
STEVEN OLMSCHENK

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Department of Physics & Astronomy
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Education

- *University of Michigan, Ann Arbor, MI*
Ph.D. in Physics, Advisor: Professor Christopher Monroe (August 2009)
Thesis: “Quantum Teleportation Between Distant Matter Qubits”
M.S.E. in Electrical Engineering (August 2007)
M.Sc. in Physics (December 2005)
- *University of Chicago, Chicago, IL*
B.A. in Physics with Specialization in Astrophysics, Advisor: Professor Mark Oreglia (June 2004)
Thesis: “Searching for Bottom Squarks”
B.S. in Mathematics (June 2004)

Experience

- *Associate professor, Denison University*
August 2018 – Present
{*Assistant professor, August 2012 – August 2018*}
Courses taught include: General Physics II (Physics 122); Principles of Physics I: Quarks to Cosmos (Physics 125); Modern Physics (Physics 200); Electronics (Physics 211); and Introduction to Quantum Mechanics (Physics 330). Research focused on experimental atomic physics, quantum optics, and quantum information with trapped atomic ions.
- *Postdoctoral researcher: Ultracold atomic physics with optical lattices*, Supervisors: Doctor James (Trey) V. Porto and Doctor William D. Phillips, National Institute of Standards and Technology
July 2009 – July 2012
Ultracold atoms confined in an optical lattice to study strongly correlated many-body states and for applications in quantum information science.
- *Graduate research assistant: Trapped ion quantum computing*, Advisor: Professor Christopher Monroe, University of Michigan/Maryland
September 2004 – July 2009
Advancements in quantum information science accomplished through experimental study of individual atomic ions and photons.
- Earlier research: *High Energy Physics* (B.A. thesis); *Solar Physics* (NSF REU); *Radio Astronomy*.

Professional Societies

- American Physical Society
- American Association of Physics Teachers

Grants

- National Science Foundation, CAREER, PI: \$400,000 (May 2018 – April 2023)
- Cottrell College Science Award, Research Corporation for Science Advancement, PI: \$45,000 (July 2014 – June 2017)
- Army Research Office, PI: \$137,763 (August 2013 – November 2017)
- Denison University Research Foundation, PI: \$4,818 (May 2013 – May 2014)

Honors and Awards

- National Science Foundation CAREER (2018)
- NIST Sigma Xi Outstanding Poster Presentation, Physics, 2nd (2012)
- APS Division of Atomic, Molecular, Optical Physics (DAMOP) Thesis Prize Finalist (2010)
- National Research Council Postdoctoral Fellowship (July 2009 – July 2011)
- Peter Franken Award for Outstanding Graduate Research (2006)
- Ford Fellowship (September 2004 – August 2006)
- National Science Foundation REU (June 2003 – August 2003)

Courses

- *Physics 121 Lab: General Physics I Lab*, Denison University, Granville, OH
Fall 2012
Lab component of Physics 121 that explores the central ideas of mechanics and thermal physics experimentally. (After 2013-2014 academic year, class/lab linked in Physics 121-122.)
- *Physics 122: General Physics II*, Denison University, Granville, OH
Spring 2013, Spring 2014, Spring 2015, Spring 2017, Spring 2018
Second course in a year-long calculus-based introductory physics sequence, with a focus on the electromagnetic force. Topics include electric charge, electric and magnetic fields, circuits, waves, light, and optics.
- *Physics 122 Lab: General Physics II Lab*, Denison University, Granville, OH
Spring 2013
Lab component of Physics 122 that explores electricity, magnetism, and optics experimentally. (After 2013-2014 academic year, class/lab linked in Physics 121-122.)
- *Physics 125: Principles of Physics I (Quarks to Cosmos)*, Denison University, Granville, OH
Fall 2015, Fall 2016, Fall 2017
First course for students interested in physics or engineering. The focus of this course is to explore the extremes of the universe, and how these revelations impact notions of science and measurement. Topics include an introduction to special relativity, waves, quantum mechanics, radioactivity and nuclear structure.
- *Physics 200: Modern Physics*, Denison University, Granville, OH
Spring 2013, Spring 2014, Spring 2015
Course in modern ideas of physics, and their extensions into our understanding of the world today. Topics include relativity, quantum physics (including the Schrödinger equation), and atomic structure. Additional topics have included solid-state physics and quantum information.
- *Physics 211: Electronics*, Denison University, Granville, OH
Fall 2012, Fall 2013, Fall 2014

A course in digital and analog electronics with an emphasis on circuit design and lab work. Topics include binary encoding, combinational and sequential logic, microcontrollers and FPGAs, AC circuits, transistors, op-amps, and interfacing with scientific instruments. Includes two labs each week.

