

Georgios Varnavides

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Education

- Ph.D., Materials Science and Engineering**, *Massachusetts Institute of Technology* and *Harvard University*, Cambridge, MA, USA. 2017-present
- Co-advisors: Prof. P. Narang (Harvard) and Prof. P. Anikeeva (MIT).
 - Thesis: *Unconventional Transport and Electron Hydrodynamics*.
- 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

- John Wulff Award for Excellence in Teaching an Undergraduate Subject**, *Department of Materials Science and Engineering, Massachusetts Institute of Technology*. 2021
- 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](#)

First/Co-first

2021

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). See also Harvard press coverage

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).

Y. Wang*, **G. Varnavides***, P. Anikeeva, J. Gooth, C. Felser, P. Narang, Generalized design principles for hydrodynamic electron transport in anisotropic metals, *arXiv:2109.00550* (2021), **Submitted**.

G. Varnavides*, Y. Wang*, P. J.W. Moll, P. Anikeeva, P. Narang, Finite-size effects of electron transport in PdCoO₂, *arXiv:2106.00697* (2021), **Submitted**.

G. Varnavides, A. Mortensen, W.C. Carter, Simulating Infiltration as a Sequence of Pinning and De-pinning Processes, *Acta Materialia* 210, 116831 (2021).

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). Featured in Nature Communications focus issue, see also MIT press coverage.

G. Varnavides*, A. S. Jermyn*, P. Anikeeva, P. Narang, Electron hydrodynamics in anisotropic materials, *Nat Commun* 11, 4710 (2020). See also Harvard press coverage.

2020

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

2019

Co-author

2021

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

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, *bioRxiv:2021.06.24.449506* (2021), **Submitted**.

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).

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).

D. Gregurec, A. W. Senko, A. Chuvilin, P. D. Reddy, A. Sankararaman, D. Rosenfeld, P.-H. Chiang, F. Garcia, I. Tefel, **G. Varnavides**, E.

2020

Ciocan, P. Anikeeva, Magnetic Vortex Nanodiscs Enable Remote Magnetomechanical Neural Stimulation, *ACS nano* 14, 7 (2020).

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). Editor's Suggestion.

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).

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).

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).

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). See also [MIT press coverage](#).

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).

2019

Conferences

Presentations

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

2021

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*.

Spatially-Resolved Phonon Hydrodynamic Flow from First Principles, American Physical Society (APS) March 2020 Meeting, *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)

2018

Fall 2018 Meeting, *Boston, MA, USA*.

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

Slack Commands and Other Office Productivity Tricks with the Wolfram Language, Wolfram Technology Conference 2018, *Champaign, IL, USA*.

(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

Darcy-Brinkman equation, 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

Teaching assistant

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

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*. 2017-2021
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-present

Memberships

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

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

