

Soon Wei Daniel Lim

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EMPLOYMENT

Alice Y. Hung Assistant Professor in Science and Technology Sep 2026 - Present

Nanyang Assistant Professor, Nanyang Technological University, Singapore

Principal Investigator, Bioinformatics Institute (BII), A*STAR (joint appointment)

Designing of low-cost, high-accessibility medical diagnostics and therapeutics based on unconventional acoustic devices. NTU School: Mechanical and Aerospace Engineering (MAE).

Schmidt Science Postdoctoral Fellow, Stanford University School of Medicine Nov 2023 - Aug 2026

Advisor: Prof. Steven Chu. Developing low cost, high efficiency intracellular delivery techniques and non-linear ultrasound contrast diagnostics. Department: Molecular and Cellular Physiology.

Postdoctoral Fellow, Harvard University Sep 2023 - Oct 2023

Doctoral Researcher, Harvard University Sep 2018 - Sep 2023

Advisor: Prof. Federico Capasso. Investigated counter-intuitive fundamental behavior of structured wavefields containing singularities (“dark” regions of light). Achieved a flat lens that uses extremely deep and narrow holes, the highest aspect ratio nanostructures for wavefront shaping.

Research Assistant, Bioprocessing Technology Institute, A*STAR Jan 2018 - Jun 2018

Advisor: Prof. Shireen Goh (now at SUTD, Singapore). Modeled multiphase computational fluid dynamics for inertial focusing in dense particle-laden flows.

Research Engineer, Singapore Institute of Manufacturing Technology, A*STAR Jul 2017 - Dec 2017

Advisor: Prof. Wong Liang Jie (now at NTU, Singapore). Simulated strong-field light-matter interactions in laser-based particle acceleration.

Undergraduate Researcher, California Institute of Technology Jan 2015 - Jun 2017

Advisor: Prof. Sandra Troian. Developed microlens arrays in polymer using spatially-varying surface tension.

Research Intern, Institute for Infocomm Research, A*STAR Jun 2014 - Aug 2014

Advisor: Dr. Ng Tian Tsong. Designed analytical tools for the medical application of micro-NMR devices.

Research Intern, Institute of Materials Research and Engineering, A*STAR May 2013 - Jul 2013

Advisor: Prof. Chin Jia Min (now at University of Vienna). Self-assembly of non-closed packed pore arrays.

Research Intern, National Neuroscience Institute, Singapore Dec 2007 - Dec 2009

Advisor: Dr. Jeanne Tan. Mouse model study on the role of heat shock proteins in neurodegeneration.

EDUCATION

2018 - 2023 Ph.D. Applied Physics, **Harvard University** **GPA: 4.0/4.0**

Advisor: Prof. Federico Capasso; Thesis: *Sculpting the dark: Singularity engineering with metasurfaces*

2013 - 2017 B.S. Physics, **California Institute of Technology** **GPA: 4.3/4.3, rank 1/254**

Advisor: Prof. Sandra Troian; Thesis: *Revolution in large-area curved surface lithography: Nanofilm sculpting by thermocapillary modulation*

