John Howell

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Academic Positions

- **University of Rochester,** Rochester NY Assistant Professor of Quantum Optics February 2002-
- Visiting Professor at MIT August 2005 (visiting Franco Wong and Jeff Shapiro)
- Visiting Professor and Lecturer at the University of Insubria, Como Italy, Sept 2005 to December 2005 (visiting Luigi Lugiato and Alessandra Gatti)

Experience and Education

- **University of Oxford,** Oxford, UK -- Postdoctoral Research Associate/Junior Research Fellow at the Centre for Quantum Computation August 2000-February 2002
- **The Pennsylvania State University**, University Park, PA -- Doctorate of Philosophy in Physics (quantum optics) August 2000
- **Utah State University**, Logan, UT -- Bachelors of Science in Physics with minor in Mathematics June 1995

Awards and Honors

- **Adolph Lomb Medal from Optical Society of America** (2006) .
- **Presidential Early Career Award for Scientists and Engineers** $500,000/(5 years) highest honor bestowed by US govt. on new faculty (2005-2009)
- **Research Innovation Award** – Research Corporation $35,000/(2 years) (2004-2005)
- **Junior Research Fellow –** Wolfson College, University of Oxford (2001-2002)
- **Physics Teaching Assistant of the Year** (1999-2000) - Penn State University (Shared with two others)
- **Duncan Fellowship** - Penn State University (1996-1997)
- **Braddock Fellowship** - Penn State University (1996-1998)
- **Graduated in top 5% of College of Science** – Utah State University (1994)
- **Tuition Waiver** - Utah State University (1989-1990,1993-1994)
- **Athletic Track and Field Scholarship** - Utah State University (1989-1990)

Grants

Previous Grants

- “Optical fiber Grover’s search algorithm”, Applied Research Laboratory (thesis funding proposal) $50,000 (1 year) (2000)

Current Grants and Awards

- Presidential Early Career Award for Scientists and Engineers, Army $592,000/(5 years) (2005-2009) (Principal Investigator)
- “Applications of Slow Light in Optical Fibers” DARPA ~$6,500,000/(4.5 years) (my portion is $680,000) /(5 years) (2004-2009) (Co-Investigator)

- "Unit efficiency counting of entangled photons" Research Corporation Research Innovation Award, $35,000 /(2 years) (dates-?) (Principal Investigator)
- "Unit efficiency, nondestructive, photon counting detector" NSF, $348,147 /(3 years) (2003-2006) (Principal Investigator)
- Multi University Research Initiative in Quantum Imaging, Army $6,000,000 /(5 years) (Co-Investigator, my share is $325,000/(5 years) 2005-2009
- MURI related DURIP through Army Research Office $50,000 (1 year)
- ARDA Quantum Cryptography $550,000 (Principal Investigator, my share is $350,000 /(18 months) (FY05 and FY06)

Talks and Colloquia

- "High dimensional entanglement, large alphabet quantum key distribution and quantum image buffering" National Academy of Science, Kavli Frontiers of Science Symposium, Irvine California (January 2006)
- "High dimensional entanglement, large alphabet quantum key distribution and quantum image buffering" Cornell University seminar (December 2006)
- "Slow Images and EIT transients", DARPA annual funding meeting, Austin TX (November 2006)
- "High bandwidth quantum information" Waterloo or IQC Colloquium (November 2006)
- "Theoretical and Practical Limits of Large Alphabet Energy-Time Quantum Key Distribution", FIO OSA annual meeting (Oct 2006) Rochester
- "High bandwidth quantum information" SPIE San Diego meeting (Aug 2006) (Invited)
- "High Bandwidth Quantum Cryptography" ARDA meeting (June 2006) San Antonio
- "High Bandwidth Quantum Cryptography" ARDA meeting (March 2006) HP Labs
- "High bandwidth quantum cryptography" Physics of Quantum Electronics (Jan 2006) (Invited)
- "Large fractional pulse delays in a hot vapor" DARPA Slow Light funding meeting (Dec 2005) (Invited)
- "High dimensional quantum cryptography" ARDA review meeting (Sept 2005) (invited)
- "High Bandwidth Quantum Communication and EPR's Paradox" SPIE annual meeting (July 2005) (Invited)
- "Quantum Imaging" Quantum Imaging MURI funding meeting (June 2005) (Invited)
- "High Entanglement Quantum Cryptography" Boulder CO, ARDA funding meeting (June 2005) (Invited)
- "Quantum Imaging and EPR entanglement" International Conference on Coherent and Nonlinear Optics (May 2005) (Invited), had to miss this.

