Andrew Lucas

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Born: September 7, 1990; Washington D.C.

Citizenship: United States of America

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Education

B.S. Physics Stanford University June 2012
GPA: 4.06 (overall); 4.13 (major); with honors and distinction

Ph.D. Physics Harvard University April 25, 2016
Advisor: Subir Sachdev; Committee: Eugene Demler, Daniel Jafferis
Thesis: "Transport and hydrodynamics in holography, strange metals and graphene"

Work

1.	intern	School of Medicine, University of California, Los Angeles	2006-2009
2.	intern	Center for Advanced Computing Research, California Institute of Technology	2010
3.	grader	Department of Mathematics, Stanford University	2011-2012
4.	intern	Department of Physics, Stanford University	2011
5.	Ph.D. student	Department of Physics, Harvard University	2012-2016
6.	postdoctoral fellow	Department of Physics, Harvard University	2016
7.	postdoctoral fellow	Department of Physics, Stanford University	2016-2019
8.	assistant professor	Department of Physics, University of Colorado, Boulder	2019-

Professional Societies

1.	member	American Physical Society (APS)	2015-

Honors

1.	United States Physics Olympiad Finalist	2007-2008
2.	Rose Hills Undergraduate Researcher	2011
3.	J.E. Sterling Award for Scholastic Achievement (top 25 GPA in Stanford School of Humanities and Sciences)	2012
4.	Smith Family Graduate Science and Engineering Fellowship	2013-2014
5.	Gordon and Betty Moore Postdoctoral Fellowship in Quantum Materials (offered at Stanford and MIT; accepted at Stanford)	2016-2019
6.	Alfred P. Sloan Fellow in Physics	2020
7.	Journal of Mathematical Physics Young Researcher Award (best paper in the journal from an early career scientist in the prior year)	2021

8. George E. Valley, Jr. Prize 2022
(APS annual prize to a promising early career scientist)

9. NSF CAREER Award 2022

Current and Former Group Members

Members with * denote group members whose official advisor was another faculty member.

Postdoctoral Fellows

1. Xiao Chen (University of Colorado, Boulder: 2019; with R. Nandkishore) *
on to: assistant professor, Boston College.

2. Aaron Friedman (University of Colorado, Boulder: 2020-; with R. Nandkishore)

3. Jason Iaconis (University of Colorado, Boulder: 2020-2021; with R. Nandkishore) *
on to: scientist, IonQ.

4. Oliver Hart (University of Colorado, Boulder: 2021-; with R. Nandkishore) *

5. Umang Mehta (University of Colorado, Boulder: 2023-)

Graduate Students

1. Caleb Cook (Stanford University: 2017-2022; with S. Kivelson) *
on to: teacher, Oklahoma School of Science and Mathematics

2. Jack Farrell (University of Colorado, Boulder: 2021-)

3. Koushik Ganesan (University of Colorado, Boulder: 2019-2023)
on to: quantitative finance industry

4. Jinkang Guo (University of Colorado, Boulder: 2020-)

5. Yifan Hong (University of Colorado, Boulder: 2019-)

6. Xiaoyang Huang (University of Colorado, Boulder: 2020-)

7. Andrew Osborne (University of Colorado, Boulder: 2020-)

8. Marvin Qi (University of Colorado, Boulder: 2020-; with M. Hermele) *

9. Chao Yin (University of Colorado, Boulder: 2020-)

10. Isabella Zane (University of Colorado, Boulder: 2022-)

Undergraduate Students

1. Chi-Fang Chen (Stanford University: 2017-2019)
on to: graduate student, California Institute of Technology.

2. Andrew Hicks (University of Colorado, Boulder: 2022-)

3. Elijah Lew-Smith (Brown University: 2023 REU)

4. Henry Waldstreicher (University of Colorado, Boulder: 2021-2023)
on to: applied mathematics industry

Teaching

as Lecturer

1. PHYS 7450 (University of Colorado, Boulder) — Fall 2019
"Solid-State Transport"

2. PHYS 4410 (University of Colorado, Boulder) — Fall 2020, Spring 2023
"Quantum Mechanics 2"

3. PHYS 5040 (University of Colorado, Boulder) — Spring 2021
"Algebra and Topology in Physics"

4. PHYS 2170 (University of Colorado, Boulder) — Fall 2021
"General Physics 3 for Majors"

5. PHYS 5210 (University of Colorado, Boulder) — Fall 2022, Fall 2023
"Graduate Classical Mechanics"

as Teaching Assistant or Grader

1. MATH 106 (Stanford University) — Spring 2011
"Functions of a Complex Variable"

2. MATH 51 (Stanford University) — Fall 2011, Winter 2012
"Linear Algebra"

3. PHYSICS 251A (Harvard University) — Fall 2014
"Graduate Quantum Mechanics 1"

4. PHYSICS 143A (Harvard University) — Spring 2015
"Quantum Mechanics 1"

5. PHYSICS 143B (Harvard University) — Fall 2015
"Quantum Mechanics 2"

6. PHYS 1120 (University of Colorado, Boulder) — Spring 2020
"General Physics 2"

Research Articles

Articles noted with △ were highlighted by the journal.

Published

1. G. Bartzokis, P. H. Lu, S. B. Stewart, B. Oluwadara, A. J. Lucas, J. Pantages, E. Pratt, J. E. Sherin, L. L. Altshuler, J. Mintz, M. J. Gitlin, K. L. Subotnik and K. H. Nuechterlein, "In vivo evidence of differential impact of typical and atypical antipsychotics on intracortical myelin in adults with schizophrenia", *Schizophrenia Research* **113** 322 (2009), PMC:2862048.

2. A. Lucas and C. H. Lee, "Multistable binary decision making on networks", *Physical Review* **E87** 032806 (2013), arXiv:1210.6044.

3. A. Lucas, "Binary decision making with very heterogeneous influence", *Journal of Statistical Mechanics* P09024 (**2013**), arXiv:1306.5511.

4. P. Chesler, A. Lucas and S. Sachdev, "Conformal field theories in a periodic potential: results from holography and field theory", *Physical Review* **D89** 026005 (2014), arXiv:1308.0329.

5. A. Lucas, "Ising formulations of many NP problems", *Frontiers in Physics* **2** 5 (2014), arXiv:1302.5843.

6. A. Lucas, S. Sachdev and K. Schalm, "Scale-invariant hyperscaling-violating holographic theories and the resistivity of strange metals with random-field disorder", *Physical Review* **D89** 066018 (2014), arXiv:1401.7993.

