

Personal Information

Name: Avraham Klein	Date of birth: Sep. 15, 1983	Country of Birth: USA
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I am currently a senior lecturer at Ariel University physics department. I specialize in the theory of quantum materials focusing on the interplay between dynamics, quantum criticality, and geometry. I am particularly interested in the intertwining of quantum dynamics with classical and semiclassical nonlinear dynamics, in the context of elastic media and classical and quantum fluids.

Occupation

(2020 – present) Assistant Professor (Senior Lecturer) at Ariel University physics department

(2019 - 2020) Research associate at the Center for Quantum Materials in the University of Minnesota.

(2016 – 2020) Research associate at the Fine Theoretical Physics Institute in the University of Minnesota.

Recent Grants

- (2021 – 2024) Research program in Quantum Technologies and Science (ISF & DDR&D Quantum grant) 2021

Education

(2013 – 2017) Obtained a Ph.D. degree under supervision of Prof. Oded Agam at the Hebrew University in Jerusalem.

(2011– 2012) Obtained a M.Sc. degree (Magna Cum Laude) in Physics at the Hebrew University. Thesis topic: Topological transitions in evaporating thin films.

(2008 – 2010) Graduated Magna Cum Laude from the Hebrew University with a B.Sc. Degree. Major: Physics; Minor: Computer Science.

Prizes and Fellowships

- Ph.D.: Worldquant scholarship 2014, Clore Scholarship 2016, Racah Prize 2016
- M.Sc.: M.Sc. Excellence Prize 2011-2012, M.Sc. Dean's list 2011, Schuller Prize 2012.
- B.Sc: Amirim-Teva Honors Scholarship, Dean's List 2008-2010, Dean's Prize 2009.

Invited conference presentations

- 1) TBD - *Strongly Correlated Matter: from Quantum Criticality to Flat Bands*, ICTP, Trieste Italy Sep. 2022 (scheduled)
- 2) A critical theory of quantum ferroelectric metals, *International conference on low energy electrodynamics in solids*, Portland (ME) - online, July 2021
- 3) A (truly) new wrinkle on liquid sheets, *Siam Conference on Mathematica Aspects of Materials Science*, Bilbao, Spain – online, May 2021
- 4) Mirage and hidden collective modes in 2D Fermi liquids, *APS March Meeting 2021*, online, March 2021
- 5) Normal state properties of quantum critical metals at finite temperature, *KITP program: Correlated Systems with Multicomponent Local Hilbert Spaces*, KITP online meeting room, September 2020 – December 2020
- 6) The intertwined pairing states of superconductivity at a nematic quantum critical point, *MPI-PKS Workshop: "Quantum Criticality and Topology in Correlated Electron Systems"*, Dresden, Germany, August 2019
- 7) Identifying mechanisms of quantum nematic transitions from the dynamic susceptibility, *Correlated Electron Systems – Novel Developments*, Minneapolis MN, May 2018
- 8) Viscous fingering in evaporation fronts of thin liquid films – *Complex Analysis and Dynamics VI*, Nahariya, May 2013
- 9) Topological transitions in interface dynamics of evaporating thin films - *The 9th AIMS Conference on Dynamical Systems, Differential Equations and Applications*; Orlando, Florida USA, July 2012

