRF DNI \$100,000 (direct costs)
PhotocARRIER generation and multiplication carbon nanotubes

PI: Minot, Co-PIs: Schneider, Roundy, Fifield, Chapman 1/1/09 - 12/31/09
Office of Naval Research \$230,000
ONAMI: Electronic detection of single molecule dynamics
(Minot lab component \$80,000)

PI: Indra, co-PI Minot 11/1/08 – 10/31/09
OSU, College of Science Economic Development Fund \$10,000

PI: Dhagat, co-PIs: Jander, Wager, Minot 9/1/08 - 8/31/09
National Science Foundation \$309,000
MRI: Acquisition of Laser Lithography Tool

PI: Lee, co-PI: Minot 1/1/08-12/31/08
Office of Naval Research \$100,000
ONAMI: Electro-optic devices based on carbon nanotubes with Terahertz switching capability
(Minot lab component \$50,000)

PI: Minot, co-PIs: Barbar, Jiao 1/1/08-12/31/08
Office of Naval Research \$107,000
ONAMI: Design of nanoscale electronics for protein sensing
(Minot lab component \$36,000)

Total funding \$4,491,000

Distribution of Funding

Minot Lab	Other Labs	Shared Equipment	Total
\$1,888,000	\$1,437,000	\$1,166,000	\$4,491,000

Pending proposals

N/A

4. Patents

Invention disclosures

Invention disclosure number: OSU-11-19.

Title: Tunneling hot electron transistor with graphene base layer

Authors: Ethan Minot, John Conley, John Wager, Douglas Keszler, Yun-Shik Lee

Filing date: May 2011

This invention grew out of discussions between the five co-inventors during preparation of a multiple-PI NSF proposal. Dr. Conley, Dr. Wager and Dr. Keszler are experts in using stacks of thin metal and dielectric films to create electronic devices. I

contributed my knowledge of graphene properties and fabrication techniques so that we could develop a new device concept. Dr. Lee contributed his expertise in materials properties at terahertz frequencies to analyze the potentially revolutionary switching speed of a tunneling hot electron transistor with a graphene base layer.

5. Other

Invited colloquia and seminars

- Nov 2017 – University of Washington, WA, Physics Seminar: “Electron-Electron Interaction Driven Phenomena in Carbon Nanotubes”
- Oct 2017 – UC Riverside, CA, Physics Seminar: “Electron-Electron Interaction Driven Phenomena in Carbon Nanotubes”
- Oct 2017 – University of Southern California, CA, Nanoscience Seminar: “Electron-Electron Interaction Driven Phenomena in Carbon Nanotubes”
- Oct 2017 – Oregon State University, OR, Solid State Seminar: “Electron-Electron Interaction Driven Phenomena in Carbon Nanotubes”
- Nov 2016 – Canterbury University, New Zealand, Physics Seminar: “Nanoelectronics meets biology”
- Nov 2016 – Victoria University, New Zealand: School of Chemical and Physical Sciences Seminar: “Nanoelectronics meets biology”
- Oct 2016 – University of Arizona, Department of Physics Colloquium: “Nanoelectronics meets biology”
- May 2016 – University of Oregon, Materials Science Seminar: “Wearable electronics for cells”
- May 2016 – University of Utah, Solid State Seminar: “Electron-Electron Interaction Driven Phenomena in Carbon Nanotubes”
- Aug 2015 – Oregon Health Sciences University, Quantitative Biology REU Seminar: “Electronic sensors in quantitative biology”
- Mar 2014 – Penn State University, Solid State Seminar: “Carbon nanotubes as nanobiosensors and 1d light harvesting devices”
- Feb 2014 – Cornell University, Solid State Seminar: “Carbon nanotubes as nanobiosensors and 1d light harvesting devices”
- Oct 2013 – Willamette University, Physics Colloquium: “Graphene and carbon nanotube based biosensors: an alternative to fluorescence detection”
- Oct 2013 – Oregon State University, Solid State and Optics Seminar: “Graphene and carbon nanotube based biosensors: an alternative to fluorescence detection”
- June 2013 – Radboud University Nijmegen, Institute of Molecules and Materials Seminar: “Graphene and carbon nanotube based biosensors: an alternative to fluorescence detection”
- June 2013 – Delft University of Technology, Physics Seminar: “Photo-thermoelectric effects in suspended carbon nanotube devices”
- Nov 2011 – Portland State University, Physics Colloquium: “Building electronics at the nanoscale to watch nature at the nanoscale”
- Nov 2011 – Oregon State University, Physics Colloquium: “Building electronics at the nanoscale to watch nature at the nanoscale”
- May 2011 – Oregon State University, Solid State and Optics Seminar: “Carbon Nanotube Optoelectronics”
- May 2011 – University of Pennsylvania, Solid State Physics Seminar: “Carbon Nanotube Transistors for Biological Applications”