- “Low light level nonlinear optics” Destin FL, DARPA slow light funding meeting (May 2005) (Invited)
- “The EPR paradox”, Georgia Institute of Technology Colloquium (March 2005) (Invited)
- “The EPR paradox”, University of Toronto quantum information seminar (March 2005)
- “Ultra-low light level optical switching” SPIE meeting (Jan 2005) (Invited)
- “Time-Energy EPR paradox” Physics of Quantum Electronics, Snowbird (Jan 2005) (Invited)
- “The EPR paradox and Nonseparability” Brigham Young University (Nov 2004) (Invited)
- “Discretizing continuous momentum-position entangled photons” Division of Laser Science OSA meeting (Oct 2004) (Invited)
- “Qudit Entanglement” ARDA single photon meeting (Oct 2004) (Invited)
- “Hot Cell Low Light Level Nonlinear Optics” DARPA kickoff meeting (Sept 2004) (Invited)
- “Einstein Podolsky Rosen Paradox” SPIE meeting (July 2004)(Invited)
- “Hot Cell Low Light Level Nonlinear Optics” DARPA group meeting (July 2004) (Invited)
- “Momentum-position realization of the Einstein-Podolsky-Rosen paradox”, University of Maryland (Apr 2004) (Invited)
- “Momentum-position realization of the Einstein-Podolsky-Rosen paradox”, NIST Gaithersburg (Apr 2004) (Invited)
- “Why Quantum Computing?” Laboratory for Laser Energetics (March 2004) (Invited)
- “Momentum-position realization of the Einstein-Podolsky-Rosen paradox”, UC Santa Barbara (Feb 2004)
- “Web-based tests of Bell’s inequalities for undergraduate laboratories” American Association of Physics Teachers meeting in Miami January 2004 (Invited)
- “Momentum-position realization of the Einstein-Podolsky-Rosen paradox”, MIT (Nov 2003)
- “Momentum-position realization of the Einstein-Podolsky-Rosen paradox”, Harvard (Nov 2003)
- “Momentum-position realization of the Einstein-Podolsky-Rosen paradox”, MIT Lincoln Laboratories (Nov 2003)
- “Quantum Cloning” University of Rochester, Rochester (Sept 2003) (Invited)
- “Quantum Cloning” University of Konstanz, Konstanz Germany, (July 2003) (Invited)
- “Quantum Cloning” Cross-Border Workshop, University of Waterloo, Canada May 2003) (Invited)
- “Quantum Cloning”,Colgate University, October 2002 (Invited)
- “Quantum Phun” University of Rochester, REU workshop, June 2002 (Invited)
- “Polarization Based Orthogonal State Quantum Cryptography” University of Rochester, Cross-Border Workshop, May 2002
- “Entangled Photon Laser: A Revolution in Nonlocality” Humboldt State University, March 2002 (Invited)
- “Entangled Photon Laser: A Revolution in Nonlocality” University of Rochester Oct 2001 (Invited)

- “Entangled Photon Laser: A Revolution in Nonlocality” Utah State University Mar 2001
- “Entangled Photon Laser: A Revolution in Nonlocality” University of California Berkeley, April 2001
- “Entangled Photon Laser: A Revolution in Nonlocality” University of Erlangen, Germany, Jan 2001 (Invited)
- “Optical Simulations of Quantum Logic” University of Geneva, Switzerland (2000)
- “Optical Simulations of Quantum Logic” University of Oxford, England (2000)
- “Optical Simulations of Quantum Logic” Los Alamos National Laboratory (2000) (Invited)

Referee for Journals

- Nature
- Physical Review Letters
- Physical Review A
- European Physics Letters
- European Physics Journal
- Physics Letters A
- Optics Express
- Journal of Physics A: Mathematical and General
- Journal of Physics B

Professional Service (National)

- CLEO/QELS quantum optics organizing committee (2007)
- Coherence and Quantum Optics organizing committee (2007)
- NSF funding review panel (2004)
- NSF funding referee (2003,2004)
- Army Research Office funding review (2003,2005)
- Chair for “Quantum Information” session in APS/OSA meeting (2004)
- Organizer of “Quantum imaging” and “Quantum Information” sessions of APS/OSA meeting. (2004)
- Chair for “Novel Optics” session of Physics of Quantum Electronics conference at Snowbird (2005)