7. A. Lucas, M. Stalzer and J. Feo, "Parallel implementation of fast randomized algorithms for the decomposition of low rank matrices", *Parallel Processing Letters* **24** 1450004 (2014), arXiv:1205.3830.

8. C. H. Lee and A. Lucas, "Simple model for multiple-choice collective decision making", *Physical Review* **E90** 052804 (2014), arXiv:1407.8350. △

9. A. Lucas and P. Surówka, "Sound-induced vortex interactions in a zero-temperature two-dimensional superfluid", *Physical Review* **A90** 053617 (2014), arXiv:1408.5913.

10. A. Lucas and P. Surówka, "Phenomenology of non-relativistic parity-violating hydrodynamics in 2+1 dimensions", *Physical Review* **E90** 063005 (2014), arXiv:1403.5239.

11. A. Lucas and S. Sachdev. "Conductivity of weakly disordered strange metals: from conformal to hyperscaling-violating regimes", *Nuclear Physics* **B892** 239 (2015), arXiv:1411.3331.

12. B. Doyon, A. Lucas, K. Schalm and M. J. Bhaseen, "Non-equilibrium steady states in the Klein-Gordon theory", *Journal of Physics* **A48** 095002 (2015), arXiv:1409.6660. △

13. A. Lucas. "Conductivity of a strange metal: from holography to memory functions", *Journal of High Energy Physics* **03** 071 (**2015**), arXiv:1501.05656.

14. M. J. Bhaseen, B. Doyon, A. Lucas and K. Schalm, "Energy flow in quantum critical systems far from equilibrium", *Nature Physics* **11** 509 (2015), arXiv:1311.3655.

15. A. Lucas and S. Sachdev. "Memory matrix theory of magnetotransport in strange metals", *Physical Review* **B91** 195122 (2015), arXiv:1502.04704.

16. A. Lucas. "Hydrodynamic transport in strongly coupled disordered quantum field theories", *New Journal of Physics* **17** 113007 (2015), arXiv:1506.02662.

17. S. Grozdanov, A. Lucas, S. Sachdev and K. Schalm. "Absence of disorder-driven metal-insulator transitions in simple holographic models", *Physical Review Letters* **115** 221601 (2015), arXiv:1507.00003.

18. J. Crossno, J. K. Shi, K. Wang, X. Liu, A. Harzheim, A. Lucas, S. Sachdev, P. Kim, T. Taniguchi, K. Watanabe, T. A. Ohki and K. C. Fong. "Observation of the Dirac fluid and the breakdown of the Wiedemann-Franz law in graphene", *Science* **351** 1058 (2016), arXiv:1509.04713.

see commentary: *Condensed Matter Journal Club*, *Quanta Magazine*, *Gizmag*, *Science*, *Harvard Press Release*

19. A. Lucas, J. Crossno, K. C. Fong, P. Kim and S. Sachdev. "Transport in inhomogeneous quantum critical fluids and in the Dirac fluid in graphene", *Physical Review* **B93** 075426 (2016), arXiv:1510.01738. △

20. S. Grozdanov, A. Lucas and K. Schalm. "Incoherent thermal transport from dirty black holes", *Physical Review* **D93** 061901 (2016), arXiv:1511.05970.

21. T. N. Ikeda, A. Lucas and Y. Nakai. "Conductivity bounds in probe brane models", *Journal of High Energy Physics* **04** 007 (**2016**), arXiv:1601.07882.

22. A. Lucas. "Sound waves and resonances in electron-hole plasma", *Physical Review* **B93** 245153 (2016), arXiv:1604.03955.

23. A. Lucas, K. Schalm, B. Doyon and M. J. Bhaseen. "Shock waves, rarefaction waves and non-equilibrium steady states at quantum critical points", *Physical Review* **D94** 025004 (2016), arXiv:1512.09037.

24. A. Lucas, R. A. Davison and S. Sachdev. "Hydrodynamic theory of thermoelectric transport and negative magnetoresistance in Weyl semimetals", *Proceedings of the National Academy of Sciences* **113** 9463 (2016), arXiv:1604.08598.

possible experimental confirmation; resulting commentary: *New York Times*, *Gizmodo*, *IEEE Spectrum*, *Nature*, *phys.org*, *IBM Press Release*

25. A. Lucas and J. Steinberg. "Charge diffusion and the butterfly effect in striped holographic matter", *Journal of High Energy Physics* **10** 143 (**2016**), arXiv:1608.03286.

26. A. Lucas, S. Gazit, D. Podolsky and W. Witczak-Krempa. "Dynamical response near quantum critical points", *Physical Review Letters* **118** 056601 (2017), arXiv:1608.02586.

27. A. Lucas. "Stokes paradox in electronic Fermi liquids", *Physical Review* **B95** 115425 (2017), arXiv:1612.00856.

28. Y. Gu, A. Lucas and X-L. Qi. "Energy diffusion and the butterfly effect in inhomogeneous Sachdev-Ye-Kitaev chains", *SciPost Physics* **2** 018 (2017), arXiv:1702.08462.

29. A. Baumgartner, A. Karch and A. Lucas. "Magnetoresistance in relativistic hydrodynamics without anomalies", *Journal of High Energy Physics* **06** 054 (**2017**), arXiv:1704.01592.

30. A. Lucas, T. Sierens and W. Witczak-Krempa. "Quantum critical response: from conformal perturbation theory to holography", *Journal of High Energy Physics* **07** 149 (**2017**), arXiv:1704.05461.

31. V. Scopelliti, K. Schalm and A. Lucas. "Hydrodynamic charge and heat transport on inhomogeneous curved spaces", *Physical Review* **B96** 075150 (2017), arXiv:1705.04325.

32. Y. Gu, A. Lucas and X-L. Qi. "Spread of entanglement in a Sachdev-Ye-Kitaev chain", *Journal of High Energy Physics* **09** 120 (**2017**), arXiv:1708.00871.

33. A. Lucas and S. A. Hartnoll. "Resistivity bound for hydrodynamic bad metals", *Proceedings of the National Academy of Sciences* **114** 11344 (2017), arXiv:1704.07384.

34. C-F. Chen and A. Lucas. "Origin of the Drude peak and of zero sound in probe brane holography", *Physics Letters* **B774** 569 (2017), arXiv:1709.01520.

35. A. Lucas and S. A. Hartnoll. "Kinetic theory of transport for inhomogeneous electron fluids", *Physical Review* **B97** 045105 (2018), arXiv:1706.04621.