- *Physics 330: Introduction to Quantum Mechanics*, Denison University, Granville, OH
Fall 2013, Fall 2015, Fall 2016, Fall 2017
A rigorous course in quantum mechanics covering wave functions, stationary states, angular momentum, mathematical formalism, and other fundamentals of quantum physics. Additional topics in quantum information are also introduced.
- Also: *Physics 361 (Directed Study)*; *Physics 362 (Directed Study)*; *Physics 363 (Independent Study)*; *Physics 364 (Independent Study)*; *Physics 451 (Senior Research)*; *Physics 452 (Senior Research)*

University Service (Selected)

- Student Research Grants Committee (2015 – 2018)
- Student Commencement Speaker Committee (2017 – present)
- Anderson Lecture host/organizer (2015 – 2016)
- Anderson Scholarship Committee (2015, 2017)
- Denison Scientific Association (DSA) co-organizer (2013 – 2014)
- Responsible Conduct of Research (RCR) co-organizer (co-founder; 2014 – present)
- Physics comprehensive exam committee (2013 – 2015, 2016 – 2017)
- Physics GRE preparation group (founder; 2012 – present)
- June Orientation advisor (2014, 2015, 2016, 2017)
- Participant, representative, or discussion leader in numerous activities for teaching, admissions, etc.

External Service (Selected)

- Journal referee: *Science*; *Nature*; *Nature Photonics*; *Nature Communications*; *Physical Review Letters*; *Physical Review A*; *Optics Express*; *New Journal of Physics*; *Int. J. Quantum Information*; *Quantum Information Processing*; *Applied Physics B*; *Review of Scientific Instruments*; *Physica Scripta*; *American Journal of Physics*
- Grant reviewer: *Research Corporation for Science Advancement*; *National Science Foundation Panelist (2019)*
- APS DAMOP Education Committee (Fall 2016 – Summer 2018; chair from Fall 2017 – Summer 2018)
- APS DAMOP session chair (June 2015, May 2016, June 2017)
- CUR Posters on the Hill reviewer (2019)
- Observatory open houses
- Planetarium shows

Publications in Refereed Journals

(** denotes a Denison University student coauthor)

22. S. Olmschenk, P. R. Banner**, J. Hankes**, and A. M. Nelson**, "Optogalvanic spectroscopy of the hyperfine structure of the $5p^65d^2D_{3/2,5/2}$ and $5p^64f^2F_{5/2,7/2}^o$ levels in La III," *Phys. Rev. A* **96**, 032502 (2017).
21. S. Olmschenk and P. Becker**, "Laser ablation production of Ba, Ca, Dy, Er, La, Lu, and Yb ions," *Appl. Phys. B* **123**, 99 (2017).
20. R. C. Brown, S. Olmschenk, S. Wu, A. M. Dyckovsky, R. Wyllie, and J. V. Porto, "Note: Pneumatically actuated and kinematically positioned optical mounts compatible with laser-cooling experiments," *Rev. Sci. Instrum.* **84**, 096101 (2013).

