Gun-Yeal Lee

Postdoctoral Researcher
Department of Electrical Engineering,
Stanford University, CA, USA
Email: gunyeal@stanford.edu Web: https://gunyeal.github.io/

EDUCATION

Seoul National University Seoul, Korea
Ph.D. in Electrical and Computer Engineering 09/2015 – 08/2021
Advisor: Prof. Byoungho Lee
Thesis: "Metasurface optical elements for holography and imaging"

Seoul National University Seoul, Korea
B.S. in Electrical and Computer Engineering 03/2011 – 02/2015
B.S. in Physics
Advisor: Prof. Byoungho Lee and Prof. DaiSik Kim

RESEARCH EXPERIENCE

Stanford University Stanford, CA
Postdoctoral Researcher in Department of Electrical Engineering 09/2022 – present
Advisor: Prof. Gordon Wetzstein

Seoul National University Seoul, Korea
Postdoctoral Researcher in Inter-university Semiconductor Research Center 09/2021 – 08/2022
(Alternative military service of Korea until August 2022)
Doctoral Student Researcher in Department of Electrical and Computer Engineering 09/2015 – 08/2021
Research Intern in Optical Engineering and Quantum Electronics Lab 03/2015 – 08/2015
Advisor: Prof. Byoungho Lee

RESEARCH INTERESTS

My current research focus is at the intersection of nanophotonics, optical engineering, and computational imaging, aiming to solve fundamental problems in optical systems and develop next-generation optical systems through the synergistic combination of advanced photonic devices and AI-driven algorithms. My research topics include:

- Photonic Devices: Nanophotonics, Nanofabrication, Metasurfaces, Flat Optics
- Optical System Engineering: Optical Imaging, Photography, Microscopy, Holography, AR/VR displays
- Computational Optics: Computational Imaging, Computational Displays, Physical AI

I have collaborated on joint projects with academic and industry researchers at Stanford University, Seoul National University, Korea University, POSTECH, Korea Institute of Machinery & Materials, Samsung, Sony, Meta Reality Labs, and NVIDIA. In addition, I have actively contributed to research proposal writing and securing competitive funding, including awards from the NRF Postdoctoral Fellowship, NRF Mid-Career Research Program, Samsung Incubation Center for Future Technology, as well as research sponsorships from Meta Reality Labs, Sony Research, Samsung Research America, Samsung Display, and US Department of Defense. I also enjoy mentoring and collaborating with PhD students and undergraduate students.

HONORS AND AWARDS

NRF Postdoctoral Fellowship
Nurturing Next-generation Researchers Program, National Research Foundation of Korea (NRF), Korea, 2022.

Outstanding Doctoral Thesis Award
Department of Electrical and Computer Engineering, Seoul National University, Korea, 2021.

Best Graduate Student Award
Seoul National University, Korea, 2021.

Doyeon Academic Paper Award
Inter-university Semiconductor Research Center, Seoul National University, Korea, 2020.

Best Paper Award of 2020
WILEY ETRI Journal, Electronics and Telecommunications Research Institute (ETRI), 2020.

SPIE Optics and Photonics Education Scholarship
International Society for Optics and Photonics (SPIE), USA, 2020

Best Paper Award
Conference on Optoelectronics and Optical Communications, Daegu, Korea, 2018.

Incubic/Milton Chang Award
Optica (formerly known as The Optical Society of America), Washington, USA, 2017.

Emil Wolf Award – Finalist
Optica (formerly known as The Optical Society of America), Washington, USA, 2017.

Best Paper Award
META'17 (International Conference on Metamaterials, Photonic Crystals and Plasmonics), Incheon, Korea, 2017.

Best Paper Award & Best Student Award
International Conference on Optical and Photonic Engineering, Chengdu, China, 2016.

Best Paper Award - Grand Prize (1st place out of 600 papers)
Nano Korea 2016, Ilsan, Korea, 2016.

National Science & Technology Scholarship
Korea Student Aid Foundation (KOSAF), Korea, 2013-2015

JOURNAL PUBLICATIONS

(Google Scholar profile: https://scholar.google.com/citations?user=SlXpVNkAAAAJ&hl=en&oi=ao)

† denotes equal contribution

Journal Publications – First authorship (10)

1. **Gun-Yeal Lee**†, Changhyun Kim†, Manu Gopakumar, Youngjin Kim, Byoungho Lee, Yoonchan Jeong, and Gordon Wetzstein, "Neural phase microscopy with metasurface optics for real-time and nanoscale quantitative phase imaging," ***Nature Communications*** (in press).

