Alexander P. Burgers

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Education

Washington University, St. Louis, MO. *September 2003 to May 2007*
B.S. in Physics, Second Major in Applied Math

University of Michigan, Ann Arbor, MI *September 2008 to July 2015*
Ph.D. Physics

Academic Research Experience

Princeton University Princeton, NJ
Postdoctoral Scholar (Adviser: Jeff Thompson) *Aug. 2019 to present*
- Ytterbium tweezer arrays for quantum computing
- Strong atom-atom interactions through Rydberg states

California Institute of Technology Pasadena, CA
Postdoctoral Scholar (Adviser: Jeff Kimble) *Aug. 2015 to Aug. 2019*
Promoted to Quantum Optics Research Scientist (Sep. 2017)
- Quantum optics with atoms trapped near nanophotonic structures
- Atom photon interactions in photonic crystal waveguides

University of Michigan Physics Department Ann Arbor, MI
Graduate Student Research Assistant (Adviser: Duncan Steel) *May 2010 to July 2015*
- Quantum dot spectroscopy
- Quantum information and entanglement studies with quantum dots

University of Michigan Physics Department Ann Arbor, MI
Graduate Student Research Assistant (Adviser: Bing Zhou) *Feb. 2009 to May 2010*
- Experimental high energy physics (ATLAS collaboration)

Princeton University Physics Department Princeton, NJ
Research Scientist (Supervisor: Christiano Galbiati) *July 2007 to July 2008*
- Astroparticle physics/detector characterization

Washington University Physics Department St. Louis, MO
Undergraduate Research Assistant (Adviser: Henric Krawczynski) *June 2004 to May 2007*
- X-Ray astrophysics

Academic Honors

Wirt and Mary Cornwell Prize (University of Michigan) *2015*
"Given to a single graduate student who has demonstrated the greatest intellectual curiosity, original study and creative work."

Ford Fellowship (University of Michigan) *2008 to 2010*
"Given to one incoming graduate student covering full tuition and stipend for 2 years."

McDonnell Fellowship (Washington University) *2006*

Undergraduate research funding

Teaching Experience

Graduate student instructor for "Applied Quantum Mechanics" *2014*

- Leading two recitation sections each week and grading assignments.

Graduate student instructor "Electricity and Magnetism Lab" *2011*

- Taught two labs each week covering concepts in E&M.

Volunteering & Outreach

Career Day Volunteer at KIPP Illuminar Academy, East Los Angeles *2016-2019*

- Talk with students about a career in STEM.

Innovation day volunteer at KIPP Illuminar Academy, East Los Angeles *2017-2109*

- Helps students navigate projects promoting science and engineering.

Physics Graduate council *__Founding Member__*, Michigan 2014-2015

- Organize events and outreach.

Coordinator for Physics gradstudent summer symposium, Michigan 2010

- Organize summer lecture series; line up speakers.

Journal Referee

- Physical Review Letters
- Quantum Materials, Nature

Publications

Burgers, A. P., Ma, S., Liu, G., Wilson, J., Zhang, B., Thompson, J. D., *High-fidelity multi-qubit gates in Yb atom arrays using a nuclear spin qubit.* In preparation (2021)

Burgers, A. P., Ma, S., Saskin, S., Wilson, J., Thompson, J. D., *Controlling Rydberg excitations using ion core transitions in alkaline earth tweezer arrays.* In review PRX Quantum (2021) arXiv:2110.06902

Beguin, J., Laurat, J., Luan, X., **Burgers, A. P.**, Luan, X. Qin, Z., & Kimble, H. J. *Reduced volume and reflection for bright optical tweezers with radial Laguerre-Gauss beams.* Proc. Natl. Acad. Sci. **117,** 26019-26117 (2020) arXiv:2001.11498

X. Luan, J-B Beguin, **A. P. Burgers,** ZZ Qin, S-P Yu, H. J. Kimble, *The Integration of Photonic Crystal Waveguides with Atom Arrays in Optical Tweezers.* Advanced Quantum Technologies **2020**, 2000008.

Wilson, J., Saskin, S., Meng, Y., Ma, S., **Burgers, A. P**. Thompson, J. D., *Efficient trapping of alkaline earth Rydberg atoms in optical tweezers.* In review Phys Rev Lett (2021). arXiv:1912.08754

Beguin*, J., **Burgers*, A. P.**, Luan, X. Qin, Z., & Kimble, H. J. *An advanced apparatus for the integration of nanophotonics and cold atoms*. Optica, **7,** 1 (2020). arXiv:1912.02198
*Equal contribution

Burgers, A. P., Peng, L. S., Muniz, J. A., McClung, A. C., M. J. Martin & Kimble, H. J. *Clocked delivery of cold atoms to a photonic crystal waveguide.* Proc. Natl. Acad. Sci. **116**, 456-465 (2019). arXiv:1810.07757

Beguin, J., Qin, Z., **Burgers, A. P**., Peng, L. S., & Kimble, H. J. *Mechanical modes in a photonic crystal waveguide*. In Preparation (2019).

Paudel, U., **Burgers, A. P**., Yakes, M. K., Bracker, A. S., Gammon, D., & Steel, D. G. *Frequency-dressing a stream of single photons with preserved coherence*. Phys. Rev. A **98**, 011802(R) (2018).

Hill, A. D., Hervas, D., Nash, J., Graham, M., **Burgers, A. P**., Paudel, U., ... & Wang, J. *Optimizing single-mode collection from pointlike sources of single photons with adaptive optics.* Optics Express, **25(16)**, 18629-18642 (2017).