Professional Service (Departmental)

- Graduate Admissions Committee (2003—current)
- Quantum Optics Seminar Chair (2002—current)
- TA workshops (2002—current)
- Informative Research Talks (undergraduate and graduate students)
- Technical Services Committee(2004—current)
- Faculty Search for Experimental Biological or Condensed Matter Physicist (2004-2005)
- Faculty Hiring Committee for James Beatty (2003)
- Thesis Committees served on
    - Xingxiang Zhou (2002)
    - David Aaronstein (2003)

- Stanley Weiss (2004)
- Alfred U'ren (2004)
- Reinhard Erdman (2004)
- Ryan Bennink (2004)
- Mishkattul Bhattacharrya (2005)
- Pedro Quinto Su (2005)
- Jeffrey Pratt (2005)
- Pablo Londero (2005)
- Jeong-Hoon Yang (2006)
- Elinor Irish (2006)
- Michael Holmes (2006)
- Fatih Yaman (2006)
- Alberto Marino (2006)
- Irfan Ali Khan (2006)

Graduate Student Advisees

Primary Thesis (in Physics) **Advisor for**

- Xingxiang Zhou (Finished Joint PhD in ECE and Physics 2002, now Postdoc ECE Rochester)
- Irfan Ali Khan (started PhD Fall 2001)
- Michael Vernon Pack (started PhD Fall 2003)
- Ryan Camacho (started PhD Summer 2003)
- Curtis Broadbent (started PhD in 2003)
- Ben Dixon (started PhD in 2006)

Secondary Advisor for

- Ryan Bennink (Finished PhD in Optics 2004, now Postdoc Oakridge National Laboratory)
- Sean Bentley (Finished PhD in Optics 2003, now Assistant Professor Adelphi University)
- Kevin Wright (started PhD in 1999 work's, now in Prof. Nicholas Bigelow's lab)
- Malcolm O'Sullivan-Hale (started PhD in 2003, now at the institute of optics in Prof. Robert Boyd's lab)

Undergraduate Student Advisees

- Ronen Mukamel (Harvard undergraduate student with Rochester REU Program Summer 2002, now doing graduate studies in mathematics) - publication "Bell Inequalities for particles of arbitrary spin in fixed analyzers", Ronen Mukamel and John C. Howell Phys. Rev. A 70, 054302 (2004)
- Evan Wendel (Rochester undergraduate student with Rochester REU Program Summer 2003)
- Siddharth Parameswaren (Rochester undergraduate student with Rochester REU Program Summer 2003, now senior in physics at UR)

- Pat Puccini (SUNY Geneseo undergraduate student with Rochester REU Program Summer student 2004, now graduate student in physics where?)
- Brock Schmutzler (Truman University undergraduate student with Rochester REU Program Summer 2005, now senior year in physics at Truman)

Talks given by graduate students or undergraduate students under my supervision

- “Einstein Podolsky Rosen Paradox” Seminar at Colgate University
- “Low light level switching” Brock Schmutzler, REU summer student talk
- “High Bandwidth Quantum Communication and EPR’s Paradox” SPIE annual meeting (July 2005) (given by Irfan Ali Khan)
- “High Bandwidth Quantum Communication and EPR’s Paradox” CLEO/QELS conference (May 2005) (given by Irfan Ali Khan)
- “Ultra-low light level optical switching” CLEO/QELS conference (May 2005) (given by Michael V. Pack)
- “Ultra-low light level optical switching” SPIE meeting (Jan 2005) (given by Michael V. Pack)
- “Higher dimensional teleportation” REU summer student talk given by Pat Puccini (August 2004)
- “Einstein Podolsky Rosen Paradox” SPIE meeting (July 2004)(given by Irfan Ali Khan
- REU summer student talk given by Evan Wendel (August 2003)
- “Bell’s inequalities for higher dimensional spin” REU summer student talk given by Ronen Mukamel (August 2002)

Collaborators

Bigelow, Nick, Dept. of Physics and Astronomy, University of Rochester
Bouwmeester, Dik, Dept. of Physics, UC Santa Barbara
Boyd, Bob, Institute of Optics, University of Rochester
Eberly, Joe, Dept. of Physics and Astronomy, University of Rochester
Hillery, Mark, Dept. of Physics, CUNY Hunter College, New York City
Stroud, Carlos, Institute of Optics, University of Rochester.