2. Manu Gopakumar†, **Gun-Yeal Lee**†, Suyeon Choi, Brian Chao, Yifan Peng, Jonghyun Kim, and Gordon Wetzstein, "Full-colour 3D holographic augmented-reality displays with metasurface waveguides," ***Nature***, vol. 629, pp. 791-797, 2024. [Citations: 234]
[Press: Stanford News, NVIDIA tech, IEEE Spectrum]

3. Junhyeok Jang†, **Gun-Yeal Lee**†, Jangwoon Sung, and Byoungho Lee, "Independent multichannel wavefront modulation for angle multiplexed meta-holograms," ***Advanced Optical Materials***, vol. 9, no. 17, pp. 2100678, 2021. [Citations: 73]

4. **Gun-Yeal Lee**, Jangwoon Sung, and Byoungho Lee, "Metasurface optics for imaging applications," ***MRS Bulletin***, vol. 45, no. 3, pp. 202-209, 2020. [Citations: 51]

5. **Gun-Yeal Lee**, Jangwoon Sung, and Byoungho Lee, "Recent advances in metasurface hologram technologies," ***ETRI Journal***, vol. 41, no. 1, pp. 10-22, 2019. [Citations: 97]

6. Jangwoon Sung†, **Gun-Yeal Lee**†, Chulsoo Choi, Jongwoo Hong, and Byoungho Lee, "Single-layer bifacial metasurface: full-space visible light control," ***Advanced Optical Materials***, vol. 7, no. 8, article 1801748, 2019. [Citations: 54]

7. **Gun-Yeal Lee**†, Jong-Young Hong†, SoonHyoung Hwang, Seokil Moon, Hyeokjung Kang, Sohee Jeon, Hwi Kim, Jun-Ho Jeong, and Byoungho Lee, "Metasurface eyepiece for augmented reality," ***Nature Communications***, vol. 9, article 4562, 2018. [Citations: 599]

8. **Gun-Yeal Lee**, Gwanho Yoon, Seung-Yeol Lee, Hansik Yun, Jaebum Cho, Kyookeun Lee, Hwi Kim, Junsuk Rho, and Byoungho Lee, "Complete amplitude and phase control of light using broadband holographic metasurface," ***Nanoscale***, vol. 10, pp. 4237-4245, 2018. [Citations: 455]

9. Eui-Young Song†, **Gun-Yeal Lee**†, Hyeonsoo Park, Joonsoo Kim, Jongwoo Hong, Hwi Kim, and Byoungho Lee, "Compact generation of Airy beams with C-aperture metasurface," ***Advanced Optical Materials,*** vol. 5, Issue 10, article 161028, 2017. [Citations: 106]

10. **Gun-Yeal Lee**, Seung-Yeol Lee, Hansik Yun, Hyeonsoo Park, Joonsoo Kim, Kyookeun Lee, and Byoungho Lee, "Near-field focus steering along arbitrary trajectory via multi-lined distributed nanoslits," ***Scientific Reports,*** vol. 6, article 33317, 2016. [Citations: 14]

Journal Publications – First authorship (1), Under consideration

1. **Gun-Yeal Lee**, Jung-Hwan Song, Youngjin Kim, Junhyeok Jang, Jangwoon Sung, Yoonchan Jeong, Byoungho Lee, Mark L. Brongersma, and Gordon Wetzstein, "Complex metalens inspired by the human eye for compact high-performance imaging systems," (in revision).

Journal Publications – Contributing authorship (18)

1. Yeongmyeong Park, Youngjin Kim, Changhyun Kim, **Gun-Yeal Lee**, Hyeongyu Choi, Taewon Choi, Yoonchan Jeong, Byoungho Lee, "End-to-End Optimization of Metalens for Broadband and Wide-Angle Imaging," ***Advanced Optical Materials***, vol. 13, no. 9, 2402853, 2025.

