Gregory R. Steinbrecher

Curriculum Vitae

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1 Education

- **Massachusetts Institute of Technology 2013-2019**
  PhD Candidate, Electrical Engineering and Computer Science
  Advisor: Professor Dirk Englund

  Thesis: Programmable photonics for quantum and classical information processing

- **Massachusetts Institute of Technology 2012-2013**
  Master of Engineering in Electrical Engineering and Computer Science
  Advisors: Professor Jeffrey Shapiro (MIT) and Dr. Eric Dauler (MIT Lincoln Laboratory)

  Thesis: Indium Arsenide Quantum Dots for Single Photons in the Communications Band

- **Massachusetts Institute of Technology 2008-2012**
  Bachelor of Science, Double Major in Physics and Electrical Engineering; Minor in Mathematics

1.1 Fellowships

- *2017-2019*: Facebook Fellowship

- *2013-2017*: National Defense Science and Engineering Graduate Fellowship

- *2013-2014*: Irwin Mark Jacobs and Joan Klein Jacobs Presidential Fellowship [decl.]

- *2011-2013*: VI-A Masters of Engineering Co-Op at MIT Lincoln Laboratory

2 Patents

- Naader Hasani, Gregory R Steinbrecher, and Hans-Juergen Schmidtke. Systems and methods for communication system resource contention monitoring, September 2020

- Gregory R Steinbrecher and Dirk Robert Englund. Apparatus, systems, and methods for nonblocking optical switching, September 7 2021. US Patent 11,112,564

- Jacques Johannes Carolan, Gregory R Steinbrecher, and Dirk Robert Englund. Quantum optical neural networks, November 26 2020. US Patent App. 16/826,364

- Jacob C Mower, Nicholas C Harris, Dirk R Englund, and Greg Steinbrecher. Programmable photonic processing, July 23 2019. US Patent 10,359,272

- Jacob C Mower, Nicholas C Harris, Dirk R Englund, and Greg Steinbrecher. Methods, systems, and apparatus for programmable quantum photonic processing, April 29 2016. US Patent App. 15/143,450

3 Journal Papers

3.1 (Co-)First Author

- Gregory R Steinbrecher, Jonathan P Olson, Dirk Englund, and Jacques Carolan. Quantum optical neural networks. *npj Quantum Information*, 5(1):60, 2019b

- Yoav Lahini, Gregory R Steinbrecher, Adam D Bookatz, and Dirk Englund. Quantum logic using correlated one-dimensional quantum walks. *npj Quantum Information*, 4 (1):2, 2018

- Jacob Mower, Nicholas C Harris, Gregory R Steinbrecher, Yoav Lahini, and Dirk Englund. High-fidelity quantum state evolution in imperfect photonic integrated circuits. *Physical Review A*, 92(3):032322, 2015a

3.2 Other

- Dirk Englund, Noel Wan, Donggyu Kim, Hyongrak Choi, Mihir Pant, Ryan Hamerly, Jacques Carolan, Darius Bunandar, Greg Steinbrecher, Tsung-Ju Lu, et al. Large-scale photonic circuits for quantum information processing. In *Photonics for Quantum 2019*, volume 11917, page 119170Q. SPIE, 2021

- Catherine Lee, Darius Bunandar, Zheshen Zhang, Gregory R Steinbrecher, P Ben Dixon, Franco NC Wong, Jeffrey H Shapiro, Scott A Hamilton, and Dirk Englund. Large-alphabet encoding for higher-rate quantum key distribution. *Optics express*, 27 (13):17539–17549, 2019

- Jelena Notaros, Jacob Mower, Mikkel Heuck, Cosmo Lupo, Nicholas C Harris, Gregory R Steinbrecher, Darius Bunandar, Tom Baehr-Jones, Michael Hochberg, Seth Lloyd, et al. Programmable dispersion on a photonic integrated circuit for classical and quantum applications. *Optics Express*, 25(18):21275–21285, 2017

- Nicholas C Harris, Gregory R Steinbrecher, Mihika Prabhu, Yoav Lahini, Jacob Mower, Darius Bunandar, Changchen Chen, Franco NC Wong, Tom Baehr-Jones, Michael Hochberg, et al. Quantum transport simulations in a programmable nanophotonic processor. *Nature Photonics*, 11(7):447, 2017b

- Nicholas C Harris, Darius Bunandar, Mihir Pant, Greg R Steinbrecher, Jacob Mower, Mihika Prabhu, Tom Baehr-Jones, Michael Hochberg, and Dirk Englund. Large-scale quantum photonic circuits in silicon. *Nanophotonics*, 5(3):456–468, 2016b

- Catherine Lee, Zheshen Zhang, Gregory R Steinbrecher, Hongchao Zhou, Jacob Mower, Tian Zhong, Ligong Wang, Xiaolong Hu, Robert D Horansky, Varun B Verma, et al. Entanglement-based quantum communication secured by nonlocal dispersion cancellation. *Physical Review A*, 90(6):062331, 2014b

