Andrew James Steinmetz, Ph.D.

Curriculum Vitae – Last Updated January 2026

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Employment

Position Title	Department	Institution	Dates
Academic Professional	School of Physics	Georgia Institute of Technology	Jan 2026–
Global Professor[a]	Arizona College of Tech.	Hebei University of Technology	Feb 2024–Jun 2025
Global Professor[a]	Dept. of Physics	University of Arizona	Nov 2023–Jun 2025
Adjunct Faculty	Physics/Astronomy Dept.	Pima Community College	Jun 2020–Dec 2023

[a] Joint international faculty appointment

Education

Degree	Field	Institution	Dates
Ph.D.	Physics	University of Arizona[b,c]	Dec 2023
B.S.	Physics	University of Arizona[d]	May 2014
B.S.	Chemical Engineering	University of Arizona	May 2014

[b] Graduate Teaching Assistant, Dept. of Physics, Dept. of Chem. & Biochem., University of Arizona (2017–2023)
[c] Graduate Research Assistant, Dept. of Physics, University of Arizona (2015–2017)
[d] Research Technician (postbaccalaureate), Dept. of Physics, University of Arizona (2014)

Research Interests

- **Relativistic Spin Dynamics:** Exploring non-minimal (and nonlinear) electromagnetism (EM) in quantum mechanics utilizing the Klein-Gordon-Pauli (KGP) equation, or classically via modifying the covariant Thomas-Bargman-Michel-Telegdi (TMBT) torque equation.
- **Neutrino Physics:** EM mixing of neutrino flavor through transition magnetic dipole moments as a possible probe of the hierarchy problem. Exploring possible EM-induced neutrino mass splitting.
- **Cosmic Magnetization:** Magnetized spin-polarized thermal plasmas during the electron-positron and quark-gluon-plasma (QGP) epochs as a possible origin of primordial magnetic fields (PMF).

Dissertation

Title: Modern Topics in Relativistic Spin Dynamics and Magnetism

Committee: Dr. Johann Rafelski (Chair), Dr. Shufang Su (Member), Dr. John Rutherfoord (Member), Dr. Stefan Meinel (Member), Dr. Sean Fleming (Member)

HDL: http://hdl.handle.net/10150/670301 **Presentation:** 10.13140/RG.2.2.24323.27689

Publications

Citations = 139; h-index = 7 (Google Scholar, Jan 2026). See also INSPIRE-HEP and arXiv.

Peer-Reviewed Journal Articles

1. **Steinmetz, A.**, Rafelski, J. Short note on spin magnetization in QGP, *Eur. Phys. J. Spec. Top.* 234, 2919–2929 (2025), 10.1140/epjs/s11734-025-01625-9.
2. Birrell, J., Formanek, M., **Steinmetz, A.**, Yang, C. T., Rafelski, J. Fermi-Dirac Integrals in Degenerate Regimes: Novel Asymptotic Expansion, *Int. J. Theor. Phys.* 63, 163 (2024), 10.1007/s10773-024-05695-8.

3. Rafelski, J., **Steinmetz, A.**, Yang, C. T. Dynamic fermion flavor mixing through transition dipole moments, *Int. J. Mod. Phys. A* 38.31 (2023): 2350163, 10.1142/S0217751X23501634.
4. **Steinmetz, A.**, Yang, C. T., Rafelski, J. Matter-antimatter origin of cosmic magnetism, *Phys. Rev. D* 108 (2023): 123522, 10.1103/PhysRevD.108.123522.
5. Formanek, M., **Steinmetz, A.**, Rafelski, J. Motion of classical charged particles with magnetic moment in external plane-wave electromagnetic fields, *Phys. Rev. A* 103.5 (2021): 052218, 10.1103/PhysRevA.103.052218.
6. Formanek, M., **Steinmetz, A.**, Rafelski, J. Radiation reaction friction: Resistive material medium, *Phys. Rev. D* 102.5 (2020): 056015, 10.1103/PhysRevD.102.056015.
7. Formanek, M., **Steinmetz, A.**, Rafelski, J. Classical neutral point particle in linearly polarized EM plane wave field, *Plasma Phys. Control. Fusion* 61.8 (2019): 084006, 10.1088/1361-6587/ab242e.
8. **Steinmetz, A.**, Formanek, M., Rafelski, J. Magnetic dipole moment in relativistic quantum mechanics, *Eur. Phys. J. A* 55, 40 (2019), 10.1140/epja/i2019-12715-5.
9. Formanek, M., Evans, S., Rafelski, J., **Steinmetz, A.**, Yang, C. T. Strong fields and neutral particle magnetic moment dynamics, *Plasma Phys. Control. Fusion* 60.7 (2018), 10.1088/1361-6587/aac06a.
10. Rafelski, J., Formanek, M., **Steinmetz, A.** Relativistic dynamics of point magnetic moment *Eur. Phys. J. C* 78 (2018): 1–12, 10.1140/epjc/s10052-017-5493-2.

