Daniel Kabat August 2023

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APPOINTMENTS

2012 – present	Professor Lehman College, Department of Physics and Astronomy – Deputy Executive Officer, CUNY Physics Ph.D. Program, 2020 – present – Director, Center for Theoretical and Computational Sciences, 2014 – 2016 – Chair, Department of Physics and Astronomy, 2012 – 2018
2008 – 2012	Associate Professor Lehman College, Department of Physics and Astronomy
2005 – 2008	Associate Professor Columbia University, Department of Physics
1999 – 2005	Assistant Professor Columbia University, Department of Physics
1997 – 1999	Post-doctoral fellow Institute for Advanced Study
1996 – 1997	Post-doctoral fellow New York University, Department of Physics
1993 – 1996	Post-doctoral fellow Rutgers University, Department of Physics

EDUCATION

Massachusetts Institute of Technology (Ph.D., 1993)
Thesis in physics, advisor: Roman Jackiw

California Polytechnic State University (B.S., 1988)
Degrees in physics and mathematics

Publications

1. "Induced Lorentz violation on a moving braneworld" (with M. Nomura), in preparation.

2. "Multipartite entanglement groups" (with X. Jiang, G. Lifschytz and A. Marthandan), arXiv:2307.06437 [quant-ph].

3. "Back to the future: Causality on a moving braneworld" (with B. Greene, J. Levin and M. Porrati), *Phys. Rev.* D **107** (2023) 025016, arXiv:2208.09014 [gr-qc].

4. "Superluminal propagation on a moving braneworld" (with B. Greene, J. Levin and A. Menon), *Phys. Rev.* D **106** (2022) 085001, arXiv:2206.13590 [hep-th].

5. "Extractable entanglement from a Euclidean hourglass" (with T. Anegawa and N. Iizuka), *Phys. Rev.* D **106** (2022) 085010, arXiv:2205.01137 [hep-th].

6. "Defining entanglement without tensor factoring: a Euclidean hourglass prescription" (with T. Anegawa and N. Iizuka), *Phys. Rev.* D **105** (2022) 085003, arXiv:2111.03886 [hep-th].

7. "Light-ray moments as endpoint contributions to modular Hamiltonians" (with G. Lifschytz, P. Nguyen and D. Sarkar), *JHEP* **2021**, 74 (2021), arXiv:2103.08636 [hep-th].

8. "Dressing bulk fields in AdS_3" (with G. Lifschytz), *JHEP* **10** (2020) 189, arXiv:2008.01198 [hep-th].

9. "Endpoint contributions to excited-state modular Hamiltonians" (with G. Lifschytz, P. Nguyen and D. Sarkar), *JHEP* **12** (2020) 128, arXiv:2006.13317 [hep-th].

10. "Bulk reconstruction for spinor fields in AdS/CFT" (with V. F. Foit and G. Lifschytz), *JHEP* **02** (2020) 129, arXiv:1912.00952 [hep-th].

11. "Anomalies and Bose symmetry," arXiv:1911.06529 [hep-th]. In *Roman Jackiw: 80th Birthday Festschrift*, A. Niemi, T. Tomboulis and K.K. Phua, eds. (World Scientific, 2020).

12. "Quasinormal modes, echoes and the causal structure of the Green's function" (with L. Hui and S. Wong), *JCAP* **12** (2019) 020, arXiv:1909.10382 [gr-qc].

13. "Black hole hair from scalar dark matter" (with L. Hui, X. Li, L. Santoni and S. Wong), *JCAP* **1906** (2019) 038, arXiv:1904.12803 [gr-qc].

14. "Emergence of spacetime from the algebra of total modular Hamiltonians" (with G. Lifschytz), *JHEP* **1905** (2019) 017, arXiv:1812.02915 [hep-th].

15. "Fluid analogs for rotating black holes" (with P. Garza and A. van Gelder), *Class. Quant. Grav.* **35** (2018) 165009, arXiv:1802.08306 [gr-qc].

16. "Does boundary quantum mechanics imply quantum mechanics in the bulk?" (with G. Lifschytz), *JHEP* **1803** (2018) 151, arXiv:1801.08101 [hep-th].

17. "Local bulk physics from intersecting modular Hamiltonians" (with G. Lifschytz), *JHEP* **1706** (2017) 120, arXiv:1703.06523 [hep-th].

18. "Locality, bulk equations of motion and the conformal bootstrap" (with G. Lifschytz), *JHEP* **1610** (2016) 091, arXiv:1603.06800 [hep-th].

19. "Asymmetric interiors for small black holes" (with G. Lifschytz), *JHEP* **1608** (2016) 097, arXiv:1601.05611 [hep-th].

