

Benjamin Feldman

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Stanford, CA 94305

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- Education:** **Harvard University**, Cambridge, MA Nov. 2013
Ph.D. in experimental condensed matter physics
Advisor: Prof. Amir Yacoby
Thesis: Measurements of Interaction-Driven States in Monolayer and Bilayer Graphene
- Haverford College**, Haverford, PA May 2007
B. S. *summa cum laude* in physics with a minor in chemistry
Advisor: Prof. Walter Smith
Undergraduate thesis: Persistent Photoconductivity and Photo-Induced Morphological Changes in Porphyrin Nanorods
- Honors and Awards:** Cottrell Scholar 2022 – 2024
Sloan Fellow 2019 – 2021
Terman Fellow 2018 – 2020
Kavli Frontiers of Science Fellow 2018
Dicke Postdoctoral Fellow, Princeton University 2013 – 2016
NSF Graduate Research Fellowship Program Honorable Mention 2007 and 2008
- Employment:** **Stanford University**, Stanford, CA 2018 – present
Assistant Professor of Physics
- Princeton University**, Princeton, NJ 2013 – 2017
Dicke postdoctoral fellow; Advisor: Prof. Ali Yazdani
- Harvard University**, Cambridge, MA 2007 – 2013
Graduate research assistant
- Publications:** J. Yu, B. A. Foutty, Z. Han, M. E. Barber, Y. Schattner, K. Watanabe, T. Taniguchi, P. Phillips, Z.-X. Shen, S. A. Kivelson, B. E. Feldman. Correlated Hofstadter Spectrum and Flavour Phase Diagram in Magic Angle Graphene. **[Accepted to Nat. Phys.] arXiv: 2108.00009** (2021).
- B. E. Feldman. The Preferred Direction. **Nat. Phys. [News and Views]** 18, 129–130 (2022).
- S. A. Parameswan, B. E. Feldman. Quantum Hall valley nematics. **J. Phys. Condens. Matter** 31, 273001 (2019).
- B. E. Feldman. Squeezing strong correlations from graphene. **Science [Perspective]** 363, 1035-1036 (2019).
- M. T. Randeria*, K. Agarwal*, B. E. Feldman, H. Ding, H. Ji, R. J. Cava, S. L. Sondhi, S. A. Parameswaran, A. Yazdani. Interacting multi-channel topological boundary modes in a quantum Hall valley system. **Nature** 466, 363-367 (2019).
- M. T. Randeria*, B. E. Feldman*, F. Wu*, H. Ding, A. Gyenis, H. Ji, R. J. Cava, A. H. MacDonald, A. Yazdani. Ferroelectric quantum Hall phase revealed by visualizing Landau level wave function interference. **Nat. Phys.** 14, 796-800 (2018).
- A. Gyenis*, B. E. Feldman*, M. T. Randeria*, G. A. Peterson, E. D. Bauer, P. Aynajian, A. Yazdani. Mapping Dimensionality and Directionality of Electronic Behavior in CeCoIn₅. **Nat. Commun.** 9, 549 (2018).

