

Bo Sun

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Appointments

- 1/2022 - Present Associate Professor, Tsinghua Shenzhen International Graduate School, Tsinghua University
4/2019 - Present Deputy Director, Guangdong Provincial Key Laboratory of Thermal Management Engineering & Materials
4/2019 - 12/2021 Assistant Professor, Tsinghua-Berkeley Shenzhen Institute & Tsinghua Shenzhen International Graduate School, Tsinghua University
9/2018 - 4/2019 Research Scientist, Tsinghua-Berkeley Shenzhen Institute, Tsinghua University
9/2016 - 8/2018 Postdoctoral Scholar, California Institute of Technology (Advisor: Prof. Austin J. Minnich)

Professional Preparation

- Ph.D. Mechanical Engineering, 2016 *National University of Singapore* Singapore
Thesis: "Anisotropic phonon transport in materials with layered structures and threading dislocations." Thesis Advisor: Prof. Yee Kan Koh
M.S. Chemistry, 2011 *Shandong University* Jinan, China
M.S. Thesis: "Synthesis and characterization of nitride nanomaterials." M.S. Advisor: Prof. Yitai Qian
B.S. Physics, 2008 *Shandong University* Jinan, China

Awards and Honors

- Shenzhen High-level Talents Class B, Shenzhen City, 2019
Wang Gungwu Medal Nominee, Singapore, 2017
Outstanding undergraduate students, Shandong University, 2005-2008

Research Interests

phonon transport, thermal sciences, ultrafast phenomena, heat conduction across interfaces

Publications

(* - corresponding author, # - equal contribution, underline - my student)

Selected publications

- [3] Q. Li#, F. Liu#, S. Hu#, H. Song#, S. Yang, H. Jiang, T. Wang, Y. K. Koh, C. Y. Zhao, F. Kang, J. Wu, X. Gu*, **B. Sun*** and X. Wang*. Inelastic phonon transport across atomically sharp metal/semiconductor interfaces. *Nature Communications*, **13**, 4901, (2022).

- [2] **B. Sun**[#], S. Niu[#], R. P. Hermann[#], N. Shulumba, J. Moon, K. L. Page, B. Zhao, K. Mahalingam, J. Milam-Guerrero, R. Haiges, M. Mecklenburg, B. C. Melot, Y.-D. Jho, B. M. Howe, A. Atlas, B. Winn, M. E. Manley^{*}, J. Ravichandran^{*} and A. J. Minnich^{*}. High-frequency atomic tunneling yields ultralow and glass-like thermal conductivity in chalcogenide single crystals. *Nature Communications*, **11**, 6039, (2020).
- [1] **B. Sun**, G. Haunschild, C. Polanco, J. Ju, L. Lindsay, G. Koblmüller and Y. K. Koh^{*}. Dislocation-induced thermal transport anisotropy in single-crystal group-III nitride films. *Nature Materials*, **18**, 136, (2019).