2. Youngjin Kim, Taewon Choi, **Gun-Yeal Lee**, Changhyun Kim, Junseo Bang, Junhyeok Jang, Yoonchan Jeong, and Byoungho Lee, "Metasurface folded lens system for ultrathin cameras," ***Science Advances***, vol. 10, no. 44, eadr2319, 2024.

3. Changhyun Kim, Jongwoo Hong, Junhyeok Jang, **Gun-Yeal Lee**, Youngjin Kim, Yoonchan Jeong, and Byoungho Lee, "Freeform metasurface color router for deep submicron pixel image sensors," ***Science Advances***, vol. 10, no. 22, eadn9000, 2024.

4. Suyeon Choi, Manu Gopakumar, Brian Chao, **Gun-Yeal Lee**, Jonghyun Kim, and Gordon Wetzstein, "Neural Holographic Near-eye Displays for Virtual Reality," ***ACM SIGGRAPH 2023 Emerging Technologies***, 2023.

5. Junhyeok Jang, **Gun-Yeal Lee**, Youngjin Kim, Changhyun Kim, Yoonchan Jeong, and Byoungho Lee, "Dispersion-engineered Metasurface Doublet Design for Broadband and Wide-angle Operation in the Visible Range," ***IEEE Photonics Journal***, 2023.

6. Joohoon Kim, Junhwa Seong, Wonjoong Kim, **Gun-Yeal Lee**, Seokwoo Kim, Hongyoon Kim, Seong-Won Moon, Dong Kyo Oh, Younghwan Yang, Jeonghoon Park, Jaehyuck Jang, Yeseul Kim, Minsu Jeong, Chanwoong Park, Hojung Choi, Gyoseon Jeon, Kyung-il Lee, Dong Hyun Yoon, Namkyoo Park, Byoungho Lee, Heon Lee, and Junsuk Rho, "Scalable manufacturing of high-index atomic layer–polymer hybrid metasurfaces for metaphotonics in the visible," ***Nature Materials***, vol. 22, no. 4, pp. 474-481, 2023.

7. Youngjin Kim, **Gun-Yeal Lee**, Jangwoon Sung, Junhyeok Jang, and Byoungho Lee, "Spiral metalens for phase contrast imaging," ***Advanced Functional Materials***, vol. 32, no. 5, 2106050, 2021.

8. Jangwoon Sung, **Gun-Yeal Lee**, Chulsoo Choi, Jongwoo Hong, and Byoungho Lee, "Polarization dependent asymmetric transmission using bifacial metasurface," ***Nanoscale Horizons***, vol. 5, no. 11, pp. 1487-1495, 2020.

9. Jangwoon Sung, **Gun-Yeal Lee**, and Byoungho Lee, "Progresses in the practical metasurface for holography and lens," ***Nanophotonics***, vol. 8, no. 10, pp. 1701-1718, 2019.

10. Chulsoo Choi, Seung-Yeol Lee, Sang-Eun Mun, **Gun-Yeal Lee**, Jangwoon Sung, Hansik Yun, Jong-Heon Yang, Hee-Ok Kim, Chi-Young Hwang, and Byoungho Lee, "Metasurface with nanostructured Ge2Sb2Te5 as a platform for broadband-operating wavefront switch," ***Advanced Optical Materials***, article 1900171, 2019.

11. Seokil Moon, Chang-Kun Lee, Seung-Woo Nam, Changwon Jang, **Gun-Yeal Lee**, Wontaek Seo, Geeyoung Sung, Hong-Seok Lee, and Byoungho Lee, "Augmented reality near-eye display using Pancharatnam-Berry phase lenses," ***Scientific Reports***, vol. 9, article 6616, doi: 10.1038/s41598-019-42979-0, 2019.

12. Kyookeun Lee, Hansik Yun, Sang-Eun Mun, ***Gun-Yeal Lee***, Jangwoon Sung, and Byoungho Lee, "Ultracompact broadband plasmonic polarimeter," ***Laser & Photonics Reviews***, vol. 12, 1700297, 2018.

13. Jinseob Kim, Hyuntai Kim, Gun-Yeal Lee, Juhwan Kim, Byoungho Lee, and Yoonchan Jeong, "Numerical and Experimental Study on Multi-Focal Metallic Fresnel Zone Plates Designed by the Phase Selection Rule via Virtual Point Sources," ***Applied Sciences***, vol. 8, 449, 2018.

