András GYENIS andras.gyenis@colorado.edu

Employment

Assistant Professor (Aug 2021 -)
- Department of Electrical, Computer and Energy Engineering, University of Colorado Boulder
- https://www.colorado.edu/lab/gyenis/

Visiting Assistant Professor (June 2020 - Aug 2021)
- Niels Bohr Institute, University of Copenhagen, Denmark
- Activity: developing hybrid semiconducting superconducting qubits for protected circuits
- https://www.nbi.ku.dk/

Postdoctoral Research Associate (Oct 2016 - June 2020)
- Department of Electrical Engineering, Princeton University
- Advisor: Prof. Andrew Houck
- Activity: realizing intrinsically protected superconducting qubits using circuit quantum electrodynamics
- https://houcklab.princeton.edu/

Graduate Student Researcher (July 2010 - Aug 2016)
- Department of Physics, Princeton University
- Advisor: Prof. Ali Yazdani
- Activity: ultra-low temperature scanning tunneling microscopy on unconventional superconductors, strongly correlated electronic systems and topological materials
- http://wwwphy.princeton.edu/~yazdaniweb

Undergraduate Researcher (July 2007 - June 2010)
- Department of Physics, Budapest University of Technology and Economics
- Advisor: Prof. Gyorgy Mihaly
- Activity: transport and point contact measurements on nanometer-scale resistive junctions
- http://nanoelectronics.physics.bme.hu/

Education

Princeton University, Department of Physics (2010 - 2016)
Princeton, New Jersey, USA

- Ph.D. in Physics (experimental condensed matter physics)
- Dissertation: *Scanning Tunneling Microscopy Studies of Correlated and Topological Electronic States*

Budapest University of Technology and Economics (2005 - 2010)
Budapest, Hungary

- B.Sc., M.Sc. in Engineering Physics (experimental condensed matter physics) with highest honors
- Thesis Title: *Resistive Memory Effects in Mesoscopic and Atomic Contacts*

Publications

[1] A. Osborne, T. Larson, S. Jones, R. W. Simmonds, **A. Gyenis**, A. Lucas. "Symplectic geometry and circuit quantization". *arXiv:2304.08531* (2023) (https://arxiv.org/abs/2304.08531)

[2] S. G. Jones, N. Materise, K. W. Leung, J. C. Weber, B. D. Isakov, X. Chen, J. Zheng, **A. Gyenis**, B. Jaeck, C. R. H. McRae. "Grain size in low loss superconducting Ta thin films on c axis sapphire". *J. Appl. Phys* **134**, 144402 (2023) (https://doi.org/10.1063/5.0169391)

[3] D. Razmadze, R. Seoane Souto, L. Galletti, A. Maiani, Y. Liu, P. Krogstrup, C. Schrade, **A. Gyenis**, C. M. Marcus, S. Vaitiekėnas. "Supercurrent reversal in ferromagnetic hybrid nanowire Josephson junctions". *Phys. Rev. B* **107**, L081301 (2023) (https://link.aps.org/doi/10.1103/PhysRevB.107.L081301)

[4] A. Hertel, M. Eichinger, L. O. Andersen, D. M. T. van Zanten, S. Kallatt, P. Scarlino, A. Kringhøj, J. M. Chavez-Garcia, G. C. Gardner, S. Gronin, M. J. Manfra, **A. Gyenis**, M. Kjaergaard, C. M. Marcus, K. D. Petersson. "Gate-tunable transmon using selective-area-grown superconductor-semiconductor hybrid structures on silicon". *Phys. Rev. Applied* **18**, 034042 (2022) (https://doi.org/10.1103/PhysRevApplied.18.034042)

[5] C. Schrade, C. M. Marcus, **A. Gyenis**. "Protected Hybrid Superconducting Qubit in an Array of Gate-Tunable Josephson Interferometers". *PRX Quantum* **3**, 030303 (2022) (https://doi.org/10.1103/PRXQuantum.3.030303)

[6] J. Danon, A. Chatterjee, **A. Gyenis**, F. Kuemmeth. "Protected solid-state qubits". *Appl. Phys. Lett.* **119**, 260502 (2021) (https://doi.org/10.1063/5.0073945)

[7] **A. Gyenis**, A. Di Paolo, J. Koch, A. Blais, A. A. Houck, D. I. Schuster. "Moving beyond the transmon: Noise-protected superconducting quantum circuits". *PRX Quantum Invited Perspective*, 030101 (2021) (https://link.aps.org/doi/10.1103/PRXQuantum.2.030101)

