Alejandro W. Rodriguez — **Curriculum Vitae**

Princeton University

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Education

- Ph.D. Physics, *MIT*, co-advised by John D. Joannopoulos and Steven G. Johnson 2006–2010
- B.S. Physics, *Massachusetts Institute of Technology* (MIT) 2003–2006

Employment

- Co-Founder and Chief Technology Officer……*Maxwell Labs Inc* 2024–Present
- Full Professor of Electrical and Computer Engineering……..*Princeton University* 2023–Present
- Director, Program in Materials Science and Engineering.....*Princeton University* 2019–Present
- Associate Professor of Electrical Engineering……..*Princeton University* 2019–2023
- Assistant Professor of Electrical Engineering……..*Princeton University* 2013–2019
- Invited Professor, Institut Fresnel……..…...*Aix-Marseille University* 2013
- Postdoctoral Fellow, SEAS.....*Harvard University* 2010–2013
- Postdoctoral Associate, Department of Mathematics……...*MIT* 2010–2013
- Research Scientist……*Lawrence Livermore National Laboratory* May–August 2008
- Research Assistant, Light Interferometer Gravitational Observatory……*MIT* May–August 2004

Honors and Awards

- Presidential Early Career Award for Scientists and Engineers (PECASE) 2019
- Society of Hispanic Professional Engineers Young Investigator Award 2016
- Princeton School of Engineering and Applied Sciences 2016
  "E. Lawrence Keys, Jr./Emerson Electric Co. Faculty Advancement Award"
- National Science Foundation Early CAREER Award 2015
- National Academy of Sciences Kavli Fellow, 2014 MIT Infinite Kilometer Award 2012
- World Economic Forum (WEF) Global Shaper 2011–2013
- Department of Energy Fredrick A. Howes Scholar in Computational Science 2011

Teaching Experience

- ECE 351 "Foundations of Modern Optics" 2019
- ECE 453 "Optical Electronics" 2018, 2022-'24
- ECE 342 "Fundamentals of Quantum Mechanics" 2014, '16
- PHY 656/ECE 560 "Foundations of Nanophotonics" 2013–'24

Postdoctoral Scholars

- Rodrick D. Kuate……..Presidential Postdoctoral Fellow 2020–2023
  Assistant Professor, *Syracuse University*
- Sean Molesky.....NSE Research Council of Canada Fellow 2017–2021
  Assistant Professor, *Polytechnique Montreal*

PhD Students

- Alessio Amaolo…….....*Chemistry Department* 2022–Present
- Thomas Maldonado.....*Electrical and Computer Engineering Department* 2022–Present
- Jewel Mohajan……...……...*Electrical and Computer Engineering Department* 2019–Present
- Benjamin Strekah……...…….*Electrical and Computer Engineering Department* 2019–2024
- Pengning Chao……...……..*Electrical and Computer Engineering Department* 2017–2023
  Instructor, *MIT Mathematics Department*
- Prashanth Venkataram…….....*Electrical and Computer Engineering Department* 2014–2020
  Bede Liu Best Dissertation Award
  Chancellors Postdoctoral Fellow, *U.C. Davis*
- Weiliang Jin……...……*Electrical and Computer Engineering Department* 2014–2019
  Postdoctoral Fellow, *Stanford University*
- Chinmay Khandekar……...….*Electrical and Computer Engineering Department* 2013–2018
  Postdoctoral scholar, Purdue University
- Zin Lin……...…….....(co-advised with Prof. Marko Loncar) *Harvard University* 2013–2017
  Assistant Professor, Virginia Tech
- Adi Pick……...……....(co-advised with Prof. Steven G. Johnson) *MIT* 2013–2016
  Assistant Professor, *The Hebrew University*

Undergraduate Students

- Shengyuan Lu…….....*Physics Department* 2020–2021
  Ph.D. Applied Physics, *Harvard University*
- Hudson A. Loughlin…….....*Physics Department* 2019
  Ph.D. Physics, *MIT*
- Teerit J. Vongkovit……....*Electrical and Computer Engineering Department* 2018
  Ph.D. Physics, *University of California, Los Angeles*
- Chawin Sitawarin……..*Electrical and Computer Engineering Department* 2015–2018
  Ph.D. Physics, *University of California, Berkeley*
- Jeremy D. Whitton……*Physics Department* 2013–2016
  Ph.D. Physics, *University of Arizona*
- Milos Nikolic…….....*Physics Department*, Newport Award 2013–2016
  Ph.D. Physics, *University of Maryland*