36. A. Lucas. "Kinetic theory of electronic transport in random magnetic fields", *Physical Review Letters* **120** 116603 (2018), arXiv:1710.11141.

37. C. B. Mendl and A. Lucas. "Dyakonov-Shur instability across the ballistic-to-hydrodynamic crossover", *Applied Physics Letters* **112** 124101 (2018), arXiv:1801.01501.

38. A. Lucas and S. Das Sarma. "Electronic sound modes and plasmons in hydrodynamic two-dimensional metals", *Physical Review* **B97** 115449 (2018), arXiv:1801.01495.

39. A. Lucas and S. Das Sarma. "Electronic hydrodynamics and the breakdown of the Wiedemann-Franz and Mott laws in interacting metals", *Physical Review* **B97** 245128 (2018), arXiv:1804.00665.

40. T. Banks and A. Lucas. "Emergent entropy production and hydrodynamics in quantum many-body systems", *Physical Review* **E99** 022105 (2019), arXiv:1810.11024.

41. G. Bentsen, Y. Gu and A. Lucas. "Fast scrambling on sparse graphs", *Proceedings of the National Academy of Sciences* **116** 6689 (2019), arXiv:1805.08215.

42. S. Grozdanov, A. Lucas and N. Poovuttikul. "Holography and hydrodynamics with weakly broken symmetries", *Physical Review* **D99** 086012 (2019), arXiv:1810.10016.

43. A. Lucas. "Hard combinatorial problems and minor embeddings on lattice graphs", *Quantum Information Processing* **18** 203 (2019), arXiv:1812.01789.

44. A. Lucas. "Operator size at finite temperature and Planckian bounds on quantum dynamics", *Physical Review Letters* **122** 216601 (2019), arXiv:1809.07769. △

45. C. Q. Cook and A. Lucas. "Electron hydrodynamics with a polygonal Fermi surface", *Physical Review* **B99** 235148 (2019), arXiv:1903.05652. △

46. C-F. Chen and A. Lucas. "Finite speed of quantum scrambling with long range interactions", *Physical Review Letters* **123** 250605 (2019), arXiv:1907.07637.

47. I. Mandal and A. Lucas. "Sign of viscous magnetoresistance in electron fluids", *Physical Review* **B101** 045122 (2020), arXiv:1908.04886.

48. X. Chen, R. M. Nandkishore and A. Lucas. "Quantum butterfly effect in polarized Floquet systems", *Physical Review* **B101** 064307 (2020), arXiv:1912.02190.

49. K. Ganesan and A. Lucas. "Breakdown of emergent Lifshitz symmetry in holographic matter with Harris-marginal disorder", *Journal of High Energy Physics* **06** 023 (**2020**), arXiv:2004.06543.

50. X. Chen, Y. Li, M. P. A. Fisher and A. Lucas. "Emergent conformal symmetry in non-unitary ranwdom dynamics of free fermions", *Physical Review Research* **2** 033017 (2020), arXiv:2004.09577. △

51. M. C. Tran, C-F. Chen, A. Ehrenberg, A. Y. Guo, A. Deshpande, Y. Hong, Z-X. Gong, A. V. Gorshkov and A. Lucas. "Hierarchy of linear light cones with long-range interactions", *Physical Review* **X10** 031009 (2020), arXiv:2001.11509.

see commentary: *Physics*, *Joint Quantum Institute Press Release*

52. A. Gromov, A. Lucas and R. M. Nandkishore. "Fracton hydrodynamics", *Physical Review Research* **2** 033124 (2020), arXiv:2003.09429.

53. C. Yin and A. Lucas. "Bound on quantum scrambling with all-to-all interactions", *Physical Review* **A102** 022402 (2020), arXiv:2005.07558.

54. A. Lucas. "Non-perturbative dynamics of the operator size distribution in the Sachdev-Ye-Kitaev model", *Journal of Mathematical Physics* **61** 081901 (2020), arXiv:1910.09539. △

55. X. Chen, Y. Gu and A. Lucas. "Many-body quantum dynamics slows down at low density", *SciPost Physics* **9** 071 (2020), arXiv:2007.10352.

56. A. Lucas and A. Osborne. "Operator growth bounds in a cartoon matrix model", *Journal of Mathematical Physics* **61** 122301 (2020), arXiv:2007.07165.

57. K. Ganesan and A. Lucas. "Holographic subdiffusion", *Journal of High Energy Physics* **12** 149 (**2020**), arXiv:2008.09638.

58. J. Iaconis, A. Lucas and X. Chen. "Measurement-induced phase transitions in quantum automaton circuits", *Physical Review* **B102** 224311 (2020), arXiv:2010.02196.

59. G. Bal, A. Lucas and M. Luskin. "Homogenization of hydrodynamic transport in Dirac fluids", *Journal of Mathematical Physics* **62** 011503 (2021), arXiv:2004.10790.

60. C. B. Mendl, M. Polini and A. Lucas. "Coherent terahertz radiation from a nonlinear oscillator of viscous electrons", *Applied Physics Letters* **118** 013105 (2021), arXiv:1909.11093.

61. P. Glorioso, L. V. Delacrétaz, X. Chen, R. M. Nandkishore and A. Lucas. "Hydrodynamics of lattice models with continuous non-Abelian symmetry", *SciPost Physics* **10** 015 (2021), arXiv:2007.13753.

62. J. Iaconis, A. Lucas and R. M. Nandkishore. "Multipole conservation laws and subdiffusion in any dimensions", *Physical Review* **E103** 022142 (2021), arXiv:2009.06507.

63. C. Yin and A. Lucas. "Quantum operator growth bounds for kicked tops and semiclassical spin chains", *Physical Review* **A103** 042414 (2021), arXiv:2010.06592.

64. X. Huang and A. Lucas. "Electron-phonon hydrodynamics", *Physical Review* **B103** 155128 (2021), arXiv:2009.10084.

65. Y. Hong and A. Lucas. "Fast high-fidelity multi-qubit state transfer with long-range interactions", *Physical Review* **A103** 042425 (2021), arXiv:2009.06587.

66. C-F. Chen and A. Lucas. "Operator growth bounds from graph theory", *Communications in Mathematical Physics* **385** 1273 (2021), arXiv:1905.03682.

67. M. C. Tran, A. Deshpande, A. Y. Guo, A. Lucas and A. V. Gorshkov. "Optimal state transfer and entanglement generation in power-law interacting systems", *Physical Review* **X11** 031016 (2021), arXiv:2010.02930.

