

Orad Reshef, PhD

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Ottawa, Ontario, Canada K1N 6N5

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orad@reshef.ca

EDUCATION

- **Harvard School of Engineering and Applied Sciences** Cambridge, MA
PhD, Applied Physics 2016
 - Dissertation: *Integrated metamaterials and nanophotonics in CMOS-compatible materials*
 - Advisor: Eric Mazur
 - Harvard Quantum Optics Fellowship (\$20k)
 - Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Doctoral Scholarship (\$63k)
 - Fonds de recherche du Québec — Nature et technologies (FQRNT) Doctoral Research Scholarship (\$60k — Awarded but declined)*Master of Science, Applied Physics* 2012
 - FQRNT Masters Research Scholarship (\$40k)
- **McGill University** Montréal, QC
Bachelor of Science, Honours Physics 2009
 - First Class Honours, magna cum laude
 - Thesis: *Fluctuations and Blueshift in Quantum Dot Emission Wavelength*
 - Advisor: Jay L. Nadeau
 - NSERC Undergraduate Student Research Award (\$4.5k)

EMPLOYMENT

- **University of Ottawa, Department of Physics** Ottawa, ON
Postdoctoral Research Fellow Sept 2016 – Present
 - Advisor: Robert W. Boyd
 - NSERC Banting Postdoctoral Fellowship (\$140k)
⊕ *Application ranked 4th in Canada.*
 - NSERC Postdoctoral Fellowship (\$90k — Awarded but declined)
- **Harvard School of Engineering and Applied Sciences** Cambridge, MA
Teaching Fellow 2011 – 2014
 - Designed project-based learning course
 - Mechanics and Electricity & Magnetism

BOOK CHAPTERS

- **Reshef O.** & Boyd R. W. Nonlinear Optics. *Handbook of Laser Technology & Applications, 2nd Edition* (2019).
- **Reshef O.** & Nadeau J. Introduction to Nanofabrication. *Introduction to Experimental Biophysics, 2nd Edition* (2017).

PATENTS

- “Space-compressing methods, materials, devices, and systems, and imaging devices and system using same,” filed February 3, 2020. Application No.: 62/969,595. Alhulaymi A. H., Bearne K. M., Boyd R. W., DelMastro M. P., Giner L., Lundeen J. S., **Reshef O.**
- “Direct entangled triplet-photon sources and methods for their design and fabrication,” U.S. Patent No. 9,470,956. 18 Oct. 2016. Evans C. C., Griesse-Nascimento S., Mazur E., Moebius M. G., **Reshef O.**
- “Integrated impedance-matched photonic zero-index metamaterials,” filed February 2, 2015. Application No.: PCT/US2015/014105. Kita S., Li Y., Lončar M., Mazur E., Muñoz P. A., **Reshef O.**, Vulis D. I.

