

Dr. Georgios Varnavides

Postdoctoral Miller Research Fellow, University of California, Berkeley

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Education

- Ph.D., Materials Science and Engineering**, *Massachusetts Institute of Technology* and *Harvard University*, Cambridge, MA, USA. 2017-2022
- Co-advisors: Prof. P. Narang (Harvard) and Prof. P. Anikeeva (MIT).
 - Thesis: *Electron Hydrodynamics in Crystalline Solids*.
- B.S., Materials Science and Engineering**, *Massachusetts Institute of Technology*, Cambridge, MA, USA. 2013-2017
- B.S., Civil and Environmental Engineering**, *Massachusetts Institute of Technology*, Cambridge, MA, USA.

Research Interests

- Spatially-resolved transport of non-equilibrium carriers.
- Electron hydrodynamics: microscopic origins and macroscopic observables.
- Non-uniform current density imaging using electron microscopy.

Awards & Honors

- Outstanding Ph.D. Thesis Research Award**, *Department of Materials Science and Engineering, Massachusetts Institute of Technology*. 2022
- Miller Institute Postdoctoral Fellow 2022-2025 (awarded and accepted)**, *Miller Institute for Basic Research in Science, University of California, Berkeley*
- Heising-Simons Postdoctoral Fellow 2022-2024 (awarded)**, *Kavli Energy NanoScience Institute, University of California, Berkeley*
- Kavli Institute at Cornell Postdoctoral Fellow 2022-2024 (awarded)**, *Kavli Institute at Cornell, Cornell University*
- Materials Research Society Graduate Student Gold Award**, MRS Fall 2021 Meeting. 2021
- John Wulff Award for Excellence in Teaching an Undergraduate Subject**, *Department of Materials Science and Engineering, Massachusetts Institute of Technology*.
- Hugh Hampton Young Fellow**, *Massachusetts Institute of Technology*. 2020
- Best Paper Award for Second or First Year Student**, *Department of Materials Science and Engineering, Massachusetts Institute of Technology*. 2019
- Piper Presidential Graduate Fellow**, *Massachusetts Institute of Technology*. 2017
- Horace A. Lubin Award for Outstanding Service to the DMSE Community**, *Department of Materials Science and Engineering, Massachusetts Institute of Technology*.
- Juan Hermosilla Prize for exceptional talent and potential at the**

intersection of mechanics, materials & structures, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology.

Julian Szekely Award for the Outstanding Junior, Department of Materials Science and Engineering, Massachusetts Institute of Technology.

2016

Undergraduate Student Teaching Award in Teaching an Undergraduate Subject, Department of Materials Science and Engineering, Massachusetts Institute of Technology.

Publications

For a complete list of publications, please see my [Google Scholar profile](#). *Denotes equal contribution.

Prepress

1. G. Varnavides*, A.S. Jermyn*, P. Anikeeva, P. Narang, Probing carrier interactions using electron hydrodynamics, *arXiv:2204.06004* (2022), **Submitted**.

Journal articles

2. Y. Wang*, **G. Varnavides***, P. Anikeeva, J. Gooth, C. Felser, P. Narang, Generalized design principles for hydrodynamic electron transport in anisotropic metals, *Phys Rev Materials* 6, 083802 (2022).

2022

3. L. Y. Maeng, D. Rosenfeld, G. J. Simandl, F. Koehler, A. W. Senko, J. Moon, **G. Varnavides**, M. F. Murillo, A. E. Reimer, A. Wald, P. Anikeeva, A. S. Widge, Probing Neuro-Endocrine Interactions Through Wireless Magnetothermal Stimulation of Peripheral Organs, *Frontiers in Neuroscience*, 949 (2022).

4. G. Varnavides*, Y. Wang*, P. J.W. Moll, P. Anikeeva, P. Narang, Mesosopic finite-size effects of unconventional electron transport in PdCoO₂, *Phys Rev Materials*, 6, 045002 (2022).

5. C. A. Garcia, D. M. Nenno, **G. Varnavides**, P. Narang, Anisotropic phonon-mediated electronic transport in chiral Weyl semimetals, *Phys Rev Materials*, 5, L091202 (2021).

2021

6. U. Vool*, A. Hamo*, **G. Varnavides***, Y. Wang*, T. X. Zhou, N. Kumar, Y. Dovzhenko, Z. Qiu, C. A. Garcia, A. T. Pierce, J. Gooth, P. Anikeeva, C. Felser, P. Narang, A. Yacoby, Imaging phonon-mediated hydrodynamic flow in WTe₂, *Nat Phys*, 1745-2481 (2021).

