

Brian S. Y. Kim

University of Arizona
Department of MSE
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Research Interest

Quantum materials & devices; nano-optics & plasmonics; light-matter interactions; 2D NEMS

Education

- 2011–2018 **Stanford University**, Stanford, CA
M.S./Ph.D. in Electrical Engineering
- 2008–2011 **Northwestern University**, Evanston, IL
B.S. in Electrical Engineering, *Summa Cum Laude*

Academic Appointments

- 2024–present **University of Arizona**, Tucson, AZ
Assistant Professor, Department of Materials Science and Engineering
Assistant Professor, Department of Physics
- 2018–2023 **Columbia University**, New York, NY
Postdoctoral Scholar, Department of Mechanical Engineering and Physics
Advisors: Profs. James C. Hone & Dmitri N. Basov
- 2012–2018 **Stanford University**, Stanford, CA
Graduate Research Assistant, Department of Applied Physics
Advisor: Prof. Harold Y. Hwang

Publications ([Google Scholar page](#))

1. I. Keren, T. A. Webb, S. Zhang, J. Xu, D. Sun, **B. S. Y. Kim**, D. Shin, S. S. Zhang, J. Zhang, G. Pereira, J. Yao, M. H. Michael, T. Okugawa, J. H. Edgar, S. Wolf, M. Julian, R. P. Prasankumar, K. Miyagawa, K. Kanoda, M. Buzzi, A. Cavalleri, C. R. Dean, D. M. Kennes, A. J. Millis, Q. Li, M. A. Sentef, A. Rubio, A. N. Pasupathy, and D. N. Basov. “Cavity-altered superconductivity probed by Meissner force microscopy,” *submitted* (2025).
2. F. L. Ruta, Y. Shao, S. Acharya, A. Mu, N. H. Jo, S. H. Ryu, D. Balatsky, D. Pashov, **B. S. Y. Kim**, M. I. Katsnelson, J. G. Analytis, E. Rotenberg, A. J. Millis, M. van Schilfgaarde, and D. N. Basov. “Good plasmons in a bad metal.” *Science* 387, 786–791 (2025). DOI: [10.1126/science.adr5926](https://doi.org/10.1126/science.adr5926).
3. Y. Shao, F. Dirnberger, S. Qiu, S. Acharya, S. Terres, E. Telford, D. Pashov, **B. S. Y. Kim**, F. Ruta, D. G. Chica, Y. Wang, Y. J. Bae, A. J. Millis, M. I. Katsnelson, K. Mosina, Z. Sofer, A. Chernikov, M. van Schilfgaarde, X. Zhu, X. Roy, and D. N. Basov. “Magnetically