2016 Caltech Cambridge Scholar, **Cambridge University** **Class: First**

PUBLICATIONS - REFEREED PAPERS

**equal contribution.*

1. [S.W.D. Lim*](#), C.M. Spaegele*, F. Capasso, “Multidimensional optical singularities and their applications”, *Nature Reviews Electrical Engineering*, 2026, [10.1038/s44287-026-00331-5](#).
2. J.S. Park*, [S.W.D. Lim*](#), A. Amirzhan, H. Kang, K. Karrfalt, D. Kim, J. Leger, A. Urbas, M. Ossiander, Z. Li, F. Capasso, All-Glass 100 mm Diameter Visible Metalens for Imaging the Cosmos, *ACS Nano*, 18, 4, 3187–3198, 2024, [10.1021/acsnano.3c09462](#) and [Cover Art](#).
3. R.J. Tang*, [S.W.D. Lim*](#), M. Ossiander, X. Yin, F. Capasso, Time reversal differentiation of FDTD for photonic inverse design, *ACS Photonics*, 10, 12, 4140–4150, 2023, [10.1021/acsp Photonics.3c00694](#).
4. J. Lu, V. Ginis, [S.W.D. Lim](#), F. Capasso, Helicity and Polarization Gradient Optical Trapping in Evanescent Fields, *Physical Review Letters*, 131, 14, 143803, 2023, [10.1103/PhysRevLett.131.143803](#).
5. D. Hazineh*, [S.W.D. Lim*](#), Q. Guo, F. Capasso, T. Zickler, Polarization Multi-Image Synthesis with Birefringent Metasurfaces, *IEEE Intl. Conf. on Computational Photography (ICCP)*, 2023, [10.1109/ICCP56744.2023.10233735](#).
6. C.M. Spaegele, M. Tamagnone, [S.W.D. Lim](#), M. Ossiander, M.L. Meretska, F. Capasso, Topologically protected optical polarization singularities in four-dimensional space, *Science Advances*, 9, 24, 2023, [10.1126/sciadv.adh0369](#).
7. [S.W.D. Lim*](#), J.S. Park*, D. Kazakov, C.M. Spaegele, A.H. Dorrah, M.L. Meretska, F. Capasso, Point singularity array with metasurfaces, *Nature Commun.*, 14, 3237, 2023, [10.1038/s41467-023-39072-6](#).
8. M. Ossiander*, M.L. Meretska*, H.K. Hampel*, [S.W.D. Lim](#), N. Knefz, T. Jauk, F. Capasso, M. Schultze, Extreme ultraviolet metalens by vacuum guiding, *Science*, 380, 59–63, 2023, [10.1126/science.adg6881](#).
9. G. Palermo, A. Lininger, A. Guglielmelli, L. Ricciardi, G. Nicoletta, A. De Luca, J.S. Park, [S.W.D. Lim](#), M.L. Meretska, F. Capasso, G. Strangi, All-optical tunability of metalenses permeated with liquid crystals, *ACS Nano*, 16, 10, 16539–16548, 2022, [10.1021/acsnano.2c05887](#).
10. [S.W.D. Lim*](#), M.L. Meretska*, F. Capasso, A high aspect ratio inverse-designed holey metalens, *Nano Letters*, 21, 8642–8649, 2021, [10.1021/acs.nanolett.1c02612](#).
11. [S.W.D. Lim](#), J.S. Park, M.L. Meretska, A.H. Dorrah, F. Capasso, Engineering phase and polarization singularity sheets, *Nature Commun.* 12, 4190, 2021, [10.1038/s41467-021-24493-y](#).
12. S. Yu, J. Lu, V. Ginis, S. Kheifets, [S.W.D. Lim](#), M. Qiu, T. Gu, J. Hu, F. Capasso, On-chip optical tweezers based on freeform optics, *Optica* 8, 3, 409–414, 2021, [10.1364/OPTICA.418837](#).
13. M. Shen, [S.W.D. Lim](#), E.S. Tan, H.H. Oon, E.C. Ren, HLA correlations with clinical phenotypes and risk of metabolic comorbidities in Singapore Chinese psoriasis patients, *Molecular Diagnosis & Therapy* 23, 6, 751–760, 2019, [10.1007/s40291-019-00423-z](#).
14. A.Z. Thong, [S.W.D. Lim](#), A. Ahsan, T.W.G. Goh, J.W. Xu, and J.M. Chin, Non-closed-packed pore arrays through one-step breath figure self-assembly and reversal, *Chemical Science* 5, 1375–1382, 2014, [10.1039/C3SC52258J](#).