14. Hyuntai Kim, Jinseob Kim, Haechan An, Yohan Lee, **Gun-Yeal Lee**, Jeongkyun Na, Kyoungyoon Park, Seungjong Lee, Seung-Yeol Lee, Byoungho Lee, and Yoonchan Jeong, "Metallic Fresnel zone plate implemented on an optical fiber facet for super-variable focusing of light," ***Optics Express***, vol. 25, no. 24, pp. 30290-30303, 2017.

15. Kyookeun Lee, Joonsoo Kim, Hansik Yun, **Gun-Yeal Lee,** and Byoungho Lee, "Interferometric control of plasmonic resonator based on polarization-sensitive excitation of surface plasmon polaritons," ***Optics Express***, vol. 24, no. 19, pp. 21861-21868, 2016.

16. Eui-Young Song†, Seung-Yeol Lee†, Jongwoo Hong, Kyookeun Lee, Yohan Lee, **Gun-Yeal Lee**, Hwi Kim, and Byoungho Lee, "A double-lined metasurface for plasmonic complex-field generation," ***Laser and Photonics Reviews***, vol. 10, no. 2, pp. 299-308, 2016. (Cover image paper)

17. Seung-Yeol Lee, **Gun-Yeal Lee**, and Byoungho Lee, "Plasmonic directional beam switching with tilted nanoslit array surrounded by gratings," ***IEEE Journal of Lightwave Technology***, vol. 34, no. 4, pp. 1368-1372, 2016.

18. Seung-Yeol Lee, Kyuho Kim, **Gun-Yeal Lee**, and Byoungho Lee, "Polarization -multiplexed plasmonic phase generation with distributed nanoslits," ***Optics Express***, vol. 23, no. 12, pp. 15598-15607, 2015.

CONFERENCES

First authorship (10)

1. **Gun-Yeal Lee**, Manu Gopakumar, Suyeon Choi, Brian Chao, Yifan Peng, Jonghyun Kim, and Gordon Wetzstein, “Nanophotonics and AI for augmented reality and imaging applications,” SID Symposium Digest of Technical Papers, vol. 56, no. 1, pp. 414-415, 2025. (Invited talk: SID display week 2025, May 2025.)

2. **Gun-Yeal Lee**, Jangwoon Sung, and Byoungho Lee, "Dielectric metasurfaces for arbitrary engineering of multi-channel spin-orbit interactions," SPIE Optics + Photonics, Virtual Conference, paper 11498-21, Aug 2020. **(SPIE Optics and Photonics Education Scholarship)**

3. **Gun-Yeal Lee**, J.-Y. Hong, and Byoungho Lee, "See-through metalens for augmented reality near-eye display with ultrawide viewing angle," OSA 2019 Frontiers in Optics + Laser Science APS/DLS, Washington D.C., USA, paper FTh1C.2, Sept 2019.

4. **Gun-Yeal Lee**, Jangwoon Sung, and Byoungho Lee, "Designed conversion of spin and orbital angular momentum," The 13th Pacific Rim Conference on Lasers and Electro-Optics (CLEO-PR 2018), Hong Kong, paper F2B.2, July 2018.

5. **Gun-Yeal Lee**, Jangwoon Sung, and Byoungho Lee, "Broadband metasurface for chiral phase control," OSA Frontiers in Optics 2017 (FiO 2017), Washington, USA, paper FTu5D.5, Oct 2017.

6. **Gun-Yeal Lee**, Kyookeun Lee, Yohan Lee, Hyeonsoo Park, Chulsoo Choi, and Byoungho Lee, "Continuous control of complex nonlinear susceptibility for harmonic generation using plasmonic metasurface," The 8th International Conference on Metamaterials, Photonic Crystals and Plasmonics - META'17, Incheon, Korea, paper P19, July 2017. **(Best Paper Award)**

7. **Gun-Yeal Lee** and Byoungho Lee, "Reflection type metasurfaces for complex-amplitude modulation at visible frequency," Global Nanophotonics 2016, Osaka Japan, paper P-01, Nov 2016.