- confined surface and bulk excitons in a layered antiferromagnet.” *Nature Mater.* 24, 391–398 (2025). DOI: [10.1038/s41563-025-02129-6](https://doi.org/10.1038/s41563-025-02129-6).
4. H. Park, H. Shin, N. Ali, H. Choi, **B. S. Y. Kim**, B. Kang, M. S. Choi, and W. J. Yoo. “P-type vertical FETs realized by using Fermi-level pinning-free 2D metallic electrodes.” *Nano Lett.* 25, 368–375 (2025). DOI: [10.1021/acs.nanolett.4c05136](https://doi.org/10.1021/acs.nanolett.4c05136).
 5. **B. S. Y. Kim**^{*,†}, T. D. Ngo^{*}, Y. Hassan, S. H. Chae, S.-G. Yoon, and M. S. Choi[†]. “Advances and applications of oxidized two-dimensional transition metal dichalcogenides.” *Adv. Sci.* 11, 2407175 (2024). DOI: [10.1002/advs.202407175](https://doi.org/10.1002/advs.202407175).
 6. K. Lee^{*}, **B. S. Y. Kim**^{*,†}, M. S. Choi, N. Ali, H. Shin, G.-H. Kim, J. Hone, and W. J. Yoo[†]. “Double-side doped 2D TMD FET Channel.” *ACS Appl. Electron. Mater.* 6, 3894–3900 (2024). DOI: [10.1021/acsaelm.4c00506](https://doi.org/10.1021/acsaelm.4c00506).
 7. F. L. Ruta, S. Zhang, Y. Shao, S. Moore, S. Acharya, Z. Sun, S. Qiu, J. Geurs, **B. S. Y. Kim**, M. Fu, D. G. Chica, D. Pashov, M. Delor, X.-Y. Zhu, A. J. Millis, X. Roy, J. C. Hone, C. R. Dean, M. I. Katsnelson, M. van Schilfgaarde, and D. N. Basov. “Hyperbolic exciton polaritons in a van der Waals magnet.” *Nature Commun.* 14, 8261 (2023). DOI: [10.1038/s41467-023-44100-6](https://doi.org/10.1038/s41467-023-44100-6).
 8. **B. S. Y. Kim**^{*,†}, A. J. Sternbach^{*}, M. Choi^{*}, Z. Sun, F. L. Ruta, Y. Shao, A. McLeod, L. Xiong, Y. Dong, A. Rajendran, S. Liu, A. Niapne, S. H. Chae, A. Zangiabadi, X. Xu, A. J. Millis, P. J. Schuck, C. R. Dean, J. C. Hone, and D. N. Basov[†]. “Ambipolar charge-transfer graphene plasmonic cavities.” *Nature Mater.* 22, 838–843 (2023). *Featured on [Columbia News](https://www.columbia.edu/news)*. DOI: [10.1038/s41563-023-01520-5](https://doi.org/10.1038/s41563-023-01520-5).
 9. A. J. Sternbach, S. Moore, A. Rikhter, S. Zhang, R. Jing, Y. Shao, **B. S. Y. Kim**, S. Xu, A. Rubio, C. Dean, J. Hone, M. Fogler, and D. N. Basov. “Negative refraction in hyperbolic hetero-bicrystals.” *Science* 379, 555–557 (2023). DOI: [10.1126/science.adf1065](https://doi.org/10.1126/science.adf1065).
 10. S. Chaikasetsin, J. Y. Jung, H. Kim, **B. S. Y. Kim**, F. B. Prinz, J. Choi, K. Bae, and W. Park. “Observation of Highly Anisotropic Thermal Expansion of Polymer Films.” *ACS Appl. Mater. Interfaces* 15, 27166–27172 (2023). DOI: [10.1021/acsami.3c03728](https://doi.org/10.1021/acsami.3c03728).
 11. F. L. Ruta^{*}, **B. S. Y. Kim**^{*}, Z. Sun, D. J. Rizzo, A. Rajendran, S. Liu, A. J. Millis, J. C. Hone, and D. N. Basov. “Surface plasmons induce topological transition in graphene/MoO₃ heterostructures.” *Nature Commun.* 13, 3719 (2022). DOI: [10.1038/s41467-022-31477-z](https://doi.org/10.1038/s41467-022-31477-z).
 12. Y. Shao, A. J. Sternbach, **B. S. Y. Kim**, A. A. Rikhter, X. Xu, U. De Giovannini, R. Jing, S. H. Chae, Z. Sun, Y. Zhu, Z. Mao, J. C. Hone, R. Queiroz, A. J. Millis, P. J. Schuck, A. Rubio, M. M. Fogler, and D. N. Basov. “Hyperbolic plasmons propagate through a nodal metal.” *Sci. Adv.* 8, eadd6169 (2022). DOI: [10.1126/sciadv.add6169](https://doi.org/10.1126/sciadv.add6169).
 13. Y. Cha, B. Seo, M. Chung, **B. S. Y. Kim**, W. Choi, and W. Park. “Skin-inspired thermometer enabling contact-independent temperature sensation via Seebeck-resistive bimodal system.” *ACS Appl. Mater. Interfaces* 14, 17920 (2022). DOI: [10.1021/acsami.1c24420](https://doi.org/10.1021/acsami.1c24420).
 14. Y. Kim, T. Kodama, Y. Kim, **B. S. Y. Kim**, C. Ko, J. Lim, and W. Park. “Suppressed phonon conduction by geometrically-induced evolution of transport characteristics from Brownian motion into Lévy walk.” *NPG Asia Mater.* 14, 33 (2022). DOI: [10.1038/s41427-022-00375-7](https://doi.org/10.1038/s41427-022-00375-7).