- B. E. Feldman*, M. T. Randeria*, J. Li*, S. Jeon, Y. Xie, Z. Wang, I. K. Drozdov*, B. A. Bernevig, A. Yazdani. High-resolution studies of the Majorana atomic chain platform. **Nat. Phys.** *13*, 286-291 (2017).
- B. E. Feldman*, M. T. Randeria*, A. Gyenis*, F. Wu, H. Ji, R. J. Cava, A. H. MacDonald, A. Yazdani. Observation of a Nematic Quantum Hall Liquid on the Surface of Bismuth. **Science** *354*, 316-321 (2016).
- A. Gyenis, H. Inoue, S. Jeon, B. B. Zhou, B. E. Feldman, Z. Wang, J. Li, S. Jiang, Q. D. Gibson, S. K. Kushwaha, J. W. Krizan, N. Ni, R. J. Cava, B. A. Bernevig, A. Yazdani. Imaging electronic states on topological semimetals using scanning tunneling microscopy. **New. J. Phys.** *18*, 105003 (2016).
- M. T. Randeria*, B. E. Feldman*, I. K. Drozdov, A. Yazdani. Scanning Josephson spectroscopy on the atomic scale. **Phys. Rev. B** *93*, 161115 (2016).
- P. K. Das, D. Di Sante, I. Vobornik, J. Fujii, T. Okuda, E. Bruyer, A. Gyenis, B. E. Feldman, J. Tao, R. Ciancio, G. Rossi, M. N. Ali, S. Picozzi, A. Yazdani, G. Panaccione, R. J. Cava. Layer-dependent quantum cooperation of electron and hole states in the anomalous semimetal WTe₂. **Nat. Commun.** *7*, 10847 (2016).
- S. K. Kushwaha, J. W. Krizan, B. E. Feldman, A. Gyenis, M. T. Randeria, J. Xiong, S.-Y. Xu, N. Alidoust, I. Belopolski, T. Liang, M. Z. Hasan, N. P. Ong, A. Yazdani, R. J. Cava. Bulk Crystal Growth and Electronic Characterization of the 3D Dirac Semimetal Na₃Bi. **APL Mat.** *3*, 041504 (2015).
- S. Jeon, B. B. Zhou, A. Gyenis, B. E. Feldman, I. Kimchi, A. C. Potter, Q. D. Gibson, R. J. Cava, A. Vishwanath, A. Yazdani. Landau Quantization and Quasiparticle Interference in the Three-Dimensional Dirac Semimetal Cd₃As₂. **Nat. Mater.** *13*, 851-856 (2014).
- A. Kou*, B. E. Feldman*, A. J. Levin, B. I. Halperin, K. Watanabe, T. Taniguchi. Electron-Hole Asymmetric Integer and Fractional Quantum Hall Effect in Bilayer Graphene. **Science** *345*, 55-57 (2014).
- D. A. Abanin, B. E. Feldman, A. Yacoby, B. I. Halperin. Fractional and integer quantum Hall effects in the zeroth Landau level in graphene. **Phys. Rev. B** *88*, 115407 (2013).
- B. E. Feldman, A. J. Levin, B. Krauss, Dmitry A. Abanin, B. I. Halperin, J. H. Smet, A. Yacoby. Fractional Quantum Hall Phase Transitions and Four-flux States in Graphene. **Phys. Rev. Lett.** *111*, 076802 (2013).
- B. E. Feldman, B. Krauss, J. H. Smet, A. Yacoby. Unconventional Sequence of Fractional Quantum Hall States in Suspended Graphene. **Science** *337*, 1196-1199 (2012).
- J. Martin, B. E. Feldman, R. T. Weitz, M. T. Allen, A. Yacoby. Local Compressibility Measurements of Correlated States in Suspended Bilayer Graphene. **Phys. Rev. Lett.** *105*, 256806 (2010).
- R. T. Weitz, M. T. Allen, B. E. Feldman, J. Martin, A. Yacoby. Broken-Symmetry States in Doubly Gated Suspended Bilayer Graphene. **Science** *330*, 812-816 (2010).
- C. K. Riley, E. A. Muller, B. E. Feldman, C. M. Cross, K. L. Van Aken, D. E. Johnston, Y. Lu, A. T. Johnson, J. C. de Paula, W. F. Smith. Effects of O₂, Xe, and Gating on the Photoconductivity and Persistent Photoconductivity of Porphyrin Nanorods. **J. Phys. Chem. C** *114*, 19227-19233 (2010).
- B. E. Feldman, J. Martin, A. Yacoby. Broken-symmetry states and divergent resistance in suspended bilayer graphene. **Nat. Phys.** *5*, 889-893 (2009).

Invited Talks: International Conferences:

“Correlated Hofstadter Spectrum and Flavor Phase Diagram in Magic-Angle Graphene.” *New Era of Two-Dimensional Quantum Matter*. Princeton, New Jersey, USA (virtual participation; March 10, 2021).