8. **Gun-Yeal Lee**, Joonsoo Kim, Yohan Lee, and Byoungho Lee, "Reflection type metasurfaces for complex-amplitude modulation at visible frequency," International Conference on Optical and Photonic Engineering (icOPEN 2016), Chengdu, China, paper N054-A, Sept 2016. **(Best Student Award & Best Paper Award)**

9. **Gun-Yeal Lee,** Joonsoo Kim, and Byoungho Lee, "Polarization multiplexed hologram via broadband metasurfaces," Nano Korea 2016, P1601_0896, July 2016. **(Best Paper Award - Grand Prize)**

10. **Gun-Yeal Lee**, Seung-Yeol Lee, and Byoungho Lee, "Plasmonic Vortex Lens with Distributed Nanoslits for Arbitrary Tuning of Vortex Size," The 11th Conference on Lasers and Electro-Optics Pacific Rim (CLEO-PR 2015), Busan, Korea, paper 26P-72, Aug 2015.

PATENTS

1. "Double sided meta lens and electronic device including the same"
   Yeongmyeong Park, Youngjin Kim, **Gun-Yeal Lee**, Byoungho Lee, Yoonchan Jeong
   USA, US20250028089A1 (2025).

INVITED TALKS AND PRESENTATIONS

Stanford SCIEN Colloquium, Invited Talk, May 2025
Nanophotonics and AI for display and imaging system applications

Society for Information Display (SID) Display Week 2025, Invited Talk, May 2025
Nanophotonics and AI for Augmented Reality and Imaging Applications

Seoul National University, Seminar, Sept 2024
Nanophotonics and AI for AR displays and imaging applications

KAIST, Seminar, Sept 2024
Nanophotonics and AI for AR displays and imaging applications

KIST, Seminar, Sept 2024
Nanophotonics and AI for AR displays and imaging applications

Apple, Seminar, Aug 2024
Full-color 3D holographic augmented reality displays with metasurface waveguides

Synopsys, Seminar, June 2024
3D holographic AR glasses with metasurface waveguides

Stanford University, Talk invited by Prof. Mark Brongersma, June 2024
3D holographic AR glasses with metasurface waveguides

Pohang University of Science and Technology (POSTECH)
Seminar invited by Prof. Seung-Hwan Baek and Prof. Junsuk Rho, Feb 2024
Recent advances in Meta-optics for imaging and AR/VR devices

Samsung Research, Seminar, Feb 2024
Recent advances in Meta-Optics for imaging and AR/VR devices

Samsung Advanced Institute of Technology (SAIT), Seminar, Feb 2024
Nanophotonics for optical imaging and displays

Seoul National University, Seminar - GoGE Workshop, Oct 2023
Metasurface Optics for next-generation displays

Stanford University, Talk invited by Prof. Mark Brongersma, Oct 2022
Metasurface Optics towards next-generation imaging systems

Synopsys, Seminar, Sept 2022
Meta-Optics: Fundamentals and Design methods

Stanford University, Talk invited by Prof. Gordon Wetzstein, Feb 2022
Metasurface optics towards next-generation imaging systems

PROFESSIONAL SERVICE

Journal Reviewer
Nature, Nature Reviews Electrical Engineering, Science Advances, Light: Science & Applications, Optica, Nature: npj Nanophotonics, Optics Express, Optics Letters, ACS Photonics, Nanophotonics, Scientific Reports.

Conference Reviewer
ACM SIGGRAPH, ACM SIGGRAPH Asia, IEEE International Symposium on Mixed and Augmented Reality.

TEACHING AND MENTORING EXPERIENCE

Graduate Student Mentoring 2024 – present
Stanford Computational Imaging Lab, Stanford University, USA
Mentored 2 graduate students in conceiving research ideas, developing methodologies, designing experiments and writing research papers.

Graduate Student Mentoring 2015 – 2022
Optical Engineering and Quantum Electronics Lab, Seoul National University, Korea
Provided core research ideas and supervised 6 graduate students in research development, simulations and experimental demonstrations, and paper writing. This mentorship resulted in 3 journal publications.

Undergraduate Student Mentoring 2017
Seoul National University, Korea
Mentored 3 undergraduate students in foundational training on nanophotonics and optical system engineering, leading to 1 journal publication.

Teaching Assistant & Guest Lecture, Introduction to Electromagnetism with Practice 2017
Seoul National University, Korea
Prepared course materials, graded homework and exams, assisted students with numerical simulations, and delivered a guest lecture on the introduction to nanophotonics and metasurfaces.