Publications

1. W. Jiang, Y. Liu, A. Klein, Y. Wang, K. Sun, A. V. Chubukov, Z-Y. Meng, Monte Carlo study of the pseudogap and superconductivity emerging from quantum magnetic fluctuations, *Nature Communications* 13, 265 (2022)
2. B. Davidovitch, A. Klein, How viscous bubbles collapse: topological and symmetry-breaking instabilities in curvature-driven hydrodynamics, arXiv:2202.11125 *
3. A. Lahiri, A. Klein, R. M. Fernandes, Defect-induced electronic smectic state at the surface of nematic materials, arXiv:2111.00541
4. V. Kozii, A. Klein, R. M. Fernandes, J. Ruhman, Synergetic ferroelectricity and superconductivity in zero-density Dirac semimetals near quantum criticality, arXiv:2110.09530
5. S. Hameed, D. Pelc, Z.W. Anderson, A. Klein, R.J. Spieker, L. Yue, B. Das, J. Ramberger, M. Lukas, Y. Liu, M. J. Krogstad, R. Osborn, Y. Li, C. Leighton, R.M. Fernandes, M. Greven, Enhanced superconductivity and ferroelectric quantum criticality in plastically deformed strontium titanate, *Nature Materials* 21 (1), 54-61 (2022)
6. Y. Liu, W. Jiang, A. Klein, Y. Wang, K. Sun, A. V. Chubukov, Z-Y. Meng, The dynamical exponent of a quantum critical itinerant ferromagnet: a Monte Carlo study, *Physical Review B* 105 (4), L041111 (2022)
7. X.-Y. Xu, A. Klein, K. Sun, A. V. Chubukov, Z. Y. Meng, Extracting non-Fermi liquid fermionic self-energy at $T=0$ from quantum Monte Carlo data, *Nature Partner Journal: Quantum Materials* 5, 65 (2020)
8. A. Klein, Y. Schattner, E. Berg, A. V. Chubukov, Normal state properties of quantum critical metals at finite temperature, *Physical Review X* 10, 031052 (2020)
9. A. Klein, D. L. Maslov, A. V. Chubukov, Hidden and mirage collective modes in two dimensional Fermi liquids, *Nature Partner Journal: Quantum Materials* 5, 1-13 (2020)
10. A. Klein, M. H. Christensen, and R. M. Fernandes, Laser-induced coherent control of an electronic nematic quantum phase transition, *Physical Review Research* 2, 013336 (2020)
11. A. Klein, D. L. Maslov, L. P. Pitaevskii and A. V. Chubukov, Collective modes near a Pomeranchuk instability in two dimensions, *Physical Review Research* 1 (3), 033134 (2019)

12. A. Klein, Y-M. Wu, and A. V. Chubukov, Multiple intertwined pairing states and temperature-sensitive gap anisotropy for superconductivity at a nematic quantum-critical point, *Nature Partner Journal: Quantum Materials* 4, 55 (2019)
13. A. Klein and A. V. Chubukov, Superconductivity near a nematic quantum critical point: Interplay between hot and lukewarm regions, *Physical Review B* 98, 220501(R) (2018)
14. A. Klein, S. Lederer, D. Chowdhury, E. Berg, and A. Chubukov, Dynamical susceptibility of a near-critical nonconserved order parameter and quadrupole Raman response in Fe-based superconductors, *Physical Review B* 98, 041101(R) (2018)
15. A. V. Chubukov, A. Klein, and D. L. Maslov, Fermi-liquid theory and Pomeranchuk instabilities: fundamentals and new developments, *JETP* 127 (5) 826-843 (2018) (invited review)
16. Y. Wu, A. Klein, and A. V. Chubukov, Conditions for $l = 1$ Pomeranchuk instability in a Fermi liquid, *Physical Review B* 97, 165101 (2018) [Editor's suggestion]
17. A. Klein, S. Lederer, D. Chowdhury, E. Berg, and A. Chubukov, Dynamical susceptibility near a long-wavelength critical point with a nonconserved order parameter, *Physical Review B* 97, 155115 (2017)
18. A. Klein and A. V. Chubukov, Role of finite-size effects in the critical behavior of itinerant fermions, *Physical Review B* 96, 041125(R) (2017)
19. A. Klein, O. Agam and I. L. Aleiner, Instability of the Abrikosov lattice due to nonanalytic core reconstruction of vortices in bosonic superfluids, *Physical Review Letters* 118, 085303 (2017)
20. A. Klein, O. Agam and I. L. Aleiner, The internal structure of a vortex in a two-dimensional superfluid with long healing length and its implications, *Annals of Physics*, 2014, 346, 195-229 (2014)
21. A. Klein, B. Spivak and O. Agam, Speckle statistics of entangled photons, *Physical Review A*, 2016, 94, 013828 (2016)
22. A. Klein and O. Agam, Topological transitions in evaporating thin films, *Journal of Physics A: Mathematical and Theoretical*, 2012, 45, 355003 (2012)
23. A. Klein and O. Agam, Critical point correlations in random Gaussian fields, *Journal of Physics A: Mathematical and Theoretical*, 2012, 45, 025001 (2011)
24. A. Klein and N. Katz, Strong coupling optimization with planar spiral resonators, *Current Applied Physics*, 2011, 11, 1188-1191 (2011)

Google scholar page: <https://scholar.google.co.il/citations?hl=en&user=n8rLU1gAAAAJ>

Courses taught in Recent Years

- 2020-2022 Mechanics for mechanical engineering, Mechanics for physics, Electricity and magnetism for civil engineering, Quantum mechanics I, Ariel University
- 2013-2015 Waves and Optics, Analytical electrodynamics, Hebrew University (teaching asst.)