15. M. S. Choi*, A. Nipane*, **B. S. Y. Kim***, M. E. Ziffer, I. Datta, A. Borah, Y. Jung, B. Kim, D. Rhodes, A. Jindal, Z. A. Lamport, M. Lee, A. Zangiabadi, M. N. Nair, T. Taniguchi, K. Watanabe, I. Kymissis, A. N. Pasupathy, M. Lipson, X. Zhu, W. J. Yoo, J. C. Hone, and J. T. Teherani. “High carrier mobility in graphene doped using a monolayer of tungsten oxyselenide.” *Nature Electron.* 4, 731 (2021). *Cover Image. Featured on [Columbia News](#)*. DOI: [10.1038/s41928-021-00696-5](https://doi.org/10.1038/s41928-021-00696-5).
16. A. J. Sternbach, S. H. Chae, S. Latini, A. A. Rikhter, Y. Shao, B. Li, D. Rhodes, **B. S. Y. Kim**, P. J. Schuck, X. Xu, X.-Y. Zhu, R. D. Averitt, J. C. Hone, M. M. Fogler, A. Rubio, and D. N. Basov. “Programmable hyperbolic polaritons in van der Waals semiconductors.” *Science* 371, 617 (2021). DOI: [10.1126/science.abe9163](https://doi.org/10.1126/science.abe9163).
17. S. L. Moore, C. J. Ciccarino, D. Halbertal, L. J. McGilly, N. R. Finney, K. Yao, Y. Shao, G. Ni, A. J. Sternbach, E. J. Telford, **B. S. Y. Kim**, S. E. Rossi, K. Watanabe, T. Taniguchi, A. N. Pasupathy, C. R. Dean, J. C. Hone, P. J. Schuck, P. Narang, and D. N. Basov. “Nanoscale lattice dynamics in hexagonal boron nitride moiré superlattices.” *Nature Commun.* 12, 5741 (2021). DOI: [10.1038/s41467-021-26072-7](https://doi.org/10.1038/s41467-021-26072-7).
18. S. Chaikasetzin, T. Kodama, K. Bae, J. Y. Jung, J. Shin, B. C. Lee, **B. S. Y. Kim**, J. Seo, U. Sim, F. Prinz, K. E. Goodson, and W. Park. “Thermal expansion characterization of thin films using harmonic Joule heating combined with atomic force microscopy.” *Appl. Phys. Lett.* 118, 194101 (2021). DOI: [10.1063/5.0049160](https://doi.org/10.1063/5.0049160).
19. M. E. Berkowitz*, **B. S. Y. Kim***, G. Ni, A. S. McLeod, C. F. B. Lo, Z. Sun, G. Gu, K. Watanabe, T. Taniguchi, A. J. Millis, J. C. Hone, M. M. Fogler, R. D. Averitt, and D. N. Basov. “Hyperbolic Cooper-pair polaritons in planar graphene/cuprate plasmonic cavities.” *Nano Lett.* 21, 308 (2020). DOI: [10.1021/acs.nanolett.0c03684](https://doi.org/10.1021/acs.nanolett.0c03684).
20. Y. Kim, H. Kwon, H. S. Han, H. K. Kim, **B. S. Y. Kim**, B. C. Lee, J. Lee, M. Asheghi, F. B. Prinz, K. E. Goodson, J. Lim, U. Sim, and W. Park. “Tunable dielectric and thermal properties of oxide dielectrics via substrate biasing in plasma-enhanced atomic layer deposition.” *ACS Appl. Mater. Interfaces* 12, 44912 (2020). DOI: [10.1021/acsami.0c11086](https://doi.org/10.1021/acsami.0c11086).
21. A. J. Sternbach, S. Latini, S. H. Chae, H. Hübener, U. De Giovannini, Y. Shao, L. Xiong, Z. Sun, N. Shi, P. Kissin, G. Ni, D. Rhodes, **B. S. Y. Kim**, N. Yu, A. J. Millis, M. M. Fogler, P. J. Schuck, M. Lipson, X.-Y. Zhu, J. C. Hone, R. D. Averitt, A. Rubio, and D. N. Basov. “Femtosecond exciton dynamics in WSe₂ optical waveguides.” *Nature Commun.* 11, 3567 (2020). DOI: [10.1038/s41467-020-17335-w](https://doi.org/10.1038/s41467-020-17335-w).
22. **B. S. Y. Kim***[†], Y. Hikita, T. Yajima, and H. Y. Hwang[†]. “Heteroepitaxial vertical perovskite hot-electron transistors down to the monolayer limit.” *Nature Commun.* 10, 5312 (2019). DOI: [10.1038/s41467-019-13290-3](https://doi.org/10.1038/s41467-019-13290-3).
23. **B. S. Y. Kim***[†], Y. Birkhölzer*, X. Feng, Y. Hikita, and H. Y. Hwang[†]. “Probing the band alignment in rectifying SrIrO₃/Nb:SrTiO₃ heterostructures.” *Appl. Phys. Lett.* 114, 133504 (2019). DOI: [10.1063/1.5087956](https://doi.org/10.1063/1.5087956).
24. **B. S. Y. Kim**[†], M. Minohara, Y. Hikita, C. Bell, and H. Y. Hwang[†]. “Atomically-engineered epitaxial anatase TiO₂ metal-semiconductor field-effect transistors.” *Appl. Phys. Lett.* 112, 133506 (2018). *Editor’s Pick*. DOI: [10.1063/1.5024418](https://doi.org/10.1063/1.5024418).

