

# Soon Wei Daniel Lim

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## EMPLOYMENT

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**Nanyang Assistant Professor**, Nanyang Technological University, Singapore From Sep 2026

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

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

**Schmidt Science Fellow**, Stanford University School of Medicine Nov 2023 - present

Advisor: Prof. Steven Chu. Developing low cost, high efficiency intracellular delivery techniques for *in vivo* diagnostics.

**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

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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

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\*equal contribution.

1. 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](https://doi.org/10.1021/acsnano.3c09462) and [Cover Art](#).
2. 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](https://doi.org/10.1021/acsp Photonics.3c00694).
3. 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](https://doi.org/10.1103/PhysRevLett.131.143803).
4. 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](https://doi.org/10.1109/ICCP56744.2023.10233735).
5. 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](https://doi.org/10.1126/sciadv.adh0369).
6. 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](https://doi.org/10.1038/s41467-023-39072-6).
7. 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](https://doi.org/10.1126/science.adg6881).
8. 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](https://doi.org/10.1021/acsnano.2c05887).
9. 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](https://doi.org/10.1021/acs.nanolett.1c02612).
10. 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](https://doi.org/10.1038/s41467-021-24493-y).
11. 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](https://doi.org/10.1364/OPTICA.418837).
12. 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](https://doi.org/10.1007/s40291-019-00423-z).
13. 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](https://doi.org/10.1039/C3SC52258J).

## MANUSCRIPTS IN PROGRESS

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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](https://arxiv.org/abs/2409.12488)
2. S.W.D. Lim, C.M. Spaegele, F. Capasso, “Multidimensional optical singularities and their applications”, ArXiv [2406.00784](https://arxiv.org/abs/2406.00784).
3. 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](https://arxiv.org/abs/2412.12028).

## PATENTS

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1. M.L. Meretska, S.W.D. Lim, and F. Capasso, “High-aspect ratio metalens,” U.S. patent [US11860336B2](https://patents.google.com/patent/US11860336B2), granted 02 Jan 2024.
2. S.W.D. Lim, J.S. Park, M.L. Meretska, F. Capasso, and A.H. Dorrah, “Systems and methods of phase and polarization singularity engineering”, U.S. patent [2023/0021549 A1](https://patents.google.com/patent/2023/0021549A1) (2023), filed 19 Jan 2022, pending.
3. M.T. Ossiander, M.L. Meretska, S.W.D. Lim, F. Capasso, “Nanooptics with high refractive index apertures”, U.S. patent [2025/0389868 A1](https://patents.google.com/patent/2025/0389868A1) (2023), filed 29 Jun 2023, pending.

## CONFERENCE TALKS

1. 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 CO<sub>2</sub> detection”, *SPIE OPTO* 2025, [10.1117/12.3041398](#).
2. [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](#).
3. [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](#).
4. 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](#).
5. 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/FLATOP-TICS.2023.FTh3G.3](#).
6. 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](#).
7. 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](#).
8. 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](#).
9. 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](#).
10. 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](#).
11. 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](#).
12. 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.
13. [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](#).
14. 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](#).
15. 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](#).
16. [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](#).
17. [S.W.D. Lim](#), M.L. Meretska, F. Capasso, “A high aspect-ratio holey metalens”, *CLEO* 2021, [10.1364/CLEO\\_SI.2021.SM4I.4](#).
18. 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](#).
19. [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](#).
20. M.L. Meretska, [S.W.D. Lim](#), F. Capasso, “Monolithic focusing metasurfaces”, *SPIE OPTO* 2021, [10.1117/12.2577320](#).
21. 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](#).
22. [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.
23. [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.
24. [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

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- **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

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Start-up grant	<a href="#">Nanyang Assistant Professorship</a> , Nanyang Technological University (2026-2030).
US\$220,000	<a href="#">Schmidt Science Fellowship</a> , Schmidt Sciences (2024-2026).
SGD\$20,000	<a href="#">NUS Development Grant</a> , National University of Singapore (2024-2025).
8 years full funding	<a href="#">National Science Scholarship</a> , A*STAR Singapore (2013-2023).

## TEACHING

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- 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

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1. 2019-2020: Rui Jie Tang (research intern), now Ph.D. candidate at the University of Toronto
2. 2021-2023: Revin Jun (research intern), now undergraduate at Harvard University

## PEER REVIEW SERVICE

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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)	10
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
<b>Total</b>	<b>35</b>

99<sup>th</sup> percentile, Feb 2024 - Feb 2025  
([Clarivate](#))

## 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).

## REFEREES

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- **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](mailto: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](mailto:schu@stanford.edu)
- **Prof. Sandra Troian**, Professor of Applied Physics, Aeronautics, and Mechanical Engineering, California Institute of Technology: [stroian@caltech.edu](mailto:stroian@caltech.edu)
- **Prof. Todd Zickler**, William and Ami Kuan Danoff Professor of Electrical Engineering and Computer Science, Harvard University: [zickler@seas.harvard.edu](mailto:zickler@seas.harvard.edu)