7. X. Tian*, X. Yan*, **G. Varnavides***, Y. Yuan, D. S. Kim, C. J. Ciccarino, P. Anikeeva, M.-Y. Li, L.-J. Li, P. Narang, X. Pan, J. Miao, Capturing 3D atomic defects and phonon localization at the 2D heterostructure interface, *Sci Adv*, 7: eabi6699 (2021).

8. M. R. van Delft, Y. Wang, C. Putzke, J. Oswald, **G. Varnavides**, C. A. C. Garcia, C. Guo, H. Schmid, V. Suss, H. Borrmann, J. Diaz, Y. Sun, C. Felser, B. Gotsmann, P. Narang, P. J.W. Moll, Sondheimer oscillations as a probe of non-ohmic flow in WP₂ crystals, *Nat Commun* 12, 4799 (2021).

9. J. Park*, F. Koehler*, **G. Varnavides**, M.-J. Antonini, and P. Anikeeva, Influence of Magnetic Fields on Electrochemical Reactions of Redox Cofactor Solutions. *Angew. Chem. Int. Ed.* (2021).

10. G. Varnavides, A. Mortensen, W.C. Carter, Simulating Infiltration as a Sequence of Pinning and De-pinning Processes, *Acta Materialia*

210, 116831 (2021).

11. K. Reidy*, **G. Varnavides***, J.D. Thomsen, A. Kumar, T. Pham, A. M. Blackburn, P. Anikeeva, P. Narang, J. M. LeBeau, F. M. Ross, Direct imaging and electronic structure modulation of moiré superlattices at the 2D/3D interface, *Nat Commun* 12, 1290 (2021).

12. **G. Varnavides***, A. S. Jermyn*, P. Anikeeva, P. Narang, Electron hydrodynamics in anisotropic materials, *Nat Commun* 11, 4710 (2020).

2020

13. D. Gregurec, A. W. Senko, A. Chuvilin, P. D. Reddy, A. Sankararaman, D. Rosenfeld, P.-H. Chiang, F. Garcia, I. Tefel, **G. Varnavides**, E. Ciocan, P. Anikeeva, Magnetic Vortex Nanodiscs Enable Remote Magnetomechanical Neural Stimulation, *ACS nano* 14, 7 (2020).

14. P. Periwal, J. D. Thomsen, K. Reidy, **G. Varnavides**, D. N. Zakharov, L. Gignac, M. C. Reuter, T. J. Booth, S. Hofmann, F. M. Ross, Catalytically mediated epitaxy of 3D semiconductors on van der Waals substrates, *Applied Physics Reviews* 7, 031402 (2020).

15. J. Moon, M. G. Christiansen, S. Rao, C. Marcus, D. C. Bono, D. Rosenfeld, D. Gregurec, **G. Varnavides**, P.-H. Chiang, S. Park, P. Anikeeva, Magnetothermal Multiplexing for Selective Remote Control of Cell Signaling, *Advanced Functional Materials* 30, 36 (2020).

16. D. Rosenfeld, A. W. Senko, J. Moon, I. Yick, **G. Varnavides**, D. Gregurec, F. Koehler, P.-H. Chiang, M. Christiansen, L. Y. Maeng, A. S. Widge, P. Anikeeva, Transgene-free remote magnetothermal regulation of adrenal hormones, *Science advances* 6, 15 (2020).

17. **G. Varnavides**, A. S. Jermyn, P. Anikeeva, P. Narang, Nonequilibrium phonon transport across nanoscale interfaces, *Phys Rev B*, 100, 115402 (2019).

2019

18. S. Rao, R. Chen, A. A. LaRocca, M. G. Christiansen, A. W. Senko, C. H. Shi, P.-H. Chiang, **G. Varnavides**, J. Xue, Y. Zhou, S. Park, R. Ding, J. Moon, G. Feng, P. Anikeeva, Remotely controlled chemomagnetic modulation of targeted neural circuits, *Nat Nanotechnol* 14, 967 (2019).

19. M. Kanik*, S. Orguc*, **G. Varnavides**, J. Kim, T. Benavides, D. Gonzalez, T. Akintilo, C. C. Tasan, A. P. Chandrakasan, Y. Fink, P. Anikeeva, Strain-programmable fiber-based artificial muscle, *Science* 365, 6449 (2019).

