

J. Andrew Spencer, PhD

Computational physicist and independent consultant

orcid.org/0000-0002-9489-6279

linkedin.com/in/andrewspencerphd

researchgate.net/profile/Joseph-Spencer-4

Profile

Computational physicist with research in numerical methods for particle collisions, kinetic closures and radio-frequency plasma waves. Experience spans research software, parallel computing, teaching, and custom tools for creative projects. Currently developing a practice in scriptwriting, social content and AI-assisted creative production.

Education

PhD, Physics, Utah State University

2012

Computational plasma physics. Dissertation: A 2D finite element/1D Fourier solution to the Fokker-Planck equation. Major professor: Eric D. Held.

BS, Mathematics, Utah State University

Magna cum laude.

BS, Physics, Utah State University

Summa cum laude.

Experience

Independent consultant, creative studio (client confidential)

2025–present

- Build web applications that automate an animation production workflow, and an AI-powered interactive fiction game.
- Built a pipeline for collecting and processing participant-submitted media for a large collaborative art project.
- Assisted with launching an online merchandise storefront.

Independent consultant, FAR-TECH, Inc.

2025–2026

- Worked with V. Svidzinski, J. S. Kim, L. Zhao and S. Galkin to publish an open-access Physics of Plasmas article benchmarking a novel full-wave code for tokamaks.

Research scientist, Utah State University

2017–2025

- Developed kinetic closures in the NIMROD code with Eric Held and collaborators, improving plasma transport modeling and equilibrium stability analysis.
- Co-PI, Center for Edge of Tokamak Optimization (CETOP), a multi-institution SciDAC project (2023–2027).
- Developed a Fortran–C++ interface to GPU-enabled linear algebra packages for preconditioning in NIMROD.
- Implemented a fully implicit simultaneous advance of hybrid fluid/kinetic equations, enabling kinetic simulations over millisecond time scales.
- Improved the accuracy of the linearized Coulomb collision operator in NIMROD.
- Presented at SciDAC and NIMROD team meetings and at APS Division of Plasma Physics and Sherwood Fusion Theory conferences; PI-proxy for a NERSC group project.

Staff scientist, FAR-TECH, Inc.

2012–2017

- Contributed to ECR and electron-beam ion source projects and investigated multiple-frequency ECR heating.
- Developed full-wave codes for ECR ion sources and tokamaks with Vladimir Svidzinski.
- Developed and maintained the CHASER and EBIS-PIC codes and graphical interfaces.
- Led enhancements to SIMPL, including a drift-kinetic ECR heating model and adaptive particle management.
- Account manager for company projects at NERSC.

Graduate research assistant, Utah State University

2010–2012

- Developed an algorithm for solving the 3D Fokker–Planck equation within NIMROD.
-

Teaching and mentoring

- Instructor, Methods of Theoretical Physics II (PHYS 5350): spring 2020, 2022 and 2024.
 - Instructor, General Physics for Science and Engineering II (PHYS 2220): summers 2009, 2018 and 2019; laboratory instructor 2003 and 2004.
 - Graduate teaching assistant, 2007–2011: recitations, laboratories and physics learning-center tutoring.
 - Designed computational assignments in Google Colab, including Fortran exercises, to remove setup barriers for students.
 - Mentored a senior research project on GPU-enabled linear algebra for NIMROD, including the 2021 Oak Ridge Leadership Computing Facility GPU Hackathon and the spring 2022 Student Research Symposium.
 - Mentored graduate researchers and served on graduate supervisory committees.
-

Technical expertise

Languages: Fortran, Python, C++. **Parallel computing:** MPI, OpenMP, GPU. **Software:** NIMROD, PETSc, SuperLU, MUMPS, Slurm, Spack, Autotools, Make, LaTeX, Jupyter, Google Colab.

Physics: plasma fluid and kinetic equations, drift-kinetic equation, collision operators, linear wave equations.

Numerical methods: particle-in-cell, finite element, meshless finite difference, velocity moment expansions, Fourier and Legendre expansions, implicit schemes.