Burgers, A. P. *"Towards Quantum Teleportation from a Spontaneous Parametric Down-Conversion Source to a Quantum Dot Spin by Hong-Ou-Mandel Interference."* Dissertation, University of Michigan (2015).

Burgers, A. P., Schaibley, J. S., Steel, D. G., *Entanglement and Quantum Optics with Quantum Dots*, In "*From Atomic to Mesoscale: The Role of Quantum Coherence in Systems of Various Complexities".* World Scientific Press, Ed. Svetlana Malinovskaya, Irina Novikova, and Christian Buth. (2015).

Schaibley*, J. S., **Burgers*, A. P**., McCracken, G. A., Duan, L-M, Berman, P. R., Bracker, A. S., Gammon, D., Sham, L. J., Steel, D. G., *Demonstration of Quantum Entanglement Between a single Quantum Dot Electron Spin and a Photon.* Phys. Rev. Lett. **110**, 167401 (2013). Editor's Choice in **Science**.
*Equal contribution

Schaibley, J.S., **Burgers, A.P**., McCracken, G.A., Bracker, A.S., Gammon, D., Sham, L.J., Steel, D.G., *Direct Detection of Time Resolved Rabi Oscillations in a Single Quantum Dot via Resonance Fluorescence.* Phys. Rev. B **87**, 115311 (2013)

Invited Talks

Quantum Science with Ytterbium Rydberg Atoms in Optical Tweezer Arrays. APS March Meeting, Denver, CO (March 2020)

Quantum Matter Built from Strongly Interacting Systems of Atoms and Photons. Department of Phyiscs, Washington University in St. Louis, St. Louis, MO (February 2020)

Atom-Light Interactions in Photonic Crystal Waveguides. Department of Phyiscs, University of Indiana, Bloomington, IN (February 2019)

Atom-Light Interactions in Photonic Crystal Waveguides. Department of Physics and Astronomy, University of Rochester, Rochester, NY (January 2019)

Engineering Atom-Light Interactions in Photonic Crystal Waveguides. Physics of Quantum Electronics Conference (PQE), Snowbird, UT (January 2019)

Engineering Atom-Light Interactions in Photonic Crystal Waveguides. Physics Department, Washington University, St. Louis, MO (Novemebr 2018)

Engineering Atom-Light Interactions in Photonic Crystal Waveguides. College of Optical Sciences, University of Arizona, Tucson, AZ (February 2018)

Engineering Atom-Light Interactions in Photonic Crystal Waveguides. Physics Department, Princeton University, Princeton, NJ (December 2017).

Engineering Light-Matter Interactions in Photonic Crystal Waveguides. Institute for Quantum Information and Matter, California Institute of Technology, Pasadena, CA (November 2017)

Coherent Optical Control of Quantum Dots: Spin Qubits and Flying Qubits APS March Meeting, San Antonio, TX (2015)

Conference Presentations

A. P. Burgers, S. Ma, S. Saskin, J. Wilson, J.D. Thompson *"Quantum Science with Ytterbium Rydberg Atoms in Optical Tweezer Arrays"* APS Division of Atomic, Molecular and Optical Physics, Vitural (2021)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Engineering Atom-Light Interactions in Photonic Crystal Waveguides"* Gordon Research Conference: Atomic Physics, Newport, RI (2019)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Engineering Atom-Light Interactions in Photonic Crystal Waveguides"* International Conference on Atomic Physics (ICAP), Barcelona, Spain (2018)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Engineering Atom-Light Interactions in Photonic Crystal Waveguides"* Gordon Research Conference: Quantum Science, Easton, MA (2018)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Engineering Atom-Light Interactions in Photonic Crystal Waveguides"* APS March Meeting, Los Angeles, CA (2018)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Engineering Atom-Light Interactions in Photonic Crystal Waveguides"* APS Division of Atomic, Molecular and Optical Physics, Sacramento, CA (2017)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Optical Lattice Transport of Atoms to Photonic Crystals"*, Workshop on Light Matter Interactions in Low Dimensions. ICFO, Castel De Fells, Spain (2017)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Optical Lattice Delivery of Atoms to Photonic Crystals"* Gordon Research Conference: Atomic Physics, Newport, RI (2017)

A. P. Burgers, L. S. Peng, J.A. Muniz, A.C. McClung, H.J. Kimble, *"Nanoscopic Atomic Lattices with Light Mediated Interactions"* Gordon Research Conference: Quantum Science, Easton, MA (2016)

A. P. Burgers, J. R. Schaibley, G. A. McCracken, L.-M. Duan, P. R. Berman, and D. G. Steel A.S. Bracker and D. Gammon L. J. Sham, *"Entanglement between a Quantum Dot and a Photon"*, Quantum Innovators Workshop, Waterloo, Canada (2014).

A. P. Burgers, J. R. Schaibley, G. A. McCracken, L.-M. Duan, P. R. Berman, and D. G. Steel A.S. Bracker and D. Gammon L. J. Sham, *"Demonstration of Entanglement between a photon and a Quantum Dot"*, APS Division of Laser Science Annual Meeting, Laser Science, Orlando, FL (2013).

A. P. Burgers, J. R. Schaibley, G. A. McCracken, L.-M. Duan, P. R. Berman, D. G. Steel, Allan Bracker, Daniel Gammon, and Lu Sham, *"Direct Detection of Optical Rabi Oscillations from a Single Quantum Dot"* CLEO/QELS, San Jose, CA (2013).