MANUSCRIPTS UNDER REVIEW

1. [S.W.D. Lim](#), Y.H. Kee, S.N.A. Smith, S.M. Tan, A.E. Lim, Y. Yang, S. Goh, “Dense Suspension Inertial Microfluidic Particle Theory (DENSE-IMPACT) Model for Elucidating Outer Wall Focusing at High Cell Densities”, ArXiv [2409.12488](#)
2. Z. Li, S.D. Campbell, J.S. Park, R.P. Jenkins, [S.W.D. Lim](#), D.H. Werner, F. Capasso, “Heterogeneous Freeform Metasurfaces: A Platform for Advanced Broadband Dispersion Engineering”, ArXiv [2412.12028](#).
3. C.M. Spaegele, M. Rezaee, T. Werkmeister, [S.W.D. Lim](#), K. Vaillancourt, J.S. Park, P. Chevalier, I. Kaminer, P. Kim, F. Capasso, M. Tamagnone, “A scalable platform for nanometer-scale quantum confinement”, ArXiv [2604.08957](#).
4. J. Li, [S.W.D. Lim](#), F. Capasso, “Resonance-Induced Sign Reversal of Optical Gradient Forces and Three-Dimensional Singularity Trapping”, ArXiv [2607.25303](#).

PATENTS

1. M.L. Meretska, [S.W.D. Lim](#), and F. Capasso, “High-aspect ratio metalens,” U.S. patent [US11860336B2](#),

granted 02 Jan 2024.

2. M.T. Ossiander, M.L. Meretska, [S.W.D. Lim](#), F. Capasso, “Nanooptics with high refractive index apertures”, U.S. patent [2025/0389868 A1](#) (2023), filed 29 Jun 2023, pending.