Scholarly Service

- Panelist, National Academy of Sciences Panel on Assessment of Photonics, Electronics, and Quantum Sciences. 2024
- Guest editor, Advanced Optical Materials Special Issue on Artificial Intelligence and Machine Learning for Advanced Materials 2024
- Guest editor, Applied Physics Letters Special Topic Collection: Thermal Radiation at the Nanoscale and Applications 2023
- Program Committee Member, Optica Quantum 2.0 Conference. 2022
- Co-rganizer, Kavli Institute for Theoretical Physics (KIT) Workshop Emerging

Regimes and Implications of Quantum and Thermal Fluctuational Electrodynamics	2022
· Organizing Committee, Optica Integrated Photonics Research Committee	2020
· Organizing Committee, APS March Meeting DMP focus session on "Van der Waals Bonding and Advanced Materials"	2017
· Steering Committee, DOE Computational Science Graduate Fellowship	2013–2019
· Review Panel Member, NSF Panel on Electronic and Photonic Materials	2014
· Committee Member, CLEO: QELS Fundamental Science of Metamaterials and Complex Media	2014–2016
· Committee Member, APS Review Committee on Research Mentor Training	2010

Publications

1. Amaolo, A., Chao, P., Maldonado, T., Molesky, S., & Rodriguez, A. (2023). Can photonic heterostructures provably outperform single-material geometries? *Nanophotonics*, *10*. https://www.degruyter.com/document/doi/10.1515/nanoph-2023-0606/html
2. Amaolo, A., Chao, P., Maldonado, T., Molesky, S., & Rodriguez, A. (2024). Physical Limits on Raman Scattering: The Critical Role of Pump and Signal Co-design. *ArXiv*, *2403.03332*. https://arxiv.org/abs/2403.03332
3. Bermel, P., Rodriguez, A., Joannopoulos, J., & Soljacic, M. (2007). Tailoring optical nonlinearities via the Purcell effect. *PRL*, *99*(5), 53601. http://link.aps.org/abstract/PRL/v99/e053601
4. Bermel, P., Rodriguez, A., Johnson, S., Joannopoulos, J., & Soljacic, M. (2006). Single-photon all-optical switching using waveguide-cavity QED. *PRA*, *74*, 043818. http://link.aps.org/abstract/PRA/v74/e043818
5. Bi, Z.-F., Rodriguez, A., Hashemi, H., Duchesne, D., Loncar, M., Wang, K.-M., & Johnson, S. (2012). High-efficiency second-harmonic generation in doubly-resonant $\chi^{(2)}$ microring resonators. *OE*, *20*(7), 7526–7543. http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-20-7-7526
6. Biehs, S., Messina, R., Venkataram, P., Rodriguez, A., Cuevas, J., & Ben-Abdallah, P. (2020). Near-field Radiative Heat Transfer in Many-Body Systems. *Rev. Mod. Phys.*, *93*, 025009. https://journals.aps.org/rmp/pdf/10.1103/RevModPhys.93.025009
7. Bravo-Abad, J., Rodriguez, A., Bermel, P., Johnson, S., Joannopoulos, J., & Soljacic, M. (2007). Enhanced nonlinear optics in photonic-crystal nanocavities. *OE*, *15*(24), 16161–16176. http://www.opticsexpress.org/abstract.cfm?id=146451
8. Bravo-Abad, J., Rodriguez, A., Joannopoulos, J., Rakich, P., Johnson, S., & Soljacic, M. (2010). Efficient low-power terahertz generation via on-chip triply resonant nonlinear frequency mixing. *APL*, *96*, 101110. http://apl.aip.org/applab/v96/i10/p101110_s1
9. Burgess, I., Rodriguez, A., McCutcheon, M., Bravo-Abad, J., Zhang, Y., Johnson, S., & Loncar, M. (2009). Difference-frequency generation with quantum-limited efficiency in triply-resonant nonlinear cavities. *OE*, *17*(11), 9241–9251. http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-17-11-9241
10. Burgess, I., Zhang, Y., McCutcheon, M., Rodriguez, A., Bravo-Abad, J., Johnson, S., & Loncar, M. (2009). Design and efficient terahertz source using triply-resonant nonlinear photonic crystal cavities. *OE*, *17*(22), 20099–20108. http://www.opticsinfobase.org/abstract.cfm?URI=oe-17-22-20099
11. Chakravarthi, S., Chao, S., Pederson, C., Molesky, S., Hatami, F., Rodriguez, A., & Fu, K.-M. (2020). Inverse-designed photon extractors for optically addressable defect qubits. *Optica*, *7*(12), 1805–1811. https://doi.org/10.1364/OPTICA.408611
12. Chao, P., Defo, R., Molesky, S., & Rodriguez, A. (2022). Maximum electromagnetic local density of states via material structuring. *Nanophotonics*, *10*. https://doi.org/10.1515/nanoph-2022-0600
13. Chao, P., Strekha, B., Defo, R., Molesky, S., & Rodriguez, A. (2022). Physical limits in electromagnetism. *Nature Reviews Physics*, *4*. https://www.nature.com/articles/s42254-022-00468-w
14. Chapuis, P.-O., Lee, B., & Rodriguez, A. (2023). Thermal radiation at the nanoscale and applications. *Applied Physics Letters*, *123*(22), 220401. https://doi.org/10.1063/5.0186406
15. Defo, R., Rodriguez, A., & Richardson, S. (2023). Charge-State Stability of Color Centers in Wide-Bandgap Semiconductors. *Phys. Rev. B*, *108*. https://journals.aps.org/prb/abstract/10.1103/PhysRevB.108.235208
16. Farjadpour, A., Roundy, D., Rodriguez, A., Ibanescu, M., Bermel, P., Burr, G., Joannopoulos, J., & Johnson, S. (2006). Improving accuracy by sub-pixel smoothing in the finite-difference time domain. *OL*, *31*, 2972–2974. http://www.opticsinfobase.org/abstract.cfm?URI=ol-31-20-2972