68. M. C. Tran, A. Y. Guo, C. L. Baldwin, A. Ehrenberg, A. V. Gorshkov, and A. Lucas. "Lieb-Robinson light cone for power-law interactions", *Physical Review Letters* **127** 160401 (2021), arXiv:2103.15828.

69. C. Q. Cook and A. Lucas. "Viscometry of electron fluids from symmetry", *Physical Review Letters* **127** 176603 (2021), arXiv:2101.08230.

70. M. Qi and A. Lucas. "Distinguishing viscous, ballistic, and diffusive current flows in anisotropic metals", *Physical Review* **B104** 195106 (2021), arXiv:2107.01216. △

71. C-F. Chen and A. Lucas. "Optimal Frobenius light cone in spin chains with power-law interactions", *Physical Review* **A104** 062420 (2021), arXiv:2105.09960.

72. A. Osborne and A. Lucas. "Infinite families of fracton fluids with momentum conservation", *Physical Review* **B105** 024311 (2022), arXiv:2111.09323.

73. X. Huang and A. Lucas. "Hydrodynamic effective field theories with discrete rotational symmetry", *Journal of High Energy Physics* **03** 082 (**2022**), arXiv:2201.03565.

74. K. Ganesan, A. Lucas and L. Radzihovsky. "Renormalization group in quantum critical theories with Harris-marginal disorder", *Physical Review* **D105** 066016 (2022), arXiv:2110.11978.

75. O. Hart, A. Lucas and R. Nandkishore. "Hidden quasi-conservation laws in fracton hydrodynamics", *Physical Review* **E105** 044103 (2022), arXiv:2110.08292.

76. C. Yin and A. Lucas. "Finite speed of quantum information in models of interacting bosons at finite density", *Physical Review* **X12** 021039 (2022), arXiv:2106.09726.

77. P. Glorioso, J. Guo, J. F. Rodriguez-Nieva and A. Lucas. "Breakdown of hydrodynamics below four dimensions in a fracton fluid", *Nature Physics* **18** 912 (2022), arXiv:2105.13365.

see commentary: *Nature Physics*

78. X. Huang and A. Lucas. "Fingerprints of quantum criticality in locally resolved transport", *SciPost Physics* **13** 004 (2022), arXiv:2105.01075.

79. A. Jenkins, S. Baumann, H. Zou, S. A. Meynell, D. Yang, K. Watanabe, T. Taniguchi, A. Lucas, A. F. Young and A. C. Bleszynski Jayich. "Imaging the breakdown of ohmic transport in graphene", *Physical Review Letters* **129** 087701 (2022), arXiv:2002.05065. △

see commentary: *Physics*

80. Y. Hong, J. T. Young, A. M. Kaufman and A. Lucas. "Quantum error correction in a time-dependent transverse field Ising model", *Physical Review* **A106** 022432 (2022), arXiv:2205.12998.

81. A. Lucas. "Non-equilibrium phase transitions in competitive markets with network effects", *Proceedings of the National Academy of Sciences* **119** e2206702119 (2022), arXiv:2204.05314.

82. J. Guo, P. Glorioso, and A. Lucas. "Fracton hydrodynamics without time-reversal symmetry", *Physical Review Letters* **129** 150603 (2022), arXiv:2204.06006.

83. M. Qi, O. Hart, A. J. Friedman, R. Nandkishore and A. Lucas. "Hydrodynamics of higher-rank gauge theories", *SciPost Physics* **14** 029 (2023), arXiv:2205.05695.

84. M. Qi, J. Guo, and A. Lucas. "Anomalous hydrodynamics with triangular point group in 2+1 dimensions", *Physical Review* **B107** 144305 (2023), arXiv:2209.08108.

85. P. Glorioso, X. Huang, J. Guo, J. F. Rodriguez-Nieva and A. Lucas. "Goldstone bosons and fluctuating hydrodynamics with dipole and momentum conservation", *Journal of High Energy Physics* **05** 022 (**2023**), arXiv:2301.02680.

86. A. J. Friedman, C. Q. Cook and A. Lucas. "Hydrodynamics with triangular point group", *SciPost Physics* **14** 137 (2023), arXiv:2202.08269.

87. C. Yin and A. Lucas. "Prethermalization and the local robustness of gapped systems", *Physical Review Letters* **131** 050402 (2023), arXiv:2209.11242.

88. X. Huang, S. Sachdev and A. Lucas. "Quantum critical fixed points in disordered holographic metals", *Physical Review Letters* (accepted), arXiv:2306.03130.

Unpublished

1. A. Lucas, "Exact mean field dynamics for epidemic-like processes on heterogeneous networks", arXiv:1206.6294.

2. P. M. Chesler and A. Lucas. "Vortex annihilation and inverse cascades in two dimensional superfluid turbulence", arXiv:1411.2610.

3. A. Lucas. "Constraints on hydrodynamics from many-body quantum chaos", arXiv:1710.01005.

4. A. Lucas. "Quantum many-body dynamics on the star graph", arXiv:1903.01468.

5. K. Ganesan and A. Lucas. "Analogue viscous current flow near the onset of superconductivity", arXiv:2204.06567.

6. A. J. Friedman, C. Yin, Y. Hong, and A. Lucas. "Locality and error correction in quantum dynamics with measurement", arXiv:2206.09929.

7. J. H. Farrell, X. Huang, and A. Lucas. "Hydrodynamics with helical symmetry", arXiv:2208.12269.

8. C. Stahl, M. Qi, P. Glorioso, A. Lucas and R. Nandkishore. "Fracton superfluid hydrodynamics", arXiv:2303.09573.

9. A. Osborne, T. Larson, S. G. Jones, R. W. Simmonds, A. Gyenis and A. Lucas. "Symplectic geometry and circuit quantization", arXiv:2304.08531.

10. C. Yin and A. Lucas. "Polynomial-time classical sampling of high-temperature quantum Gibbs states", arXiv:2305.18514.

11. C. Yin and A. Lucas. "Heisenberg-limited metrology with perturbing interactions", arXiv:2308.10929.

12. Y. Hong, M. Marinelli, A. M. Kaufman and A. Lucas. "Long-range-enhanced surface codes", arXiv:2309.11719.

Review Articles and Monographs

Articles noted with ♢ are invited contributions.