Publications (refereed)

23. "All-optical delay of images using slow light" Ryan M. Camacho, Curtis Broadbent, Irfan Ali Khan and John C. Howell, Phys. Rev. Lett (in press)

22. "Slow light with large fractional delays by spectral hole-burning in rubidium vapor" Ryan M. Camacho, Michael V. Pack, and John C. Howell, Phys. Rev. A 74, 033801 (2006)

21. "Transients of the electromagnetically-induced-transparency-enhanced refractive Kerr nonlinearity: Theory" M. V. Pack, R. M. Camacho, and J. C. Howell, Phys. Rev. A 74, 013812 (2006)

20. "Low-distortion slow light using two absorption resonances" Ryan M. Camacho, Michael V. Pack, and John C. Howell, Phys. Rev. A 73, 063812 (2006)

19. “Experimental demonstration of high two-photon time-energy entanglement**”** I. Ali Khan and J. C. Howell Phys. Rev. A 73, R 031801 (2006)

18. "Pixel Entanglement: Experimental Realization of Optically Entangled d=3 and d=6 qudits", M.N. O'Sullivan-Hale, I. Ali Khan, R.W. Boyd and J. C. Howell, Phys. Rev. Lett. **94**, 220501 (2005)

17. “Exploring the optimal sensitivity of sum-variance nonseparability criteria for spin-1/2 systems”, Irfan Ali Khan and John C. Howell Phys. Rev. A **70**, 062320 (2004)

16. “Bell Inequalities for particles of arbitrary spin in fixed analyzers”, Ronen Mukamel and John C. Howell Phys. Rev. A **70**, 054302 (2004)

15. “Hong Ou Mandel Cloning: quantum copying without an ancilla”, Irfan Ali Khan and J.C. Howell, Phys. Rev. A **70**, 010303(R) (2004)

14. “Momentum-Position Realization of the Einstein-Podolsky-Rosen Paradox using Spontaneous Parametric Downconversion”, J.C. Howell, R.S. Bennink, S.J. Bentley, and R.W. Boyd, Phys. Rev. Lett. **92**, 210403 (2004)

13. “Reconciling Cloning Fidelities” I. Ali Khan and J.C. Howell, Quantum Information and Computation **4**, 146 (2004)

12. “Quantum and Classical Coincidence Imaging” R.S. Bennink, S.J. Bentley, R.W. Boyd, and J.C. Howell, Phys. Rev. Lett. **92**, 033601 (2004)

11. Generalized Bell inequalities with parametric down-conversion” A. Lamas-Linares, W.T.M. Irvine, J.C. Howell and D. Bouwmeester, Quantum Information and Computation **3**, 471 (2003)

10. “Quantum cloning of single photons” A. Lamas-Linares, C. Simon, J. C. Howell, and D. Bouwmeester, Science **296**, 712 (2002)

9. “Experimental violation of a spin-1 Bell inequality using maximally-entangled four-photon states”, J. C. Howell, A. Lamas-Linares, D. Bouwmeester, Phys. Rev. Lett. **88**, 030401 (2002)

8. “Stimulated entanglement: The onset of an Entangled Photon Laser”, A. Lamas-Linares, J. Howell and D. Bouwmeester, Nature **412**, 887-890 (2001)

7. “Optically simulating a quantum associative memory”, J. Howell, D. Ventura and J. Yeazell, Phys. Rev. A **62**, 042303 (2000)

6. “Nondestructive single-photon trigger”, J. Howell and J. Yeazell, Phys. Rev. A **62**, 032311 (2000)

5. “Quantum computation through entangling single-photons in multipath interferometers”, J. Howell and J. Yeazell, Phys. Rev. Lett. **85**, 198 (2000).

