Ben Bartlett, Ph.D.

Physicist specializing in programmable photonics, quantum information, optical computation, and machine learning

Summary

I am a physicist and software engineer working at OpenAI to speed up model training on some of the world's largest supercomputers. My research background is in the intersection of physics, ML, and nanophotonics.

Contact

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Skills

Programming:
Fluent: Python, Mathematica, TypeScript, QuTiP, PyTorch, NumPy/SciPy/Matplotlib, LaTeX
Experienced: TensorFlow, JavaScript, GLSL, meep
Familiar: C++, C, Julia, rllib, ray
Passable: Kotlin, Haskell, MATLAB

Software:
Blender, Ableton Live, AutoCAD, Autodesk Inventor, Illustrator, Final Cut Pro, ffmpeg, LyX, Sphinx, Doxygen, TypeDoc

Mathematical:
quantum physics, electrodynamics, linear algebra, machine learning, complexity theory, general relativity, nonlinear optics, numerical methods

Laboratory:
nanofabrication, optical lithography, free-space optics, high-vacuum systems

Miscellaneous:
scientific visualization and animation *[portfolio]*, generative art, music production, sound design

Selected honors

2018: Hertz Fellowship Finalist
2015: Jean J. Dixon Fellowship
2012: Davidson Fellows Finalist
2012: CERN research award
2012: 4th in physics, International Science and Engineering Fair
2012: 1st in physics, National JSHS

Education

Stanford University • Ph.D. Applied Physics • 2017 – 2022
› Dissertation: *Photonic computing architectures for classical and quantum information processing* [link]
› Advised by Prof. Shanhui Fan; research in optical computing, machine learning, quantum information, nanophotonics, nanofabrication, quantum optics

Stanford University • M.S. Electrical Engineering • 2019 – 2022

Caltech • B.S. Physics + Computer Science • 2013 – 2017

Employment

OpenAI • *Member of Technical Staff* • San Francisco, CA • 2024 – Present
Working with the platform ML team on a project which could speed up AI training

PsiQuantum • *Quantum computer architect* • Palo Alto, CA • 2022 – 2024
Large-scale simulation of photonic components for a fault-tolerant quantum computer

X Development (Google X) • *AI resident* • Mountain View, CA • 2021 – 2022
Undisclosed project involving electromagnetics, machine learning, distributed computing

AT&T Foundry / INQNET • *Quantum networks* • Palo Alto, CA • 2017
Developed a parallelized quantum network simulator with channel noise models

SLAC National Accelerator Lab • *Engineering intern* • Menlo Park, CA • 2016
Wrote testing system for camera readout boards on the Large Synoptic Survey Telescope

CERN • *Undergraduate researcher* • Geneva, Switzerland • 2015 – 2016
Developed a vertex reconstruction algorithm for the CMS, improving resolution by ~160×

Patents

› B. Bartlett, A. Dutt, and S. Fan, "A scalable design for a photonic quantum computer using a fiber ring and a single coherently controlled atom", USPTO 63/087,661 (2020)
› B. Bartlett, A. Dutt, and S. Fan, "Systems and methods for deterministic photonic quantum computing in a synthetic time dimension", WO 2022/076982 A1 (2022) [link]

Selected publications (out of 18 total, >700 citations)

› Pai, et al. "Experimentally realized in situ backpropagation for deep learning in photonic neural networks", ***Science***, 380, 398-404 (2023) [link] [press coverage]
› Bartlett, et al. "Deterministic photonic quantum computation in a synthetic time dimension", ***Optica***, 8, 1515-1523 (2021) [link] [press coverage]
› Bartlett, et al. "Universal programmable photonic architecture for quantum information processing", *Physical Review A,* 101, 042319 (2020) [link]
› Fard, et al. "Experimental realization of arbitrary activation functions for optical neural networks", *Optics Express*, 28, 12138-12148 (2020) [link]
› Pai, Bartlett, et al. "Matrix optimization on universal unitary photonic devices", *Physical Review Applied*, 11, 064044 (2019) [link]
› Williamson, et al. "Reprogrammable Electro-Optic Nonlinear Activation Functions for Optical Neural Networks" *[Invited]*, *IEEE JSTQE*, 26 (1), 1-12 (2019) [link]

Open-source software contributions (* = lead developer)

› neuroptica* (★ 182 ⑂ 39): a flexible simulation package for optical neural networks
› SQUANCH* (★ 42 ⑂ 10): distributed simulation framework for quantum networks
› QuTiP (★ 1.5k ⑂ 630): the Quantum Toolbox in Python
› meep (★ 993 ⑂ 543): popular open-source electromagnetics simulation package
› 3D-printed-mirror-array* (★ 2.4k ⑂ 143): generates custom 3D-printable hexagonal mirror arrays capable of reflecting sunlight into arbitrary patterns
› Overmind* (★ 497 ⑂ 146): a multi-agent bot for a competitive online strategy game
› ising-compiler* (★ 49 ⑂ 2): compiles Boolean circuits into adiabatically cooled spins
› neural-maxwell* (★ 54 ⑂ 20): ML model for computing electromagnetic field solutions
› qpga* (★ 98 ⑂ 18): TensorFlow-based simulations of photonic programmable gate arrays
› psiblend*: library for visualizing photonic circuits in Blender, used at PsiQuantum