CURRICULUM VITAE

Charles Cheung
Postdoctoral Research Associate

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Research Interests and Skills

- Development of high-precision methodologies and codes for relativistic atomic structure calculations
- Application of high-performance computing to large-scale atomic physics calculations
- Search for physics beyond the Standard Model
- Theoretical atomic clock research
- Deep learning algorithms for large atomic structure calculations
- Modernization of legacy codes and applications

Education

- Ph.D. Physics, Department of Physics and Astronomy, University of Delaware (2016 – 2021).
  Thesis: *Development of a relativistic atomic theory for accurate treatment of complex correlations.*
  Ph.D. Advisor: Marianna Safronova.
- B.S. Physics, Department of Physics and Astronomy, University of Delaware (2011 – 2016)
- B.A. Foreign Languages and Literature, Department of Languages, Literatures and Cultures, University of Delaware (2011 – 2016)

Professional Positions

Department of Physics and Astronomy
University of Delaware

- Postdoctoral Research Associate, (Feb. 2021 – current)
- Graduate Research Assistant, (Feb. 2018 – Feb. 2021)
- Instructor, (Jul. 2018 – Aug. 2018)
- Graduate Teaching Assistant, (2016 – 2018)
- Undergraduate Research Assistant, (2015 – 2016)

Teaching

I was a graduate teaching assistant for undergraduate courses: PHYS201: Introductory Physics I, PHYS202: Introductory Physics II, PHYS207: Fundamentals of Physics I, and PHYS208: Fundamentals of Physics II. I was also an instructor for an undergraduate course: PHYS202: Introductory Physics II.

Service

- Poster Session Chair, 2023 UD DARWIN Symposium organization Committee (2022 – 2023)
- Early-access tester of the UD DARWIN cluster (2020 – 2021)
- Early-access tester of the UD Caviness community cluster (2019)
- Reviewer for the Multidisciplinary Digital Publishing Institute (2022 – present)

Professional Development

- INTERSECT Bootcamp '24, Princeton University, New Jersey, July 2024. Intensive hands-on workshop focusing on practices that will help research software developers improve the quality, reproducibility, and sustainability of their software.
- Argonne Training Program on Extreme-Scale Computing, St. Charles, Illinois, August 2019. Competitive training program designed to teach key skills and tools needed to efficiently use leading-edge supercomputers.
- International HPC Summer School on HPC Challenges in Computational Sciences, Kobe, Japan, July 2019. Competitive program to familiarize the best students in computational sciences with major state-of-the-art aspects of HPC.
- 3rd RIKEN R-CCS HPC Youth Workshop, Kobe, Japan, February 2019. Competitive workshop and symposium to give students and young researchers in computational science and technology an opportunity to hone communication and presentation skills in an international setting.

Professional Organizations

- The Division of Atomic, Molecular and Optical Physics of the American Physical Society
- The Topical Group on Precision Measurement & Fundamental Constants of the American Physical Society

Publications

17. ***High-Precision Transition Energy Measurements of Neonlike Fe XVII Ions***, Chintan Shah, Moto Togawa, Marc Botz, Jonas Danisch, Joschka J. Goes, Sonja Bernitt, Marleen Maxton, Kai Köbnick, Jen Buck, Jörn Seltmann, Moritz Hoesch, Ming Feng Gu, F. Scott Porter, Thomas Pfeifer, Maurice A. Leutenegger, Charles Cheung, Marianna S. Safronova, José R. Crespo López-Urrutia, arXiv:2401.08395, in press, ApJ (2024).
16. ***Lifetime-Limited Linewidth Measurements of the 3C and 3D Soft X-ray Transitions in Ni XIX***, Chintan Shah, Steffen Kühn, Sonja Bernitt, René Steinbrügge, Moto Togawa, Lukas Berger, Jens Buck, Moritz Hoesch, Jörn Seltmann, Mikhail G. Kozlov, Sergey G. Porsev, Ming Feng Gu, F. Scott Porter, Thomas Pfeifer, Maurice A. Leutenegger, Charles Cheung, Marianna S. Safronova, and José R. Crespo López-Urrutia, Phys. Rev. A 109, 063108 (2024).
15. ***State-Insensitive Trapping of Alkaline-Earth Atoms in a Nanofiber-Based Optical Dipole Trap***, K. Ton, G. Kestler, D. Filin, C. Cheung, P. Schneeweiss, T. Hoinkes, J. Volz, M. S. Safronova, A. Rauschenbeutel, and J. T. Barreiro, PRX Quantum 4, 040308 (2023).
14. ***Calculations of multipole transitions in Sn II for kilonova analysis***, Andrey I. Bondarev, James Gillanders, Charles Cheung, Marianna S. Safronova, and Stephan Fritzsche, Eur. Phys. J. D 77, 126 (2023).
13. ***Optical telecommunications-band clock based on neutral titanium atoms***, Scott Eustice, Dmytro Filin, Jackson Schrott, Sergey Porsev, Charles Cheung, Diego Novoa, Dan M. Stamper-Kurn, and Marianna S. Safronova, Phys. Rev. A 107, L051102 (2023).