4 Conference Papers

- Gregory Steinbrecher, Jonathan Olson, Dirk Englund, and Jacques Carolan. Quantum optical neural networks for next generation quantum information processing. In *APS March Meeting Abstracts*, volume 2019, pages E27–012, 2019a

- Gregory R Steinbrecher, Jonathan P Olson, Dirk Englund, and Jacques Carolan. Quantum photonic neural networks. In *CLEO: QELS_Fundamental Science*, pages FF1F–2. Optica Publishing Group, 2019c

- Gregory R Steinbrecher, Vincent WS Chan, Dirk R Englund, and Scott A Hamilton. Hybrid flow switched network with an arbitrarily reconfigurable optical switch. In *CLEO: Science and Innovations*, pages SW4C–1. Optical Society of America, 2018

- Siva S Yegnanarayanan, Ryan T Maxson, Cheryl Sorace-Agaskar, Dave Kharas, Gregory Steinbrecher, and Paul W Juodawlkis. Automated initialization of reconfigurable silicon-nitride (sinx) filters. In *CLEO: Applications and Technology*, pages JTh3D–4. Optical Society of America, 2018

- Nicholas C Harris, Yichen Shen, Gregory R Steinbrecher, Mihika Prabhu, Tom Baehr-Jones, Michael Hochberg, Marin Soljacic, and Dirk R Englund. Programmable nanophotonics for quantum simulation and machine learning. In *Integrated Photonics Research, Silicon and Nanophotonics*, pages ITu3A–3. Optical Society of America, 2017a

- Gregory R Steinbrecher, Hemonth G Rao, Nicholas C Harris, Jacob Mower, Tom Baehr-Jones, Michael Hochberg, Vincent WS Chan, Dirk R Englund, and Scott A Hamilton. Optical network switch for dynamically reconfigurable single-and multi-cast topologies. In *Lasers and Electro-Optics (CLEO), 2017 Conference on*, pages 1–2. IEEE, 2017

- Jelena Notaros, Jacob Mower, Mikkel Heuck, Nicholas Harris, Gregory Steinbrecher, Darius Bunandar, Cosmo Lupo, Tom Baehr-Jones, Michael Hochberg, Seth Lloyd, et al. Tunable-coupling resonator arrays for chip-based quantum enigma machines. In *CLEO: QELS_Fundamental Science*, pages FTh4C–4. Optical Society of America, 2016

- Catherine Lee, Darius Bunandar, Zheshen Zhang, Gregory Steinbrecher, P Ben Dixon, Franco N Wong, Jeffrey H Shapiro, Scott Hamilton, and Dirk R Englund. High-rate large-alphabet quantum key distribution over deployed telecom fiber. In *CLEO: QELS_Fundamental Science*, pages FTh3C–7. Optical Society of America, 2016

- Nicholas Harris, Gregory Steinbrecher, Jacob Mower, Yoav Lihini, Mihika Prabhu, Tom Baehr-Jones, Michael Hochberg, Seth Lloyd, and Dirk Englund. Controlling quantum

transport with a programmable nanophotonic processor. In *APS Meeting Abstracts*, 2016a

- Jacob Mower, Nicholas C Harris, Gregory R Steinbrecher, Faraz Najafi, Yoav Lahini, Tom Baehr-Jones, Michael Hochberg, Karl K Berggren, and Dirk Englund. Quantum information processing using active silicon photonic integrated circuits. In *The European Conference on Lasers and Electro-Optics*, page CK_4b_1. Optical Society of America, 2015b

- Nicholas C Harris, Gregory R Steinbrecher, Jacob Mower, Yoav Lahini, and Dirk Englund. Quantum random walks in a programmable nanophotonic processor. In *2015 Conference on Lasers and Electro-Optics (CLEO)*, pages 1–2. IEEE, 2015

- Gregory Steinbrecher, Nicholas C Harris, Jacob Mower, Mihika Prabhu, and Dirk R Englund. Programmable nanophotonic processor for arbitrary high fidelity optical transformations. In *CLEO: QELS_Fundamental Science*, pages FW4A–2. Optical Society of America, 2015

- Catherine Lee, Zheshen Zhang, Jacob C Mower, Greg Steinbrecher, Hongchao Zhou, Ligong Wang, Xiaolong Hu, Robert Horansky, Varun B Verma, Michael Allman, et al. High-dimensional time-energy entanglement-based quantum key distribution using dispersive optics. In *CLEO: QELS_Fundamental Science*, pages FM4A–3. Optical Society of America, 2014a

- Jacob C Mower, Nicholas C Harris, Greg Steinbrecher, Yoav Lahini, and Dirk Englund. An integrated programmable quantum photonic processor for linear optics. In *CLEO: QELS_Fundamental Science*, pages FM2A–3. Optical Society of America, 2014

- Gregory R Steinbrecher. Cross-layer design to maintain earthquake sensor network connectivity after loss of infrastructure. In *MILITARY COMMUNICATIONS CONFERENCE, 2012-MILCOM 2012*, pages 1–6. IEEE, 2012

5   Teaching

- Teaching Assistant for *6.267: Heterogeneous Networks: Architecture, Transport, Proctocols, and Management* in Fall 2015
Professors: Vincent Chan and Robert Gallager