[8] **A. Gyenis***, P. S. Mundada*, A. Di Paolo*, T. M. Hazard, X. You, D. I. Schuster, J. Koch, A. Blais, A. A. Houck. "Experimental realization of a protected superconducting circuit derived from the $0-\pi$ qubit". *PRX Quantum* **2**, 010339 (2021) (https://doi.org/10.1103/PRXQuantum.2.010339)

[9] Z. Huang, P. S. Mundada, **A. Gyenis**, D. I. Schuster, A. A. Houck, J. Koch. "Engineering dynamical sweet spots to protect qubits from $1/f$ noise". *Phys. Rev. Applied* **15**, 034065 (2021) (https://doi.org/10.1103/PhysRevApplied.15.034065)

[10] A. P. Place*, L. V. Rodgers*, P. S. Mundada, B. M. Smitham, M. Fitzpatrick, Z. Leng, A. Premkumar, J. Bryon, A. Vrajitoarea, S. Sussman, G. Cheng, T. Madhavan, H. K. Babla, X. H. Le, Y. Gang, B. Jaeck, **A. Gyenis**, N. Yao, R. J. Cava, N. P. de Leon, A. A. Houck. "New material platform for superconducting transmon qubits with coherence times exceeding 0.3 milliseconds". *Nature Communications* **12**, 1779 (2021) (https://doi.org/10.1038/s41467-021-22030-5)

[11] P. S. Mundada*, **A. Gyenis***, Z. Huang, J. Koch, A. A. Houck. "Floquet-engineered enhancement of coherence times in a driven fluxonium qubit". *Phys. Rev. Applied* **14**, 054033 (2020) (https://doi.org/10.1103/PhysRevApplied.14.054033)

[12] M. Abdelhafez, B. Baker, **A. Gyenis**, P. Mundada, A. A. Houck, D. Schuster, J. Koch. "Universal gates for protected superconducting qubits using optimal control". *Phys. Rev. A* **101**, 022321 (2020) (https://doi.org/10.1103/PhysRevA.101.022321)

[13] T. M. Hazard*, **A. Gyenis***, A. Di Paolo*, A. T. Asfaw, S. A. Lyon, A. Blais and A. A. Houck. "Nanowire-Superinductance Fluxonium Qubit". *Phys. Rev. Lett.* **122**, 010504 (2019) (http://doi.org/10.1103/PhysRevLett.122.010504)

[14] A. T. Asfawa, E. I. Kleinbaum, T. M. Hazard, **A. Gyenis**, A. A. Houck and S. A. Lyon. "SKIFFS: Superconducting Kinetic Inductance Field-Frequency Sensors for sensitive magnetometry in moderate background magnetic fields". *Appl. Phys. Lett.* **113**, 172601 (2018) (https://doi.org/10.1063/1.5049615)

[15] M. T. Randeria*, B. E. Feldman*, F. Wu*, H. Ding, **A. Gyenis**, H. Ji, R. J. Cava, A. H. MacDonald and A. Yazdani. "Ferroelectric quantum Hall phase revealed by visualizing Landau level wavefunction interference". *Nat. Phys.* **14**, 796 (2018) (http://doi.org/10.1038/s41567-018-0148-2)

[16] **A. Gyenis***, B. E. Feldman*, M. T. Randeria*, G. A. Peterson, E. D. Bauer, P. Aynajian and A. Yazdani. "Visualizing heavy fermion confinement and Pauli-limited superconductivity in layered $CeCoIn_5$". *Nat. Commun.* **9**, 549 (2018) (http://doi.org/10.1038/s41467-018-02841-9)

[17] **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, and B. A. Bernevig, A. Yazdani. "Imaging electronic states on topological semimetals using scanning tunneling microscopy". *New J. Phys.* **18**, 105003 (2016) (http://doi.org/10.1088/1367-2630/18/10/105003)

[18] **A. Gyenis***, E. H. da Silva Neto*, R. Sutarto, E. Schierle, F. He, E. Weschke, M. Kavai, R. E. Baumbach, J. D. Thompson, E. D. Bauer, Z. Fisk, A. Damascelli, A. Yazdani, P. Aynajian. "Quasiparticle interference of heavy fermions in resonant x-ray scattering". *Science Advances* **2**, 10 (2016) (http://doi.org/10.1126/sciadv.1601086)