Book Chapters & Review Articles

1. Rafelski, J., Birrell, J., Grayson, C., **Steinmetz, A.**, Yang, C. T. Quarks to Cosmos: Particles and Plasma in Cosmological evolution, *Eur. Phys. J. Spec. Top.* 234, 1125–1329 (2025), 10.1140/epjs/s11734-025-01470-w.
2. Rafelski, J., **Steinmetz, A.**, Yang, C. T. Dynamic Flavor Mixing Through Transition Moments, *Harald Fritzsch Memorial Volume*, pp. 269–284 (2024), 10.1142/9789811292279_0015.
3. Rafelski, J., Birrell, J., **Steinmetz, A.**, Yang, C.T. A Short Survey of Matter-Antimatter Evolution in the Primordial Universe, *Universe* 9.7 (2023): 309, 10.3390/universe9070309.

Institutional & Technical Reports

1. **Steinmetz, A.** Status and Outlook of PHYS 381/382: Methods in Experimental Physics I/II at ACT HEBUT, internal report (curricular and equipment proposal; $36,000), University of Arizona, Tucson, AZ, 2025.
2. ATLAS Collaboration (coauthor: **A. Steinmetz**). Large Eta Task Force Report, ATL-UPGRADE-INT-2015-001, CERN, Geneva, Switzerland, 2015. https://cds.cern.ch/record/2020591.

Works in Progress

1. **Steinmetz, A.**, Evans, S., Formanek, M., Grayson, C., Labun, L., Price, W., Rafelski, J. Strong fields in classical and quantum physics, (in preparation, 2026).
2. **Steinmetz, A.**, Rafelski, J. Magnetized primordial heavy-quark plasma, (in preparation, 2026).
3. **Steinmetz, A.**, Yang, C. T., Rafelski, J. Electromagnetic field forcing of dynamic CP-violation in lepton sector, (in preparation, 2026).
4. Evans, S., **Steinmetz, A.** Anomalous magnetic moment in the QCD vacuum, (in preparation, 2026).

Conference Presentations & Talks

Talks Presented by Steinmetz, A.

1. **Steinmetz, A.** Impact of AI on Education and Professional Careers, *GRIT*, Tampa, FL. October 16, 2025. Invited talk (honorarium). 10.13140/RG.2.2.28318.60486
2. **Steinmetz, A.** Physics Lab, Journal Club, and AI Tools, *Cross College Faculty Forum (CCFF)*, Arizona College of Technology, Hebei University of Technology, Tianjin, China. April 11, 2025.
3. **Steinmetz, A.** UA-HEBUT Pedagogical Adventures, *Cross College Faculty Forum (CCFF)*, Arizona College of Technology, Hebei University of Technology, Tianjin, China. November 15, 2024.
4. **Steinmetz, A.**, Yang, C. T., Rafelski, J. Primordial Cosmic Magnetism, *SMT 30th Anniversary Steward Observatory Symposium*, University of Arizona, Tucson, AZ, September 22, 2023.

10.13140/RG.2.2.19213.24806.

5. **Steinmetz, A.**, Yang, C. T., Rafelski, J. Magnetism in the Cosmic Plasma Epoch, *ELI-Beamlines Strong Fields Frontiers*, The Extreme Light Infrastructure ERIC, Prague, Czech Republic, June 13, 2023. 10.13140/RG.2.2.32635.02087.
6. **Steinmetz, A.**, Yang, C. T., Rafelski, J. Magnetism in the Cosmic Plasma Epoch, *Margaret Island Symposium on Particles and Plasmas (PP2023)*, HUN-REN Wigner Research Centre for Physics, Budapest, Hungary, June 8, 2023. 10.13140/RG.2.2.29279.57762.
7. **Steinmetz, A.** Relativistic Two-Body Quantum Mechanics, University of Arizona, Tucson, AZ, March 2017.