4. “Entangling macroscopic quantum states” J. Howell and J. Yeazell, Phys. Rev. A **62**, 12102 (2000)

3. “Reducing the complexity of linear optics quantum circuits”, J. Howell and J. Yeazell, Phys. Rev. A **61**, 052303-1 (2000)

2. “Linear optics simulations of the quantum baker's map”, J. Howell and J. Yeazell, Phys. Rev. A **61**, 01234-1 (2000)

1. “Optical simulations of quantum logic” PhD Thesis, Penn State (2000)

Contributions to Books (chapter)

“Fundamentals of Quantum Information: Quantum Computation, Communication, Decoherence and all that” D. Bouwmeester, J. Howell, A. Lamas-Linares, Springer (2002)

Papers under review

1. “Experimental Demonstration of High Dimensional Time-Energy Entangled Two-Photon States” I. Ali Khan and J.C. Howell (submitted to Physical Review Letters)

Papers in progress

1. “Quantum Imaging and Popper's Experiment” I. Ali Khan, J. C. Howell R. S. Bennink, R. W. Boyd (on the backburner, but to be submitted)
2. “Refractive Switching Dynamics” M.V. Pack, R. Camacho, and J.C. Howell (to be submitted to Physical Review A)
3. “10 Fractional Delays in a Hot Rubidium Vapor” Ryan M. Camacho, Michael V. Pack and John C. Howell (to be submitted to Physical Review Letters)
4. “High Bandwidth Quantum Cryptography” Irfan Ali Khan, Curtis Broadbent and John C. Howell (to be submitted to Physical Review Letters)
5. “Energy Phase entanglement and the no signaling theorem” C. Broadbent, I. Ali Khan and J.C. Howell

Research Statement

Our group is involved in two major efforts. The first effort comprises studies of various types of two-photon entanglement. The second effort is to work on ultra-low light level nonlinear optics. We have been able to achieve some very exciting results in both of these studies over the last two years and anticipate several exciting experiments in the coming years.

Discrete entanglement: Most people, when discussing entanglement, think about polarization entangled photons. If one photon is horizontal the other photon is vertical, which is in a superposition with the opposite state. This state exhibits some very strange and interesting physics. Fundamental studies of entangled photons have been done for many years. Recently, Artur Ekert showed that entangled photons may actually be

useful for secret communications. Since then, the use of entangled photons has blossomed into a very large field in quantum communication. We recently experimentally demonstrated a sensitive test of polarization entanglement, demonstrated the first phase covariant cloning machine and recently finished a quantum state discrimination protocol proposed by Mark Hillery.

Continuous Entanglement: Our primary efforts in entanglement will be to explore novel entanglement measures, imaging and quantum information using continuous two-photon entanglement. We recently demonstrated two important experiments in continuous momentum-position entanglement. Most importantly, we demonstrated the original Einstein-Podolsky-Rosen paradox, the "Gedanken experiment" proposed in 1935 to test the postulates of the Copenhagen interpretation of quantum mechanics. We violated the EPR bound by two orders of magnitude and then showed that we could use these correlations for imaging an object with high resolution in any complementary set of planes. We recently showed that we are able to send the continuously entangled states over fibers for long distance imaging and quantum communication. We showed that we could violate the EPR bound and the separability bound by several orders of magnitude and that it is possible to send large amounts of information in a single pair of entangled photons. We are currently developing and have measured some preliminary results of a cryptosystem with the capability of sending 100 states per pair of entangled photons in fiber. These projects are well funded, because of its high bandwidth quantum information capabilities. We also have interests in testing the boundaries of relativity and quantum mechanics using entangled photons.

Low Light Level Nonlinear Optics: Our other major thrust is achieving strong nonlinear capabilities with very weak light fields. We recently explored a new method for achieving large fractional pulse delays. We have observed 50 pulse delays with a fractional broadening of only 40%. Working between two strongly absorbing resonances instead of a single transparency resonance we showed that it is possible to have very large bandwidths and pulse delays while minimizing broadening, which is an important step toward practical optical delay lines.

We are now going to use the strong nonlinearities to look at light-light control via Stark shifting resonances. We are going to explore many of the phenomena that have been developed for EIT such as giant cross-phase modulations and quantum nondemolition detection.

We also recently began collaborating with Nick Bigelow to achieve very deep transparency in an ultra-cold thermal gas (just above the Bose-Einstein Condensation threshold). The effort is to get extremely deep transparency (100 to 1000 optical depth or more) with relatively narrow resonances (10 kHz to 1 MHz). Our hope is that between the two approaches we will be at the forefront in single photon detection and low light level switching.

Other things we will be working on in this project include, the dark area theorem (studied by Eberly and co-workers), low light level optical logic for telecommunications and optical buffers.