CONFERENCE TALKS

1. K. Liang, G.E.W. Marti, [S.W.D. Lim](#), Y. Wei, A. Chronopoulos, N. Torok, J. Dahl, S. Chu, “Difference-frequency ultrasound imaging with multiple linear array transducers”, *SPIE Medical Imaging* 2026, [10.1117/12.3085634](#).
2. J. Lenaerts, D. Cassara, P. Chevalier, J.S. Park, L. Sacchi, [S.W.D. Lim](#), R. Pestourie, V. Ginis, M.L. Meretska, F. Capasso, “Polychromatic metalens in the NIR for CO₂ detection”, *SPIE OPTO* 2025, [10.1117/12.3041398](#).
3. [S.W.D. Lim](#), C.M. Spaegele, F. Capasso, “Singularity engineering with metasurfaces: from 0D to 4D”, *SPIE Photonics West* 2024, [10.1117/12.3004234](#).
4. [S.W.D. Lim](#), J.S. Park, D. Kazakov, C.M. Spaegele, A.H. Dorrah, M.L. Meretska, F. Capasso, “Point singularity array with metasurfaces for blue-detuned atomic traps”, *SPIE Nanosci. + Eng.* 2023, [10.1117/12.2676740](#).
5. R.J. Tang, [S.W.D. Lim](#), M. Ossiander, X. Yin, F. Capasso, “Minimal memory differentiable FDTD for photonic inverse design”, *SPIE Nanoscience + Engineering* 2023, [10.1117/12.2677131](#).
6. M. Ossiander, M.L. Meretska, H.K. Hampel, [S.W.D. Lim](#), N. Knefz, T. Jauk, F. Capasso, M. Schultze, “Holey metalens focusing of extreme ultraviolet light”, *Optica Imaging Congress* 2023, [10.1364/FLATOPTICS.2023.FTh3G.3](#).
7. D. Hazineh, [S.W.D. Lim](#), Q. Guo, F. Capasso, T. Zickler, Polarization Multi-Image Synthesis with Birefringent Metasurfaces, *ICCP* 2023, [10.1109/ICCP56744.2023.10233735](#).
8. R. Jun, [S.W.D. Lim](#), D. Hazineh, F. Capasso, “Computing the Optical Response of Metasurfaces Under Partially Coherent Illumination”, *CLEO* 2023, [10.1364/CLEO_FS.2023.FW4H.6](#).
9. C.M. Spaegele, M. Tamagnone, S.W.D. Lim, M. Ossiander, M.L. Meretska, F. Capasso, “Topologically protected polarization singularities in four dimensions”, *CLEO* 2023, [10.1364/CLEO_FS.2023.FTh3C.7](#).
10. M. Ossiander, M.L. Meretska, H.K. Hampel, [S.W.D. Lim](#), N. Knefz, T. Jauk, M. Schultze, F. Capasso, “Extreme Ultraviolet Metaoptics enabled by Vacuum Guiding”, *CLEO* 2023, [10.1364/CLEO_FS.2023.FM3D.6](#).
11. Z. Sun, M.L. Meretska, F.H.B. Somhorst, J.S. Park, [S.W.D. Lim](#), Y. Hou, J.S. Moodera, F. Capasso, “Free-standing Metasurface-based Faraday Rotator”, *CLEO* 2023, [10.1364/CLEO_AT.2023.JW2A.98](#).
12. J.S. Park, K. Vaillancourt, [S.W.D. Lim](#), C.M. Spaegele, F. Capasso, “All-dielectric, visible wavelength focusing metalens with planar surface for mechanical robustness”, *CLEO* 2023, [10.1364/CLEO_SI.2023.SF3K.3](#).
13. J.S. Park, [S.W.D. Lim](#), A. Amirzhan, H. Kang, D. Kim, M. Ossiander, Z. Li, F. Capasso, *The International Conference on Surface Plasmon Photonics 10*, 2023.
14. [S.W.D. Lim](#), J.S. Park, M.L. Meretska, A.H. Dorrah, D. Kazakov, F. Capasso, “Metasurface blue-detuned atom trap arrays using singularity engineering”, *CLEO* 2022, [10.1364/CLEO_QELS.2022.FF4D.4](#).
15. J.S. Park, [S.W.D. Lim](#), M. Ossiander, Z. Li, A. Amirzhan, F. Capasso, “All-Glass, Mass-Produced, Large-Diameter Metalens at Visible Wavelength for 100 mm Aperture Optics and Beyond”, *CLEO* 2022, [10.1364/CLEO_AT.2022.AW4I.1](#).
16. R. Tang, [S.W.D. Lim](#), X. Yin, F. Capasso, “Minimal memory differentiable FDTD for inverse design”, *CLEO* 2022, [10.1364/CLEO_QELS.2022.FM5H.4](#).
17. [S.W.D. Lim](#), J.S. Park, M.L. Meretska, A.H. Dorrah, F. Capasso, “Structuring phase and polarization singularity sheets in 2D”, *CLEO* 2021, [10.1364/CLEO_QELS.2021.FW4G.5](#).
18. [S.W.D. Lim](#), M.L. Meretska, F. Capasso, “A high aspect-ratio holey metalens”, *CLEO* 2021, [10.1364/CLEO_SI.2021.SM4I.4](#).
19. J. Lu, S. Yu, V. Ginis, S. Kheifets, [S.W.D. Lim](#), M. Qiu, T. Gu, J. Hu, F. Capasso, “On-Chip Optical Tweezers Based on Micro-Reflectors”, *CLEO* 2021, [10.1364/CLEO_SI.2021.SW3B.1](#).
20. [S.W.D. Lim](#), J. S. Park, M.L. Meretska, A.H. Dorrah, F. Capasso, “Singularity engineering: sculpting the dark”, *SPIE OPTO* 2021, [10.1117/12.2577222](#).
21. M.L. Meretska, [S.W.D. Lim](#), F. Capasso, “Monolithic focusing metasurfaces”, *SPIE OPTO* 2021, [10.1117/12.2577320](#).
22. J. Lu, S. Yu, V. Ginis, S. Kheifets, [S.W.D. Lim](#), M. Qiu, T. Gu, J. Hu, F. Capasso, “On-chip optical tweezers based on free-form optics”, *SPIE Nanoscience + Engineering* 2021, [10.1117/12.2594988](#).
23. [S.W.D. Lim](#), K. Fiedler, C. Zhou, S.M. Troian, “Fabrication of Converging and Diverging Polymeric Microlens

- Arrays By Spatiotemporal Control of Thermocapillary Forces”, *APS March Meeting* 2017.
24. S.W.D. Lim, K. Fiedler, S.M. Troian, “Fabrication of Converging and Diverging Polymeric Microlens Arrays By A Thermocapillary Replication Technique”, *APS Division of Fluid Dynamics* 2016.
 25. S.W.D. Lim, K. Fiedler, S.M. Troian, “Fabrication of Converging and Diverging Polymeric Microlens Arrays By A Thermocapillary Replication Technique”, *APS March Meeting* 2016.