Published

1. A. Lucas and K. C. Fong. "Hydrodynamics of electrons in graphene", *Journal of Physics: Condensed Matter* **30** 053001 (2018), arXiv:1710.08425. ♢

2. S. A. Hartnoll, A. Lucas and S. Sachdev. *Holographic Quantum Matter*, (MIT Press, 2018), arXiv:1612.07324.

   book review: *Physics Today*

3. C-F. Chen, A. Lucas and C. Yin. "Speed limits and locality in many-body quantum dynamics", *Reports on Progress in Physics* (accepted), arXiv:2303.07386. ♢

Unpublished

1. M. Blake, Y. Gu, S. A. Hartnoll, H. Liu, A. Lucas, K. Rajagopal, B. Swingle and B. Yoshida. "Snowmass White Paper: New ideas for many-body quantum systems from string theory and black holes", arXiv:2203.04718.

Teaching and Pedagogical Articles

Articles noted with △ were highlighted by the journal.

Published

1. L. Janson, M. Klein, H. Lewis, A. Lucas, A. Marantan and K. Luna, "Undergraduate experiment in point-contact spectroscopy with a Nb/Au junction", *American Journal of Physics* **80** 133 (2012), arXiv:1110.6254. △

Unpublished

1. A. Lucas, "Lagrangian mechanics on Lie groups: a pedagogical approach", arXiv:1111.1275.

2. A. Lucas, "Connecting microscopic physics with the macroscopic properties of materials in introductory physics courses", arXiv:1402.2593.

Popular Articles

Published

1. A. Lucas, "An exotic quantum fluid in graphene", *Science* **364** 125 (2019).

Presentations and Talks

Posters marked with □. Talks marked with ♢ are invited; with ♡ are review talks; ✆ denotes remote seminars; ✗ denotes talks which were cancelled due to external circumstances. I have not listed talks where I am not the presenter.

During their time in my group, my group members have given 6 invited talks.

1. "A parallel implementation of a fast randomized algorithm for the decomposition of low rank matrices"
Departments of Electrical Engineering and Computer Science Summer Research Presentations, California Institute of Technology — August 26, 2010

2. "The O(n) model in the large n limit" ♡
Condensed Matter Theory Informal Seminar, Stanford University — July 15, 2011

3. "A functional approach to holographic duality" □
Department of Physics Summer Research Presentations, Stanford University — August 26, 2011

4. "Linear, nonlinear and influential voting: an introduction" ♡
Condensed Matter Theory Journal Club, Stanford University — February 10, 2012

5. "Functional methods for holographic duality"
Department of Physics Honors Thesis Presentations, Stanford University — May 22, 2012

6. "A simple introduction to AdS/CFT" ♡
Graduate String Theory Seminar, Harvard University — February 4, 2013

7. "Holographic RG" ♡
Graduate String Theory Seminar, Harvard University — February 11, 2013

8. "Graphene vs. AdS-Einstein-Maxwell theory"
Quantum Matter Seminar, Harvard University — September 20, 2013

9. "An introduction to CFT hydrodynamics" ♡
Graduate String Theory Seminar, Harvard University — September 23, 2013

10. "Charged black holes and condensed matter physics" ♡
Graduate String Theory Seminar, Harvard University — March 3, 2014

11. "Universal energy transport in quantum critical systems in any dimension" □
Department of Physics Prospective Students Poster Session, Harvard University — March 27, 2014
Department of Physics Alumni Reunion Poster Session, Harvard University — April 4, 2014
Field Theoretic Computer Simulations for Particle Physics and Condensed Matter; Boston University — May 8, 2014

12. "A mechanism for vortex annihilation in two dimensional superfluid turbulence"
Strong Gravity Seminar, Perimeter Institute for Theoretical Physics — May 22, 2014

13. "Vortex dynamics in finite temperature two-dimensional superfluid turbulence"
Condensed Matter Theory Seminar, Unversity of Cologne ♢ — August 11, 2014
Physics Informal Seminar, King's College London ♢ — August 15, 2014

14. "Interacting quantum critical heat baths",
Condensed Matter Theory Informal Seminar , Unversity of Cologne — August 12, 2014

15. "NP-hard combinatorial problems as Ising spin glasses"
Workshop on Classical and Quantum Optimization; ETH Zürich ♢ — August 20, 2014

16. "Holographic transport with random-field disorder"
Quantum Field Theory, String Theory and Condensed Matter Physics; Orthodox Academy of Crete, Kolymbari, Greece ♢ — September 1, 2014

17. "Vortex dynamics in low temperature two dimensional superfluids"
Lorentz Seminar, Leiden University ♢ — September 8, 2014

18. "Vortex annihilation and inverse cascades in two dimensional superfluid turbulence"
Condensed Matter Theory Kids Seminar, Harvard University — November 18, 2014
APS March Meeting 2015; San Antonio Convention Center — March 6, 2015

19. "Transport in weakly disordered strange metals via holography"
String Family Lunch Seminar, Harvard University — December 5, 2014

20. "Memory matrix theory of magnetotransport in strange metals"
Quantum Matter Seminar, Harvard University — February 27, 2015

21. "Hydrodynamic transport in holography and in clean graphene"
SITP Colloquium, Stanford University ♢ — October 26, 2015
String Theory Seminar, University of British Columbia ♢ — November 9, 2015
Informal Seminar, King's College London — March 8, 2016

22. "Hydrodynamic transport in the Dirac fluid in graphene"
Special Condensed Matter Seminar, Massachusetts Institute of Technology ♢ — November 4, 2015

23. "When do the electrons in a metal behave hydrodynamically?"
Q Seminar, Raytheon BBN ♢ — January 14, 2016

24. "Holographic conductivity bounds for disordered metals"
Gauge/Gravity Duality and Condensed Matter Physics; Banff International Research Station ♢ — March 1, 2016

25. "Dirty black holes and transport in strange metals"
String Theory Seminar, Imperial College London ♢ — March 9, 2016
DAMTP Friday GR Seminar, Cambridge University ♢ — March 11, 2016
Delta-ITP Holography Meeting, Utrecht University ♢ — April 29, 2016

26. "Transport in inhomogeneous quantum critical fluids and in the Dirac fluid in graphene"
APS March Meeting 2016; Baltimore Convention Center — March 17, 2016

27. "Revealing the Dirac fluid in graphene"
IQIM Seminar, California Institute of Technology ♢ — April 1, 2016

28. "From black holes to graphene"
Physics Colloquium, University of Southern California ♢ — April 4, 2016