Talks Co-Prepared by Steinmetz, A. (Presented by Others)

1. Rafelski, J. (presenter), Yang, C. T., **Steinmetz, A.** Non-Stationary Quark-gluon Plasma in the Universe *Hungarian-German WE-Heraeus Seminar*, Goerlitz & HZDR Dresden, Germany, June 24, 2025. 10.13140/RG.2.2.21726.75844.
2. Rafelski, J. (presenter), Yang, C. T., **Steinmetz, A.** Thermal Non-equilibrium and Quark-gluon Plasma *Joint European Thermodynamics Conference (JETC 2025)*, Belgrade, Serbia, May 28, 2025. 10.13140/RG.2.2.25443.05922.
3. Rafelski, J. (presenter), Birrell, J., Grayson, C., **Steinmetz, A.**, Yang, C. T., Foster, S. Quarks to Cosmos: Particles and Plasma in Cosmological Evolution, *16th Conference on Quark Confinement and the Hadron Spectrum (QCHSC 2024)*, University of Adelaide, Cairns, Australia, August 9, 2024. 10.13140/RG.2.2.19642.30407.
4. Rafelski, J. (presenter), Yang, C. T., Birrell, J., Grayson, C., Foster, S., **Steinmetz, A.** Particles & Plasmas in the First Hour of the Universe, *Particles & Plasmas Symposium (PP2024)*, HUN-REN Wigner Research Centre for Physics, Budapest, Hungary, June 11, 2024. 10.13140/RG.2.2.22997.74727.
5. Rafelski, J. (presenter), **Steinmetz, A.** Space-time, Acceleration and Matter, The Extreme Light Infrastructure ERIC, Prague, Czech Republic, December 2022. 10.13140/RG.2.2.25933.76001.
6. Rafelski, J. (presenter), Yang, C. T., Birrell, J., Grayson, C., **Steinmetz, A.** Particles and Plasmas in the Universe, *22nd Zimanyi School Winter Workshop on Heavy Ion Physics*, HUN-REN Wigner Research Centre for Physics, Budapest, Hungary, December 2022. 10.13140/RG.2.2.27611.48160.
7. Rafelski, J. (presenter), **Steinmetz, A.** Strong Field Physics: Report on Frankfurt School and Current Arizona Effort, *Margaret Island Symposium on Particles & Plasmas (PP2022)*, HUN-REN Wigner Research Centre for Physics, Budapest, Hungary, May 17, 2022. 10.13140/RG.2.2.13363.13600.

In addition, I have closely collaborated on preparing research and academic talks delivered at the following conferences/institutes: Deutsche Elektronen-Synchrotron/DESY (2024), Margaret Island Symposium on Particles & Plasmas (PP2023), Polish Academy of Science at Warsaw University (2023), XI International Conference on New Frontiers in Physics (ICNFP 2022), University of Arizona (2022), Hungarian Academy of Sciences (2022), Institute of Theoretical Physics Uniwersytet Wroclawski (2022), 21st Zimanyi School Winter Workshop on Heavy Ion Physics (2021), 4th LeCosPA Symposium (2021).

Grants & Awards

- 2023 Young Researcher Meeting Grant, European Physical Journal (EPJ), Springer-Verlag (PP2023)
- 2023 Fanfare Graduate Travel Award, University of Arizona (PP2023, ELI-Beamlines)

Teaching Experience

Key: GT (Georgia Tech), UA (University of Arizona), ACT (Arizona College of Tech.), PCC (Pima Community College)

Faculty Courses at GT (as Instructor-of-Record)[e]:

Course #	Title	Sections	Students	Semester
PHYS 2212	Principles of Physics II	1	163	Spring 2026

Faculty Courses at UA/ACT (as Instructor-of-Record):

PHYS 371	Quantum Theory	1	75	Spring 2025
PHYS 381	Methods in Exp. Physics I	2	67	Spring 2025
PHYS 321	Theoretical Mechanics	2	139	Fall 2024
PHYS 382	Methods in Exp. Physics II[f]	2	46	Fall 2024
ENGR 498A	Senior Design/Capstone[g]	1	43	Fall 2024
PHYS 240	Intro. Electricity & Magnetism	3	203	Spring 2024
PHYS 381	Methods in Exp. Physics I[f]	2	50	Spring 2024

[e] Full teaching record and recent student course evaluations available upon request.

