

Geoff Wehmeyer
Assistant Professor
Department of Mechanical Engineering
William Marsh Rice University
213 Mechanical Engineering Building
Houston, TX 77005
geoff.wehmeyer@rice.edu

Education

University of California, Berkeley **08/13 – 07/18**
Ph.D. in Mechanical Engineering
Major: Heat transfer. Minors: Electron microscopy, solid state physics.
Thesis : “Heat conduction in complicated nanostructures: experiments and theory”

The University of Texas at Austin **08/09 - 05/13**
B.S. in Mechanical Engineering, minor in English Literature. Highest honors.

Professional Experience

Assistant Professor, Dept. of Mechanical Engineering, Rice University **07/18 - present**
Graduate researcher, UC Berkeley **08/13 - 07/18**
Undergraduate researcher, UT Austin **08/11 - 06/13**
Intern, Samsung Austin Semiconductor **06/12 – 08/12**

Honors and Awards

NASA Early Career Faculty Award (2019-2022; awarded to 9 faculty nationwide in 2019)
Sophia Meyer Farb Prize for Teaching (2021; awarded to 2 Rice junior faculty members in 2021)
National Science Foundation Graduate Research Fellow (2013 -2018)
Berkeley Graduate Fellowship (2013 - 2015) (2 years fully funded of Ph.D.)

Journal Papers (peer reviewed)

- 1) L.W. Taylor, O.S. Dewey, R.J. Headrick, N. Komatsu, N.M. Peraca, **G. Wehmeyer**, J. Kono, M. Pasquali. Improved Properties, Increased Production, and the Path to Broad Adoption of Carbon Nanotube Fibers. *Carbon*, **171**, 689-694 (2021).
- 2) S.M. Rehn, T.M. Gerrard-Anderson, L. Qiao, Q. Zhu, **G. Wehmeyer**, M. R. Jones. Mechanical Reshaping of Inorganic Nanostructures with Weak Nanoscale Forces, *Nano Letters*, **21**, 130-135 (2021).
- 3) **G. Wehmeyer**. Modeling ballistic phonon transport from a cylindrical electron beam heat source. *Journal of Applied Physics* **126**, 124306 (2019).
- 4) O. Kwon, **G. Wehmeyer**, C. Dames. Modified ballistic–diffusive equations for obtaining phonon mean free path spectrum from ballistic thermal resistance. Part II. Derivation of integral equation based on ballistic thermal resistance. *Nanoscale and Microscale Thermophysical Engineering* **4**, 334-347 (2019).
- 5) O. Kwon, **G. Wehmeyer**, C. Dames. Modified ballistic–diffusive equations for obtaining phonon mean free path spectrum from ballistic thermal resistance. Part I: Introduction and Validation of the Equations. *Nanoscale and Microscale Thermophysical Engineering* **3**, 259-273 (2019).
- 6) H.S. Choe*, R. Prabhakar*, **G. Wehmeyer***, F.I. Allen, W. Lee, L. Jin, Y. Li, P. Yang, C. Qiu, C. Dames, M. Scott, A. M. Minor, J.-H. Bahk, and J. Wu. Ion write micro-thermotics: programing

thermal metamaterials at the microscale. *Nano Letters* **19** (6), 3830-3837 (2019). (* indicates equal contribution)

- 7) **G. Wehmeyer**, K. Bustillo, A.M. Minor, and C. Dames. Measuring temperature-dependent thermal diffuse scattering using scanning transmission electron microscopy. *Applied Physics Letters* **113**, 253101 (2018). (*Featured article*)
- 8) **G. Wehmeyer**, A.D. Pickel, and C. Dames. Onsager reciprocity relation for ballistic phonon heat transport in anisotropic thin films of arbitrary orientation. *Physical Review B* **98**, 014304 (2018).
- 9) **G. Wehmeyer**, T. Yabuki, C. Monachon, J. Wu, and C. Dames. Thermal diodes, regulators, and switches: physical mechanisms and potential applications. *Applied Physics Reviews* **4**, 041304 (2017).
- 10) J. Lee*, W. Lee*, **G. Wehmeyer***, S. Dhuey, D. Olynick, S. Cabrini, C. Dames, J. Urban, and P. Yang. Investigation of phonon coherence and backscattering using silicon nanomeshes. *Nature Communications* **8**, 14054 (2017). (* indicates equal contribution)
- 11) Z. Wei, **G. Wehmeyer**, C. Dames, and Y. Chen. Geometric tuning of thermal conductivity in three-dimensional anisotropic phononic crystals. *Nanoscale* **8**, 16612-16620 (2016).
- 12) S.D. Lubner, J. Choi, **G. Wehmeyer**, B. Waag, V. Mishra, H. Natesan, J.C. Bischof, and C. Dames. Reusable bi-directional 3ω sensor to measure thermal conductivity of 100- μm thick biological tissues. *Review of Scientific Instruments* **86**, 014905 (2015).