Refereed Journal Publications

- [23] Q. Li[#], F. Liu[#], S. Hu[#], H. Song[#], S. Yang, H. Jiang, T. Wang, Y. K. Koh, C. Y. Zhao, F. Kang, J. Wu, X. Gu^{*}, **B. Sun**^{*} and X. Wang^{*}. Inelastic phonon transport across atomically sharp metal/semiconductor interfaces. *Nature Communications*, **13**, 4901, (2022).
- [22] S. Hou, **B. Sun**, F. Tian, Q. Cai, Y. Xu, S. Wang, X. Chen, Z. Ren, C. Li^{*} and R. B. Wilson^{*}. Thermal conductivity of BAs under pressure. *Advanced Electronic Materials*, **xxx**, xxx, (2022).
- [21] L. Zhao[#], L. Zhang[#], H. Song, J. Wu, F. Kang and **B. Sun**^{*}. Incoherent phonon transport dominates heat conduction in van der Waals superlattices. *Applied physics Letters*, **121**, 022201, (2022). "Editor's Pick" "Cover Article"
- [20] K. Upadhyaya, R. Kumar, Q. Li, **B. Sun** and B. Saha^{*}. Vibrational spectrum and thermal conductivity of rareearth semiconducting ErN thin films. *Physica Status Solidi (RRL)*, **xxx**, xxx, (2022).
- [19] P. Ci, M. Sun, M. Upadhyaya, H. Song, L. Jin, **B. Sun**, M. R. Jones, J. W. Ager, Z. Aksamija^{*} and J. Wu^{*}. Giant isotope effect of thermal conductivity in silicon nanowires. *Physical Review Letters*, **128**, 085901, (2022).
- [18] R. Guo[#], P. Jiang[#], T. Tu, S. Lee, **B. Sun**, H. Peng and R. Yang^{*}. Electrostatic interaction determines thermal conductivity anisotropy of Bi₂O₂Se. *Cell Reports Physical Science*, **2**, 100624, (2021).
- [17] Y. Chu, Y. Sang, Y. Liu, Y. Liu, Z. Xu, J. Chen, F. Liu, S. Li, **B. Sun** and X. Wang^{*}. Reduced thermal conductivity of epitaxial GaAsSb on InP due to lattice mismatch induced biaxial strain. *Journal of Applied Physics*, **130**, 015106, (2021).
- [16] S. Yang[#], H. Song[#], Y. Peng, L. Zhao, Y. Tong, F. Kang, M. Xu^{*}, **B. Sun**^{*}, and X. Wang^{*}. Reduced thermal boundary conductance in GaN-based electronic devices introduced by metal bonding layer. *Nano Research*, **14**, 3616, (2021).
- [15] **B. Sun**[#], S. Niu[#], R. P. Hermann[#], N. Shulumba, J. Moon, K. L. Page, B. Zhao, K. Mahalingam, J. Milam-Guerrero, R. Haiges, M. Mecklenburg, B. C. Melot, Y.-D. Jho, B. M. Howe, A. Atlas, B. Winn, M. E. Manley^{*}, J. Ravichandran^{*} and A. J. Minnich^{*}. High-frequency atomic tunneling yields ultralow and glass-like thermal conductivity in chalcogenide single crystals. *Nature Communications*, **11**, 6039, (2020).
- [14] K. Tang, X. Wang, K. Dong, Y. Li, J. Li, **B. Sun**, X. Zhang, C. Dames, C. Qiu, J. Yao and J. Wu^{*}. A thermal radiation modulation platform by emissivity engineering with graded metal-insulator transition. *Advanced Materials*, **32**, 1907071, (2020).
- [13] **B. Sun**, G. Haunschild, C. Polanco, J. Ju, L. Lindsay, G. Koblmüller and Y. K. Koh^{*}. Dislocation-induced thermal transport anisotropy in single-crystal group-III nitride films. *Nature Materials*, **18**, 136, (2019).
- [12] Q. Zeng[#], **B. Sun**[#], K. Du, W. Zhao, P. Yu, C. Zhu, J. Xia, Y. Chen, X. Cao, Q. Yan, Z. Shen, T. Yu, Y. Long, Y. K. Koh^{*} and Z. Liu^{*}. Highly-anisotropic thermoelectric properties of black phosphorus crystals. *2D Materials*, **6**, 045009, (2019).
- [11] S. Kerdsonpanya[#], O. Hellman[#], **B. Sun**, Y. K. Koh, J. Lu, N. V. Nong, S. I. Simak, B. Alling, P. Eklund^{*}. Phonon thermal conductivity of scandium nitride for thermoelectrics from first-principles calculations and thin-film growth. *Physical Review B*, **96**, 195417, (2017).
- [10] **B. Sun**, X. Gu, Q. Zeng, X. Huang, Y. Yan, Z. Liu, R. Yang and Y. K. Koh^{*}. Temperature dependence of anisotropic thermal conductivity tensor of bulk black phosphorus. *Advanced Materials*, **29**, 1603297, (2017).