25. W. Park, J. Sohn, G. Romano, T. Kodama, A. Sood, J. S. Katz, **B. S. Y. Kim**, H. So, E. C. Ahn, M. Asheghi, A. M. Kolpak, and K. E. Goodson. “Impact of thermally dead volume on phonon conduction along silicon nanoladders.” *Nanoscale* 10, 11117 (2018). DOI: [10.1039/c8nr01788c](https://doi.org/10.1039/c8nr01788c).
26. **B. S. Y. Kim***, W. Zhou*, Y. D. Shah, C. Zhou, N. Işik, and M. Grayson. “Generalized four-point characterization method using capacitive and ohmic contacts.” *Rev. Sci. Instrum.* 83, 024703 (2012). DOI: [10.1063/1.3677331](https://doi.org/10.1063/1.3677331).

*Equal contribution; †Corresponding author

Presentations

Invited Colloquia/Seminars

1. **Charge-transfer polaritons in van der Waals heterojunctions.**
2D Photonic Materials and Devices VIII, SPIE Photonics West, San Francisco, CA (1/2025).
2. **Charge-transfer polaritons in van der Waals heterojunctions.**
NANOscientific Symposium Americas, Phoenix, AZ (11/2024).
3. **Band engineered 2D heterostructures for graphene plasmonics.**
KPS Fall Meeting, online (10/2024).
4. **Charge-transfer polaritons in van der Waals heterojunctions.**
XII Ultrafast Dynamics & Metastability and Ultrafast Bandgap Photonics Conference, Tucson, AZ (09/2024).
5. **Charge-transfer polaritons in van der Waals heterojunctions.**
US-Korea Conference, San Francisco, CA (8/2024).
6. **Charge-transfer polaritons in van der Waals heterojunctions.**
Association of Korean Physicists in America, online (6/2024).
7. **Quest for novel quantum materials and devices.**
Physics Colloquium, University of Tennessee, Knoxville, TN (4/2024).
8. **Charge-transfer polaritons in van der Waals heterostructures.**
KPS Spring Meeting, online (4/2024).
9. **Quest for novel quantum materials and devices.**
Physics Colloquium, University of Arizona, Tucson, AZ (2/2024).
10. **Charge-transfer polaritons in van der Waals heterostructures.**
ECE Colloquium, Sungkyunkwan University, Suwon, South Korea (11/2023).
11. **Charge-transfer polaritons in van der Waals heterostructures.**
Physics Colloquium, Kyung Hee University, Seoul, South Korea (11/2023).
12. **Charge-transfer polaritons in van der Waals heterostructures.**
Mechanical Engineering Colloquium, Sogang University, Seoul, South Korea (10/2023).
13. **Charge-transfer polaritons in van der Waals heterostructures.**
CNU Conference of Advanced Technology 2023, Daejeon, South Korea (10/2023).

14. **Quest for novel quantum materials and devices.**
Physics Colloquium, University of Central Florida, Orlando, FL (4/2023).
15. **Quest for novel quantum materials and devices.**
MSE Colloquium, University of Arizona, Tucson, AZ (3/2023).
16. **Quest for novel quantum materials and devices.**
ECE Colloquium, University of Central Florida, Orlando, FL (3/2023).
17. **Quest for novel quantum materials and devices.**
Physics Colloquium, Washington State University, Pullman, WA (3/2023).
18. **Quest for novel quantum materials and devices.**
ECE Colloquium, Louisiana State University, Baton Rouge, LA (2/2023).
19. **Quest for novel quantum materials and devices.**
ECE Colloquium, Tufts University, Medford, MA (2/2023).
20. **Quest for novel quantum materials and devices.**
Physics and Astronomy Colloquium, University of Georgia, Athens, GA (2/2023).
21. **Quest for novel quantum materials and devices.**
ECE Seminar, University of Wisconsin–Madison, Madison, WI (3/2022).
22. **Van der Waals polaritons: From fundamental probes to applications.**
CMU-Pitt Colloquium, Carnegie Mellon University, Pittsburgh, PA (2/2022).
23. **Atomically imprinted graphene plasmonic cavities.**
GRL Seminar, Sungkyunkwan University, Suwon, South Korea (10/2021).
24. **Atomically imprinted graphene plasmonic cavities.**
Pro-QM Seminar, Columbia University, New York, NY (7/2021).
25. **Hyperbolic Cooper-pair polaritons in layered graphene/cuprate heterostructure.**
Pro-QM Seminar, Columbia University, New York, NY (10/2020).