- May 2011 – Columbia University, Solid State Physics Seminar:
“Carbon Nanotube Transistors for Biological Applications”
- Apr 2011 – University of Oregon, Materials Science Seminar:
“Carbon nanotube applied physics: 1d Photovoltaics & Nanobiosensors”
- Nov 2010 – Oregon State University, Physics Colloquium:
“The 2010 Nobel Prize in Physics: Graphene”
- Feb 2010 – Oregon State University, Physics Colloquium:
“Opportunities for Undergraduate Research”
- Sep 2009 – Colorado State University, Biomedical Engineering Seminar:
“Carbon Nanotube Transistors for Biological Applications”
- Feb 2009 – Oregon State University, Physical Chemistry Seminar:
“Nanotransistors for Chemical and Biological Sensing Applications”
- Oct 2008 – Portland State University, Physics Colloquium:
“Charge sensing in biological environments with carbon nanotube devices”
- Apr 2008 – Oregon Health Science University, Biomedical Engineering Seminar:
“Charge sensing in biological environments with carbon nanotube devices”
- Jan 2008 – University of Oregon, Physics Colloquium:
“Charge sensing in biological environments with carbon nanotube devices”
- Oct 2007 – Virogenomics Inc. (Tigard, OR), Research Seminar:
“Biosensing with Carbon Nanotube Devices”
- Oct 2007 – Molecular Probes Inc. (Eugene, OR), Research Seminar:
“Biosensing with Carbon Nanotube Devices”
- Oct 2007 – Oregon State University, Materials Science Seminar:
“Biosensing with Carbon Nanotube Devices”
- May 2007 – University of Washington, Physics Seminar:
“Charge sensing in biological environments with carbon nanotube devices”
- Feb 2005 – ETH (Switzerland), Physics Seminar:
“Tuning the band structure of carbon nanotubes”
- May 2004 – Stanford University, Physics Seminar:
“Tuning the band structure of carbon nanotubes”
- May 2004 – Delft University of Technology, Applied Physics Seminar:
“Tuning the band structure of carbon nanotubes”

Ongoing Scientific Collaborations

- *Dr. Kirsten Blank, Research Group Leader, Max Planck Institute of Colloids and Interfaces, Germany:*
I met Dr. Blank at the Gordon Conference “Single Molecule Approaches to Biology” in July 2008. We began discussions of the relative merits of nanoelectronic sensors compared to fluorescence detection. After the conference we developed our ideas into a research proposal. We contributed equally to the proposal development, leveraging my strengths in the physical sciences and her strengths in the life sciences. The proposal was submitted to the Human Frontiers of Science Program (HFSP) and was chosen for funding (only 9 out of 300 proposals were successful). We are continuing to publish results from this fruitful collaboration.
- *Dr. Michael Crosser, Associate Prof. of Physics, Linfield College, Oregon:*
Linfield College is an Undergraduate Institution near Oregon State University with a small physics department. Dr. Crosser spent his 2014 sabbatical working with me at OSU. We have established a

productive collaboration that led to a 2015 publication in Nano Letters and a second publication in preparation.