[19] 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**, 6310 (2016) (http://doi.org/10.1126/science.aag1715)

[20] H. Inoue*, **A. Gyenis***, Z. Wang, J. Li, S. Woo Oh, S. Jiang, N. Ni, B. A. Bernevig, A. Yazdani. "Quasi-particle interference of the Fermi arcs and surface-bulk connectivity of a Weyl semimetal". *Science* **351**, 1184 (2016) (http://doi.org/10.1126/science.aad8766)

[21] 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 WTe_2". *Nat. Commun.* **7**, 10847 (2016) (http://doi.org/10.1038/ncomms10847)

[22] S. Kushwaha, I. Pletikosic, T. Liang, **A. Gyenis**, S. Lapidus, Y. Tian, H. Zhao, K. Burch, H. Ji, A. Fedorov, A. Yazdani, P. Ong, T. Valla, R. Cava. "Sn-doped $Bi_{1.1}Sb_{0.9}Te_2S$, a bulk topological insulator with ideal properties". *Nat. Commun.* **7**, 11456 (2016) (http://doi.org/10.1038/ncomms11456)

[23] H. Luo, W. Xie, J. Tao, H. Inoue, **A. Gyenis**, J. Krizan, A. Yazdani, Y. Zhu, R. Cava. "Polytypism, polymorphism, and superconductivity in $TaSe_{2-x}Te_x$". *Proc. Natl. Acad. Sci. U. S. A.*, **112**, E1174 (2015) (http://dx.doi.org/10.1073/pnas.1502460112)

[24] S. Kushwaha, J. Krizan, B. Feldman, **A. Gyenis**, M. Randeria, J. Xiong, S-Y. Xu, N. Alidoust, I. Belopolski, T. Liang, Z. Hasan, P. Ong, A. Yazdani, R. Cava. "Bulk crystal growth and electronic characterization of the 3D Dirac semimetal Na_3Bi". *APL Mater.* **3**, 041504 (2015) (http://dx.doi.org/10.1063/1.4908158)

[25] S. Jeon*, B. Zhou*, **A. Gyenis**, B. Feldman, I. Kimchi, A. Potter, Q. Gibson, R. Cava, A. Vishwanath, A. Yazdani. "Landau Quantization and Quasiparticle Interference in the Three-Dimensional Dirac Semimetal Cd_3As_2". *Nat. Mater.* **13**, 851 (2014) (http://dx.doi.org/10.1038/nmat4023)

[26] E. da Silva Neto*, P. Aynajian*, A. Frano, R. Comin, E. Schierle, E. Weschke, **A. Gyenis**, J. Wen, J. Schneeloch, Z. Xu, S. Ono, G. Gu, M. Le Tacon, A. Yazdani. "Ubiquitous Interplay between Charge Ordering and High-Temperature Superconductivity in Cuprates". *Science* **343**, 393 (2014) (http://dx.doi.org/10.1126/science.1243479)

[27] S. Misra, B. Zhou, I. Drozdov, J. Seo, **A. Gyenis**, S. Kingsley, H. Jones, A. Yazdani. "Design and performance of an ultra-high vacuum scanning tunneling microscope operating at dilution refrigerator temperatures and high magnetic fields". *Rev. Sci. Instrum.* **84**, 103903 (2013) (http://dx.doi.org/10.1063/1.4822271)

[28] **A. Gyenis**, I. Drozdov, S. Nadj-Perge, O. Jeong, J. Seo, I. Pletikosic, T. Valla, G. Gu, A. Yazdani. "Quasiparticle Interference on the Surface of Topological Crystalline Insulator $Pb_{1-x}Sn_xSe$". *Phys. Rev. B* **88**, 125414 (2013) (http://dx.doi.org/10.1103/PhysRevB.88.125414)

[29] P. Aynajian*, E. da Silva Neto*, **A. Gyenis**, R. Baumbach, J. Thompson, Z. Fisk, E. Bauer, A. Yazdani. "Visualizing heavy fermions emerging in a quantum critical Kondo lattice". *Nature* **486**, 201 (2012) (http://dx.doi.org/10.1038/nature11204)

[30] A. Geresdi, A. Halbritter, **A. Gyenis**, P. Makk, G. Mihaly. "From stochastic single atomic switch to nanoscale resistive memory device". *Nanoscale* **3**, 1504 (2011) (http://dx.doi.org/10.1039/C0NR00951B)

*Authors contributed equally to the work.