“Imaging a nematic quantum Hall liquid and its boundary modes.” *Quantum Fluids and Solids 2019*. Edmonton, Canada (August 10, 2019).

“Visualizing a nematic domain wall in bismuth: a tunable platform for topological edge modes.” *New Trends in Topological Insulators*. Luxembourg, Luxembourg (July 19, 2018).

“Imaging the wave functions of broken symmetry quantum Hall phases.” *Frontiers in Quantum Materials and Devices Workshop*. Boston, Massachusetts, USA (June 5, 2018).

“Imaging a Nematic Quantum Liquid in Real Space.” *Quantum Transport in 2D Systems*. Luchon, France (May 24, 2017).

“Imaging of a Nematic Quantum Liquid in Real Space.” *First EPIQS Postdoctoral Symposium (Gordon and Betty Moore Foundation)*. Aspen, Colorado, USA (Feb. 21, 2017).

“Real-Space Imaging of a Nematic Quantum Hall Liquid.” *Quantum Criticality and Topology in Itinerant Electron Systems*. Albuquerque, New Mexico, USA (Aug. 16, 2016).

“Exploring Signatures of Majorana Fermions in Chains of Magnetic Atoms on a Superconductor.” *Physical Science Symposium on Quantum, Crystal, and Graphene Science*. Boston, Massachusetts, USA (Sept. 22, 2015).

“Quantum Computers: Fundamentals, Applications and Implementation.” *Big Techday, hosted by TNG Technology Consulting*. Munich, Germany (June 14, 2013).

“Unconventional Sequence of Fractional Quantum Hall States in Graphene.” *March Meeting 2013*. Baltimore, Maryland, USA (Mar. 20, 2013).

“Unconventional Sequence of Fractional Quantum Hall States in Graphene.” *International CECAM Workshop; Graphene: From Band Structure to Many-Body Physics*. Bremen, Germany (Sept. 5, 2012).

“Unconventional Sequence of Fractional Quantum Hall States in Suspended Graphene.” *26th International Winterschool on Electronic Properties of Novel Materials*. Kirchberg, Austria (Mar. 7, 2012).

“Electronic Transport and Compressibility Measurements of Correlated States in Suspended Bilayer Graphene.” *19th International Conference on the Application of High Magnetic Fields in Semiconductor Physics and Nanotechnology*. Fukuoka, Japan (Aug. 6, 2010).

Seminars and Colloquia:

“Correlated Hofstadter spectrum and flavor phase diagram in magic angle graphene” *Hong Kong University of Science and Technology Condensed Matter Seminar*. Virtual (July 7, 2021).

“Mapping flavor polarization and competing Chern insulators in twisted bilayer graphene” *George Mason University Physics Colloquium*. Virtual (April 9, 2021).

“Imaging and spectroscopy of nematic quantum Hall phases and their boundary modes.” *Oklahoma State University Physics Colloquium*. Stillwater, OK (Nov. 14, 2019).

“Imaging and spectroscopy of nematic quantum Hall phases and their boundary modes.” *National High Magnetic Field Laboratory Condensed Matter Seminar*. Tallahassee, FL (Sept. 9, 2019).

“Visualizing broken-symmetry quantum Hall phases and their boundary modes.” *University of California, Santa Cruz Condensed Matter Physics Seminar*. Santa Cruz, CA (Feb. 8, 2019).

“Spectroscopy and imaging of quantum Hall wavefunctions.” *University of California, Berkeley, ALS Users Meeting*. Berkeley, CA (Oct 4, 2018).

“Imaging the wave functions of broken symmetry quantum Hall phases.” *University of California, Santa Barbara abc...z (CMP) Seminar*. Santa Barbara, CA (May 10, 2018).

“Imaging the wave functions of broken symmetry quantum Hall phases.” *University of California, Davis Condensed Matter Seminar*. Davis, CA (Apr. 5, 2018).