20. "Bulk equations of motion from CFT correlators" (with G. Lifschytz), *JHEP* **1509** (2015) 059, arXiv:1505.03755 [hep-th].

21. "Finite N and the failure of bulk locality: Black holes in AdS/CFT" (with G. Lifschytz), *JHEP* **1409** (2014) 077, arXiv:1405.6394 [hep-th].

22. "Decoding the hologram: Scalar fields interacting with gravity" (with G. Lifschytz), *Phys. Rev.* **D89** (2014) 066010, arXiv:1311.3020 [hep-th].

23. "On the mutual information in Hawking radiation" (with N. Iizuka), *Phys. Rev.* **D88** (2013) 084010, arXiv:1308.2386 [hep-th].

24. "Black hole formation in fuzzy sphere collapse" (with N. Iizuka, S. Roy and D. Sarkar), *Phys. Rev.* **D88** (2013) 044019, arXiv:1306.3256 [hep-th].

25. "Black hole formation at the correspondence point" (with N. Iizuka, S. Roy and D. Sarkar), *Phys. Rev.* **D87** (2013) 126010, arXiv:1303.7278 [hep-th].

26. "CFT representation of interacting bulk gauge fields in AdS" (with G. Lifschytz), *Phys. Rev.* **D87** (2013) 086004, arXiv:1212.3788 [hep-th].

27. "On three dimensions as the preferred dimensionality of space via the Brandenberger-Vafa mechanism" (with B. Greene and S. Marnerides), *Phys. Rev.* **D88** (2013) 043527, arXiv:1212.2115 [hep-th].

28. "Cosmic string interactions induced by gauge and scalar fields" (with D. Sarkar), *Phys. Rev.* **D86** (2012) 084021, arXiv:1206.5642 [hep-th].

29. "Holographic representation of bulk fields with spin in AdS/CFT" (with G. Lifschytz, S. Roy and D. Sarkar), *Phys. Rev.* **D86** (2012) 026004, arXiv:1204.0126 [hep-th].

30. "Thermal diffractive corrections to Casimir energies" (with D. Karabali), *Phys. Rev.* **D84** (2011) 065029, arXiv:1107.0952 [hep-th].

31. "Constructing local bulk observables in interacting AdS/CFT" (with G. Lifschytz and D. Lowe), *Phys. Rev.* **D83** (2011) 106009, arXiv:1102.2910 [hep-th].

32. "On the Casimir interaction between holes" (with D. Karabali and V.P. Nair), *Phys. Rev.* **D82** (2010) 025014, arXiv:1005.3352 [hep-th].

33. "Edges and diffractive effects in Casimir energies" (with D. Karabali and V.P. Nair), *Phys. Rev.* **D81** (2010) 125013, arXiv:1002.3575 [hep-th].

34. "A bulk inflaton from large-volume extra dimensions" (with B. Greene, J. Levin and D. Thurston), *Phys. Lett.* **B694** (2011) 485, arXiv:1001.1423 [hep-th].

35. "Dynamical decompactification and three large dimensions" (with B. Greene and S. Marnerides), *Phys. Rev.* **D82** (2010) 043528, arXiv:0908.0955 [hep-th].

36. "Bouncing and cyclic string gas cosmologies" (with B. Greene and S. Marnerides), *Phys. Rev.* **D80** (2009) 063526, arXiv:0809.1704 [hep-th].

37. "Pseudo-redundant vacuum energy" (with P. Batra, K. Hinterbichler and L. Hui), *Phys. Rev.* **D78** (2008) 043507, arXiv:0801.4526 [hep-th].

38. "Local bulk operators in AdS/CFT and the fate of the BTZ singularity" (with A. Hamilton, G. Lifschytz and D. Lowe), arXiv:0710.4334 [hep-th]. In *Advances in String Theory: The First Sowers Workshop in Theoretical Physics*, E. Sharpe and A. Greenspoon, eds. (American Mathematical Society, 2008).

39. "Local bulk operators in AdS/CFT: A holographic description of the black hole interior" (with A. Hamilton, G. Lifschytz and D. Lowe), *Phys. Rev.* **D75** (2007) 106001, arXiv:hep-th/0612053.

40. "Holographic representation of local bulk operators" (with A. Hamilton, G. Lifschytz and D. Lowe), *Phys. Rev.* **D74** (2006) 066009, arXiv:hep-th/0606141.

41. "A note on the Coulomb branch of susy Yang-Mills" (with G. Lifschytz), *Phys. Lett.* **B633** (2006) 641, arXiv:hep-th/0511226.