29. "Hydrodynamic theory of transport for Dirac and Weyl semimetals"
Low-Energy Challenges for High-Energy Physicists II; Perimeter Institute for Theoretical Physics ♢ — August 24, 2016

30. "Fluid dynamics of electrons in graphene"
Condensed Matter Seminar, Princeton University ✆ — October 17, 2016

31. "Disordered spacetimes in AdS/CMT" ♡
Disorder in Condensed Matter and Black Holes; Lorentz Center, Leiden University ♢ — January 9, 2017

32. "Building a theory of transport for strange metals"
290K Seminar, University of California, Berkeley ♢ — February 13, 2017

33. "Hydrodynamics in the Dirac fluid in graphene"
APS March Meeting 2017; New Orleans Conference Center ♢ — March 16, 2017
Fluid Flows from Graphene to Planet Atmospheres; Simons Center for Geometry and Physics, Stony Brook University ♢ — March 20, 2017

34. "Boltzmann transport revisited"
Special Theoretical Physics Seminar, University of California, Berkeley ♢ — April 20, 2017
Condensed Matter Seminar, University of California, Irvine ♢ — June 7, 2017

35. "Transport bounds for condensed matter physics"
High Energy Theory Seminar, University of Washington ♢ — May 2, 2017

36. "Session on transport and chaos: introduction to transport" ♡
Information in Quantum Field Theory; Aspen Center for Physics ♢ — June 19, 2017

37. "Hydrodynamic theory of transport in condensed matter physics"
Basic Research Forum, Department of Defense ♢ — July 27, 2017

38. "Theory of metallic transport in strongly coupled matter" ♡
– 1. Introduction.
– 2. Memory matrix formalism.
– 3. Hydrodynamics and conductivity bounds.
– 4. Magnetotransport.
Geometry and Holography for Quantum Criticality; Asia-Pacific Center for Theoretical Physics ♢ — August 18-19, 2017

39. "Kinetic theory of transport for inhomogeneous electron fluids"
Physics Next: from Quantum Fields to Condensed Matter; Hyatt Place Long Island ♢ — August 25, 2017

40. "Transport bounds: from resistor networks to quantum chaos"
Condensed Matter Seminar; Perimeter Institute for Theoretical Physics ♢ — September 26, 2017

41. "Constraints on hydrodynamics from many-body quantum chaos"
Many-Body Quantum Chaos, Bad Metals and Holography; NORDITA ♢ — October 6, 2017
Condensed Matter Seminar, Oxford University ♢ — October 11, 2017
High Energy Theory Seminar, McGill University ♢ — December 13, 2017
Black Holes, Quantum Chaos and SYK Models; Tsinghua Sanya International Mathematics Forum ♢ — January 26, 2018

42. "Signatures of electronic hydrodynamics in electrical and thermal transport"
Condensed Matter Seminar, University of Maryland ♢ — November 28, 2017
Condensed Matter Seminar, Université de Montréal ♢ — December 11, 2017
Condensed Matter Seminar, Hong Kong University of Science and Technology ♢ — February 1, 2018

43. "Discussion on the Schwarzian action"
Black Holes, Quantum Chaos and SYK Models; Tsinghua Sanya International Mathematics Forum ♢ — January 29, 2018

44. "Exploring the hydrodynamic limit of many-body quantum systems"
Special Physics Colloquium, University of Colorado, Boulder ♢ — February 8, 2018
Physics Colloquium, Rutgers University ♢ — April 4, 2018

45. "Bounds on hydrodynamic data from many-body quantum chaos"
APS March Meeting 2018; Los Angeles Convention Center — March 5, 2018

46. "Solid-state physics at the ballistic-to-hydrodynamic crossover"
– 1. Introduction.
– 2. Open problems.
Theory and Computation for Transport Properties in 2D Materials; Institute for Mathematics and its Applications, University of Minnesota ♢ — March 26-27, 2018

47. "Fast scrambling on sparse graphs"
High Energy Theory Seminar, Rutgers University ♢ — April 3, 2018
Joint Theory Colloquium, University of Maryland ♢ — April 19, 2018
It From Qubit Seminar, Stanford University — May 4, 2018

48. "Thermoelectric transport across the ballistic-to-hydrodynamic crossover"
Condensed Matter Seminar, Rutgers University ♢ — April 5, 2018
Condensed Matter Seminar, University of California, Santa Barbara ♢ — April 26, 2018
LASSP Seminar, Cornell University ♢ — May 1, 2018
Transport in Strongly Correlated Quantum Systems; International Institute of Physics, Federal University of Rio Norte do Grande ♢ — July 19, 2018

49. "Transport, localization, and Planckian time scales"
Workshop on Advances in Non-Fermi Liquids; Lawrence Berkeley National Laboratory ♢ — August 16, 2018

50. "Planckian bound on the decay of simple operators"
Bounding Transport and Chaos in Condensed Matter and Holography; NORDITA ♢ — August 20, 2018

51. "Emergent entropy production and hydrodynamics in quantum many-body systems"
Condensed Matter Seminar; Stanford University ♢ — November 15, 2018
Hydrodynamics in Low Dimensional Quantum Systems; International Institute of Physics, Federal University of Rio Norte do Grande ♢ — May 17, 2019

52. "Theory of hydrodynamic electron fluids" ♡
Fluid Flows, from Graphene to Planet Atmospheres; Weizmann Institute of Science ♢ — December 30, 2018

53. "Memory matrix methods and hydrodynamics" ♡
School on Electronic Hydrodynamics; Weizmann Institute of Science ♢ — January 6-8, 2019

54. "Operator growth bounds, graph theory, and the SYK model"
It from Qubit Seminar; Stanford University — January 18, 2019

55. "Electron hydrodynamics with a polygon Fermi surface"

Condensed Matter Seminar, Scuola Normale Superiore ♢	January 29, 2019
Condensed Matter Seminar, Max Planck Institute for Chemical Physics of Solids ♢	January 31, 2019
Special Seminar, Leiden University ♢	February 7, 2019
Hydrodynamic Models for Transport in 2D Materials; Institute for Mathematics and its Applications, University of Minnesota ♢	June 3, 2019
Spintronics Meets Topology in Quantum Materials; Kavli Institute for Theoretical Physics ♢	November 14, 2019
Fluid Phases of Matter; City University of New York ♢	December 12, 2019
Theory and Computation for 2D Models; Institute for Pure and Applied Mathematics, University of California, Los Angeles ♢	January 13, 2020

56. "Exotic hydrodynamics in electron fluids"