12. ***Calculation of energies and hyperfine structure constants of $^{233}U^{+}$ and ^{233}U***, S. G. Porsev, C. Cheung, and M. S. Safronova, Phys. Rev. A 106, 042810 (2022).

11. ***Prospects of a thousand-ion Sn^{2+} Coulomb-crystal clock with sub-10^{-19} inaccuracy***, David R. Leibrandt, Sergey G. Porsev, Charles Cheung, and Marianna S. Safronova, arXiv:2205.15484, submitted to Nature Communications (2022).

10. ***New Measurement Resolves Key Astrophysical Fe XVII Oscillator Strength Problem***, Steffen Kühn, Charles Cheung, Natalia S. Oreshkina, René Steinbrügge, Moto Togawa, Sonja Bernitt, Lukas Berger, Jens Buck, Moritz Hoesch, Jörn Seltmann, Florian Trinter, Christoph H. Keitel, Mikhail G. Kozlov, Sergey G. Porsev, Ming Feng Gu, F. Scott Porter, Thomas Pfeifer, Maurice A. Leutenegger, Zoltán Harman, Marianna S. Safronova, José R. Crespo López-Urrutia, Chintan Shah, Phys. Rev. Lett. 129, 245001 (2022).

9. ***Laser spectroscopy of the $y\ ^7P^o_J$ states of Cr I***, E. B. Norrgard, D. S. Barker, S. P. Eckel, S. G. Porsev, C. Cheung, M. G. Kozlov, I. I. Tupitsyn, and M. S. Safronova, Phys. Rev. A 105, 032812 (2022).

8. ***Low-lying energy levels of $^{229}Th^{35+}$ and the electronic bridge process***, S. G. Porsev, C. Cheung and M. S. Safronova, Quantum Science and Technology 6, 034014 (2021).

7. ***Scalable Codes for Precision Calculations of Properties of Complex Atomic Systems***, Charles Cheung, Marianna Safronova and Sergey Porsev, Symmetry 13(4), 621 (2021).

6. ***Observation of an electric quadrupole transition in a negative ion: Experiment and Theory***, C.W. Walter, S. E. Spielman, R. Ponce, N. D. Gibson, J. N. Yukich, C. Cheung, M. S. Safronova, Phys. Rev. Lett. 126, 083001 (2021).

5. ***Predicting quasibound states of negative ions: La^- as a test case***, M. S. Safronova, C. Cheung, M. G. Kozlov, S.E. Spielman, N. D. Gibson, C. W. Walter, Phys. Rev. A 103, 022819 (2021).

4. ***Detection of the Lowest-Lying Odd-Parity Atomic Levels in Actinium***, Ke Zhang, Dominik Studer, Felix Weber, Vadim M. Gadelshin, Nina Kneip, Sebastian Raeder, Dmitry Budker, Klaus Wendt, Tom Kieck, Sergey G. Porsev, Charles Cheung, Marianna S. Safronova, Mikhail G. Kozlov, Phys. Rev. Lett. 125, 073001 (2020).

3. ***Optical clocks based on the Cf^{15+} and Cf^{17+} ions***, S. G. Porsev, U. I. Safronova, M. S. Safronova, P. O. Schmidt, A. I. Bondarev, M. G. Kozlov, I. I. Tupitsyn, C. Cheung, Phys. Rev. A 102, 012802 (2020).

2. ***High-resolution photo-excitation measurements exacerbate the long-standing Fe XVII emission problem***, Steffen Kühn, Chintan Shah, José R. Crespo López-Urrutia, Keisuke Fujii, René Steinbrügge, Jakob Stierhof, Moto Togawa, Zoltán Harman, Natalia S. Oreshkina, Charles Cheung, Mikhail G. Kozlov, Sergey G. Porsev, Marianna S. Safronova, Julian C. Berengut, Michael Rosner, Matthias Bissinger, Ralf Ballhausen, Natalie Hell, SungNam Park, Moses Chung, Moritz Hoesch, Jörn Seltmann, Andrey S. Surzhykov, Vladimir A. Yerokhin, Jörn Wilms, F. Scott Porter, Thomas Stöhlker, Christoph H. Keitel, Thomas Pfeifer, Gregory V. Brown, Maurice A. Leutenegger, Sven Bernitt, Phys. Rev. Lett. 124, 225001 (2020).