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19. A. M. Dyckovsky and S. Olmschenk, "Analysis of photon-mediated entanglement between distinguishable matter qubits," *Phys. Rev. A* **85**, 052322 (2012).
 18. R. Chicireanu, K. D. Nelson, S. Olmschenk, N. Lundblad, A. Derevianko, and J. V. Porto, "Differential Light-Shift Cancellation in a Magnetic-Field-Insensitive Transition of ^{87}Rb ," *Phys. Rev. Lett.* **106**, 063002 (2011).
 17. S. Olmschenk, R. Chicireanu, K. D. Nelson, and J. V. Porto, "Randomized benchmarking of atomic qubits in an optical lattice," *New J. Phys.* **12**, 113007 (2010).
 16. S. Pironio, A. Acin, S. Massar, A. Boyer de la Giroday, D. N. Matsukevich, P. Maunz, S. Olmschenk, D. Hayes, L. Luo, T. A. Manning, and C. Monroe, "Random Numbers Certified by Bell's Theorem," *Nature* **464**, 1021 (2010).
 15. D. Hayes, D. N. Matsukevich, P. Maunz, D. Hucul, Q. Quraishi, S. Olmschenk, W. Campbell, J. Mizrahi, C. Senko, and C. Monroe, "Entanglement of Atomic Qubits using an Optical Frequency Comb," *Phys. Rev. Lett.* **104**, 140501 (2010).
 14. S. Olmschenk, D. Hayes, D. N. Matsukevich, P. Maunz, D. L. Moehring, and C. Monroe, "Quantum Logic Between Distant Trapped Ions," *Int. J. Quant. Info.* **8**, 337 (2010).
 13. L. Luo, D. Hayes, T.A. Manning, D.N. Matsukevich, P. Maunz, S. Olmschenk, J.D. Sterk, and C. Monroe, "Protocols and Techniques for a Scalable Atom-Photon Quantum Network," *Fortschritte der Physik* **57**, 1133 (2009).
 12. S. Olmschenk, D. Hayes, D. N. Matsukevich, P. Maunz, D. L. Moehring, K. C. Younge, and C. Monroe, "Measurement of the lifetime of the $6p\ ^2P_{1/2}^o$ level of Yb^+ ," *Phys. Rev. A* **80**, 022502 (2009).
 11. P. Maunz, S. Olmschenk, D. Hayes, D. N. Matsukevich, L.-M. Duan, and C. Monroe, "Heralded Quantum Gate between Remote Quantum Memories," *Phys. Rev. Lett.* **102**, 250502 (2009).
 10. S. Olmschenk, D. N. Matsukevich, P. Maunz, D. Hayes, L.-M. Duan, and C. Monroe, "Quantum Teleportation Between Distant Matter Qubits," *Science* **323**, 486 (2009).
 9. D. N. Matsukevich, P. Maunz, D. L. Moehring, S. Olmschenk, and C. Monroe, "Bell Inequality Violation with Two Remote Atomic Qubits," *Phys. Rev. Lett.* **100**, 150404 (2008).
 8. D. Hucul, M. Yeo, W. K. Hensinger, J. Rabchuk, S. Olmschenk, and C. Monroe, "On the Transport of Atomic Ions in Linear and Multidimensional Ion Trap Arrays," *Quant. Inf. Comp.* **8**, 501 (2008).
 7. S. Olmschenk, K. C. Younge, D. L. Moehring, D. N. Matsukevich, P. Maunz, and C. Monroe, "Manipulation and Detection of a Trapped Yb^+ Hyperfine Qubit," *Phys. Rev. A* **76**, 052314 (2007).
 6. D. L. Moehring, P. Maunz, S. Olmschenk, K. C. Younge, D. N. Matsukevich, L.-M. Duan, and C. Monroe, "Entanglement of single-atom quantum bits at a distance," *Nature* **449**, 68 (2007).
 5. P. Maunz, D. L. Moehring, S. Olmschenk, K. C. Younge, D. N. Matsukevich, and C. Monroe, "Quantum interference of photon pairs from two remote trapped atomic ions," *Nature Physics* **3**, 538 (2007).
 4. L. Deslauriers, M. Acton, B. B. Blinov, K.-A. Brickman, P. C. Haljan, W. K. Hensinger, D. Hucul, S. Katnik, R. N. Kohn Jr., P. J. Lee, M. J. Madsen, P. Maunz, S. Olmschenk, D. L. Moehring, D. Stick, J.