Conference Presentations

- 1) **G. Wehmeyer**. Modeling the Quasiballistic Phonon Thermal Resistance During Electron Beam Heating of Thin Films. MRS Spring Meeting, April 20, 2021 (virtual conference).
- 2) **G. Wehmeyer**. Boltzmann equation modeling of quasiballistic phonon transport from a cylindrical electron beam heat source. APS March Meeting, March 13-18, 2021. (virtual conference).
- 3) **G. Wehmeyer**, Probing nanoscale heat transfer using the scanning transmission electron microscope. Poster presentation, NSF New Frontiers in Thermal Transport Workshop, Dec. 14-16, 2020. (virtual workshop)
- 4) **G. Wehmeyer**. Boltzmann equation modeling of quasiballistic phonon transport from a cylindrical electron beam heat source. ASME Summer Heat Transfer Conference, Orlando, FL, July 13-15, 2020. (virtual conference).
- 5) **G. Wehmeyer**, Modeling quasiballistic phonon transport from a cylindrical electron beam heat source. APS March Meeting (virtual conference), March 2-6, 2020.
- 6) **G. Wehmeyer**. Boltzmann transport equation modeling of electron beam heating in thin samples. ASME Summer Heat Transfer Conference, Bellevue, WA, July 14-17, 2019.
- 7) **G. Wehmeyer**, K.C. Bustillo, A.M. Minor, and C. Dames. Temperature-dependent thermal diffuse scattering measurements using scanning transmission electron microscopy. 2019 Spring MRS Meeting, Phoenix, AZ, April 22-26, 2019.
- 8) **G. Wehmeyer**, A. D. Pickel, and C. Dames. Onsager reciprocity relation for ballistic phonon heat transport in anisotropic thin films of arbitrary orientation. APS March Meeting, Boston MA, March 4-8, 2019.
- 9) **G. Wehmeyer**, A. D. Pickel, and C. Dames. Modeling thin film boundary scattering effects on the off-diagonal elements of the thermal conductivity tensor. ASME Summer Heat Transfer Conference, Bellevue WA, July 9-12, 2017.
- 10) **G. Wehmeyer**, C. Dames. Nanoscale thermometry utilizing thermal diffuse scattering in the scanning transmission electron microscope. Poster session, US-Japan Joint Seminar on Nanoscale Transport Phenomena. Tokyo, Japan, July 3-5, 2017.
- 11) **G. Wehmeyer**, J. Lee, W. Lee, S. Dhuey, D. Olynick, S. Cabrini, J. Urban, P. Yang, C. Dames. Ray tracing simulations of incoherent phonon transport in silicon nanomeshes. Poster session, Materials Research Society Spring Meeting, Phoenix AZ, April 17-21, 2017.
- 12) **G. Wehmeyer**, K. Bustillo, A.M. Minor, and C. Dames. Measuring temperature using the thermal diffuse scattering in transmission electron microscope diffraction patterns. Poster, Molecular Foundry User Meeting 2016, Lawrence Berkeley National Laboratory, August 11-12 2016.

- 13) **G. Wehmeyer**, W.B. Chang, B. Russ, J.J. Urban, R.A. Segalman, and C. Dames. Ligand Length Effect on the Thermal Conductivity of Nanocrystal Arrays. IMECE2014-38659, Montreal, Canada, September 14-20, 2014.
- 14) C. Miers, **G. Wehmeyer**, and C.H. Hidrovo. A novel thermo-hydraulic test platform for micropillared array thermal wick optimization. 10th Annual ASME International Conference on Nanochannels, Microchannels, and Minichannels, Rio Grande, Puerto Rico, July 8-12, 2012