- *Dr. Yun-Shik Lee, Associate Prof. of Physics, Oregon State University:*

Dr. Lee and I began collaborating soon after I joined the faculty at Oregon State University. We have successfully combined my expertise in carbon-based nanoelectronics, with Dr. Lee's expertise in terahertz spectroscopy of thin films. We work closely together to interpret experimental results and establish the relationships between terahertz measurements of carbon nanomaterials and "traditional" nanoelectronics measurements. So far, the collaboration has led to several exploratory projects funded by the Onami Nanoscience and Microtechnologies Institute (ONAMI), an invention disclosure, and two joint publications.

- *Dr. Paul McEuen, Prof. of Physics, Cornell University:*

Dr. McEuen was my research advisor during my PhD work. Dr. McEuen is a pioneer and leading expert in carbon nanotube and graphene physics. Since 2009 my research group at Oregon State University has had unique capabilities for building chemical vapour deposition (CVD) systems for carbon nanotubes and graphene. In 2009 I began collaborating with Dr. McEuen to implement these CVD systems in his lab at Cornell University. The collaboration has been "two-way", Dr. McEuen's students have shared valuable technical advice on preparing graphene nanoelectronic devices. This collaboration played an important role in the 2011 publication "Terahertz Imaging and Spectroscopy of Large-Area Single-Layer Graphene" (Optics Express). My lab technician who led the development of the chemical vapour deposition systems, Josh Kevek, was recently hired to be a research support specialist in Dr. McEuen's lab. In 2014 the collaboration grew to include the development graphene field-effect transistors for recording signals from single neurons (NSF funded project).

Hosting of visiting scientists

2014 My lab hosted Prof. Michael Crosser (Professor of Physics) from Linfield College, Oregon. Prof. Crosser for a 6 month sabbatical in my lab to pursue research in graphene-based nanoelectronic sensors.

2012-2013 – My lab hosted Prof. Kerstin Blank (Prof. of Chemistry) from Radboud University Nijmegen, for a 4-month sabbatical (Dec 2012 – March 2013)

2010-2011 – My lab hosted Prof. Ji-Yong Park (Professor of Physics) from Ajou University, for a 1-year sabbatical. Dr. Park had an office next to mine and interacted with my group on a daily basis. During his visit, he helped establish additional scanning probe microscopy capabilities in my lab and was a contributing author on two papers. Dr. Park chose my group for two reasons. First, my lab is well equipped for scanning probe microscopy of nanoelectronic devices (Dr. Park's specialty). Second, my lab has unique expertise integrating nanoelectronic systems with biological systems. This "nano-bio" field is a research direction that Dr. Park wanted to explore during his sabbatical.

2010-2011 – My lab hosted Dr. Tom Novet, process engineer from Voxel Inc., for a 1-year project. Dr. Novet's project was to demonstrate a new technique of producing chirally-pure carbon nanotubes. Dr. Novet had an office next to my lab and interacted on a daily basis with my group. Voxel chose to place Dr. Novet in my group because of our expertise in carbon nanotube growth and nanometrology techniques.

Research Commercialization

Graphene and Carbon Nanotube Growth Systems:

Work in my lab lead to the development of low-cost, fully automated, research-level chemical vapor deposition systems for growth of graphene and horizontally-aligned carbon nanotubes. Systems have been installed at OSU, University of Washington and Cornell University.

- www.kevekinnovations.com

In-situ electrical probe station for atomic force microscopy:

Work in my lab lead to the development of a miniaturized probe station that fits inside the MFP-3D atomic force microscope (Asylum Research). The MFP-3D is the most popular atomic force microscope on the market. Asylum Research now sells our probe station as an accessory for their instrument.