Service

- Graduate Tracking Committee, USU Physics Department, 2023–2025.
 - Evaluator, Student Research Symposium, spring 2023.
-

Publications

1. **J. A. Spencer**, V. A. Svidzinski, J. S. Kim, L. Zhao, S. A. Galkin, “An implementation of a high-order generalized finite difference method for solving the time-harmonic cold plasma wave equation in toroidal geometry,” *Physics of Plasmas* 32, 063902 (2025).
2. J. R. Jepson, C. C. Hegna, E. D. Held, C. R. Sovinec, **J. A. Spencer**, E. C. Howell, “An analysis and successful benchmarking of the Chapman-Enskog-like (CEL) continuum kinetic closure approach algorithm in NIMROD,” *Computer Physics Communications* 306, 109382 (2025).
3. J.-Y. Ji, E. D. Held, **J. A. Spencer**, Y.-S. Na, “Moment-Fourier approach to ion parallel fluid closures and transport for a toroidally confined plasma,” *Plasma Physics and Controlled Fusion* 65, 035018 (2023).

4. **J. A. Spencer**, B. Adair, E. D. Held, J.-Y. Ji, J. R. Jepson, “Accurate numerical, integral methods for computing drift-kinetic Trubnikov-Rosenbluth potentials,” *Journal of Computational Physics* 450, 110862 (2022).
 5. J. R. Jepson, C. C. Hegna, E. D. Held, **J. A. Spencer**, B. C. Lyons, “Benchmarking NIMROD continuum kinetic formulations through the steady-state poloidal flow,” *Physics of Plasmas* 28, 082503 (2021).
 6. J.-Y. Ji, B. F. Edwards, **J. A. Spencer**, E. D. Held, “Potential, field, and interactions of multipole spheres: Coated spherical magnets,” *Journal of Magnetism and Magnetic Materials* 529, 167861 (2021).
 7. J.-Y. Ji, **J. A. Spencer**, E. D. Held, “Exact irreducible moments of the Landau collision operator in the random-velocity moment expansion,” *Plasma Research Express* 2 (2020).
 8. V. A. Svidzinski, J.-S. Kim, L. Zhao, S. A. Galkin, **J. A. Spencer**, “Hybrid iterative approach for simulation of radio-frequency fields in plasma,” *Physics of Plasmas* 25, 082509 (2018).
 9. V. A. Svidzinski, J. S. Kim, **J. A. Spencer**, L. Zhao, S. A. Galkin, E. G. Evstatiev, “Hot plasma dielectric response to radio-frequency fields in inhomogeneous magnetic field,” *Physics of Plasmas* 23, 112101 (2016).
 10. J. S. Kim, L. Zhao, **J. A. Spencer**, E. G. Evstatiev, “Electron-beam-ion-source (EBIS) modeling progress at FAR-TECH, Inc.,” *AIP Conference Proceedings* 1640, 44 (2015).
 11. **J. A. Spencer**, C. Kim, J.-S. Kim, E. G. Evstatiev, V. Svidzinski, B. Cluggish, “Modeling multiple-frequency electron cyclotron resonance heating,” *Review of Scientific Instruments* 85, 02A914 (2014).
 12. E. G. Evstatiev, V. A. Svidzinski, **J. A. Spencer**, J. S. Kim, “Analytical and numerical modeling of radio frequency electron cyclotron resonance power absorption within the cold plasma picture,” *Review of Scientific Instruments* 85, 02A503 (2014).
 13. **J. A. Spencer**, J.-Y. Ji, E. D. Held, “A finite element/Fourier treatment of the Fokker-Planck equation,” *Journal of Computational Physics* 231, 6192 (2012).
 14. **J. A. Spencer**, “A 2D finite element/1D Fourier solution to the Fokker-Planck equation,” PhD dissertation, Utah State University (2012).
 15. **J. A. Spencer**, J. T. Wheeler, “The existence of time,” *International Journal of Geometric Methods in Modern Physics* 8, 273–301 (2011).
-