

Soon Wei Daniel Lim (Daniel)

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SUMMARY

I am an interdisciplinary applied physicist with a unique background in both life and physical sciences. I have research experience in mouse model studies of neurodegeneration, micro-optical device fabrication by harnessing surface tension, particle-laden computational fluid dynamics, and algorithmic tools and nanoscale devices to control every degree of freedom in optical wavefronts.

EDUCATION

Sep 2018 - Sep 2023 Ph.D. Applied Physics, **Harvard University** **GPA: 4.0/4.0**
Advisor: Prof. Federico Capasso; Thesis: *Sculpting the dark: Singularity engineering with metasurfaces*

Sep 2013 - Jun 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*

Jan 2016 - Mar 2016 Caltech Cambridge Scholar, **Cambridge University** **Class: First**

RECENT RESEARCH EXPERIENCE

Schmidt Science Fellow, Stanford University School of Medicine Nov 2023 - present
Advisor: Prof. Steven Chu. Developing novel ultrasound and photoacoustic medical imaging devices.

Doctoral Researcher, Harvard University Sep 2018 - Sep 2023
Advisor: Prof Federico Capasso. Investigated counter-intuitive fundamental behavior of structured light fields containing optical singularities (“dark” regions of light). Achieved a flat lens that uses extremely deep and narrow holes, the highest aspect ratio nanostructures for wavefront shaping as of publication. Mentored a undergraduate (now PhD student, University of Toronto) and a high school student (now Harvard undergraduate).

Research Assistant, Bioprocessing Technology Institute, A*STAR Jan 2018 - Jun 2018
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
Numerically 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. Fabricated microlens arrays in polymer with spatially-varying surface tension.

SELECTED FELLOWSHIPS AND AWARDS

Schmidt Science Fellowship (2024-2026), Schmidt Sciences. **National Science Scholarship** (2011-2023), A*STAR Singapore. **Lindau Young Scientist** (2019). **A*STAR Roll of Honor** (2017). California Institute of Technology awards: **D.S. Kothari Prize in Physics** (2017) for outstanding research project, **Friends of the Caltech Libraries Senior Thesis Prize** (2017) for excellence in research, writing and effective use of library resources in Senior Thesis, **Haren Lee Fisher Memorial Award in Junior Physics** (2016) for demonstrating greatest promise of future contributions to physics, and **Jack E. Froehlich Memorial Award** (2016) for junior in upper 5 percent of class showing outstanding promise for creative professional career. **Ken Hass Outstanding Student Paper Award** (2017), American Physical Society. **International Physics Olympiad Silver Medal** (2010).

SKILLS

- **Computational:** Assembly, C++, Python, Mathematica, MATLAB, COMSOL, FDTD, Automatic Differentiation/Machine learning (Tensorflow, Pytorch).
- **Dry bench:** Microscopy (confocal, polarimetric, atomic force), analog/digital circuit design, automated instrument control, visible/infrared coherent sources.
- **Wet bench:** Aseptic technique, cell culture, microfluidic devices, optical tweezing.
- **Nanofabrication:** Lithography down to 10-100 nm feature scales (electron, focused ion beam, soft), standard semiconductor processes (e.g., chemical/physical vapor deposition, dry/wet etch).
- **Electron microscopy:** STEM/TEM, FIB sample preparation, EDS, (R)EELS, environmental SEM.

PUBLICATIONS **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 and [Supplemental 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.
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.
4. D. Hazineh*, **S.W.D. Lim***, Q. Guo, F. Capasso, T. Zickler, [Polarization Multi-Image Synthesis with Birefringent Metasurfaces](#), *IEEE International Conference on Computational Photography (ICCP)*, 2023.
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.
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 Communications*, 14, 3237, 2023.
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.
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.
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. **S.W.D. Lim**, J.S. Park, M.L. Meretska, A.H. Dorrah, F. Capasso, [Engineering phase and polarization singularity sheets](#), *Nature Communications* 12, 4190, 2021.
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.
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.
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.

PATENTS

1. M.L. Meretska, **S.W.D. Lim**, and F. Capasso, “High-aspect ratio metalens,” U.S. patent [US11860336B2](#).
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](#) (2023), pending.
3. M.T. Ossiander, M.L. Meretska, **S.W.D. Lim**, F. Capasso, “Nanooptics with high refractive index apertures”, U.S. patent [US2023/26650](#) (2023), pending.