[f] Advanced Physics Laboratory (PHYS 381/382), ACT/HEBUT. Developed full-year experimental physics lab curriculum, advising and guidance for the purchasing of +$14,000 USD (+¥100,000 RMB) in new equipment, and coordinated instruction for 100+ undergraduate students (2024–2025).

[g] Senior Design/Capstone (ENGR 498A), ACT/HEBUT. Co-developed a one-semester senior design and career preparation curriculum, and coordinated instruction for 40+ undergraduate students (2024).

- **Adjunct Courses at PCC (Physics & Astronomy Dept., as Instructor-of-Record):** Intro. Physics I/II (2020, 2021, 2023), The Solar System (2020–2023), Intro. Electricity & Magnetism (2022)
- **TA Courses at UA (Dept. of Physics, Dept. of Chemistry & Biochemistry):** Intro. to Scientific Computing (2017), Intro. Electricity & Magnetism (2017), Methods in Exp. Physics I/II (2018, 2019), Intro. Mechanics I/II Lab (2020), Intro. Physics I/II Lab (2020), General Chemistry I(Honors)/II Lab (2019, 2021–2023)

Academic Service & Associations

Institutional Committees & Appointments

- Member, Academic Program Committee, School of Physics, GT (2026)
- Member, Undergraduate Advising and Assessment Committee, School of Physics, GT (2026)
- Associate, Designated Campus Colleague (DCC), Department of Physics, UA (2025–present)
- Member, Faculty Search Committee(s), Department of Physics, UA (2024, 2025)

Professional Service & Membership

- Mentor, Wildcat Mentor Society, UA (2025–present)
- Fellow, Career Mentoring Fellows Program, APS (2025–present)
- Organizer, Undergraduate Journal Club, ACT, HEBUT (2025)
- Member, American Physical Society (APS) (2025–present)
- Member, Cross College Faculty Forum (CCFF), ACT, HEBUT (2024–2025)
- Reviewer for *Physical Review Letters*, *Physical Review D*, *Physical Review Research*, *European Physical Journal Plus*, *Modern Physics Letters A*, *International Journal of Modern Physics A*, and *ICPMS 2025*.

Public Outreach

1. **Steinmetz, A.** (2024, November 7). Proving that SU(2) is compact (and other group theory bits) Link
2. **Steinmetz, A.** (2024, October 17). Einstein's mass-energy and kinetic energy. Link
3. **Steinmetz, A.** (2024, October 16). Can we ever detect the graviton? Link

External & Institutional Press

1. World Scientific Publishing. (2025, January 9). The International Journal of Modern Physics A (IJMPA) Celebrates 40 Years of Excellence, *LinkedIn*. Link.
2. Hebei University of Technology. (2024, November 20). Cross-College Faculty Forum between Arizona Tech and Hebei University of Technology successfully held [translated]. *Hebei University of Technology News*. Link.
3. Kong, X. (2024, March 20). Professor Andrew Steinmetz of the University of Arizona Visited the Physics Demonstration and Exploration Laboratory [translated]. *Physics Experiments at HEBUT, Hebei University of Technology*. Link.
4. University of Arizona, Department of Physics. (2024, January 26). Announcing Department of Physics new Faculty Member Prof. Andrew Steinmetz, *UA Science Physics*. Link.

5. University of Arizona, Department of Physics. (2023, July 25). International Symposium on 'Particles and Plasmas' and 'Strong Fields', *UA Science Physics*. Link.
6. Springer. (2018, January 29). Relativity matters: Two opposing views of the magnetic force reconciled, *Phys.org*. Phys.org, EPJ C Highlight, Springer Press, ScienceDaily; also featured in EuroPhysicsNews, EurekAlert!, Science Newsline, Sky Nightly, Space Daily.