PEER REVIEWED PUBLICATIONS

1. **Reshef O.**, Aharonovich I., Armani A., Gigan S., Grange R., Kats M. A. & Sapienza R. How to organize an online conference. *Nat. Rev. Mater.*, in press (2020). doi:[10.1038/s41578-020-0194-0](https://doi.org/10.1038/s41578-020-0194-0)
2. Zhou Y.*, Alam M. Z.*, Karimi M., Upham J., **Reshef O.**, Liu C., Wilner A. W. & Boyd R. W. Broadband adiabatic frequency conversion through time refraction using an epsilon-near-zero material. *Nat. Commun.*, in press (2020).
3. D’Mello Y., **Reshef O.**, Bernal S., El-fiky E., Wang Y., Jacques M., & Plant D. V. Integration of Sub-wavelength Structures with Silicon Photonic Devices. *IET Optoelectronics*, in press (2020). doi:[10.1049/iet-opt.2019.0077](https://doi.org/10.1049/iet-opt.2019.0077)
4. **Reshef O.**, DelMastro M. P., Bearne K. M., Alhulaymi A. H., Giner L., Boyd R. W. & Lundeen J. S. Towards ultra-thin imaging systems: an optic that replaces space. arXiv:[2002.06791](https://arxiv.org/abs/2002.06791) [physics.optics] (2020).
5. Tsakmakidis K. L., **Reshef O.**, Almpanis E., Zouros G. P., Mohammadi E., Saadat D., Sohrabi F., Fahimi-Kashani N., Etezadi D., Boyd R. W. & Altug H. Ultrabroadband 3D invisibility with fast-light cloaks. *Nat. Commun.*, **10** 4859 (2019). doi:[10.1038/s41467-019-12813-2](https://doi.org/10.1038/s41467-019-12813-2)
6. **Reshef O.**, Saad-Bin-Alam M., Huttunen M. J., Carlow G., Sullivan B., Ménard, J.-M., Dolgaleva K. & Boyd R. W. Multiresonant high-*Q* plasmonic metasurfaces. *Nano Lett.*, **19** 6429 – 6434 (2019). doi:[10.1021/acs.nanolett.9b02638](https://doi.org/10.1021/acs.nanolett.9b02638)
7. **Reshef O.**, De Leon I., Alam M. Z., & Boyd R. W. Nonlinear optical effects in epsilon-near-zero media. *Nat. Rev. Mater.* **4**, 535 – 551 (2019). doi:[10.1038/s41578-019-0120-5](https://doi.org/10.1038/s41578-019-0120-5)
8. Huttunen M. J., **Reshef O.**, Stolt T., Dolgaleva K., Boyd R. W. & Kauranen M. Efficient nonlinear metasurfaces by using multiresonant high-*Q* plasmonic arrays. *J. Opt. Soc. Am. B* **36**, E30 – E35 (2019). doi:[10.1364/JOSAB.36.000E30](https://doi.org/10.1364/JOSAB.36.000E30)
9. Vulis D., **Reshef O.**, Camayd-Muñoz P. & Mazur E. Manipulating the Flow of Light using Dirac-cone Zero-Index Metamaterials. *Rep. Prog. Phys.* **82**, 012001 (2019). doi:[10.1088/1361-6633/aad3e5](https://doi.org/10.1088/1361-6633/aad3e5)
10. Shneidman A.*, Becker K.*, Lukas M., Torgerson N., Wang C., **Reshef O.**, Hui P., Paul K., McLellan J. & Lončar M. High quality all-polymer integrated optical resonators by roll-to-roll nanoimprint lithography. *ACS Photonics* **5**, 3225 – 3228 (2018). doi:[10.1021/acsp Photonics.8b00022](https://doi.org/10.1021/acsp Photonics.8b00022)