Contributed Conference Presentations

26. **Atomically imprinted graphene plasmonic cavities.**
APS March Meeting, Chicago, IL (3/2022).
27. **Hyperbolic Cooper-pair polaritons in layered graphene/cuprate heterostructure.**
APS March Meeting, online (3/2021).
28. **Tunable charge-transfer surface plasmons at tungsten oxyselenide/graphene interface.**
Graphene and 2D Materials International Conference, online (2/2021).
29. **Hot-electron dynamics in oxide heterostructures.**
APS March Meeting, Los Angeles, CA (3/2018).
30. **Heteroepitaxial ferromagnetic perovskite hot-electron transistor down to the monolayer limit.**
MRS Spring Meeting, Phoenix, AZ (4/2017).
31. **Ballistic hot electron transport in heteroepitaxial SrRuO₃ metal-base transistors.**
APS March Meeting, Baltimore, MD (3/2016).

32. **Atomically engineered epitaxial anatase TiO₂ metal-semiconductor field-effect transistors.**
Workshop on Oxide Electronics 22, Paris, France (10/2015).
33. **All-perovskite oxide SrRuO₃ metal-base hot-electron transistor.**
MRS Spring Meeting, San Francisco, CA (4/2015).
34. **Device application for epitaxial anatase TiO₂ using termination layer control.**
CIFAR Quantum Materials Summer School, Montreal, Canada (5/2014).
35. **Depletion-mode epitaxial anatase TiO₂ metal-semiconductor field-effect transistor.**
MRS Spring Meeting, San Francisco, CA (4/2014).
36. **Depletion-mode epitaxial anatase TiO₂ metal-semiconductor field-effect transistor.**
Center for Integrated Systems Roundtables Seminar, Stanford, CA (11/2013).

Awards & Patents

- Scialog Fellow in Quantum Matter and Information, Research Corporation for Science Advancement (2025).
- Outstanding Young Researcher Award, Association of Korean Physicists in America and Korean Physical Society (2024).
- USERN Prize Nominee (2023).
- Korea Patent: KR-10-2022-0007293 (2022).
Skin-inspired thermometer enabling contact-independent temperature sensation via Seebeck-resistive bimodal system.
- Reid Weaver Dennis Fellowship, Stanford University (2011–2012).
- Best Senior Award, EECS Department, Northwestern University (2011).
- Korean-American Scientists and Engineers Association Scholarship (2010).
- Eta Kappa Nu Electrical and Computer Engineering Honor Society (2010–2011).
- Tau Beta Pi Engineering Honor Society (2010–2011).
- Golden Key International Honor Society (2009–2011).
- Murphy Institute Scholar and Dean’s List, Northwestern University (2008–2011).

External Service & Membership

- Reviewer, FY25 NSF Quantum Leap Challenge Institutes Program (2025)
- Member of APL Photonics Early Career Editorial Advisory Board (2025 – 2026).
- Session Chair of 2D Photonic Materials and Devices VIII, SPIE Photonics West (2025).
- Reviewer of FY24 DOE BES Early Career Research Program (2024).
- Official Nominator for the VinFuture Prize (2024).
- Reviewer of Nature; Nature Communications; npj 2D Materials and Applications; ACS Applied Materials & Interfaces; Applied Physics A; The Journal of Physical Chemistry Letters; Journal of Applied Physics; and Journal of Materials Chemistry C.
- Member of American Physical Society; Materials Research Society; International Society for Optics and Photonics; Association of Korean Physicists in America; and Korean-American Scientists and Engineering Association.

Outreach Activities

University of Arizona	Team leader, Semiconductor-sector Course-based Undergraduate Research Experience Program (2025–present).
University of Arizona	Team leader, Vertically Integrated Projects Program (2024–present).
Columbia University	Research advisor, Engineering the Next Generation Program (2019).
Stanford University	Organizer, Outreach at Korean-American Student Association (2013).