- www.asylumresearch.com/Products/Options/MFPOptions.shtml#Mat

Interactions with Industry

- | | |
|----------------|--|
| 2016 – present | Consultant for Accelerate Diagnostics.
Accelerate Diagnostics develops new medical technology for determining the antibiotic resistance of bacteria. I am helping the company explore new technologies for their next generation of products. |
| 2010 – 2014 | Member of the Scientific Advisory Board of Nanotechnology Biomachines Inc.
http://nanotechbiomachines.com/
I gave advice regarding the nanoelectronic device geometries that can be used for medical sensing applications. |
| 2010 – 2014 | Consultant for Voxel Inc: I help plan experiments to test whether segmented carbon nanotubes can be used as seeds for chemical vapor deposition of chirally-pure carbon nanotubes. |
| 2010 – present | Lab Service Provider for Inpria Inc.
(Atomic Force Microscopy Imaging. Value of services provided ~ \$5,000)
My lab assists with surface characterization of spin-on thin-film technology that is being developed by Inpria. |
| 2010 – 2014 | Lab Service Provider for Voxel Inc.
(Carbon Nanotube Deposition. Value of services provided ~ \$24,000)
My lab assists with chemical vapor deposition of carbon nanotubes on quartz. My lab also assists with characterization of carbon nanotube uniformity. |

D. Service

1. University Service

Department Service

1. Graduate Admissions Committee 2007, 2008 (chair), 2009 (chair)
2. Graduate Recruitment 2008, 2009
3. Graduate Open House Organizer 2008
4. Graduate Course Group 2007, 2008, 2009
5. Yunker Lecture Organizer 2009 (Paul McEuen), 2011 (Philip Kim)
6. Solid State/Optics Seminar Series Winter 2009, Fall 2013
7. Physics Machine Shop Supervisor 2009, 2010
8. Organizing Machine Shop Course 2009, 2010
9. Faculty Search, Physics 2010, 2011, 2012, 2013 (chair)
10. Technician Search, Phys/Chem 2010
11. Colloquium Committee 2011 (chair)
12. Editor of department newsletter 2011
13. Communications Seminar (Spring) 2014, 2015, 2016
14. Chair's Advisory Committee 2014, 2015, 2016
15. Comprehensive Exam 2014, 2015, 2016
16. Department Website Upgrade 2015, 2016
17. Outreach coordinator 2015, 2016
18. Chair of Lazzati P&T committee 2015
19. Faculty grant writing lunches 2016
20. Physics GRE Seminar (Spring) 2016
21. Paradigms 2.0 committee 2016

College of Science Service

1. Hiring Committee – Director of CoSINE 2014
2. Capital Planning Committee 2016
3. Faculty Research Websites Upgrade 2016

Graduate Council Representative for

1. Stephen Meliza	MS (Elec. Eng.)	2009
2. Matthew Ryder	MS (Chem. Eng.)	2009
3. Patrick Schmidt	MS (Elec. Eng.)	2010
4. Ira Jewel	MS (Elec. Eng.)	2010
5. Camden Driggers	Ph.D. (Biophysics)	2014
6. Tim Lewis	Ph.D. (EECE)	2013
7. Bao Yeh	Ph.D. (EECE)	2014
8. Daniel Coleman	Ph.D. (Pharmacy)	2014
9. Somdev Banerjee	Ph.D. (Chemistry)	2015
10. Maureen Caupp	Ph.D. (Chemistry)	Current student
11. Chris Heist	Ph.D. (Chemistry)	2016
12. Andrew Ferreira	Ph.D. (Chemistry)	2017
13. Lei Zheng	Ph.D. (EECE)	Current student
14. Shaan Sengupta	Ph.D. (EECE)	Current student

Development of OSU shared user-facilities

- MicroRaman Microscopy Facility (OSU/ONAMI shared facility). I was co-PI on the proposal to create this facility, and contributed to installation and user training.
- Direct Write Lithography Facility (OSU/ONAMI shared facility). I was co-PI on the proposal to create this facility, and contributed to installation and user training.
- Physics Properties Measurement System (OSU/ONAMI shared facility). I was co-PI on the proposal to create this facility, and contributed to installation and user training.