42. "Local bulk operators in AdS/CFT: A boundary view of horizons and locality" (with A. Hamilton, G. Lifschytz and D. Lowe), *Phys. Rev.* **D73** (2006) 086003, arXiv:hep-th/0506118.

43. "String windings in the early universe" (with R. Easther, B. R. Greene and M. G. Jackson), *JCAP* **0502** (2005) 009, arXiv:hep-th/0409121.

44. "A first-quantized formalism for cosmological particle production" (with A. Hamilton and M. Parikh), *JHEP* **0407** (2004) 024, arXiv:hep-th/0311180.

45. "Brane gases in the early universe: Thermodynamics and cosmology" (with R. Easther, B. R. Greene and M. G. Jackson), *JCAP* **0401** (2004) 006, arXiv:hep-th/0307233.

46. "Stretched horizons, quasiparticles and quasinormal modes" (with N. Iizuka, G. Lifschytz and D. Lowe), *Phys. Rev.* **D68** (2003) 084021, arXiv:hep-th/0306209.

47. "Quasiparticle picture of black holes and the entropy–area relation" (with N. Iizuka, G. Lifschytz and D. Lowe), *Phys. Rev.* **D67** (2003) 124001, arXiv:hep-th/0212246.

48. "Brane gas cosmology in M-theory: Late time behavior" (with R. Easther, B. R. Greene and M. G. Jackson), *Phys. Rev.* **D67** (2003) 123501, arXiv:hep-th/0211124.

49. "QCD vacuum structure in strong magnetic fields" (with K. Lee and E. Weinberg), *Phys. Rev.* **D66** (2002) 014004, arXiv:hep-ph/0204120.

50. "de Sitter entropy from conformal field theory" (with G. Lifschytz), *JHEP* **0204** (2002) 019, arXiv:hep-th/0203083.

51. "Probing black holes in non-perturbative gauge theory" (with N. Iizuka, G. Lifschytz and D. Lowe), *Phys. Rev.* **D65** (2001) 024012, arXiv:hep-th/0108006.

52. "Black hole entropy from non-perturbative gauge theory" (with G. Lifschytz and D. Lowe), *Phys. Rev.* **D64** (2001) 124015, arXiv:hep-th/0105171.

53. "Testing cosmological supersymmetry breaking" (with A. Rajaraman), *Phys. Lett.* **B516** (2001) 383, arXiv:hep-ph/0102309.

54. "Black hole thermodynamics from calculations in strongly-coupled gauge theory" (with G. Lifschytz and D. Lowe), *Phys. Rev. Lett.* **86** (2001) 1426, arXiv:hep-th/0007051. Also appeared in Strings 2000 proceedings, *Int. J. Mod. Phys.* **A16** (2001) 856 and in *Mirror symmetry 4: proceedings of the 2000 CRM workshop on strings, duality and geometry*, D. Phong, ed. (American Mathematical Society, 2002).

55. "Approximations for strongly-coupled supersymmetric quantum mechanics" (with G. Lifschytz), *Nucl. Phys.* **B571** (2000) 419, arXiv:hep-th/9910001.

56. "Gauge theory origins of supergravity causal structure" (with G. Lifschytz), *JHEP* **9905** (1999) 005, arXiv:hep-th/9902073.

57. "Tachyons and black hole horizons in gauge theory" (with G. Lifschytz), *JHEP* **9812** (1998) 002, arXiv:hep-th/9806214.

58. "Linearized supergravity from matrix theory" (with W. Taylor), *Phys. Lett.* **B426**, 297 (1998), arXiv:hep-th/9712185.

59. "Spherical membranes in matrix theory" (with W. Taylor), *Adv. Theor. Math. Phys.* **2**, 181 (1998), arXiv:hep-th/9711078. Reprinted in *Physics in non-commutative world,* M. Li and Y.-S. Wu eds. (Rinton Press, 2002).

60. "Wilson lines and T-duality in heterotic M(atrix) theory" (with S.–J. Rey), *Nucl. Phys.* **B508**, 535 (1997), arXiv:hep-th/9707099.

61. "D-branes and short distances in string theory" (with M. R. Douglas, P. Pouliot and S. H. Shenker), *Nucl. Phys.* **B485**, 85 (1997), arXiv:hep-th/9608024.

62. "A comment on zero-brane quantum mechanics" (with P. Pouliot), *Phys. Rev. Lett.* **77**, 1004 (1996), arXiv:hep-th/9603127.

63. "Black hole entropy in the $O(N)$ model" (with S. H. Shenker and M. J. Strassler), *Phys. Rev.* **D52**, 7027 (1995), arXiv:hep-th/9506182.

64. "Black hole entropy and entropy of entanglement," *Nucl. Phys.* **B453**, 281 (1995), arXiv:hep-th/9503016.