Invited Presentations

- 1) **G. Wehmeyer**, Passive heat switching using temperature-dependent magnetic forces. University of Rochester Department of Mechanical Engineering Remote Seminar, February 26, 2021.
- 2) **G. Wehmeyer**, Passive heat switching using temperature-dependent magnetic forces. Washington University in St. Louis Department of Mechanical Engineering and Materials Science Remote Seminar, December 3, 2020.
- 3) **G. Wehmeyer**, Probing heat conduction in complicated nanostructures using simulations and experiments. Kansas State Department of Mechanical and Nuclear Engineering Seminar, Manhattan KS, February 25, 2020.
- 4) **G. Wehmeyer**. Temperature-Dependent Thermal Diffuse Scattering for Scanning Transmission Electron Microscope Thermometry. 236th Meeting of the ElectroChemical Society, Atlanta GA, October 13-17, 2019.
- 5) **G. Wehmeyer**. Characterizing thermal performance of materials with high spatial resolution. AMPT Symposium, Rice University, August 15, 2019.
- 6) **G. Wehmeyer**. Developing nanoscale thermometry techniques using scanning transmission electron microscopy. 2019 Telluride Science Research Conference: Thermal Transport at the Nanoscale, Telluride, CO, June 16-20, 2019.
- 7) **G. Wehmeyer**. Probing thermal properties of materials using transmission electron microscopy (Keynote). ASM Houston Chapter Seminar, Rice University, May 2 2019.
- 8) **G. Wehmeyer**. Understanding heat transfer in complicated nanostructures: simulations and experiment. Rice University Department of Materials Science and Nanoengineering Seminar, November 1 2018.
- 9) C. Dames and **G. Wehmeyer**, Thermal diodes, regulators, and switches: Physical mechanisms and potential applications (Keynote). Tunable Thermal Materials Workshop, Charlottesville VA, July 16-17, 2018.
- 10) **G. Wehmeyer**. Thermal Conductivity Size Effects in Silicon Nanomeshes. San Jose State University Department of Physics and Astronomy Seminar, November 5 2015.

Teaching

- MECH 481: Introduction to Heat Transfer. Junior level required course. Spring 2019, Spring 2020, Spring 2021.
- MECH 484/584: Microscopic Thermodynamics and Transport. Undergraduate/graduate elective course. Fall 2020, Fall 2021.

Service

University:

- Faculty Fellow for Center for Teaching Excellence (Fall 2021-Spring 2024)

School of Engineering:

- Associate at McMurtry College (Fall 2019-present)
- Freshman Design Mentor for ENGI 120 (Spring 2020)

- AMPT Center PhD Recruitment Award Committee (Spring 2021-present)

Department:

- Rice Mechanical Engineering Graduate Committee Member (Fall 2018 – present)
- Rice Mechanical Engineering Seminar Series Committee Member (Spring 2021-present)
- Faculty Liaison to MECH Undergraduate Committee on DEI (Fall 2020-present)
- Ph.D. Qualifying Exam Committee Member :
 - AY '18-'19 : Austin Ward, Marcelo Fernandes, Kenechi Agbim
 - AY '19-'20: Danielle Perdue, Nick Jean-Louis
 - AY '20-21: Trevor Shimokusu, Yingru Song, Te Faye Yap, Zhen Liu, Rawand Rasheed, Boyu Zhang, Mohammad Sajadi.
- MECH Senior Design Project Mentor (Fall 2019-present)

Professional Activities

- Member of ASME, MRS, and APS.
- Member of ASME HTD K9 Committee on Nanoscale Thermal Transport
- Session Organizer for ASME 2020 Summer Heat Transfer Conference: Session 09-06 “Modeling and Simulation” (conference moved virtual after organizing session).
- Session Organizer for APS 2022 March Meeting Focus Topic: “Electron, Exciton, and Phonon Transport in Nanostructures”
- Reviewing journal articles

ACS Macro Letters	Journal of Heat Transfer
ACS Nano	Materials Today
Advanced Energy Materials	Materials Today Physics
Advanced Materials Interfaces	Nano Letters
Advanced Science	National Science Review
Applied Energy	Physica E
Applied Physics Letters	Physical Review Applied
Carbon	Physical Review B
European Physical Journal Plus	Physical Review Letters
Intern. Comms. in Heat and Mass Transfer	Science Advances
Intern. Journal of Heat and Mass Transfer	Soft Matter
Journal of Applied Physics	Ultramicroscopy

Broader Impacts

- Research Mentor for Rice Nano-REU program **Summer '21**
- Mentoring local community-college student Andrea Fabila working 40 hrs/week in research lab for 10 weeks.
- Co-chair of science program Students for Environmental Energy Development **08/13 – 05/17**
- Led biweekly energy science outreach program at Berkeley High School for three years
 - Coordinated 31 graduate students for >900 mentoring hours
- Mentor for Berkeley Engineering Research Experience for Teachers (BERET) **Summer '14 and '15**
- Supervised two undergraduates (Rachael Klaiss and Conor Carroll) and two high school science teachers (Kurt Osmer and Stephanie Morgado) on summer research projects

Postdoctoral Scholars Supervised

1. Nazari, Mojdeh (2020). 4 month postdoctoral appointment. Next position: LAM Research.
2. Zhu, Qing (2020-2022). 2 year postdoctoral appointment.

