

JUNGMIN KIM, PH.D.

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SUMMARY

I am an experienced researcher in optics and photonics, with a strong background in theory and numerical simulations. My recent work focuses on developing optical computing devices based on metasurfaces and photonic integrated circuit platforms.

EDUCATION

Ph.D. Electrical and Computer Engineering Seoul National University Advisors: Prof. Namkyoo Park & Prof. Sunkyu Yu	Mar 2017–Feb 2023 Seoul, South Korea
B.S. Electrical and Computer Engineering Seoul National University	Mar 2012–Feb 2017 Seoul, South Korea

WORK EXPERIENCE

University of Wisconsin-Madison <i>Research Associate/Scientist I</i>	Madison, WI, USA Apr 2023–Present
– Designed mmWave face verification system using metasurface, with > 90% accuracy. – Designed incoherent meta-imaging system for low-light environment, with ~2.9 dB enhancement of PSNR. – Designed photonic systolic array for all-optical matrix-matrix multiplication, achieving theoretical computing density of $4.4 \text{ PMACS} \cdot \text{mm}^{-2} \text{s}^{-1}$.	

Seoul National University <i>Research/Teaching Assistant</i>	Seoul, South Korea Mar 2017–Feb 2023
– Designed tilted Dirac cones and investigated temporal disordered modulation of photonic system to achieve target scattering. – ECE courses on Quantum Mechanics, Electromagnetism, and Nanophotonics.	

RESEARCH PROJECTS

Optical computing Related publications: [1–3, 5]

Using gradient-based optimization techniques, including the adjoint method and neural network modeling of diffractive optical systems, I have inverse-designed various optical devices for neuromorphic and computing applications. These include neuromorphic metasurfaces for face recognition systems and output-stationary optical systolic arrays that accelerate matrix–matrix multiplication.

Disordered photonics Related publications: [4, 6, 7]

Harnessing hidden degrees of freedom in material phase can unlock numerous functionalities. I used a deep learning approach to inverse-design photonic multilayer structures with angle-dependent optical target responses and active tunability. On the other hand, I extended the concept of correlated disorder—an intermediate regime between perfect order and complete disorder—into the temporal domain, enabling top-down

control of light scattering through time-varying disordered modulation without the need for complex material structures.

Photonic band structure engineering

Related publications: [8, 9]

The photonic Dirac cone enables exceptional light propagation with intriguing applications such as optical cloaking and light funneling, while its directional control has remained largely unexplored. To address this, I developed an inverse design approach that perturbs the eigenmodes of a conventional upright Dirac cone to create a tilted version, enabling more efficient and directional light transport in photonic devices.

SKILLS

Optics & Photonics	FDTD (Tidy3D), FEM (COMSOL), RCWA, PWEM
Optimization	Adjoint sensitivity method
Numerical analysis	MATLAB, Python (NumPy, SciPy, etc.)
Machine Learning	PyTorch

PUBLICATION – [GOOGLE SCHOLAR](#)

- ¹J. Kim, N. Yu, and Z. Yu, “Compute-first optical detection for noise-resilient visual perception”, [ACS Photonics](#) **12**, 1137–1145 (2025).
- ²J. Kim, Q. Zhou, and Z. Yu, “Photonic systolic array for all-optical matrix-matrix multiplication”, [Laser & Photonics Reviews](#), e01995 (2025).
- ³J. Kim, J.-Y. Kim, J. Kim, et al., “Inverse design of nanophotonic devices enabled by optimization algorithms and deep learning: recent achievements and future prospects”, [Nanophotonics](#) **14**, 121–151 (2025).
- ⁴J. Kim, D. Lee, S. Yu, and N. Park, “Unidirectional scattering with spatial homogeneity using correlated photonic time disorder”, [Nature Physics](#) **19**, 726–732 (2023).
- ⁵S. Choi, J. Kim, J. Kwak, N. Park, and S. Yu, “Topologically protected all-optical memory”, [Advanced Electronic Materials](#) **8**, 2200579 (2022).
- ⁶J. Kim, S. Park, S. Yu, and N. Park, “Machine-engineered active disorder for digital photonics”, [Advanced Optical Materials](#) **10**, 2102642 (2022).
- ⁷S. Oh, J. Kim, X. Piao, et al., “Control of localization and optical properties with deep-subwavelength engineered disorder”, [Optics Express](#) **30**, 28301–28311 (2022).
- ⁸S. Park, I. Lee, J. Kim, N. Park, and S. Yu, “Hearing the shape of a drum for light: isospectrality in photonics”, [Nanophotonics](#) **11**, 2763–2778 (2022).
- ⁹J. Kim, S. Yu, and N. Park, “Universal design platform for an extended class of photonic dirac cones”, [Physical Review Applied](#) **13**, 044015 (2020).

PRESENTATION

- ^{C1}J. Kim, N. Yu, and Z. Yu, “Incoherent meta-imaging system for noise-robust object recognition”, in [2024 conference on lasers and electro-optics pacific rim \(cleo-pr\)](#) (2024), Mo1A4.
- ^{C2}D. Lee, J. Kim, H. Park, et al., “Design of correlated photonic time disorder for unidirectional scattering”, in [Advanced photonics congress 2023](#) (2023), NoTu3C.4.
- ^{C3}J. Kim, S. Park, D. Lee, S. Yu, and N. Park, “Data-driven engineering of active photonic disorder”, in [Frontiers in optics + laser science 2022 \(fio, ls\)](#) (2022), JW4A.20.

^{C4}D. Lee, J. Kim, N. Park, and S. Yu, “Molecular dynamics for microscopic analysis of refractive index in amorphous hafnium oxides”, in [Frontiers in optics + laser science 2022 \(fio, ls\)](#) (2022), FW7C.5.

^{C5}J. Kim, S. Yu, and N. Park, “Neural-network-based design of tunable multilayer films”, in [Osa advanced photonics congress 2021](#) (2021), JW4B.3.

HONORS AND AWARDS

Feb 2023 Distinguished Dissertation Award, ECE, SNU

Feb 2019 Best Poster Award, OSK Winter Meeting

2014–2016 National Science & Engineering Undergraduate Scholarship, Korea Student Aid Foundation

ACADEMIC SERVICES

Reviewer *Optica, Photonics Research, Optics Express, Optics Letters*

Nature Electronics, Nature Communications

ACS Photonics, Advanced Functional Materials