

Matthew J. Hirn

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papers: matthewhirn.com/research/papers/

citations: [Google Scholar](#)

PROFESSIONAL PREPARATION

Cornell University	Ithaca, NY	Mathematics	BA	2004
University of Maryland	College Park, MD	Mathematics	PhD	2009
Yale University	New Haven, CT	Applied Mathematics	Postdoc	2009-2013
Cornell University	Ithaca, NY	Mathematics	Visit. Asst. Prof.	2013 (2 months)
École Normale Supérieure	Paris, France	Computer Science	Postdoc	2013-2015

APPOINTMENTS

Michigan State University East Lansing, MI CMSE & Math **Asst. Prof.** 2015-Present

HONORS, AWARDS & GRANTS

- [DARPA Director's Fellowship](#) (2018 – 2019)
- [Kavli Fellow](#) (2017) [Awarded by the National Academy of Sciences]
- [Alfred P. Sloan Fellowship](#) (2016 – 2020)
- [DARPA Young Faculty Award](#) (2016 – 2018)
- [NSF grant #1620216](#) (2016 – 2019)
- [Senior Fellow](#), Institute for Pure and Applied Mathematics (Fall 2016 long program)
- [AMS-Simons Travel Grant](#) (2012 – 2014)
- [Ann G. Wylie Dissertation Fellowship](#) (2009) [Awarded by the University of Maryland]

SELECTED PUBLICATIONS

Authors are generally listed in alphabetical order, per the convention in mathematics. Publications [2,3] are exceptions.

- [1] Adam Gustafson, Matthew Hirn, Kitty Mohammed, Hariharan Narayanan and Jason Xu. Structural Risk Minimization for $C^{1,1}(\mathbb{R}^d)$ Regression. *Journal of Machine Learning Research*, submitted, 2018.
- [2] Kevin R. Moon, David van Dijk, Zheng Wang, William Chen, Matthew J Hirn, Ronald R Coifman, Natalia B Ivanova, Guy Wolf and Smita Krishnaswamy. Visualizing Transitions and Structure for High Dimensional Data Exploration. *Cell*, submitted, 2018.
- [3] Nicholas F. Marshall and Matthew J. Hirn. Time Coupled Diffusion Maps. *Applied and Computational Harmonic Analysis*, to appear, 2018.
- [4] Michael Eickenberg, Georgios Exarchakis, Matthew Hirn, Stéphane Mallat, and Louis Thiry. Solid Harmonic Wavelet Scattering for Predictions of Molecule Properties, *The Journal of Chemical Physics* (Editor's Pick), vol. 148, 241732, 2018.

- [5] Michael Eickenberg, Georgios Exarchakis, Matthew Hirn, and Stéphane Mallat. Solid Harmonic Wavelet Scattering: Predicting Quantum Molecular Energy from Invariant Descriptors of 3D Electronic Densities, *Advances in Neural Information Processing Systems 30 (NIPS 2017)*, pp. 6543-6552, 2017.
- [6] Matthew J. Hirn, Nicolas Poilvert, and Stéphane Mallat. Wavelet scattering regression of quantum chemical energies. *Multiscale Modeling and Simulation*, vol. 15, no. 2, pp. 827-863, 2017.
- [7] Ariel Herbert-Voss, Matthew J. Hirn, and Frederick McCollum. Computing minimal interpolants in $C^{1,1}(\mathbb{R}^d)$. *Revista Matemática Iberoamericana*, vol. 33, no. 1, pp. 29-66, 2017.
- [8] Ronald R. Coifman and Matthew J. Hirn. Diffusion maps for changing data. *Applied and Computational Harmonic Analysis*, vol. 36, no. 1, pp. 79-107, 2014.
- [9] Matthew J. Hirn and Erwan Le Gruyer. A general theorem of existence of quasi absolutely minimal Lipschitz extensions. *Mathematische Annalen*, vol. 359, no. 3-4, pp. 595-628, 2014.
- [10] Ronald R. Coifman and Matthew J. Hirn. Bi-stochastic kernels via asymmetric affinity functions. *Applied and Computational Harmonic Analysis*, vol. 35, no. 1, pp. 177-180, 2013.

SELECTED TALKS

1. *Introduction to Understanding Many-Particle Systems with Machine Learning*. Evening lecture at the UCLA Institute for Pure and Applied Mathematics (Jun 11, 2018).
2. *Three dimensional deep learning and many body physics*. Hong Kong University of Science and Technology Institute for Advanced Study workshop on "The Mathematics of Deep Learning" (Jan 8, 2018).
3. *Transferring diffusion based manifold learning to trajectories and time varying data*. Brown Institute for Computational and Experimental Research in Mathematics workshop on "Geometry and Topology of Data" (Dec 11, 2017).
4. *Learning Many Body Physics with Multiscale, Multilayer Machine Learning Architectures*. Hong Kong Baptist University "First International Conference on Mathematics of Data Science" (Mar 20, 2017).
5. *Multiscale Machine Learning*. Opening day lecture for the long program on "Understanding Many-Particle Systems with Machine Learning" at the UCLA Institute for Pure and Applied Mathematics (Sep 12, 2016).

SELECTED SYNERGISTIC ACTIVITIES

1. **Student Interactions**

- Currently supervising four PhD students and three postdocs.
- Developed two new graduate courses, *Mathematical Foundations of Data Science* and *Computational Harmonic Analysis and Data Science*.
- Directed an NSF REU on *Machine Learning from Quantum Computing* at MSU (Summer 2018), and an NSF REU on *High Dimensional Data Analysis* at Cornell (Summer, 2013).

2. **Conference and Seminar Organization**

- Organized session on *Kernel Learning and Harmonic Analysis* for the Culminating Workshop of the IPAM program on Understanding Many-Particle Systems with Machine Learning (Dec 13, 2016).

3. **Journal Referee**

Applied and Computational Harmonic Analysis, European Journal of Operational Research, IEEE Signal Processing Letters, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Information Theory, Linear Algebra and Its Applications, Neural Computation, Proceedings of the American Mathematical Society, SIAM Journal on Applied Dynamical Systems, Signal Processing.