- [9] **B. Sun** and Y. K. Koh*. Understanding and eliminating artifact signals from diffusely scattered pump beam in measurements of rough samples by time-domain thermoreflectance (TDTR). *Review of Scientific Instruments*, **87**, 064901, (2016).
- [8] S. Kerdsongpanya, **B. Sun**, F. Eriksson, J. Jensen, J. Lu, Y. K. Koh, N. V. Nong, B. Balke, B. Alling, P. Eklund*. Experimental and theoretical investigation of Cr_{1-x}Sc_xN solid solutions for thermoelectrics. *Journal of Applied Physics*, **120**, 215103, (2016).
- [7] J. Ju, **B. Sun**, G. Haunschild, B. Loitsch, B. Stoib, M. S. Brandt, M. Stutzmann, Y. K. Koh and G. Koblmüller*. Thermoelectric properties of In-rich InGaN and InN/InGaN superlattices. *AIP Advances*, **6**, 045216 (2016).
- [6] O. Cometto, **B. Sun**, S. H. Tsang, X. Huang, Y. K. Koh and E. H. T. Teo*. Vertically self-ordered orientation of nanocrystalline hexagonal boron nitride thin films for enhanced thermal characteristics. *Nanoscale*, **7**, 18984 (2015).
- [5] Y. K. Koh*, D. G. Cahill and **B. Sun**. Nonlocal Theory for Heat Transport at High Frequencies. *Physical Review B*, **90**, 205412 (2014).
- [4] T. Li, C. Guo*, **B. Sun**, T. Li, Y. Li, L. Hou and Y. Wei. Well-shaped Mn₃O₄ tetragonal bipyramids with good performance for lithium ion batteries. *Journal of Materials Chemistry A*, **3**, 7248 (2015).
- [3] Z. Bai, **B. Sun**, N. Fan, Z. Ju, M. Li, L. Xu*, Y. Qian*. Branched mesoporous Mn₃O₄ nanorods: facile synthesis and catalysis in the degradation of methylene blue. *Chemistry A European Journal*, **18**, 5319 (2012).
- [2] **B. Sun**, L. Xu*, K. Tang, L. Wang, Z. Ju, Y. Qian*. Synthesis of superconducting sphere like Mo₂C nanoparticles in an autoclave. *Crystal Research and Technology*, **47**, 467 (2012).
- [1] Z. Bai, Z. Ju, L. Wang, **B. Sun**, C. Sun, L. Xu*, Y. Qian*. Fe₃BO₅@carbon core shell urchin like structures prepared via a one-step co-pyrolysis method. *Materials Letters*, **65**, 2479 (2011).

Conference Presentations

- [14] Qinshu Li, Fang Liu, Xiaokun Gu, Xinqiang Wang and Bo Sun. *Inelastic phonon transport across atomically sharp Al/Si interface*. MRS Fall Meeting Exhibits, Virtual, Dec.8, 2021.
- [13] Lu Zhao and Bo Sun. *Intrinsically high cross-Plane thermal conductivity of HOPG*. Twenty-First Symposium on Thermophysical Properties. Boulder, CO, USA, June 20-25, 2021
- [12] Houfu Song and Bo Sun. *Toward intrinsic thermal conductance of epitaxial Al/Si interfaces*. Twenty-First Symposium on Thermophysical Properties. Boulder, CO, USA, June 20-25, 2021
- [11] **Invited** Bo Sun. *Observation of atomic tunneling and its effect on thermal transport*. Workshop on Thermal Transport 2020. Qingdao, China, November 13-16, 2020.
- [10] **Invited** Bo Sun. *Atomic tunneling induced ultralow and glass-like thermal conductivity*. 2nd International Symposium on Measurement Technology in Thermal Science and Engineering. Dalian, China, November 16-18, 2019.
- [9] **Invited** Bo Sun. *Dislocation induced thermal transport anisotropy in group III nitrides*. Workshop on Thermal Transport 2019. Wuhan, China, September 22-25, 2019.
- [8] **Session chair** Bo Sun. *Thermal transport in crystalline materials*. 1st International Conference on Energy and Environment. Nanjing, China, September 19-21, 2019.
- [7] Bo Sun, Nina Shulumba, Shanyuan Niu, Jayakanth Ravichandran and Austin Minnich. *Ultralow thermal conductivity of single crystalline BaTiS₃*. APS March meeting, Los Angeles, March 5-9, 2018.
- [6] Bo Sun, James (Zi-Jian) Ju, Georg Haunschild, Carlos Polanco, Gregor Koblmüller, Lucas Lindsay and Yee Kan Koh. *Anisotropic phonon scattering by threading dislocations*. ASME International Mechanical Engineering Congress & Exposition, Tampa, November 3-9, 2017.