11. Kang S., Evans C. C., Shukla S., **Reshef O.** & Mazur E. Patterning and reduction of graphene oxide using femtosecond-laser irradiation. *Opt. Laser Technol.* **103**, 340 – 345 (2018). doi:[10.1016/j.optlastec.2018.01.059](https://doi.org/10.1016/j.optlastec.2018.01.059)
12. **Reshef O.***, Camayd-Muñoz P.*, Vulis D. I., Li Y., Lončar M. & Mazur E. Direct observation of phase-free propagation in a silicon waveguide. *ACS Photonics* **4**, 2385 – 2389 (2017). doi:[10.1021/acsp Photonics.7b00760](https://doi.org/10.1021/acsp Photonics.7b00760)
 ⊕ *Featured on cover of the issue.*
 ⊕ *Selected as Editor's choice by APS Physics. (more)*
13. **Reshef O.**, Giese E., Alam M. Z., De Leon I., Upham J. & Boyd R. W. Beyond the perturbative description of the nonlinear optical response of low-index materials. *Opt. Letters* **42**, 3225 – 3228 (2017). doi:[10.1364/OL.42.003225](https://doi.org/10.1364/OL.42.003225)
14. Vulis D. I.*, Li Y.*, **Reshef O.***, Yin M., Camayd-Muñoz P., Lončar M. & Mazur E. Monolithic CMOS-compatible zero-index metamaterials. *Opt. Express* **25**, 12381 – 12399 (2017). doi:[10.1364/OE.25.012381](https://doi.org/10.1364/OE.25.012381)
15. **Reshef O.**, Moebius M. G. & Mazur E. Extracting loss from asymmetric resonances in micro-ring resonators. *J. Opt.* **19**, 065804 (2017). doi:[10.1088/2040-8986/aa7006](https://doi.org/10.1088/2040-8986/aa7006)
 ⊕ *Featured as the "Paper of the Week," May 22 – 29, 2017. (more)*
16. Kita S., Li Y., Camayd-Muñoz P., **Reshef O.**, Vulis D. I., Day, R. W., Mazur E., Lieber C. & Lončar M. On-chip all-dielectric fabrication-tolerant zero-index metamaterials. *Opt. Express* **25**, 8326 – 8334 (2017). doi:[10.1364/OE.25.008326](https://doi.org/10.1364/OE.25.008326)
17. Moebius M. G., Herrera F., Griesse-Nascimento S., **Reshef O.**, Evans C. C., Guerreschi G. G., Aspuru-Guzik A. & Mazur E. Efficient photon triplet generation in integrated nanophotonic waveguides. *Opt. Express* **24**, 9932 – 9954 (2016). doi:[10.1364/OE.24.009932](https://doi.org/10.1364/OE.24.009932)
18. Li Y.*, Kita S.*, Muñoz P., **Reshef O.**, Vulis D. I., Yin M., Lončar M. & Mazur E. On-chip zero-index metamaterials. *Nature Photon.* **9**, 738 – 742 (2015). doi:[10.1038/nphoton.2015.198](https://doi.org/10.1038/nphoton.2015.198)
 ⊕ *Featured on cover of the issue.*
 ⊕ *Highlighted in the Boston Globe, Engadget, Gizmodo, among others. (more)*
19. **Reshef O.**, Shtyrkova K., Moebius M. G., Griesse-Nascimento S., Spector S., Evans C. C., Ippen E. & Mazur E. Polycrystalline anatase titanium dioxide micro-ring resonators with negative thermo-optic coefficient. *J. Opt. Soc. Am. B.* **32**, 2288 – 2293 (2015). doi:[10.1364/JOSAB.32.002288](https://doi.org/10.1364/JOSAB.32.002288)
20. Evans C. C., Shtyrkova K., **Reshef O.**, Moebius M. G., Bradley J. D. B., Griesse-Nascimento S., Ippen E. & Mazur E. Multimode phase-matched third-harmonic generation in sub-micrometer-wide anatase TiO₂ waveguides. *Opt. Express* **23**, 7832 – 7841 (2015). doi:[10.1364/OE.23.007832](https://doi.org/10.1364/OE.23.007832)
21. Evans C. C., Shtyrkova K., Bradley J. D. B., **Reshef O.**, Ippen E. & Mazur E. Spectral broadening in anatase titanium dioxide waveguides at telecommunication and near-visible wavelengths. *Opt. Express* **21**, 18582 – 18591 (2013). doi:[10.1364/OE.21.018582](https://doi.org/10.1364/OE.21.018582)
22. Bradley J. D. B., Evans C. C., Choy J. T., **Reshef O.**, Deotare P. B., Parsy F., Phillips K. C., Lončar M. & Mazur E. Submicrometer-wide amorphous and polycrystalline anatase TiO₂ waveguides for microphotonic devices. *Opt. Express* **20**, 23821 – 23831 (2012). doi:[10.1364/OE.20.023821](https://doi.org/10.1364/OE.20.023821)
23. Lasry N., Rosenfield S., Dedic H., Dahan A. & **Reshef O.** Reply to "Comment on 'The puzzling reliability of the Force Concept Inventory,' by N. Lasry, S. Rosenfield, H. Dedic, A. Dahan, and O. Reshef [Am. J. Phys. 79, 909 – 912 (2011)]" *Am. J. Phys.* **80**, 350 (2012). doi:[10.1119/1.3660663](https://doi.org/10.1119/1.3660663)

