

JOE SCHERRER

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EDUCATION

Princeton University

2016

Princeton, NJ

- AB in Physics, *summa cum laude*
- Minors in Biophysics and Engineering Physics

TECHNICAL SKILLS

- **Machining:** Lathe, milling, CNC, brazing, 3D printing, laser cutter, waterjet, shop safety
- **Electronics:** PCB Design, high speed digital signaling, SMD soldering, high voltage design and safety, RF power electronics, microcontrollers, image sensors, code-compliant electrical wiring
- **Laser Systems:** Diode laser systems, low-linewidth external cavity locking, solid-state amplifiers, nonlinear optics, laser safety
- **Microscopy:** Fluorescence microscopy, two-photon microscopy, electron microscopy, ultramicrotome design, atomic force microscopy
- **Optics:** cavity optics, vapor cell spectroscopy, imaging systems
- **Micro/Nanofabrication:** Photolithography, evaporative coating, plasma etching, PDMS microfluidic design and fabrication, class 100 cleanroom practices
- **Nuclear Physics:** X-ray generation, ion sources, scintillation counters, proportional tubes, signal processing, radiation safety
- **High Vacuum Systems:** Diffusion pumps, turbomolecular pumps, ion pumps, sublimation pumps, design and construction practices
- **Cryogenic Engineering:** Pulse tube refrigerators, dilution refrigerators, cryogenic fluid handling and safety
- **Animal Work:** Zebra finch husbandry, stereotactic neurosurgery
- **Computational:** Python, C, Matlab, Labview, Bonsai

RESEARCH EXPERIENCE

MIT

2018-Present

Fee Lab

Developing head-mounted microscopes for use in zebra finches. These microscopes break records in both weight and field-of-view, and enable large-scale population recording of calcium activity in previously inaccessible organisms like juvenile zebra finches. Working on using these microscopes for real-time neural feedback experiments. These feedback experiments will test a hypothesis that vocal learning in songbirds is mediated by basal ganglia-thalamocortical loops that bias motor output to avoid vocal errors.

Broad Institute/MIT

2017

Chen Lab

Developed RNA editing substrates for an RNA tickertape system to measure transcript lifetimes. Resulted in a paper and pending patent application.

Max Planck Institute for Neurobiology

2016-2017

Denk Lab

Worked on a variety of technologies for multibeam serial blockface electron microscopy. Developed techniques for nanometer-precision 5-axis stabilization of an ultrasonic vibrating diamond knife ultramicrotome. Developed algorithms for fast nanometer-precision repositioning of sample using surface interferometry between microtome slices. Designed negative spring stabilizers to reduce microtome jitter.

Princeton University

2015-2016

Page Lab

Developed a polarizing microwave Fourier transform spectrometer as a testbed for an interstellar dust observation satellite mission. Performed microwave scattering measurements on interstellar dust analogs.

Princeton University

2014-2015

Bakr Lab

Designed and built a three-laser system for two-photon Rydberg spectroscopy in ^6Li . Built two external cavity diode lasers, solid-state optical amplifiers, a 10 MHz locked high-finesse doubling cavity, and custom vapor cells. Developed a novel method of Doppler-free Electromagnetically Induced Transparency spectroscopy, resulting in measurements of Rydberg state levels two orders of magnitude higher in precision than previously published data.

Princeton University

2014-2016

Physics Lecture Demo Lab

Built a Farnsworth Fusor for demonstrating deuterium fusion as a physics lecture demo. The neutron flux could be used for activation of silver, making for a compelling demonstration of neutron capture.

Vanderbilt University**2011-2013***Wikswow Lab*

Designed and constructed a novel plasma-activated chemical vapor deposition device for use in microfabrication. The device was installed in the Vanderbilt microfabrication core facility for silanizing and functionalizing surfaces. I am co-first author on a publication about the device.

Vanderbilt University**2010-2013***Wikswow Lab*

Designed and fabricated microfluidic valves, pumps, and microformulators based on motor-driven bearing arrays, resulting in two patents.

Independent Research**2011-2013***Home Lab*

Designed and characterized a small pyroelectric crystal-driven particle accelerator in my backyard shed. The device could accelerate both electrons and atmospheric ions and produced X-rays in the hundreds of keV. X-ray flux was used for X-ray photography and X-ray fluorescence spectroscopy.

TEACHING AND OUTREACH

- Built physics demo devices for the Princeton physics lecture demo collection used for college courses and educational outreach. These demos included a 2D acoustic levitation apparatus and a functioning deuterium fusion reactor.
- McGraw center tutor for introductory physics classes at Princeton.
- Mentored a summer high school researcher in the Fee lab at MIT, as part of the LEAH Knox Scholars Program for low-income students of color.
- MIT Splash teacher for high school students. Have taught classes on the thermodynamics of molecular motors and the optics and physiology of the human eye.

FELLOWSHIPS AND AWARDS

- Fulbright Research Fellowship, 2016-2017
- Hertz Foundation Fellowship, Class of 2016
- Kusaka Memorial Prize in Physics, Princeton, 2016

PUBLICATIONS AND PATENTS

Joseph R. Scherrer*, Galen F. Lynch*, Jie J. Zhang, Michale S. Fee. An optical design enabling lightweight and large field-of-view head-mounted microscopes, *Nature Methods* (2023) (10.1038/s41592-023-01806-1)

Samuel G. Rodrigues, Linlin M. Chen, Sophia Liu, Ellen D. Zhong, **Joseph R. Scherrer**, Edward S. Boyden, Fei Chen. RNA timestamps identify the age of single molecules in RNA sequencing. *Nature Biotechnology* 39, 320-325 (2021).

US Patent 10,487,819: Peristaltic micropump and related systems and methods. Parker A. Gould, Loi T. Hoang, **Joseph R. Scherrer**, William J. Matloff, Kevin T. Seale, Erica L. Curtis, David K. Schaffer, Douglas J. Hall, Ayeeshik Kole, Ronald S. Reiserer, Hunter Tidwell, Philip C. Samson, John P. Wikswow

US Patent 10,119,622: Organ on chip integration and applications of the same. Frank E. Block, III, Philip C. Samson, Erik M. Werner, Dmitry A. Markov, Ronald S. Reiserer, Jennifer R. McKenzie, David E. Cliffl, William J. Matloff, Frank E. Block, Jr., **Joseph R. Scherrer**, W. Hunter Tidwell, John P. Wikswow

Adam J. Bowman*, **Joseph R. Scherrer***, and Ronald S. Reiserer. Note: A single-chamber tool for plasma activation and surface functionalization in microfabrication. *Review of Scientific Instruments* 86, 066106 (2015).