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- Sterk, M. Yeo, K. C. Younge, and C. Monroe, "Efficient Photoionization-Loading of Trapped Ions with Ultrafast Pulses," *Phys. Rev. A* **74**, 063421 (2006).
 3. L. Deslauriers, S. Olmschenk, D. Stick, W. K. Hensinger, J. Sterk, C. Monroe, "Scaling and Suppression of Anomalous Quantum Decoherence in Ion Traps," *Phys. Rev. Lett.* **97**, 103007 (2006).
 2. W. K. Hensinger, S. Olmschenk, D. Stick, D. Hucul, M. Yeo, M. Acton, L. Deslauriers, C. Monroe, and J. Rabchuk, "T-junction ion trap array for two-dimensional ion shuttling, storage, and manipulation," *App. Phys. Lett.* **88**, 034101 (2006).
 1. D. Stick, W. K. Hensinger, S. Olmschenk, M. J. Madsen, K. Schwab, and C. Monroe, "Ion trap in a semiconductor chip," *Nature Physics* **2**, 36 (2006).

Other Scientific Publications (Selected)

4. S. Olmschenk, "Quantum optics: Linking crystals with a single photon," *Nature Photon.* **6**, 221 (2012).
3. S. Olmschenk, S. Pironio, A. Acin, S. Massar, A. Boyer de la Giroday, D. N. Matsukevich, P. Maunz, D. Hayes, L. Luo, T. A. Manning, and C. Monroe, "Private random number generation through remote atom entanglement," *IEEE Photonics Society Summer Topical Meeting Series*, 31 (2011).
2. D. Stick, W. K. Hensinger, S. Olmschenk, and C. Monroe, "Semiconductor Traps for Laser-Cooled Atomic Ions and Scalable Quantum Computing," *IEEE Lasers and Electro-Optic Society Newsletter* **20** (3), 13 (June, 2006).
1. D. L. Moehring, M. Acton, B. B. Blinov, K.-A. Brickman, L. Deslauriers, P. C. Haljan, W. K. Hensinger, D. Hucul, R. N. Kohn, P. J. Lee, M. J. Madsen, P. Maunz, S. Olmschenk, D. Stick, M. Yeo, C. Monroe, and J. Rabchuk, "Ion Trap Networking: Cold, Fast, and Small," *Laser Spectroscopy XVII*, E. A. Hinds, A. Ferguson, and E. Riis, (eds.), World Scientific, Singapore 2005, pp. 421-428.

Invited Conference Presentations, Seminars, and Colloquia

29. July 2018, Spectroscopy Institute at Ohio State University, Columbus, OH, "AMO Physics at Denison University."
28. December 2017, Williams College, Williamstown, MA, "Quantum Information with Atoms and Light."
27. June 2017, Army Research Office Physics Program Review, Cocoa B., FL, "Laser cooling trapped ions with telecom light for applications in quantum information."
26. May 2017, Ohio State University, Columbus, OH, "Ions and Photons for Quantum Information."
25. April 2017, Smith College, Northampton, MA, "Ions and Photons for Quantum Information."
24. April 2017, Amherst College, Amherst, MA, "Ions and Photons for Quantum Information."
23. March 2017, Denison University (Faculty Research Dinner), Granville, OH, "Lasers, Atoms, and Bits."
22. January 2017, Optics and Photonics Workshop, Tucson, AZ, "Ions and Photons for Quantum Information."
21. February 2016, College of Wooster, Wooster, OH, "Quantum Information with Ions and Photons."