17. Forcade, G., Valdivia, C., Molesky, S., Lu, S., Rodriguez, A., Krich, J., St-Gelais, R., & Hinzer, K. (2022). Efficiency-optimized near-field thermophotovoltaics using InAs and InAsSbP. *Applied Physics Letters*, *121*(19), 193903. https://doi.org/10.1063/5.0116806
18. Giroux, M., Stephan, M., Brazeau, M., Molesky, S., Rodriguez, A., Krich, J., Hinzer, K., & St-Gelais, R. (2023). Measurement of Near-Field Radiative Heat Transfer at Deep Sub-Wavelength Distances using Nanomechanical Resonators. *Nano Letters*, *23*(18), 8490–8497. https://doi.org/10.1021/acs.nanolett.3c02049
19. Hashemi, H., Rodriguez, A., Joannopoulos, J., Soljacic, M., & Johnson, S. (2008). Nonlinear harmonic generation and devices in doubly-resonant Kerr cavities. *Physical Review A*, *79*(1), 013812. http://link.aps.org/doi/10.1103/PhysRevA.79.013812
20. Hui, P.-C., Woolf, D., Iwase, E., Sohn, Y.-I., Ramos, D., Khan, M., Rodriguez, A., Johnson, S., Capasso, F., & Loncar, M. (2013). Optical bistability with a repulsive optical force in coupled silicon photonic crystal membranes. *APL*, *103*(2), 021102. http://apl.aip.org/resource/1/applab/v103/i2/p021102_s1
21. Iwase, E., Hui, P.-C., Woolf, D., Rodriguez, A., Johnson, S., Capasso, F., & Loncar, M. (2012). Control of buckling in large micromembranes using engineered support structures. *J. Micromech. Microeng.*, *22*(6). http://iopscience.iop.org/0960-1317/22/6/065028/
22. Jin, W., Khandekar, C., Pick, A., Polimeridis, A., & Rodriguez, A. (2016). Amplified and directional spontaneous emission from arbitrary composite bodies: self-consistent treatment of Purcell effect below threshold. *PRB*, *93*, 125415. http://journals.aps.org/prb/abstract/10.1103/PhysRevB.93.125415
23. Jin, W., Messina, R., & Rodriguez, A. (2017a). General formulation of coupled radiative and conductive heat transfer between compact bodies. *PRB-Rapid*, *95*, 161409. https://journals.aps.org/prb/abstract/10.1103/PhysRevB.95.161409
24. Jin, W., Messina, R., & Rodriguez, A. (2017b). Overcoming limits to near-field radiative heat transfer in uniform planar media through multilayer optimization. *OE*, *25*(13), 293277. https://www.osapublishing.org/oe/fulltext.cfm?uri=oe-25-13-14746
25. Jin, W., Molesky, S., Lin, Z., & Rodriguez, A. (2018). Inverse design of compact multi-mode cavity couplers. *OE*, *26*, 26713–26721. https://www.osapublishing.org/oe/abstract.cfm?uri=oe-26-20-26713
26. Jin, W., Molesky, S., Lin, Z., & Rodriguez, A. (2019). Material scaling and frequency-selective enhancement of near-field radiative heat transfer for lossy metals in two dimensions via inverse design. *PRB-Rapid*, *99*, 041403. https://journals.aps.org/prb/abstract/10.1103/PhysRevB.99.041403
27. Jin, W., Polimeridis, A., & Rodriguez, A. (2016). Temperature control of thermal radiation from composite bodies. *PRB-Rapid*, *93*, 121403. http://journals.aps.org/prb/abstract/10.1103/PhysRevB.93.121403
28. Johnson, S., McCauley, A., & Rodriguez-Wong, A. (2014). *Computation and visualization of photonic quasicrystal spectra* (L. D. Negro, Ed.; pp. 451–489). Pan Stanford Publishing. https://doi.org/doi:10.4032/9789814463096
29. Khandekar, C., Buddhiraju, S., Wilkinson, P., Gimzewski, J., Rodriguez, A., Chase, C., & Fan, S. (2021). Nonequilibrium lateral force and torque by thermally excited nonreciprocal surface electromagnetic waves. *PRB*, *104*(24), 245433.
30. Khandekar, C., Jin, W., Miller, O., Pick, A., & Rodriguez, A. (2016). Giant frequency-selective near-field heat transfer in active–passive structures. *PRB*, *94*, 115402. http://journals.aps.org/prb/abstract/10.1103/PhysRevB.94.115402
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33. Khandekar, C., Pick, A., Johnson, S., & Rodriguez, A. (2015). Radiative heat transfer in nonlinear Kerr media. *PRB*, *91*, 115406. http://journals.aps.org/prb/abstract/10.1103/PhysRevB.91.115406
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35. Khandekar, C., & Rodriguez, A. (2017b). Thermal bistability through coupled photonic resonances. *APL*, *111*, 083104. http://aip.scitation.org/doi/10.1063/1.5000151
36. Khandekar, C., Yang, L., Rodriguez, A., & Jacob, Z. (2020). Quantum nonlinear mixing of thermal photons to surpass the blackbody limit. *OE*, *28*, 2045–2059. https://www.osapublishing.org/oe/abstract.cfm?uri=oe-28-2-2045