24. Lasry N., Rosenfield S., Dedic H., Dahan A. & **Reshef O.** The puzzling reliability of the Force Concept Inventory. *Am. J. Phys.* **79**, 909 – 912 (2011). doi:[10.1119/1.3602073](https://doi.org/10.1119/1.3602073)

TEACHING EXPERIENCE

Teaching Fellow	Mechanics. Harvard University	<i>Fall 2014</i>
Teaching Fellow	Mechanics and Electricity & Magnetism. Harvard University	<i>2012 – 2013</i>
Course Designer	Mechanics and Electricity & Magnetism. Harvard University	<i>2011 – 2012</i>
Substitute Teacher	History, Math, Chemistry. Herzliah High School	<i>Fall 2009</i>
Grading Assistant	Mechanics and Electricity & Magnetism. John Abbott College	<i>2007 – 2009</i>
Peer Tutor	Calculus, Mechanics, Waves, Chemistry. Dawson College.	<i>Fall 2005</i>

FUNDING

Co-authored awarded research grants		
Giant Nonlinear Response of ENZ Metastructures DARPA HR001118S0014-NLM-FP-012, \$3M		<i>2018 – 2022</i>
Integrated Photonic Chips for Generating Entangled Photon Triplets NSF PHY-1415236, \$450K		<i>2014 – 2017</i>
Low-Loss, Impedance-Matched Dirac-Cone Metamaterials for Integrated Optics NSF DMR-1360889, \$400K		<i>2014 – 2016</i>
TiO ₂ Ultrafast All-Optical Devices NSF ECCS-1201976, \$375K		<i>2012 – 2015</i>

CONFERENCE PARTICIPATION

1. Novel Optical Materials and Applications. *Committee member*. **OSA Advanced Photonics Congress, Montréal, QC** Forthcoming: July (2020).
2. **Reshef O.** *Invited talk*. **CAP Congress, Hamilton, ON** Forthcoming: June (2020).
3. **Reshef O.**, Saad-Bin-Alam M., Chaitanya N. A., Stolt T., Hogan R., Karimi M., Alam M. Z., Carlow G., Sullivan B., De Leon I., Ménard, J.-M., Huttunen M. J., Dolgaleva K. & Boyd R. W. Nonlinear plasmonic metasurfaces using multiresonant surface lattice resonances. *Invited talk*. **CLEO: Science and Innovations, San Jose, CA** Forthcoming: May 10, (2020).
4. **Reshef O.** Dividing by zero — infinite velocities and unbounded nonlinear optics in low-index media. *Seminar*. **Queen's University at Kingston, Kingston, ON** February 11, (2020).
5. **Reshef O.**, DelMastro M., Bearne K., Alhulaymi A., Giner L., Boyd R. W. & Lundeen J. S. Towards ultra-thin monolithic imaging systems: introduction of an optic that mimics space. *Contributed talk*. **SPIE Photonics West, San Francisco, CA** February 6, (2020).
6. **Reshef O.** *Conference co-chair*. **Photonics Online Meetup, Worldwide** January 13, (2020).
7. **Reshef O.** *Invited talk but declined*. **Workshop on Complex Materials for Nonlinear Optics, Zurich, SUI** January (2020).
8. **Reshef O.**, Nacke C. H., Upham J. & Boyd R. W. Waveguide-to-waveguide directional coupling beyond a free space wavelength. *Contributed talk*. **Photonics North, Québec, QC** May 22, (2019).