“Imaging Electronic Liquid Crystal Wave Functions in Real Space.” *American University Physics Colloquium*. Washington, DC (Mar. 10, 2017).

“Real-Space Imaging of a Nematic Quantum Liquid.” *Boston College Physics Colloquium*. Chestnut Hill, MA (Feb. 27, 2017).

“Imaging a Nematic Quantum Liquid in Real Space.” *Virginia Tech Physics Colloquium*. Blacksburg, VA (Feb. 10, 2017).

“Real-Space Imaging of a Nematic Quantum Liquid.” *Boston University Condensed Matter Physics Seminar*. Boston, MA (Feb. 6, 2017).

“Real-Space Imaging of a Nematic Quantum Liquid.” *University of Minnesota Condensed Matter Physics Seminar*. Minneapolis, MN (Feb. 1, 2017).

“Imaging a Nematic Quantum Liquid in Real Space.” *Stanford University Condensed Matter Physics Seminar*. Stanford, CA (Jan. 26, 2017).

“Imaging Electronic Liquid Crystal Wave Functions in Real Space.” *Harvey Mudd College Physics Colloquium*. Claremont, CA (Jan. 24, 2017).

“Imaging Electronic Liquid Crystal Wave Functions in Real Space.” *Middlebury College Physics Colloquium*. Middlebury, VT (Jan. 16, 2017).

“Real-Space Imaging of a Nematic Quantum Liquid.” *University of Pennsylvania Condensed Matter Physics Seminar*. Philadelphia, PA (Jan. 13, 2017).

“Influence of Symmetry on Quantum Hall States in Monolayer and Bilayer Graphene.” *Caltech Condensed Matter Physics Seminar*, Pasadena, CA (Apr. 21, 2014).

“Spin and Valley Influence on the Fractional Quantum Hall Effect in Suspended Graphene.” *Princeton Special Condensed Matter Seminar*. Princeton, NJ (Dec. 21, 2012).

“Electronic Compressibility at a Monolayer-Bilayer Graphene Interface.” Office of Naval Research *MURI-GATE Grant Review*. Washington, DC (Nov. 16, 2012).

“Unconventional Sequence of Fractional Quantum Hall States in Graphene.” *Harvard Condensed Matter Theory Kids’ Seminar*. Boston, MA (Sept. 11, 2012).

“Electronic Compressibility of Fractional Quantum Hall States in Suspended Graphene.” *Boston Area CarbOn Nanoscience (BACON) Meeting*. Boston, MA (Sept. 16, 2011).

“Electronic Transport in Suspended Bilayer Graphene.” *Inaugural Boston Area CarbOn Nanoscience (BACON) Meeting*. Boston, MA (Oct. 17, 2008).

**Teaching,
Mentorship,
and Service:**

EPIQS Postdoctoral Symposium Organizer

2018 – 2021

Chaired the organizing committee for the 2018 and 2019 conferences, organized quantum materials community-building activities for junior researchers in the Bay Area, and facilitated research participation among undergraduate students from underrepresented groups.

Teacher, Stanford University

2018 – present

Courses: Physics 67 (introductory modern laboratory), Physics 170, Physics 171 (junior/senior statistical mechanics), Physics 190 (undergraduate independent research)

Summer undergraduate physics research faculty liaison, Stanford University

2018 – present

Helped develop and coordinate the summer undergraduate physics research program and its activities in spring and summer.

Teaching Fellow, Harvard University

Fall 2011

Guided students in an inquiry-based introductory physics laboratory, led in-class lectures/discussions, helped teach students Matlab, and assisted with grading.

Student mentorship: Harvard, Princeton and Stanford Universities

2008 – present

Provided laboratory guidance and training for multiple summer undergraduate students and several graduate students.

Referee

2013 – present

Reviewed manuscripts for *Science*, *Nature*, *Nature Physics*, *Nature Materials*, *Physical Review Letters*, *Physical Review B*, *Physical Review X*, *Nano Letters*, *Applied Physics Letters*, *Journal of Applied Physics*, and *Proceedings of the Royal Society A*.