37. Klopstech, K., Konne, N., Biehs, S.-A., Rodriguez, A., Worbes, L., Hellmann, D., & Kittel, A. (2017). Giant heat transfer in the crossover regime between conduction and radiation. *Nature Communications*, *8*(14475). http://www.nature.com/articles/ncomms14475
38. Latella, I., Biehs, S.-A., Messina, R., Rodriguez, A., & Ben-Abdallah, P. (2017). Ballistic near-field heat transport in dense many-body systems. *PRB*, *97*, 035423. https://journals.aps.org/prb/abstract/10.1103/PhysRevB.97.035423
39. Levin, M., McCauley, A., Rodriguez, A., Reid, H., & Johnson, S. (2010). Casimir repulsion between metallic objects in vacuum. *PRL*, *105*(9), 090403. http://prl.aps.org/abstract/PRL/v105/i9/e090403
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41. Lin, Z., Groever, B., Capasso, F., Rodriguez, A., & Loncar, M. (2018). Topology optimized multilayered meta-optics. *Physical Review Applied*, *9*, 044030. https://arxiv.org/abs/1706.06715
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43. Lin, Z., Liang, X., Loncar, M., Johnson, S., & Rodriguez, A. (2016). Cavity-enhanced second harmonic generation via nonlinear-overlap optimization. *Optica*, *3*(3), 233–238. http://dx.doi.org/10.1364/OPTICA.3.000233
44. Lin, Z., Loncar, M., & Rodriguez, A. (2016). Topology optimization of multitrack ring resonators and 2d microcavities for nonlinear frequency conversion. *OL*, *42*(14), 2818–2822. https://www.osapublishing.org/ol/abstract.cfm?uri=ol-42-14-2818
45. Lin, Z., Lysander, C., Li, Y., Mazur, E., Rodriguez, A., & Loncar, M. (2018). Topology-optimized dual-polarization Dirac cones. *PRB-Rapid*, *97*, 081408. https://journals.aps.org/prb/abstract/10.1103/PhysRevB.97.081408
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47. Liu, L., Woolf, A., Rodriguez, A., & Capasso, F. (2014). Absolute Position Total Internal Reflection Microscopy with an Optical Tweezer. *PNAS*, *111*(52), 5609–5615. http://www.pnas.org/content/early/2014/12/12/1422178112.abstract
48. Logan, A., Gould, M., Schmidgall, E., Hestroffer, K., Lin, Z., Jin, W., Majumdar, A., Hatami, F., Rodriguez, A., & Fu, K.-M. (2018). 400%/W second harmonic conversion efficiency in 14 μm-diameter gallium phosphide-on-oxide resonators. *OE*, *26*(26), 33687–33699. https://www.osapublishing.org/OE/abstract.cfm?uri=OE-26-26-33687
49. Maldonado, T., Pham, D., Amaolo, A., Rodriguez, A., & Türeci, H. (2023). Negative electrohydrostatic pressure between superconducting bodies. *ArXiv*. https://arxiv.org/abs/2307.04903
50. Maldonado, T., Pham, D., Amaolo, A., Rodriguez, A., & Türeci, H. (2024). Negative electrohydrostatic pressure between superconducting bodies. *Phys. Rev. B*, *110*, 014508. https://doi.org/10.1103/PhysRevB.110.014508
51. Malekakhlagh, M., & Rodriguez, A. (2019). Quantum Rabi model with two-photon relaxation. *PRL*, *122*, 043601. https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.122.043601
52. McCauley, A., Rodriguez, A., Joannopoulos, J., & Johnson, S. (2010). Casimir forces in the time domain: Applications. *Physical Review A*, *81*(1), 012119. http://pra.aps.org/pdf/PRA/v81/i1/e012119
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54. McCauley, A., Rosa, F., Rodriguez, A., Joannopoulos, J., Davlit, D., & Johnson, S. (2011). Structural anisotropy and orientation-induced Casimir repulsion in fluids. *PRA*, *83*, 052503. http://pra.aps.org/abstract/PRA/v83/i5/e052503
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64. Molesky, S., Chao, P., & Rodriguez, A. (2021). Causality, passivity and optimization: Strong duality in quadratically constrained quadratic programs for waves. *ArXiv:Xiv:2105.02154*. https://arxiv.org/abs/2105.02154
65. Molesky, S., Jin, W., Venkataram, P., & Rodriguez, A. (2019). T-operator bounds on absorption and thermal radiation for arbitrary objects. *PRL*, *123*, 257401. https://link.aps.org/doi/10.1103/PhysRevLett.123.257401
66. Molesky, S., Lin, Z., Jin, W., Piggott, A., Vuckovic, J., & Rodriguez, A. (2018). Inverse Design in Nanophotonics. *Nature Photonics*, *12*, 659–670. https://www.nature.com/articles/s41566-018-0246-9
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68. Pan, K., McCauley, A., Rodriguez, A., Reid, M., White, J., & Johnson, S. (2011). Calculation of nonzero-temperature Casimir forces in the time domain. *PRA-Rapid*, *83*, 040503. http://pra.aps.org/abstract/PRA/v83/i4/e040503
69. Pick, A., Cerjan, A., Liu, D., Rodriguez, A., Stone, A., Chong, Y., & Johnson, S. (2015). Ab-initio multimode linewidth theory for arbitrary inhomogeneous laser cavities. *PRA*, *91*, 063806. http://journals.aps.org/pra/abstract/10.1103/PhysRevA.91.063806
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Patents