9. **Reshef O.**, Nacke C. H., Upham J. & Boyd R. W. Waveguide-to-waveguide directional coupling beyond a free space wavelength. *Contributed talk*. **CLEO: Science and Innovations, San Jose, CA** May 10, (2019).
10. **Reshef O.** Dividing by zero — infinite velocities and unbounded nonlinear optics in low-index media. *Seminar*. **Polytechnique Montréal, Montréal, QC** October 23, (2018).
11. **Reshef O.**, Camayd-Muñoz P., Vulis D., Li Y., Lončar M. & Mazur E. Integrated Zero-Index Metamaterials and Waveguides. *Invited talk*. **OSA Advanced Photonics Congress, Zurich, SUI** July 5, (2018).
12. Novel Photonic Platforms. *Session chair*. **OSA Advanced Photonics Congress, Zurich, SUI** July 5, (2018).
13. **Reshef O.**, Boyd R. W. Epsilon-near-zero and zero-index materials. *Contributed talk*. **McGill University Ultrafast Workshop, Montréal, QC** June 7, (2018).
14. **Reshef O.**, Boyd R. W. Epsilon-near-zero and zero-index materials. *Contributed talk*. **Max Planck Centre Annual Meeting, Ottawa, ON** October 11, (2017).
15. **Reshef O.**, Giese E., Alam A. Z., De Leon I., Upham J., Boyd R. W. Beyond the perturbative description of the nonlinear optical response of low-index materials. *Contributed talk*. **Photonics North, Ottawa, ON** June 8, (2017).
16. **Reshef O.**, Camayd-Muñoz P., Vulis D., Li Y., Lončar M. & Mazur E. Integrated zero-index waveguides. *Contributed talk*. **Photonics North, Ottawa, ON** June 6, (2017).
17. **Reshef O.**, Camayd-Muñoz P., Vulis D., Li Y., Lončar M. & Mazur E. Integrated zero-index waveguides. *Contributed talk*. **CLEO: QELS Applications and Technology, San Jose, CA** May 15, (2017).
18. **Reshef O.**, Giese E., Alam A. Z., De Leon I., Upham J., Boyd R. W. Nonlinear optical response of highly nonlinear low-index materials. *Invited talk*. **PQE, Snowbird, Utah** January 12, (2017).
19. **Reshef O.**, Li Y., Yin M., Christakis L., Vulis D., Camayd-Muñoz P., Kita S., Lončar M. & Mazur E. Phase-Matching in Dirac-Cone-Based Zero-Index Metamaterials. *Contributed talk*. **CLEO: QELS Applications and Technology, San Jose, CA** June 7, (2016).
20. **Reshef O.**, Raymond A. W., Li Y., Muñoz P., Yin M., Vulis D., Christakis L., Kita S., Lončar M. & Mazur E. Nonlinear optics in on-chip zero-index metamaterials. *Seminar*. **Université de Montréal, Montréal, QC** November 23, (2015).
21. **Reshef O.**, Li Y., Muñoz P., Yin M., Vulis D., Christakis L., Kita S., Lončar M. & Mazur E. Nonlinear Phase-Matching in 2D Integrated Zero-Index Metamaterials. *Contributed talk*. **MRS Optical Metamaterials — From New Plasmonic Materials to Metasurface Devices, Boston, MA** December 2, (2015).
 ⊕ *Winner of NKT Photonics Best Student Paper Award. ([more](#))*
22. **Reshef O.**, Shtyrkova K., Moebius M. G., Evans C. C., Griesse-Nascimento S., Ippen E. & Mazur E. Polycrystalline anatase micro-ring resonators at telecommunication wavelengths. *Contributed talk*. **CLEO: Science and Innovations, San Jose, CA** June 9, (2014).
23. **Reshef O.**, Evans C. C., Bradley J. D. B., Griesse-Nascimento S. & Mazur E. Titanium dioxide for nanophotonics. *Invited talk*. **SPIE Optics + Photonics — Nanophotonic Materials X, San Diego, CA** August 29, (2013).

