Sang Hyun Park, PhD

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Employment

The University of Texas at Austin June 2025 -
Postdoctoral Fellow Austin, TX, USA

- Advisor: Junyeong Ahn

Education

University of Minnesota Sep. 2020 - May 2025
PhD, Electrical Engineering Minneapolis, MN, USA

- Advisor: Tony Low
- Thesis: Engineering Surface Plasmons and Light-Matter Interactions in Two-Dimensional Materials

University of Oxford Oct. 2013 - July 2017
MPhys (Integrated Bachelor's/Master's degree), Physics, *first class honours* Oxford, UK

- Advisors: Ian Walmsley, Benjamin Brecht
- Thesis: Complex temporal shaping and characterization of laser pulses for quantum memories

Publications

First author

[6] **Sang Hyun Park**, E. J. Mele, and Tony Low. "Nodal Lines in a Honeycomb Plasmonic Crystal with Synthetic Spin", arXiv:2502.00932 (2025).

[5] **Sang Hyun Park**, Michael Sammon, E. J. Mele, and Tony Low. "Helical boundary modes from synthetic spin in a plasmonic lattice". *Phys. Rev. B* **109**, L161301 (2024).

[4] Soojeong Baek†, **Sang Hyun Park**†, Donghak Oh†, Kanghee Lee, Sangha Lee, Hosub Lim, Taewoo Ha, Hyun Sung Park, Shuang Zhang, Lan Yang, Bumki Min, and Teun-Teun Kim. "Non-Hermitian chiral degeneracy of gated graphene metasurfaces". *Light Sci. Appl.* **12**, 87 (2023).

[3] **Sang Hyun Park**, Michael Sammon, Eugene Mele, and Tony Low. "Plasmonic gain in current biased tilted Dirac nodes". *Nat. Commun.* **13**, 7667 (2022).

[2] **Sang Hyun Park**, Shengxuan Xia, Sang-hyun Oh, Phaedon Avouris, and Tony Low. "Accessing the Exceptional Points in a Graphene Plasmon–Vibrational Mode Coupled System". *ACS Photonics* **8**, 3241 (2021).

[1] **Sang Hyun Park**†, Sung Gyu Lee†, Soojeong Baek, Taewoo Ha, Sanghyub Lee, Bumki Min, Shuang Zhang, Mark Lawrence, and Teun Teun Kim. "Observation of an exceptional point in a non-Hermitian metasurface". *Nanophotonics* **9**, 1031 (2020).

Coauthor

[3] Brayden Lukaskawcez, Shivasheesh Varshney, Sooho Choo, **Sang Hyun Park**, Dongjea Seo, Liam Thompson, Devon Uram, Hayden Binger, Steve Koester, Sang-Hyun Oh, Tony Low, Bharat Jalan, and Alexander McLeod. "Interfacial Strong Coupling and Negative Dispersion of Propagating Polaritons in Freestanding Oxide Membranes", arXiv:2503.01171 (2025).

[2] Seungjun Lee†, Dongjea Seo†, **Sang Hyun Park**, Nezhueytl Izquierdo, Eng Hock Lee, Rehan Younas, Guanyu Zhou, Milan Palei, Anthony J. Hoffman, Min Seok Jang, Christopher L. Hinkle, Steven J. Koester, and Tony Low. "Achieving near-perfect light absorption in atomically thin transition metal dichalcogenides through band nesting". *Nat. Commun.* **14**, 3889 (2023).

[1] Tianye Huang†, Xuecou Tu†, Changqing Shen, Binjie Zheng, Junzhuan Wang, Hao Wang, Kaveh Khaliji, **Sang Hyun Park**, Zhiyong Liu, Teng Yang, Zhidong Zhang, Lei Shao, Xuesong Li, Tony Low, Yi Shi, and Xiaomu Wang. "Observation of chiral and slow plasmons in twisted bilayer graphene". *Nature* **605**, 63 (2022).

In preparation

[1] **Sang Hyun Park**, Phaedon Avouris, and Tony Low. "Strong coupling of chiral surface plasmons and chiral molecules".

Research experience

Graduate Research Assistant Sep 2020 - Present
University of Minnesota Minneapolis, MN, USA

Chiral light-matter interactions with surface plasmons

- Used quantum electrodynamic theory to describe the interaction between chiral quantum emitters and chiral surface plasmons supported by twisted two-dimensional materials. Identified an enhanced chiral discrimination factor when compared to existing schemes based on chiral cavities.

Topological plasmonic crystals with synthetic spin

- Proposed a plasmonic crystal with synthetic spin degrees of freedom. Identified an intrinsic inter-orbital interaction that opens a topologically non-trivial band gap in an artificial Lieb lattice. Verified the existence of spin-polarized helical edge modes using finite-element simulations and tight-binding theory.

Surface plasmon amplification in current-biased two-dimensional materials

- Calculated the nonlocal optical response of two-dimensional materials with closely located electron and hole pockets. Showed that a current-induced population inversion leads to an internal source of surface plasmon amplification. Threshold currents were calculated to be experimentally accessible.

Exceptional points in plasmon-vibrational mode coupled systems

- Applied a non-Hermitian framework to a coupled graphene plasmon-vibrational mode system and identified an exceptional point at the transition between weak and strong coupling. Proposed that the exceptional point can be accessed via tuning of the incident angle of light and graphene Fermi energy.

Experimental collaborations

- Collaborated with experimentalists and provided modeling for measurements on optical absorption in TMDs, surface plasmons in twisted bilayer graphene, and surface phonons in $SrTiO_3$ membranes.

Researcher Aug. 2017 - Aug. 2020
Center for Integrated Nanostructure Physics, Institute for Basic Science Suwon, South Korea

- Experimentally observed an exceptional point in a non-Hermitian metasurface. Fabricated metasurface with gold split ring resonators using photolithography and measured polarization-dependent transmission using terahertz time-domain spectroscopy.
- Mandatory military service as research agent (3 years)

Industry experience

Seagate Technology May 2023 - Aug. 2023, June 2022 - Sep. 2022
Summer intern Bloomington, MN, USA

- Implemented and trained a variational autoencoder (VAE) for freeform optimization of a near-field plasmonic coupler. Utilized high-performance computing clusters to generate datasets from finite-element simulations. Proposed a design with a 20% increase in efficiency based on the trained VAE.

Teaching experience

Quantum+Chips Summer/Winter School, University of Minnesota Summer 2024/Winter 2023

- Led sessions on using numerical methods to solve quantum mechanical problems. Developed worksheets and code used during the sessions and for group projects.

EE2115: Analog and Digital Electronics, University of Minnesota Summer 2021

- Gave demonstrations, led lab sessions, held office hours, and graded homework assignments

Academic Services

Reviewer

- Light: Science & Applications, Optics Express, Advanced Science, Advanced Materials, Advanced Functional Materials, Advanced Optical Materials, Journal of Applied Physics, Scientific Reports