1. Method of Producing a Photonic Metasurface for Performing Computationally Intensive Mathematical Computations. U.S. patent # 0176383. H Chi, H Xu, Alejandro W. Rodriguez, M. E. A Houyou, W Reinhart, S. Molesky, P. Chao.
2. Topology optimized multilayer metaoptics, U.S. patent # 11835681. Zin Lin, Federico Capasso, Alejandro W. Rodriguez, Marko Loncar, and Benedikt Groever.
3. Overlap optimization of nonlinear frequency conversion in multi-mode cavities, U.S. patent # 10353269. Alejandro Rodriguez, Zin Lin, Steven G. Johnson, Marko Loncar, and Xiangdong Liang.
4. Efficient harmonic generation and frequency conversion in nonlinear multimode cavities. U.S. patent # 7768694. Alejandro W. Rodriguez, Marin Soljacic, J. D. Joannopoulos and Steven G. Johnson.
5. Efficient terahertz sources based on di erence-frequency generation in triply resonant photonic resonators. W.O. patent # 046648, U.S. patent # 2012-0194901. Jorge Bravo-Abad, Alejandro W. Rodriguez, J. D. Joannopoulos, Steven G. Johnson and Marin Soljacic.
6. Enhancement and inhibition of optical nonlinearities via the Purcell e ect. Provisional led. Peter Bermel, Alejandro Rodriguez, John. D. Joannopoulos and Marin Soljacic.
7. Nonlinear harmonic generation and devices in multi-resonant cavities. U.S. patent # 8045257. Hila Hashemi, Alejandro Rodriguez, John. D. Joannopoulos, Marin Soljacic and Steven G. Johnson.