TEACHING:

I have taught a wide range of courses over the last ten years.

Rochester (2002-2006)

- Physics 532/ Optics 552 – Quantum Optics II, this is a second year graduate course in quantum optics. The course was a study in modern quantum optics and

included, but was not limited to: Fock states, coherent states, squeezed states, beam splitters, Mach-Zehnder Interferometers, Brown-Twiss interferometers, multiports, parametric downconversion, commutation relations, Heisenberg's uncertainty principle, Einstein Podolsky Rosen Paradox, Bohm's spin-1/2 entanglement, Bell states, Bell's inequalities, Stimulated emission of entanglement, bell state interferometer, Franson interferometer (time-energy), momentum-position entanglement, quantum cryptography, quantum cloning machines, coherent amplifiers, quantum nondemolition measurements, and teleportation. I am in process of writing a book on this material. I have taught this course one time.

- Physics 243W -- Advanced Laboratory for Junior/ Senior Level students. The experiments in the course included: Franck-Hertz, Gamma-ray spectroscopy, Hall effect, Muon decay, Berry's phase in fibers, electron spin resonance, chaos in a diode circuit, water drop chaos. I have two goals for this class: improve the technical writing abilities of the students and improve their problem solving skills.
- Physics 121—Introductory calculus-based physics course in Newtonian mechanics for Freshmen. This course covers basic Newtonian mechanics. This course was difficult the first time around, but the second time has gone much smoother. I enjoy the interactions with the students and the class time is well spent with a combination of derivation, examples and demonstrations.

Oxford (2001 to 2002)

- Lectureship in mathematical physics at Brasenose College. I primarily taught the mathematics of quantum mechanics to second year students.

Penn State (1996 to 1999)

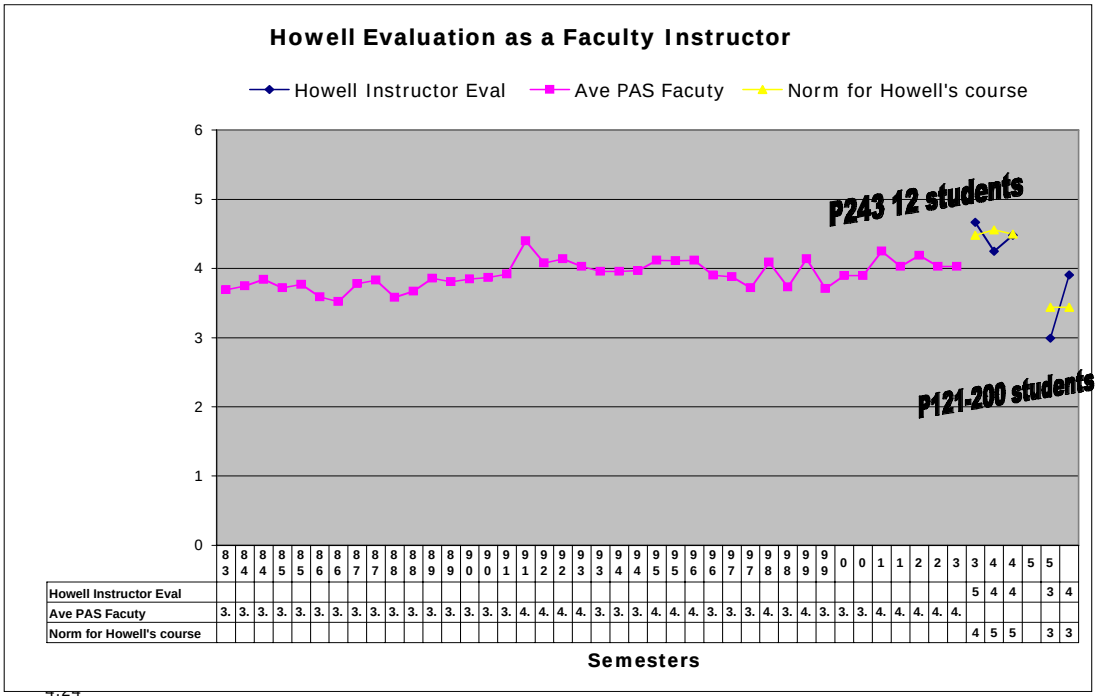
- Teaching Assistant for junior/senior level electronics laboratory. We covered a wide range of topics in basic electronics from basic linear circuits to TTL logic to transmission lines and impedance matching. I taught this two times.
- Teaching Assistant for junior/senior level optics laboratory. Once again, this lab covered many topics including, but not limited to: lens design, Fourier filtering/imaging, Michelson interference, acousto-optic modulators, diffraction, etalons.
- Teaching Assistant for introductory physics courses 121, 122 and 123 (Newtonian Mechanics, E&M, and Modern physics). I taught the recitation sections for each of these courses.