Teaching

University of Colorado Boulder

- "Semiconducting and Superconducting Quantum Computers", graduate-level course (2021, 2022 Fall)
- "Foundation of Quantum Hardware", graduate/undergraduate-level course (2022 Spring)
- "Electromagnetic Fields and Waves", undergraduate-level course (2023 Spring)
- "Foundation of Quantum Engineering", graduate/undergraduate-level course (2023 Fall)
- supervised 3 graduate and 5 undergraduate students

Princeton University

- teaching assistant for undergraduate (introductory physics lab) and graduate (condensed matter physics) courses
- mentor for two undergraduate senior theses & one junior project, supervising four graduate students

Talks

[1] † "Protected superconducting circuits from disordered superconductors", Quantum Machines Seminar Series, CU Boulder, Boulder CO, USA (2023)

[2] † "Geometrical approach for designing protected superconducting qubits", Physics Colloquium, Boulder CO, USA (2023)

[3] † "Towards new superconducting circuit elements from disordered materials", International Workshop on "The physics of disordered superconductors and their application to quantum circuits", Les Houches, France (2023)

[4] † "Towards new superconducting circuit elements from disordered materials", Seminar at the Institut Neel, Grenoble, France (2023)

[5] † "Towards new elements for protected superconducting qubits ", Seminar at the Spring Colloquium Series at the Colorado School of Mines, Golden CO, USA (2023)

[6] † "Towards new elements for protected superconducting qubits", Seminar at the Center for Experiments on Quantum Materials, Boulder CO, USA (2023)

[7] † "Quantum Computing with Next-Generation Superconducting Qubits", 6th IEEE Electron Devices Technology and Manufacturing (EDTM), Oita, Japan (2022)

[8] † "Experimental demonstration of a superconducting 0-π qubit", APS March Meeting (2021)

[9] † "Experimental demonstration of the error-protected superconducting 0-π qubit", Microsoft Station Q Fall Meeting (2020)

[10] † "Experimental demonstration of the error-protected superconducting 0-π qubit", Byron Bay Quantum Computing Workshop (2020)

[11] † "Experimental demonstration of the error-protected superconducting 0-π qubit", University of Colorado Boulder, CO (2020)

[12] † "Experimental demonstration of the error-protected superconducting 0-π qubit", University of British Columbia, Vancouver, BC, Canada (2020)

[13] † "Experimental demonstration of the error-protected superconducting 0-π qubit", University of Copenhagen, Denmark (2020)

[14] "Intrinsically error protected superconducting architecture based on superinductance", APS March Meeting, Boston, MA (2019)

[15] "Spectroscopic measurements on error protected superconducting qubit design based on Josephson junction arrays", APS March Meeting, Los Angeles, CA (2018)

[16] "Mapping Dimensionality and Directionality of Electronic Behavior in $CeCoIn_5$: the Normal State", APS March Meeting, Baltimore, MD (2016)

[17] "Atomic scale imaging and spectroscopic investigation of Cd_3As_2 with the STM", APS March Meeting, Denver, CO (2014)

[18] "Scanning tunneling microscopy studies of topological crystalline insulators", APS March Meeting, Baltimore, MD (2013)

[19] "Scanning tunneling microscopy studies of heavy fermion compound $CeCo(In_{1-x}Cd_x)_5$", APS March Meeting, Boston, MA (2012)

[20] "Giant magnetoresistance in granular materials", Seminar of the European Graduate College "Electron-Electron Interactions in Solids," Section of Magnetism, Rackeve, Hungary (2009)

[21] "Spin transfer torques", Seminar of the European Graduate College "Electron-Electron Interactions in Solids," Section of Characterization of Semiconductor Structures, Riezlern, Austria (2008)

† Invited talk.

Service

Reviewer for Nature Physics, Nature Communications, PRX, PRX Quantum, PRL, PRA, PRB, Science Adv., NPJ Quantum Information, JLTP, MDPI Condensed Matter, Transactions on Microwave Theory and Techniques, and APL.

Awards

- International Physics Olympiad, Bronze Medal, Salamanca, Spain (2005)
- Scientific Undergraduate Student Research, Experimental Physics, 1st place (2008)
- National Scientific Undergraduate Student Research, Nanotechnology, 3rd place (2009)