24. **Reshef O.**, Evans C. C., Griesse-Nascimento S., Bradley J. D. B. & Mazur E. Maximizing intensity in TiO₂ waveguides for nonlinear optics. *Poster presentation*. **SPIE Photonics West, San Francisco, CA** February 6, (2013).
25. Evans C. C.*, **Reshef O.***, Bradley J. D. B., Choy J. T., Deotare P. B., Lončar M. & Mazur E. TiO₂ nanophotonic waveguides for on-chip nonlinear optical devices. *Contributed talk*. **SPIE Photonics West, San Francisco, CA** January 23, (2012).
26. **Reshef O.**, Turner M., Carlini L., Nadeau J. Spectral shifts and spectral jumps in quantum dots by colour. *Contributed talk*. **CAP Congress, Moncton, NB** June 8, (2009)

OTHER SERVICE AND ACTIVITIES

Peer reviewer — <i>Optics Letters; Optics Express; Optical Materials Express; JOSA B; IEEE Journal of Lightwave Technology; IEEE Photonics Journal; IEEE Photonics Technology Letters; IEEE Antennas and Wireless Propagation Letters; Annalen der Physik; Nature Scientific Reports; Light: Science & Applications; ACS Photonics; Photonics Research</i>	2020 – present
Co-Supervisor — uOttawa SPIE student chapter	
Internal reviewer — Banting and Vanier scholarship for University of Ottawa	2018
Judge — Canada-Wide Science Fair	2018
Judge — Shalheveth Freier Physics Tournament	2009, 2010, 2017
Podcast founder and host — <i>Yet Another Science Show</i>	2013 – 2015
Webmaster of Harvard Photonics — SPIE/OSA student chapter	2011 – 2012, 2014 – 2016
Vice President of Harvard Photonics — SPIE/OSA student chapter	2012 – 2014
Vice President of Social Activities — McGill Society of Physics Students	2008 – 2009

OUTREACH

1. **Reshef O.** The incredible delayed quantum eraser experiment. *Colloquium*. **Collège Sainte-Anne, Montréal, QC** March 22, (2019).
2. **Reshef O.** Banting — Tips for a Successful Application. *Invited talk*. **University of Ottawa, Ottawa, ON** June 14, (2018).
3. **Reshef O.** Herzliah Chai Awards keynote: 5 pieces of advice. *Invited talk*. **Herzliah High School, Montréal, QC** November 20, (2017).
4. **Reshef O.** Banting — Tips for a Successful Application. *Invited talk*. **University of Ottawa, Ottawa, ON** May 31, (2017).
5. **Reshef O.** The incredible delayed quantum eraser experiment. *Colloquium*. **Collège Sainte-Anne, Montréal, QC** March 23, (2017).
6. **Reshef O.** What does a refractive index of zero even mean? *Colloquium*. **Herzliah High School, Montréal, QC** February 19, (2016).
7. **Reshef O.** Telling your story. *Workshop*. **Samuel Adams Elementary School, East Boston, MA** April 10, (2013).
8. **Reshef O.** Getting into graduate school: a graduate student's perspective. *Colloquium*. **McGill University, Montréal, QC** September 29, (2011)

PREVIOUS RESEARCH EXPERIENCE

- **McGill University** Montréal, QC
Research Assistant to Professor Jay Nadeau *Sep. 2008 – Jun. 2010*
 - Quantum dot fluorescence microscopy and blinking statistics.
- **Concordia University** Montréal, QC
Research Assistant to Dr. Nathaniel Lasry *Sep. 2007 – Jun. 2010*
 - Peer Instruction: Studying students understanding and learning process of physics.
- **McGill University** Montréal, QC
Research Assistant to Professor Hong Guo *Summer 2008*
 - Tight-binding band structure calculations of graphene and chiral carbon nanotubes.