SELECTED AWARDS

- **Schmidt Science Fellowship** (2024).
 - A postdoctoral fellowship enabling the world’s best emerging scientists to pivot from their PhD discipline and pursue their goals through bold interdisciplinary research [Source: [Schmidt Science Fellows](#)].
 - First Singaporean (jointly) to receive this fellowship, one of 32 fellows for 2024.
- **Lindau Young Scientist** (2019).
 - One of eight young scientists selected to represent Singapore in the 2019 Lindau Nobel Laureate Meetings.
- **A*STAR Roll of Honor** (2017).
 - One of six A*STAR scholars recognized for top undergraduate academic achievement.
- **D.S. Kothari Prize in Physics** (2017), California Institute of Technology.
 - Given to a graduating senior in physics who has produced an outstanding research project during the past year [Source: [Caltech Physics](#)].
- **Friends of the Caltech Libraries Senior Thesis Prize** (2017), California Institute of Technology.
 - Recognizes senior theses that exemplify excellent research, writing, and the effective use of library resources [Source: [Caltech Libraries](#)].
- **Haren Lee Fisher Memorial Award in Junior Physics** (2016), California Institute of Technology.
 - Awarded annually to a physics major who has completed their second year and demonstrates great promise for future contributions to the field [Source: [Caltech Physics](#)].
- **Jack E. Froehlich Memorial Award** (2016), California Institute of Technology.
 - Awarded to a junior in the upper 5 percent of their class who shows outstanding promise for a creative professional career [Source: [Caltech Deans](#)].
- **Ken Hass Outstanding Student Paper Award** (2017), American Physical Society.
 - Recognizes an outstanding student paper addressing the subject of industrial applications of physics [Source: [APS](#)].
 - Paper: “Fabrication of Converging and Diverging Polymeric Microlens Arrays By Spatiotemporal Control of Thermocapillary Forces”
- **International Physics Olympiad Silver Medal** (2010).
 - One of five students selected to represent Singapore.

FELLOWSHIPS AND GRANTS

Named Professorship	Alice Y. Hung Assistant Professor in Science and Technology (2026-2030).
Start-up grant	Nanyang Assistant Professorship , Nanyang Technological University (2026-2030).
US\$220,000	Schmidt Science Fellowship , Schmidt Sciences (2024-2026).
SGD\$20,000	NUS Development Grant , National University of Singapore (2024-2025).
8 years full funding	National Science Scholarship , A*STAR Singapore (2013-2023).

TEACHING

- Fall 2019: Harvard University Physics 123/223, “**Laboratory Electronics**”, Teaching Fellow
- Fall 2016: California Institute of Technology Physics 5/105, “**Analog Electronics for Physicists**”, Teaching Fellow

MENTORSHIP

1. 2019-2020: Rui Jie Tang (Waterloo co-op intern). Co-led the Time Reversal Differentiation FDTD project, resulting in co-first authorship on Tang*, Lim*, et al., *ACS Photonics* 10, 4140–4150 (2023). Now Ph.D. candidate at the University of Toronto.
2. 2021-2023: Revin Jun (research intern). Co-authored CLEO 2023 talk “Computing the Optical Response of

PEER REVIEW SERVICE

ACS Omega (American Chemical Society)	2
Journal of the Optical Society of America A (Optica Publishing Group)	1
Journal of the Optical Society of America B (Optica Publishing Group)	2
Laser & Photonics Reviews (Wiley-VCH)	12
Light: Science & Applications (Nature Portfolio)	1
Nanophotonics (de Gruyter)	1
Nature Communications (Nature Portfolio)	4
Nature Physics (Nature Portfolio)	1
Optica (Optica Publishing Group)	1
Optics Express (Optica Publishing Group)	9
Optics Letters (Optica Publishing Group)	2
PhotonIX (Springer)	1
Total	37

LEADERSHIP AND COMMUNITY SERVICE

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- **Head**, National Science Challenge Scientific Working Committee (2017 - 2018)
 - Spearheaded a diverse team of 15 members across multiple organizations, overseeing the planning and implementation of scientific projects, competitive rounds, and outreach initiatives for the National Science Challenge, a nationally-broadcast inter-school science contest. Provided expert advice to the national broadcaster (Mediacorp) throughout competition and filming stages.
 - Successfully concluded with the [2017 broadcast](#) (6 episodes) and [2018 broadcast](#) (6 episodes).

