

BRANDON J. FUREY

Postdoctoral Researcher - Quantum Physics



CONTACT

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COMPUTER SKILLS

Python (QuTiP, Jupyter) 4+ yrs

OOP, Git, collaborative 1 yr

MATLAB 12+ yrs

Mathematica 10+ yrs

LabVIEW 11+ yrs

LaTeX 12+ yrs

SolidWorks 3+ yrs

EDUCATION

Ph.D. - Physics

University of Texas at Austin - Austin, TX (USA)

2021

Dissertation: Nonlinear Absorption Spectroscopy and Anisotropy of Bulk Semiconductors and Nanocrystalline Silicon Quantum Dots **GPA: 3.65**

Supervisor: Prof. Michael C. Downer

B.A. - Physics and Mathematics

Gustavus Adolphus College - St. Peter, MN (USA)

2012

Honors: *Cum laude, Sigma Pi Sigma, Sigma Xi*

GPA: 3.51

RESEARCH EXPERIENCE

Postdoctoral Researcher

- QCosmo (Philipp Schindler)

- Quantum Optics & Spectroscopy (Rainer Blatt)

Universität Innsbruck, Innsbruck (Austria)

2022 - present

I am investigating theoretically and experimentally the feasibility of implementing a QEC code utilizing the rotational states of a single molecular ion confined in a linear Paul trap. State preparation and logic operations are achieved with a combination of Raman frequency comb spectroscopy and a single microwave tone. Error syndrome readout and measurement is assisted by quantum logic spectroscopy which couples QI from the molecule to the electronics states of a co-trapped atomic ion.

Graduate Research Assistant

- Femtosecond Spectroscopy (Michael Downer)

University of Texas at Austin, Austin, TX (USA)

2012 - 2021

I measured time-resolved two-photon absorption (2PA) spectra and anisotropy in bulk semiconductors (Si, GaAs, GaP) and 2PA-induced photoluminescence in nanocrystalline Si quantum dots.

Collaboration

- Óptica Ultrarrápida (Ramon Carriles)

Centro de Investigaciones en Optica, Leon (Mexico)

2018 - 2019

I built and performed nonlinear optical experiments as a visiting experimentalist for 2 campaigns over 8 months.

Undergraduate Research

- Molecular Ion Trapping (Jessie Petricka)

Gustavus Adolphus College, St. Peter, MN (USA)

2011 - 2012

I developed a linear Paul ion trap and loaded SrF⁺ ions by ablation. I also built a time-of-flight radial-extraction mass spectrometer.

Internship

- NASA Student Airborne Research Program

University of California Irvine, Irvine, CA (USA)

2011

I collected hyperspectral imagery of almond and pistachio orchards in California from the NASA DC-8 aircraft to model crop water stress.

SKILLS

Ti:Sapphire Lasers	10+ yrs
Frequency Combs	1+ yrs
Fiber Amplifiers	1+ yrs
OPAs	10+ yrs
Diode Lasers	1+ yrs
AOMs	1+ yrs
Fiber Optics	2+ yrs
Linear Paul Ion Traps	2+ yrs
Ultra-High Vacuum	2+ yrs
Clean Room	3+ yrs
Machining and CAD	11+ yrs
Ellipsometry	3+ yrs
Electron Microscopy	2+ yrs

PROFESSIONAL DEVELOPMENT

German Language (B1)

Universität Innsbruck ongoing
10 ECTS course on German as a foreign language.

German Language (A2)

Universität Innsbruck 2023
Certificate: 10 ECTS course on German as a foreign language.

Machine Learning

Coursera, Inc. ongoing
60 hr online course on machine learning.

PUBLICATIONS

- Two-photon excitation spectroscopy of silicon quantum dots and ramifications for bio-imaging** 2022
ACS Nano, Vol 16, Issue 4, 6023-6033
doi: 10.1021/acsnano.1c11428
B.J. Furey, B.J. Stacy, T. Shah, R.M. Barba-Barba, R. Carriles, A. Bernal, B.S. Mendoza, B.A. Korgel, and M.C. Downer
- Im $\{\chi^{(3)}\}$ spectra of 110-cut GaAs, GaP, and Si near the two-photon absorption band edge** 2021
J. Appl. Phys., Vol 129, Issue 18, 183109
doi: 10.1063/5.0047478
B.J. Furey, R.M. Barba-Barba, R. Carriles, A. Bernal, B.S. Mendoza, and M.C. Downer
- Measurement of two-photon absorption of silicon nanocrystals in colloidal suspension for bio-imaging applications** 2018
Phys. Status Solidi B, Vol 255, Issue 4, 1700501
doi: 10.1002/pssb.201700501
B.J. Furey, D.A. Silbaugh, Y. Yu, A.C. Guillaussier, A.D. Estrada, C. Stevens, J.A. Maynard, B.A. Korgel, and M.C. Downer

FELLOWSHIPS & GRANTS

- 1000 Ideas: Molecular Quantum Error Correction FWF (Austria), Quantum Austria Initiative** 2022-2024
Grant of €152,100 for completely new, daring or particularly original research ideas that are beyond current scientific understanding.
- Glenn Focht Memorial Fellowship in Laser Physics University of Texas at Austin** 2019, 2020
Summer support in the amount of \$10,600 (each) for physics Ph.D. candidates who are pursuing research in experimental physics using lasers.

CONFERENCES & WORKSHOPS

- SFB BeyondC Workshop Universität Wien, Vienna, Austria** 2023
Presenting: *Precision spectroscopy and quantum information with trapped molecular ions*, B.J. Furey, S. Walser, Z. Wu, R. Nardi, G. Mu, and P. Schindler
- DPG SAMOP23 Hannover Universität, Hannover, Germany** 2023
Presenting: *Group report: Precision spectroscopy and quantum information with trapped molecules*, B.J. Furey, S. Walser, Z. Wu, G. Mu, R. Nardi, et al.
- North American Conference on Trapped Ions 22 Duke University, Durham, NC (USA)** 2022
Presenting: *Quantum state characterization and coherent control of molecular ions*, B.J. Furey, Z. Wu, S. Walser, V. Podlesnic, G. Mu, and P. Schindler
- STAQ Quantum Ideas Virtual Summer School Duke University, Durham, NC (USA)** 2021
Attended NSF-funded 5 day summer school in quantum computing.