20. J. Vukajlovic-Plestina, W. Kim, L. Ghisalberti, **G. Varnavides**, G. Tutuncuoglu, H. Potts, M. Friedl, L. Guniat, W.C. Carter, V.G. Dubrovskii, A. Fontcuberta i Morral, Fundamental aspects to localize self-catalyzed III-V nanowires on silicon, *Nat Commun* 10, 869 (2019).

Conferences

Presentations

Investigating the Role of Microscopic Interactions in Electron Hydrodynamics, Materials Research Society (MRS) Spring 2022, Honolulu, HI, USA.

2022

SpaRTaNS: Spatially Resolved Transport of Non-equilibrium Species, American Physical Society (APS) March 2022 Meeting, Chicago, IL, USA.

Imaging anisotropic electron fluids with high spatial resolution, KIC Special Seminar, Virtual Seminar.

2021

Electron Hydrodynamics: Microscopic Origins and Effects of Macroscale Geometries, Materials Research Society (MRS) Spring 2021, *Virtual Conference*.

Electron Hydrodynamics: Microscopic Origins, American Physical Society (APS) March 2021 Meeting, *Virtual Conference*.

Temperature-Resolved Observations and Predictions of Phonon-Mediated Hydrodynamic Flow of Electrons in WTe₂, Materials Research Society (MRS) Fall 2020, *Virtual Conference*. 2020

Teaching Materials Science using the Wolfram Language, Wolfram Technology Conference 2020, *Virtual Conference*.

Crystal Symmetry and Electron Hydrodynamics: A Group Theory Approach, Materials Research Society (MRS) Fall 2019 Meeting, *Boston, MA, USA*. 2019

Spatially-Resolved Non-equilibrium Phonon Transport Across Nanoscale Interfaces, American Physical Society (APS) March Meeting 2019, *Boston, MA, USA*.

Ab initio Predictions of Spatially-Resolved Non-equilibrium Coherent Transport Phenomena, Materials Research Society (MRS) Fall 2018 Meeting, *Boston, MA, USA*. 2018

Non-Equilibrium Phonon Transport Across Semi-Coherent Interfaces, 16th International Conference on Phonon Scattering in Condensed Matter, *Nanjing, China*.

(De)Generative Art, Wolfram Technology Conference 2017, *Champaign, IL, USA*. 2017

Capillarity in pressure infiltration part I & II: Experiment and modelling, Materials Science & Technology (MS&T16), *Salt Lake City, UT, USA*. 2016

Posters

Finite-size Effects of Electron Transport in Anisotropic Quasi-Two Dimensional Metals, Materials Research Society (MRS) Fall 2021 Meeting, *Boston, MA, USA*. 2021

Darcy-Brinkman multiscale modelling applied on the Mosul Dam, New England Mechanics 2017 Workshop, *Cambridge, MA, USA*. 2017

Simulating capillarity in metal infiltration, Materials Science & Technology (MS&16), *Salt Lake City, UT, USA*. 2016

Teaching

Lead Instructor

Instructor-G, *Department of Materials Science and Engineering*, Cambridge, MA, USA 2022
- Mathematics and Computational Thinking for Materials Scientists and Engineers I (3.029)

Teaching Assistant

Graduate Teaching Assistant, *Department of Materials Science and Engineering*, Cambridge, MA, USA 2020
- Materials Project Laboratory (3.042)

Undergraduate Teaching Assistant, *Department of Materials Science and Engineering*, Cambridge, MA, USA 2016-2017

- Mathematics for Materials Science and Engineers (3.016)
- Electrical, Optical and Magnetic Properties of Materials (3.024)

Short Courses

Generative Art Workshop, 4-day IAP workshop, Massachusetts Institute of Technology, Cambridge, MA, USA. 2017-2022
 Co-taught with Emma Vargo, Amina Matt, Jovana Andrejevic, and Nina Andrejevic.

Service & Outreach

Graduate Materials Council (GMC) officer on the Departmental Committee on Graduate Studies (DCGS). 2019-2021

Teen Counselor and Teen Advisor for Camp Kesem, a student-run organization helping children through and beyond a parent's cancer. 2015-2021

Memberships

Microscopy Society of America (MSA). 2022-present

Materials Research Society (MRS). 2018-present
 American Physical Society (APS).

Tau Beta Pi (TBP) - Engineering Honor Society Member. 2017-present
 Chi Epsilon (XE) - Civil Engineering Honor Society Member.

Last updated: August 2022