1. ***Accurate prediction of clock transitions in a highly charged ion with complex electronic structure***, C. Cheung, M. S. Safronova, S. G. Porsev, M. G. Kozlov, I. I. Tupitsyn, A. I. Bondarev, Phys. Rev. Lett. 124, 163001 (2020).

Talks and Posters

- **Talk**. *High-Precision Transition Energy Measurements of Neonlike Fe XVII Ions.* American Physics Society Division of Atomic, Molecular and Optical Physics, Fort Worth, TX, June 2024.

- **Poster**. *Community Portal for High-Precision Atomic Physics Data and Computation.* NSF Cyberinfrastructure for Sustained Scientific Innovation Principal Investor Meeting, Houston, TX, Sept 2023.

- **Talk**. *Searching for new physics with atomic clocks.* MIAPbP workshop for particle & AMO physicists discussing quantum sensors and new physics, Garching, Germany, Aug-Sept 2023.

- **Poster**. *Machine Learning Configuration Interaction.* The International Conference on Laser Spectroscopy, Estes Park, CO, June 2023.
- **Poster**. *Machine Learning Configuration Interaction.* Gordon Research Seminar and Conference, Newport, RI, June 2023.
- **Talk**. *Machine learning approach to configuration interaction.* American Physics Society Division of Atomic, Molecular and Optical Physics, Spokane, WA, June 2023.
- **Talk**. *Developing a suite of scalable atomic codes.* A Workshop on Atomic Data, Heidelberg, Germany, October 2022.
- **Talk**. *Further developments in a parallel configuration interaction code for applications on complex systems.* American Physics Society Division of Atomic, Molecular and Optical Physics, Orlando, FL, June 2022.
- **Talk**. *High precision atomic physics code pCI@UD.* DARWIN Computing Symposium, University of Delaware, Newark, DE, March 2022.
- **Talk**. *Accurate prediction of clock transitions in a highly charged ion with complex electronic structure.* International Symposium on Molecular Spectroscopy, Online, June 2021.
- **Talk**. *Development of parallel relativistic atomic codes for accurate treatment of complex systems.* American Physics Society Division of Atomic, Molecular and Optical Physics Virtual Meeting, Online, June 2021.
- **Poster**. *Scalable codes for precision calculations of properties of complex atomic systems.* DARWIN Computing Symposium, University of Delaware, Online, February 2021.
- **Talk**. *Accurate prediction of clock transitions in a highly charged ion with complex electronic structure.* American Physics Society Division of Atomic, Molecular and Optical Physics Virtual Meeting, Online, June 2020.
- **Poster**. *Calculation of the $3C/3D$ line intensity ratio in Fe XVII.* American Physics Society Division of Atomic, Molecular and Optical Physics Virtual Meeting, Online, June 2020.
- **Poster**. *Development of a new community portal for high-precision atomic physics data and computation.* DARWIN Computing Symposium, University of Delaware, Newark, DE, February 2020.
- **Poster**. *Towards large-scale configuration interaction calculations for atoms and ions with complex correlations.* 2019 HPC Poster Symposium, University of Delaware, Newark, DE, July 2019.
- **Poster**. *Development of high precision relativistic atomic structure code for atoms and ions with complex correlations.* International HPC Summer School on HPC Challenges in Computational Sciences, Kobe, Japan, July 2019.
- **Poster**. *Towards accurate prediction of clock transitions in highly charged ions with complex electronic structure.* Gordon Research Seminar and Conference, Newport, RI, June 2019.
- **Talk**. *Towards accurate prediction of clock transitions in highly charged ions with complex electronic structure.* American Physics Society Division of Atomic, Molecular and Optical Physics, Milwaukee, WI, May 2019.
- **Poster**. *Development of next-generation relativistic atomic code for treatment of many-electron systems.* The 1st R-CCS International Symposium, Kobe, Japan, February 2019.
- **Poster**. *CI+PT: A CI+MBPT extension combining configuration interaction and Møller-Plesset perturbation theory for valence space.* Supercomputing Conference 2018, Dallas, TX, November 2018.
- **Poster**. *CI+PT: A CI+MBPT extension combining configuration interaction and Møller-Plesset perturbation theory for valence space.* 2018 HPC Poster Symposium, University of Delaware, Newark, DE, June 2018.

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