Utah State University (1994 to 1996)

- Temporary faculty for summer course in Newtonian mechanics.
- Laboratory assistant for Newtonian mechanics.

Semester	**UR Course**	**Instructor Rating/ Norm**	**Course Rating/ Norm**	**Response**	**Comments**
Teaching experience as a Teaching Assistant at Utah State (1994-1996). Temporary faculty for summer course in Newtonian mechanics. Laboratory assistant for Newtonian mechanics					
Teaching experience as a Teaching Assistant at Penn State (1996-2000). As a teaching assistant at Penn State, **selected as Physics Teaching Assistant of the year (an award shared with 2 other TA's) in 1999-2000**. Teaching experience at Penn State includes teaching assistantships in Introductory Calculus Based Physics courses for freshmen and sophomores at Penn State (Mechanics, Electricity and Magnetism and Modern Physics). Served as a TA in each of these courses (which are equivalent to					

PHY121, PHY122 and PHY123 at Rochester) for two-three semester in 1995-1998. Served as TA in the Undergraduate Optics Laboratory (for juniors and seniors) in Fall 1999, and in the Undergraduate Electronics Laboratory (for juniors and seniors) in Spring 1998 and Spring 1999					
At Oxford (2001-2002) served as a lecturer and tutor in Mathematical Physics (to second year students) and in Quantum Mechanics (to third year students) in Spring 2001 and Fall 2001-Winter 2002.					
S02	--	---	---	---	**Arrived at Rochester end of semester**
F02 (1)	**P243W/P 244W**	**4.10/4.45** **Attached**	**4.40/4.13** **Attached**	**10/17**	**Advanced Laboratory (Seniors, first time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_243W.html**
S03 (2)	**off**	**off**	**off**	**off**	**One semester off in first year**
F03 (3)	**P243W/P 244W**	**4.67/4.48** **Attached**	**4.56/4.25** **Attached**	**9/10**	**Advanced Lab (Seniors, second time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_243W.html**
S04 (4)	**P532**	**4.25/4.56** **Attached**	**4.00/4.21** **Attached**	**4/7**	**Quantum Optics of the electron II (2nd year grad students, first time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_532.html**
F04 (5) *Review for Reapp as Asst. Prof.*	**P243W/** **P244W/** **P245**	**4.48/4.50** **Attached**	**4.58/4.14** **Attached**	**12/12**	**Advanced Lab (Seniors, third time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_243W.html**
S05 (6)	**P121**	**2.99/3.44** **Attached**	**2.68/3.32** **Attached**	**87/196**	**Mechanics (Freshmen, first time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_121.html** **http://www.pas.rochester.edu/~howell/phys121-05/**
F05 (7)	**Jr. Leave**	---	---	---	**Junior Faculty Leave- Current**
S06 (8) *End of First term Assist .Prof*	**P121**	**3.91/3.44** **Reappointed for Second Term as Asst. Prof.**	**3.51/3.32** **Also under Review for promotion to Assoc. Prof. with tenure**	**95/193**	**Mechanics (Freshmen, 2nd time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_121.html** **http://www.pas.rochester.edu/~howell/phys121-05/** **Awarded 2006 Adolph Lomb Medal from the Optical Society of America Spring 06**
F06 *(9)* *Begin 2nd 3 year term*	**P243W** **/P244W/P 245**	**planned**	**TBA**	**~ 30**	**Advanced Lab (Seniors, fourth time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_243W.html**
S07 *(10)*	**P532**	**planned**	**TBA**	**~ 10**	**Quantum Optics of the electron II (2nd year grad students, second time)** **http://spider.pas.rochester.edu/mainFrame/education/pages/PHY_532.html**



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Howell Instructor Eval																																									5	4	4		3	4
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Norm for Howell's course																																									4	5	5		3	3

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