SELECTED MEDIA COVERAGE

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- **Schmidt Science Fellowship (2024)**
 - Schmidt Science Fellows: [Fellow profile, Soon Wei Daniel Lim](#)
 - Harvard Gazette: [Recent Harvard Grad Named 2024 Schmidt Science Fellow](#)
 - Harvard SEAS: [Lim Named Schmidt Science Fellow](#)
 - **All-Glass 100 mm Diameter Visible Metalens for Imaging the Cosmos** (*ACS Nano* 18, 2024)
 - Harvard SEAS: [The Metalens Meets the Stars](#)
 - Phys.org: [Large, All-Glass Metalens Images Sun, Moon and Nebulae](#)
 - Photonics Spectra: [Large-scale, Mass-producible Metalens Enables Astral Imaging](#)
 - Interesting Engineering: [First 10-cm Glass Metalens Promises Stunning Views of Sun, Moon, Cosmos](#)
 - **Point Singularity Array with Metasurfaces** (*Nat. Commun.* 14, 2023) and **Topologically Protected Optical Polarization Singularities in Four-Dimensional Space** (*Sci. Adv.* 9, 2023)
 - Harvard SEAS: [Building Robust Optical Structures Made of Darkness](#)
 - Phys.org: [Building Robust Optical Structures Made of Darkness](#)
 - Photonics Spectra: [Metasurfaces Exert Control Over Darkness](#)
 - The Debrief: [Controlling Points of Darkness with Metasurfaces Could Enable New Covert Detection Technologies, Harvard Team Says](#)
 - **A High Aspect Ratio Inverse-Designed Holey Metalens** (*Nano Lett.* 21, 2021)
 - Harvard SEAS: [Holey Metalens!](#)
 - Phys.org: [Holey Metalens! New Metalens Focuses Light with Ultra-Deep Holes](#)
 - Photonics Spectra: [Metalens Design Uses Millions of Holes to Focus Light into Single Point](#)
 - Optics.org: [Pitted Metalens Gives Light Holey Orders](#)
 - **Engineering Phase and Polarization Singularity Sheets** (*Nat. Commun.* 12, 2021)
 - Harvard SEAS: [Harnessing the Dark Side](#)
 - Physics World: [Metamaterial Sculpts Heart-Shaped Darkness from Light](#)
 - Phys.org: [Optical Singularities Could be Used for a Wide Range of Applications](#)
 - Photonics Spectra: [On-Demand Optical Singularities Strengthen Range of Applications](#)

- **A*STAR National Science Scholarship** (BrightSparks Magazine, July 2018)
 - BrightSparks Magazine: *The Science of Tomorrow*
- **Friends of the Caltech Libraries Senior Thesis Prize (2017)**
 - Caltech News: *The 2017 Library Thesis Prize*

REFEREES

- **Prof. Federico Capasso**, Robert L. Wallace Professor of Applied Physics and Vinton Hayes Senior Research Fellow in Electrical Engineering, Harvard University: capasso@seas.harvard.edu
- **Prof. Steven Chu**, William R. Kenan Jr. Professor, Professor of Molecular and Cellular Physiology and of Energy Science and Engineering, Stanford University: schu@stanford.edu
- **Prof. Sandra Troian**, Professor of Applied Physics, Aeronautics, and Mechanical Engineering, California Institute of Technology: stroian@caltech.edu
- **Prof. Todd Zickler**, William and Ami Kuan Danoff Professor of Electrical Engineering and Computer Science, Harvard University: zickler@seas.harvard.edu