- [5] Taeyong Kim, Bo Sun and Austin Minnich. *Probing in-plane phonon mean free paths of few-layer MoS₂ using transit grating technique*. MRS Spring Meeting & Exhibits, Phoenix, April 17-21, 2017.
- [4] Bo Sun and Yee Kan Koh. *Anisotropic thermal conductivity of black phosphorus*. ASME Summer Heat Transfer Conference, Washington DC, July 10-14, 2016.
- [3] Bo Sun and Yee Kan Koh. *Measurements of the thermal conductivity of rough samples using time-domain thermoreflectance (TDTR)*. ASME International Mechanical Engineering Congress & Exposition, Houston, Nov 13-19, 2015.
- [2] Sit Kerdsonpanya, Olle Hellman, Bo Sun, Yee Kan Koh, Ngo van Nong, Jun Lu, Sergei I. Simak, Bjorn Alling, and Per Eklund. *The effect of microstructure on lattice thermal conductivity of ScN thin films*. 34th Annual International Conference on Thermoelectrics, Dresden, Germany, June 28-July 2, 2015.
- [1] James (Zi-Jian) Ju, Bernhard Loitsch, Bo Sun, Thomas Stettner, Fabian Schuster, Martin Stutzmann, Yee Kan Koh and Gregor Koblmüller. *Growth and thermoelectric properties of InN/InGaN heterostructures*. 42nd International Symposium on Compound Semiconductors, University of California Santa Barbara, CA, USA, June 28-July 2, 2015.

Invited Seminars and Presentations

- [2] Beijing Institute of Technology, "Thermal transport anisotropy by intrinsic and extrinsic scattering mechanisms," Beijing, March 21, 2019
- [1] Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, "Thermal transport in low-dimensional materials," Shenzhen, November 1, 2018

Research Grants

RMB 10.34M in total. (1 RMB = 0.16 USD)

- [6] Joint NSFC-ISF Research Grant (with Prof. Eilam Yalon at Technion - Israel Institute of Technology), RMB 2M, Oct.2021 - Sep.2024, PI.
- [5] Outstanding Young Scholar Fund of Shenzhen, RMB 2M, Jan. 2021 - Dec. 2023, Sole PI.
- [4] National Science Foundation of China, RMB 240K, Jan. 2021 - Dec. 2023, Sole PI.
- [3] Shenzhen Peacock Program, RMB 5M, Oct. 2020 - Apr. 2022, Sole PI.
- [2] Key Project of Shenzhen Fundamental Research Program, RMB 1M (total 3M), Aug. 2020 - 2022, Co-PI.
- [1] General Program of Natural Science Foundation of Guangdong Province (No.2019A1515010868), *Effect of complex lattice imperfections on thermal transport properties of semiconductors*, RMB 100K, Jan.2020-Dec.2022, sole PI.

Professional Activity and Service

Organizing meeting symposiums

With Profs. Xiulin Ruan (Purdue University), Yee Kan Koh (National University of Singapore), Yanfei Xu (University of Massachusetts Amherst), we organized *Symposium EN₃: Thermal Materials and Modeling for Thermal Management and Energy Application* in 2021 MRS Fall Meeting, Boston, MA, United States

Professional Affiliations

Member of APS, MRS, ASME, Chinese Society of Engineering Thermophysics, Chinese Society for Measurement

Reviewing Journal Articles

Nature Communications	Physical Review Letters	ACS Nano
PNAS	Physical Review B	ACS Applied Materials & Interfaces
Scientific Reports	Physical Review Applied	Journal of Physical Chemistry
Nano Energy	Journal of Applied Physics	Physica Status Solidi B
Journal of Physical Chemistry C	Applied Physics Letters	Physics Letters A

Present PhD Thesis Advisees

Lu Zhao (2017), Yufeng Wang (2019), Shasha Huo (2020), Yizhe Liu (2020), Qinshu Li (2020), Doudou Gao (2021), Rongjie He (2021)

Past Postdoctoral Scholar Advisees

Dr. Lijuan Zhang 2019.1-2021.3
award of NSFC Young Scholar Grant, General Grant from China Postdoctoral Science Foundation, Postdoctoral Grant of Shenzhen, RMB 750 K in total

Dr. Bin Wang 2019.10-2022.1
award of NSFC Young Scholar Grant, Guangdong-Shenzhen Joint Grant, General Grant from China Postdoctoral Science Foundation, RMB 540 K in total

Campus Service

Junior Member of Department Search Committee (2019), Member of Department Preliminary Examination Committee (2019-), Member of Graduate Students Entrance Examination Committee (2019-), Member of Graduate Students Scholarship Evaluation Committee (2020-).

Teaching

8600023: *Thermal Physics and Engineering (Spring)*

8600893: *Nanoscale Energy Transfer (Fall)*

References

Prof. Yee Kan Koh (Ph.D. Advisor)
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National University of Singapore
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Prof. Austin J. Minnich (Postdoc Advisor)
Professor of Mechanical Engineering and Applied Physics
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Prof. Junqiao Wu
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