Special Seminar, University of Würzburg ♢	February 5, 2019

57. "Graph theory and bounds on operator growth"

APS March Meeting 2019; Boston Convention Center	March 4, 2019

58. "Operator growth bounds from graph theory"

Geoflow Group Meeting; Stanford University	May 28, 2019

59. "Recent developments on quantum chaos/OTOCs"

Amsterdam String Workshop 2019; University of Amsterdam ♢	July 22, 2019

60. "Mathematics of operator growth in quantum many-body systems"

Quantum Matter Seminar, University of Colorado, Boulder	December 6, 2019
Quantum Matter Seminar, The Ohio State University ♢	February 3, 2020
Kadanoff Center Seminar, University of Chicago ♢	February 24, 2020

61. "Friendly introduction to AdS/CMT" ♡

Theory Winter School 2020; Maglab, Florida State University ♢	January 7, 2020

62. "Viscous fluid of electrons in graphene"

Physics Colloquium; The Ohio State University ♢	February 4, 2020

63. "Finite speed of quantum scrambling with long range interactions"

APS March Meeting 2020; Colorado Convention Center ♢✗	March 6, 2020

64. "Viscous fluids of electrons"

HoloMatter2020; Autonomous University of Madrid ♢✆	March 9, 2020
Quantum Fluids Seminar, Boston College ✆	April 16, 2020
Condensed Matter Seminar, Case Western Reserve University ✆	March 8, 2021
CIFAR Quantum Materials Summer School 2021 ✆	May 7, 2021

65. "Fracton hydrodynamics"

Quantum Dynamics E-Seminar; Oxford University ✆	May 29, 2020
Condensed Matter Seminar; University of Colorado, Boulder ✆	September 3, 2020

66. "Holography-inspired advances in mathematical quantum dynamics"

Holography: from High-Energy Physics to Quantum Information; Steklov Mathematical Institute ♢✆	October 14, 2020

67. "Electron hydrodynamics with phonon scattering and anisotropic Fermi surfaces"
Condensed Matter Seminar; Technical University of Munich ♢✆ — October 28, 2020

68. "How locality bounds quantum information dynamics"
Condensed Matter Seminar; California Institute of Technology ♢✆ — November 12, 2020

69. "Speed limits on quantum dynamics with long-range interactions"
APS DAMOP Meeting 2021 ♢✆ — June 4, 2021

70. "Fingerprints of quantum criticality in locally resolved transport"
HoloTube Seminar ♢✆ — June 8, 2021
Condensed Matter Seminar; University of California, San Diego ♢✆ — October 27, 2021
Condensed Matter Seminar; University of Maryland ♢ — December 17, 2021

71. "Frobenius bounds on quantum information spreading"
JMP Young Researcher Award Talk, International Congress of Mathematical Physics 2021; Geneva Conference Center ♢✆ — August 4, 2021

72. "Breakdown of hydrodynamics below four dimensions in a fracton fluid"
Hydrodynamics and Fluctuations – Microscopic Approaches in Condensed Matter Systems; International Centre for Theoretical Sciences ♢✆ — September 7, 2021
Non-Equilibrium Universality in Many-Body Physics; Kavli Institute for Theoretical Physics ♢ — September 29, 2021

73. "Bounding quantum dynamics using many-body quantum walks"
Probing Complex Quantum Dynamics through Out-of-time-ordered Correlators; Max Planck Institute for the Physics of Complex Systems ♢✆ — October 12, 2021

74. "Viscous hydrodynamics of electrons"
Physics Colloquium, Colorado State University ♢ — March 7, 2022

75. "New universality classes of hydrodynamics in constrained systems"
APS March Meeting 2022; McCormick Place Convention Center ♢ — March 16, 2022

76. "Fracton hydrodynamics without time-reversal symmetry"
Emergent Hydrodynamics in Condensed Matter and High-Energy Physics; Max Planck Institute for the Physics of Complex Systems ♢✆ — May 3, 2022

77. "Fracton hydrodynamics with and without time-reversal"
Geometrical Aspects of Topological Phases of Matter: Spatial Symmetries, Fractons and Beyond; Simons Center for Geometry and Physics ♢ — May 23, 2022

78. "Spatially resolved electrical transport in correlated quantum materials"
Special Seminar, Stanford University — June 7, 2022
Recent Developments in Strongly-Correlated Quantum Matter; NORDITA ♢ — June 22, 2022
Condensed Matter Seminar, University of Manchester ♢✆ — July 13, 2022

79. "Analogue viscous current flow near the onset of superconductivity"
Topology and Correlations: Long-Range Entanglement in Many-Body Systems: Gordon Research Conference, Mount Holyoke College ♢ — June 29, 2022
Gordon and Betty Moore Foundation EPiQS Symposium 2022; Seascape Hotel ♢ — August 8, 2022

80. "Panel on future directions for holography and many-body physics" ♡
HoloTube Discussion Panel ♢✆ July 5, 2022

81. "Viscous electrons" ♡
Hydrodynamics Across Scales: Boulder Summer School 2022, University of Colorado Boulder ♢ July 19, 2022

82. "Locality and error correction in quantum dynamics with measurement"
AFOSR QI/AMO Program Review 2022; Arlington, VA ♢ August 3, 2022
APS March Meeting 2023; Caesar's Forum March 6, 2023

83. "Hydrodynamics with kinetic constraints"
Simons UQM Mini-Meeting; University of Texas, Austin ♢ August 12, 2022

84. "Hydrodynamics of kinematically constrained fluids"
Physics Colloquium; IIT Roorkee ♢✆ September 12, 2022
Kadanoff Seminar; University of Chicago ♢ October 24, 2022
Particle Theory Seminar; University of Washington ♢ January 10, 2023
Low-Dimensional Quantum Systems; University of Chile ♢ March 16, 2023

85. "Locality bounds for quantum dynamics with measurement"
Quantum Matter Seminar; Perimeter Institute ♢✆ November 8, 2022

86. "Hydrodynamics with dipole and momentum conservation"
Frontiers of Quantum Condensed Matter Physics 2022; Graduate Center, City University of New York ♢ November 14, 2022

87. "Lieb-Robinson bounds for power-law interactions, bosons, and dynamics with measurement"
Mathematical Challenges in Quantum Physics; Princeton Center for Theoretical Science ♢ March 22, 2023

88. "Prethermalization and the local robustness of gapped systems"
Simons UQM Meeting, University of Colorado Boulder ♢ May 4, 2023