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20. April 2015, Otterbein University, Westerville, OH, "Quantum information with atoms and light."
 19. September 2014, Denison University (Tuesday Lunch), Granville, OH, "Quantum information with atoms and light."
 18. September 2014, Kenyon College, Gambier, OH, "Quantum information with atoms and light."
 17. March 2014, Ohio Northern University, Ada, OH, "Quantum Information with Trapped Ions and Telecom Photons."
 16. April 2013, Wabash College, Crawfordsville, IN, "Teleportation, Randomness, and Entanglement."
 15. March 2013, Denison University (DSA seminar), Granville, OH, "Teleportation, Randomness, and Entanglement."
 14. October 2012, New Laser Scientists Conference, Rochester, NY, "Quantum Information with Trapped Ions and Telecom Photons."
 13. January 2012, Institute for Quantum Computing/University of Waterloo, Waterloo, Canada, "Quantum Information with Atoms and Light."
 12. January 2012, University of Oregon, Eugene, OR, "Quantum Information with Atoms and Light."
 11. December 2011, Denison University (department seminar), Granville, OH, "Quantum Teleportation and Information Processing with Atoms and Light."
 10. July 2011, IEEE Photonics Summer Topicals Meeting, Montreal, Canada, "Private random number generation through remote atom entanglement."
 9. February 2011, Cornell University, Ithaca, NY, "Quantum information with atoms and light."
 8. February 2011, Princeton University, Princeton, NJ, "Quantum information with atoms and light."
 7. October 2010, SPIE/OSA Student Chapter, University of Maryland, College Park, MD, "Quantum teleportation between distant matter quantum bits."
 6. May 2010, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Houston, TX, "Quantum Information Processing with Ions and Photons."
 5. May 2009, National Institute of Standards and Technology (QIBEC Seminar), Gaithersburg, MD, "Quantum Teleportation Between Distant Matter Qubits."
 4. March 2009, Georgia Tech Research Institute, Atlanta, GA, "Quantum Teleportation between Remote Atoms."
 3. March 2009, Sandia National Lab, Albuquerque, NM, "Quantum Teleportation between Remote Atoms."
 2. February 2009, Integrated Atomic Systems II, Seattle, WA, "Quantum Computation with Ions and Photons."
 1. February 2007, University of Michigan (FOCUS short-talk), Ann Arbor, MI, "Quantum Interference of Photon Pairs from Two Trapped Ions."

Contributed Conference Presentations and Posters

(** presented by a Denison University student)

23. June 2017, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Sacramento, CA, "Toward laser cooling and trapping lanthanum ions," (Presentation).
22. **June 2017, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Sacramento, CA, "Towards trapping and laser cooling Ba and La ions," Jessie Hankes** ('17), Amanda Nelson** ('17), Patrick Banner** ('18), Steven Olmschenk (Poster).
21. **June 2017, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Sacramento, CA, "Optogalvanic spectroscopy of lanthanum hyperfine structure," Amanda Nelson** ('17), Jessie Hankes** ('17), Patrick Banner** ('18), Steven Olmschenk (Poster).
20. **January 2017, Optics and Photonics Winter School and Workshop, Tucson, AZ, "Optogalvanic Spectroscopy of La I Hyperfine Structure," Jessie Hankes** ('17), Amanda Nelson** ('17), Patrick Banner** ('18), Steven Olmschenk (Poster).
19. February 2016, Southwest Quantum Information and Technology (SQuInT) Workshop, Albuquerque, NM, "Towards Laser Cooling of Trapped Ions with Telecom Light" (Poster).
18. November 2015, Midwest Cold Atom Workshop (MCAW), Madison, WI, "Towards Laser Cooling of Trapped Ions with Telecom Light" (Poster).
17. **July 2015, Ohio College Summer Research Symposium, Delaware, OH, "Progress Towards Laser Cooling Barium Ions," Patrick Becker** ('16), Zach Pewitt** ('16), Steven Olmschenk (Presentation).
16. **July 2015, Ohio College Summer Research Symposium, Delaware, OH, "Progress towards trapping and laser cooling of Ba⁺," Zach Pewitt** ('16), Patrick Becker** ('16), Steven Olmschenk (Poster).
15. **June 2015, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Columbus, OH, "Towards Laser Cooling Trapped Ions with Telecom Light," Kristina Dungan** ('15), Patrick Becker** ('16), Liz Donoghue** ('15), Jackie Liu** ('15), Steven Olmschenk (Poster).
14. **June 2015, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Columbus, OH, "La Saturated Absorption Spectroscopy for Applications in Quantum Information," Patrick Becker** ('16), Liz Donoghue** ('15), Kristina Dungan** ('15), Jackie Liu** ('15), Steven Olmschenk (Poster).
13. July 2014, Quantum Science Gordon Research Conference, Easton, MA, "Towards Laser Cooling Ions with Telecom Light" (Poster).
12. **July 2014, Ohio College Summer Research Symposium, Delaware, OH, "La Saturated Absorption Spectroscopy for Applications in Quantum Information," Patrick Becker** ('16), Liz Donoghue** ('15), Jackie Liu** ('15), Steven Olmschenk (Poster).
11. June 2014, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Madison, WI, "Towards Laser Cooling Ions with Telecom Light" (Poster).
10. **November 2013, Midwest Cold Atom Workshop (MCAW), West Lafayette, IN, "Towards Quantum Information with Ions and Telecom Photons," B. Bedacht** ('14), N. Theisen** ('14), S. Olmschenk (Poster).