2. Service to Profession

- Invited panel reviewer for grants submitted to
National Science Foundation: Engineering Division, Electronic and Photonic Devices (Dec 2009)
National Science Foundation: Division of Materials Research, Condensed Matter Physics (Mar 2011)
National Science Foundation: Division of Materials Research, Condensed Matter Physics (Feb 2013)
National Science Foundation: Division of Materials Research, Condensed Matter Physics (Feb 2014)
National Science Foundation: Division of Materials Research, Condensed Matter Physics (Feb 2017)
National Science Foundation: Engineering, Nanobiosensors (Feb 2018)
- Invited reviewer for the American Chemical Society: Petroleum Research Fund (February 2011).
- Invited reviewer for the Keck Foundation: (February 2015).
- Invited reviewer for DOE Basic Energy Sciences Program (CPIMS) (April 2016)
- Invited reviewer for the Murdoch Trust: (August 2017)(October 2017).
- Invited textbook reviewer for the publisher W.H. Freeman (June 2011).
- Conference organization:
 1. IEEE Nanotechnology, Portland OR (2011): I was a member of the selection committee for the Nanomaterials Track.
 2. Annual Meeting of the Northwest Section of the American Physical Society, Corvallis, OR (2011): I was a member of the on-site organizing committee.
 3. Session Chair of Carbon Nanotube Transport Session at the American Physical Society March Meeting in Denver CO (March, 2014)
 4. Session Chair of Carbon Nanotube Session at the Materials Research Society Fall Meeting in Boston, MA (Dec, 2014)
- Invited reviewer for the following peer-reviewed journals

Journal	First served as referee	Number of papers reviewed
Physical Review Letters	2005	2
Physical Review B	2007	5
Journal of Physical Chemistry	2007	2
Nanotechnology	2007	2
Nano Letters	2008	3
ACS Nano	2010	3
Langmuir	2010	1
Applied Physics Letters	2010	7
Nano Research	2011	1
Journal of Applied Physics	2011	1

Proc. IEEE Nano	2011	8
Sensors & Actuators: B	2013	2
Nature Communications	2014	1
IEEE Trans. on Elec. Dev.	2015	1
Nanoscale	2015	1
Nature Communications	2014	1
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3. Service to the Public (professionally related)

Organization of public lectures

June 2009 – The 22nd Annual Physics Yunker Lecture at OSU:
 "Small is All: Nano, Bio and the Future of Technology"
 Paul McEuen, Professor of Physics, Cornell University.

Nov 2011 – The 24th Annual Physics Yunker Lecture at OSU:
 "Relativity, Quantum Physics and Graphene"
 Philip Kim, Professor of Physics, Columbia University.

Notable physics outreach events

Jan 2015 – I presented "The Physics of Air", a 2 hour workshop, to a group of 40 children and their parents. The event was featured on the front page of the Corvallis Gazette times.

Participation in University Pre-college Programs

- Project mentor for the Science Experience in Science and Engineering for Youth program (2010, 2011, 2012, 2013, 2014, 2015, 2016) (<http://cbee.oregonstate.edu/sesey>).
- Presenter for Lincoln High School Campus visit "Nanoelectronics Research" (2011)
- Presenter for the Saturday Academy Mid-Summer Conference "Nanoelectronics Research" (2011)
- Presenter the LSAMP Summer Bridge Program (Sept 2016)

Participation in Free-Choice Learning

- NanoDays volunteer at Oregon Museum of Science and Industry (OMSI) (March 2012, March 2013)
- Discovery Days volunteer at OSU (May 2012, Sept 2015)
- OMSI Meet a Scientist at Oregon Museum of Science and Industry (May 2016)

E. Awards

- OMSI Science Communication Fellow 2016
- Finalist for College of Science Carter Graduate Teaching Award 2016
- Visiting Fellow of the Kavli Institute at Cornell for Nanoscale Science 2014
- NSF CAREER Award 2011
- Human Frontier Science Program Young Investigator Award 2010
- NSF Graduate Fellowship 2000-2003
- Massey University Scholar 1998