89. "Wilsonian perspective on thermal and active fluids: generalized KMS and beyond"
The Many Faces of Relativistic Fluid Dynamics; Kavli Institute for Theoretical Physics ♢ June 20, 2023

90. "Disordered quantum critical fixed points from holography"
SYK Models: From Strongly Correlated Systems to Quantum Gravity; Solvay Institute ♢ June 27, 2023

91. "Lieb-Robinson bounds" ♡
Non-equilibrium Quantum Dynamics: Boulder Summer School 2023; University of Colorado, Boulder ♢ July 7, 2023

92. "Fundamental speed limits on quantum information dynamics"
AFOSR QI/AMO Program Review 2023; Arlington, VA ♢ August 2, 2023

93. "Speed limits and locality in many-body quantum dynamics"
Physics Colloquium; University of Colorado, Boulder ♢ August 30, 2023
Quantum Colloquium; Princeton University ♢ November 20, 2023

94. "Spatially resolved transport of interacting electrons"
Electron Correlations Beyond the Quasiparticle Paradigm: Theory and Experiment; Kavli Institute for Theoretical Physics ♢ — September 21, 2023

95. "Constraints from stationarity on effective theories for stochastic dynamics"
Hydrodynamics at All Scales; NORDITA ♢ — September 25, 2023

Additional Event Attendance

Events marked with ♡ were winter/summer schools or lecture series; events marked with ♢ were invitation only.

1. Summer School on Gauge-Gravity Duality and Condensed Matter Physics; Ludwig-Maximillians-Universität ♡ — August 5-9, 2013

2. 8^{th} Asian Winter School on Strings, Particles and Cosmology; Blue Lily Hotel, Puri, India ♡♢ — January 9-19, 2014

3. ARO/AFOSR MURI Program Review; University of Chicago — September 26-27, 2016

4. Order from Chaos; Kavli Institute for Theoretical Physics ♢ — December 10-14, 2018

5. Non-equilibrium Quantum Dynamics; Aspen Center for Physics ♢ — August 14-18, 2023

Reviewing

Journals

Been a reviewer for approximately 107 papers and 18 grants. Invited to review for the following journals or (repeat) conference proceedings:

1. *ACM Transactions on Quantum Computing*

2. *Annals of Physics*

3. *Applied Physics Letters*

4. *Canadian Journal of Physics*

5. *Communications in Partial Differential Equations*

6. *Computers and Fluids*

7. *Entropy*

8. *European Physical Journal* **C**

9. *European Physical Journal Plus*

10. *Europhysics Letters*

11. *Frontiers in ICT*

12. *Frontiers in Physics*

13. *International Journal of Modern Physics* **B**

14. *Journal of High Energy Physics*

15. *Journal of Low Temperature Physics*

16. *Journal of Mathematical Physics*

17. *Journal of Parallel and Distributed Computing*

18. *Journal of Physics* **A**

19. *Journal of Statistical Mechanics*

20. *Nano Letters*

21. *Nature*

22. *Nature Communications*

23. *Nature Physics*

24. *npj Quantum Information*

25. *npj Quantum Materials*

26. *Nuclear Physics* **B**

27. *Physical Review* **B**, **D**, **X**

28. *Physical Review Applied*

29. *Physical Review Letters*

30. *Physics Letters* **A**, **B**

31. *Proceedings of IEEE Conference on Decision and Control*

32. *Proceedings of the National Academy of Sciences* (reviewer and guest editor)

33. *PRX Quantum*

34. *Quantum Information Processing*

35. *Quantum Science and Technology*

36. *Reviews of Modern Physics*

37. *Science*

38. *Science Advances*

39. *Science Bulletin*

40. *SciPost Physics*

Grants

1. *Department of Energy*
2. *German Research Foundation (DFG)*
3. *National Science Foundation*
4. *Swiss National Science Foundation*
5. *US-Israel Binational Science Foundation*

Organizing

Conferences and Workshops

1. Hydrodynamic Models for Transport in 2D Materials; Institute for Mathematics and its Applications, University of Minnesota (with M. Luskin, D. Margetis) — June 3-7, 2019

Winter/Summer Schools

1. Dynamics of Strongly Correlated Electrons; 2025 Boulder Summer School in Condensed Matter Physics; University of Colorado, Boulder (with M. Lee, D. Chowdhury, S. Hartnoll) — June 30-July 25, 2025

Seminars

1. Condensed Matter Family Lunch Seminar, Stanford University — 2017-2018
2. CTQM Theory Colloquium, University of Colorado, Boulder — 2021-2023
3. Physics Research Opportunity Seminar, University of Colorado, Boulder — 2021-2022
4. Physics Colloquium, University of Colorado, Boulder — 2023-2024

Grants

1. Alfred P. Sloan Foundation; Grant FG-2020-13795 — 9/2020-9/2024
   "2020 Sloan Research Fellowship in Physics"
   A. Lucas
   Budget: $75,000 direct costs
2. Air Force Office of Scientific Research; Grant FA9550-21-1-0195 — 5/2021-5/2024
   "Fundamental speed limits on quantum information dynamics"
   A. Lucas
   Budget: ∼$311,000 direct costs; $450,000 total.
3. Gordon and Betty Moore Foundation; Grant GBMF10279 — 6/2021-6/2025
   Awarded from 2020 EPiQS Flexible Funding Competition.
   "Investigating spatially resolved electrical transport in strange metals"

A. Bleszynski Jayich, A. Lucas
Budget: ∼$407,000 direct costs to me, ∼$447,000 total costs to me, $1,096,058 total.

4. National Science Foundation; Grant DMR-2145544 2/2022-1/2027
Awarded from 2021 NSF CAREER call for early career scientists.
"CAREER: Infinitely many new universality classes of hydrodynamics"
A. Lucas
Budget: ∼$337,000 direct costs, $500,000 total.

5. Office of Naval Research; Grant N00014-23-1-2533 6/2023-5/2026
"Measurement-accelerated preparation of entangled quantum states"
A. Kaufman, A. Lucas
Budget: ∼$107,000 direct costs to me, $150,000 total to me, $690,000 total.

6. Department of Energy; Grant DE-SC0024324 7/2023-6/2027
Awarded from 2023 DOE ASCR Quantum Pathfinder call.
"What does qubit connectivity tell us about what quantum computers can and cannot do?"
A. Gorshkov, A. Childs, A. Lucas
Budget: ∼$779,000 direct costs to me, $1,200,000 total to me, $2,400,000 total.