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9. February 2011, Southwest Quantum Information and Technology (SQuInT) Conference, Boulder, CO, “Randomized benchmarking of atomic qubits and differential light shift cancellation in an optical lattice” (Presentation).
 8. May 2009, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Charlottesville, VA, “Precision measurement of the lifetime of the $6p\ ^2P_{1/2}$ level of Yb^+ ” (Poster).
 7. July 2008, International Conference in Atomic Physics (ICAP), Storrs, CT, “Quantum Information Processing with Ions and Photons” (Poster).
 6. May 2008, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, State College, PA, “Ytterbium Ion Qubits for Quantum Information Processing” (Presentation).
 5. August 2007, EYSCQI Conference, Vienna, Austria, “Quantum Information Processing with Ions and Photons” (Presentation).
 4. July 2007, Atomic Physics Gordon Research Conference, Tilton, NH, “Ultrafast Control of a Single Ion and Yb^+ Qubits” (Poster).
 3. May 2006, APS Division of Atomic, Molecular, and Optical Physics (DAMOP) Conference, Knoxville, TN, “Scaling and Suppression of Heating in an Adjustable Ion Trap” (Presentation).
 2. February 2006, Southwest Quantum Information and Technology (SQuInT) Conference, Albuquerque, NM, “Micron-Scale Ion Traps” (Poster).
 1. November 2005, Midwest Cold Atom Workshop (MCAW), Urbana, IL, “Heating in Novel Micron-Scale Ion Traps” (Poster).

Popular accounts of research: APS News, BBC Radio News, Der Spiegel, Discover Magazine, GlobalPost, FOX News, IEEE Spectrum, MSNBC, Nature News, New Scientist, New York Times, NPR, NSF, Odyssey Magazine, PBS, Physics Today, Physics World, PhysOrg, Popular Science, Salon, Science Daily, Science News, Scientific American, The Science Channel (Discovery Network), Time Magazine, Through the Wormhole with Morgan Freeman, Wired, WUSA 9 Evening News.

Undergraduate Student Researchers (Denison University)

- Rahul Shrestha ('21): summer 2018.
- Tongyao (Cornelia) Wang ('19): summer 2018.
- Patrick Banner ('18): summer 2016; summer 2017; fall 2017; spring 2018. Last known position: graduate student (physics), U Maryland.
- Jessica (Jessie) Hankes ('17): summer 2016; fall 2016; spring 2017. Last known position: system engineer, ASSETT, Inc.
- Amanda Nelson ('17): summer 2016; spring 2017. Last known position: .
- Patrick Becker ('16): summer 2014; fall 2014; spring 2015; summer 2015; fall 2015; spring 2016. Last known position: graduate student (physics), U Maryland.
- Edward (Zach) Pewitt ('16): summer 2015. Last known position: graduate intern at Boeing.
- Kristina Dungan ('15): fall 2014; spring 2015. Last known position: graduate student (physics), U Illinois.
- Elizabeth Donoghue ('15): summer 2014. Last known position: graduate student (physics), U Arizona.
- Dongwei (Jackie) Liu ('15): summer 2014; fall 2014; spring 2015. Last known position: graduate student (operations research and information engineering), Cornell U.
- Eric Meier ('14): spring 2014. Last known position: graduate student (physics), U Illinois.

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- Bradley Bedacht ('14): summer 2013; spring 2014. Last known position: graduate student (electrical engineering), U Cincinnati.
 - Nick Theisen ('14): summer 2013; spring 2014. Last known position: City Year corp member, Detroit.

High School Student Researchers

- Ari Dyckovsky (Loudoun Academy of Science, VA): January 2010-June 2012. Last known position: undergraduate student, Stanford U.