65. "A comment on entropy and area" (with M. J. Strassler), *Phys. Lett.* **B329**, 46 (1994), arXiv:hep-th/9401125.

66. "Canonical quantization and braid invariance of (2+1)-dimensional gravity coupled to point particles" (with M. E. Ortiz), *Phys. Rev.* **D49**, 1684 (1994), arXiv:hep-th/9305155.

67. "Validity of the eikonal approximation," *Comments Nucl. Part. Phys.* **20**, 325 (1992), arXiv:hep-th/9204103.

68. "Eikonal quantum gravity and Planckian scattering" (with M. Ortiz), *Nucl. Phys.* **B388**, 570 (1992), arXiv:hep-th/9203082.

69. "Electromagnetic fields of a massless particle and the eikonal" (with R. Jackiw and M. Ortiz), *Phys. Lett.* **B277**, 148 (1992), arXiv:hep-th/9112020.

70. "Conditions for the existence of closed time-like curves in 2+1 gravity," *Phys. Rev.* **D46**, 2720 (1992).

71. "Canonical quantization of abelian Chern–Simons solitons," *Phys. Lett.* **B281**, 265 (1992).

72. "Effects of oxygen and nitrogen on drifting electrons in a liquid argon TPC" (with S. D. Biller, R. C. Allen, G. Bühler and P. J. Doe), *Nucl. Instrum. Methods* **A276**, 144 (1989).

Teaching

At Lehman College

Undergraduate courses on conceptual physics, general physics, physics for engineers, modern physics, classical mechanics, special topics (particles and cosmology), quantum mechanics.

At CUNY Graduate Center

Graduate courses on quantum field theory and high energy physics.

At Columbia University

Graduate courses on quantum mechanics, general relativity, particle physics and string theory.

Graduate advising

- Aakash Marthandan (Ph.D. in progress)
- Xiaole Jiang (Ph.D. in progress)
- Ariana van Gelder (M.Phil., 2018)
- Debajyoti Sarkar (Ph.D., 2014)
- Alex Hamilton (Ph.D., 2007)
- Norihiro Iizuka (Ph.D., 2003)

Mentoring (selected examples)

- Fall '21: supervised a science fair project with a local high school student Arjun Menon on the twin paradox in a cylindrical spacetime. See A. Menon et al., *Phys. Rev.* D **106** (2022) 085001.
- Fall '12 – Spring '17: mentored a series of high school students (Cheryl Kang, Nazmul Islam, Max Brodheim, Pablo Garza) in projects on geodesics and rotating black holes in fluid analog models for gravity. See P. Garza et al., *Class. Quant. Grav.* **35** (2018) 165009.

Seminars (last five years)

- "A prescription for entanglement in field theory and gravity"
  YITP workshop on quantum physics of black holes, 4/7/23.
- "A Euclidean prescription for extractable entanglement entropy"
  Seminar at IIS Bengaluru, 10/5/22.
- "Emergence of spacetime from the algebra of modular Hamiltonians"
  Progress and Challenges in Analytic Gravity, APS April Meeting, 4/11/22.

- "What is a black hole?"
  Barnard – Nevis Summer Colloquium Series, 7/2/20.

- "Building bulk observables in AdS/CFT"
  IPM workshop on recent trends in string theory and related topics, 4/24/19. Laval University, 4/1/19. U. Michigan, 2/15/19.

- "Perspectives on bulk reconstruction"
  Seminar at CERN workshop on black holes, quantum information, and space-time reconstruction, August 20, 2018.

- "Building bulk observables in AdS/CFT"
  Talk at 21st Eastern Gravity Meeting, May 24, 2018.

Service to the community

Divisional associate editor, *Physical Review Letters*, 2020 – present

Co-organized a series of symposia at the CUNY Initiative for the Theoretical Sciences, from *Quantum field theory in diverse dimensions* in Fall 2017 to *Thermalization and Quantum Field Theory* in Fall 2022.

Funding history

- U.S. National Science Foundation grants #0855582, 1214410, 1519705, 1820734, 2112548 (total of $855 000 in funding from 8/09 – 8/24)

- PSC-CUNY awards #60038-39-40, 63332-00-41, 64497-00-42, 65302-00-43 (internal CUNY grants, award dates: 7/09 – 6/13)

- CUNY Collaborative Incentive Research Grant #1840
  (award amount: $30 000, award dates: 9/11 – 9/12)

- Columbia University Initiatives in Science and Engineering
  (award amount: $68 500, award dates: 7/06 – 6/08)

- US-Israel Binational Science Foundation grant #2000359
  (award amount: $35 952, award dates: 10/01 – 9/05)