Students Supervised

Ph.D. Advisees (In Progress)

1. Song, Yingru. Expected May 2024.
2. Shimokusu, Trevor. Expected May 2024. NASA NSTGRO Research Fellow (2020-2024).

M.S. Advisees (In Progress)

1. Garg, Ajay. Expected Dec. 2022.

Committee Member

1. Singer, Amanda (PhD, Robinson). *Magnetolectric Materials for Wireless Power Delivery to Miniature Bioelectronic Implants*. April 2021.
2. Perdue, Danielle (PhD, Schaefer). *Flow and Thermal Modeling for Enhanced Direct Contact Membrane Distillation Performance*. April 2021.
3. Doiron, Chloe (PhD, Naik). *Alternative Materials for Harnessing Symmetry and Topology in Thermal Light Sources for Thermophotovoltaics*. Nov. 2020.
4. Agbim, Kenechi (PhD, Schaefer). *Simulation of Property Variation in Thermoresponsive Hydrogels*. April 2020.

Undergraduate Research Supervised

4 women, 6 underrepresented minorities, 3 went on to pursue graduate degrees.

1. Fabila Mireles, Andrea Yamilez (MECH). *Finite-element thermal modeling of passive magnetic heat switch*. Summer 2021.
2. Rivera, Natan (MECH), *System integration of carbon nanotube fibers for power transmission*. Summer 2021.
3. Yao, Audrey (MECH), *Data mining of first-principles thermal conductivity accumulation functions*. Spring 2021.
4. Zdrojewski, Kaitlyn (MECH), *Time-periodic thermal switching using oscillating heat switch*. Fall 2020, Spring 2021.
5. Martinez Cordeiro, Juan Pablo (MECH). *Analysis of pulsed thermoelectric heat switches*. Summer 2020, Fall 2020, Spring 2021.
6. Landa, Hociel (MECH). *Geometric design of additively manufactured heat sinks*. Summer 2020, Fall 2020, Spring 2021. Awarded "Best Engineering Poster Presentation" at 2021 Rice Undergraduate Research Symposium. Awarded 2020 OURI Summer Research Fellowship.
7. Onyeagoro, Chidera (MECH). *Optimization of phase-change thermal energy storage devices for time-periodic thermal response*. Summer 2020.
8. Adiole, Chima (MECH). *Visualization of thermoelectric module heating and cooling*. Spring 2020, Summer 2020.
9. Liu, Harry (MECH). *Extracting local and heterogeneous thermal conductivity using deep learning*. Spring 2019, Summer 2019, Fall 2019, Spring 2020.
10. Song, Jacob (MECH). *Gravity-driven thermal rectification using thermosiphons*. Spring 2019.

Funding

George R. Brown Teaching Grant (PI) - \$3,600

Co-PI's: Yildiz Bayazitoglu, Daniel Preston

Title: Student-Led Projects Visualizing Heat Transfer Using Portable Smartphone Thermal Imaging
May 2021-May 2022

Carbon Hub 2020 Proposals on Materials-Energy Nexus (lead PI) –\$135,000 total, \$67,500 to GW.
Co-PI's: Junichiro Kono, Matthew Foster
Title: Multiscale optimization of electrical and thermal transport in carbon nanotube conductors for power cable applications
March 2021 – Feb. 2022

NASA Space Technologies Graduate Research Opportunity (NSTGRO) (PI) – \$320,000
Title: Jumping droplet thermal diodes for spacecraft thermal control
Aug 2020 – July 2024

NASA-STMD Early Career Faculty Award (PI) - \$599,986
Title: High turndown ratio heat switch leveraging temperature-dependent magnetic forces
Oct. 2019 – Sep. 2022

Welch Foundation Research Grant Program (PI) - \$195,000
Title: Probing anharmonic atomic bonding using thermal phonon mean free path spectroscopy
June 2019 – May 2022

Rice Creative Ventures Faculty Initiatives Fund (PI) - \$50,000
Title: Mapping temperature at the nanoscale using transmission electron microscopy
April 2019 – June 2021

Rice Shared Equipment Authority New Equipment (lead PI) - \$50,821
Title: In-Situ TEM Heating / Biasing Holder
Co-Is: Jun Lou, Zachary Cordero, Hua Guo, Matthew Brake, and Ned Thomas
Awarded July 8, 2019