

# Jim Schroeder, Ph.D.

---

CONTACT INFORMATION	Wheaton College Department of Physics & Engineering 501 College Avenue Wheaton, IL 60187	<i>E-mail:</i> jim.schroeder@wheaton.edu
RESEARCH INTERESTS	Laboratory plasma astrophysics, plasma waves and antennas, space and astrophysical plasmas, measurements of particle distributions in plasmas, kinetic plasma physics	
EDUCATION	<b>Ph.D. Physics, 2017</b> University of Iowa, Iowa City, IA <i>Thesis:</i> Exploring the Alfvén-Wave Acceleration of Auroral Electrons in the Laboratory  <b>B.S. Physics; Summa Cum Laude, 2009</b> Wheaton College, Wheaton, IL	
APPOINTMENTS	2018-Present	Assistant Professor of Physics Wheaton College, Wheaton IL
	2018-Present	Assistant Research Scientist University of Iowa, Iowa City IA
	2017-2018	Postdoctoral Research Scholar University of Iowa, Iowa City IA
	Summer 2017	Adjunct Instructor of Physics University of Iowa, Iowa City IA
	2011-2017	Graduate Fellow University of Iowa, Iowa City IA
	2009-2011	High School Math & Science Teacher Chicago Hope Academy, Chicago IL
MEMBERSHIPS	2012-Present	American Physical Society Division of Plasma Physics, Topical Group in Plasma Astrophysics
	2017-Present	American Astronomical Society Laboratory Astrophysics Division
TEACHING	<b>Wheaton College</b>  PHYS 231 Introductory Physics 1 & Lab: Kinematics, dynamics, conservation laws, and thermodynamics. Making and evaluating scientific arguments. Fall 2018 and 2019.  PHYS 232 Introductory Physics 2 & Lab: Oscillations, waves, ray and wave theories of light, and electricity and magnetism. Spring 2020.  PHYS 331 Spacetime & Quanta: Special relativity, quantum mechanics, and applications of modern physics. Spring 2019 and 2020.  PHYS 342 Electromagnetic Theory: Electrostatics, magnetostatics, linear materials, Maxwell's equations, and electromagnetic waves. Fall 2018.  PHYS 353L Introductory Optics Lab: Interference, diffraction, and optical instruments. Spring 2019.	

PHYS 362 Plasma Physics: Single particle motion, magnetohydrodynamics, plasma waves, space and research applications. Spring 2019.

PHYS 495 Independent Study: Supervised student research on helicon plasma sources. Fall 2020.

### University of Iowa

PHYS 1511 College Physics 1: Mechanics, motion, sound, heat, and thermodynamics for pre-medical, pre-dental, and other students needing a physics course without calculus. Primary instructor. Summer 2017.

Graduate Certificate in College Teaching: Took two courses in classroom theory and practice. Practica in undergraduate physics recitation and lecture. 2014-2017.

Hawkeyes on Science: Community outreach events, interactive physics demonstration shows. 2013-2014.

### Chicago Hope Academy High School

Physics and Algebra: College preparation for socioeconomically and racially diverse student population. 2009-2011.

### PUBLICATIONS

**Schroeder, J. W. R.**, Howes, G. G., Kletzing, C. A., Skiff, F., Carter, T. A., Vincena, S., and Dorfman, S. Laboratory measurements of the physics of auroral electron acceleration by Alfvén waves, *Nature Communications* **12**: 3103 (2021).

**Schroeder, J. W. R.**, Skiff, F., Howes, G. G., Kletzing, C. A., Carter, T. A., and Dorfman, S. Linear theory and measurements of electron oscillations in an inertial Alfvén wave, *Physics of Plasmas* **24**: 032902 (2017).

**Schroeder, J. W. R.**, Skiff, F., Kletzing, C. A., Howes, G. G., Carter, T. A., and Dorfman, S. Direct measurement of electron sloshing of an inertial Alfvén wave, *Geophysical Research Letters* **43**: 4701-4707 (2016).

Drake, D. J., Howes, G. G., Rhudy, J. D., Terry, S. K., Carter, T. A., Kletzing, C. A., **Schroeder, J. W. R.**, and Skiff, F. Measurements of the nonlinear beat wave produced by the interaction of counterpropagating Alfvén waves, *Physics of Plasmas* **23**: 022305 (2016).

**Schroeder, J. W. R.**, Skiff, F., Howes, G. G., Kletzing, C. A., Carter, T. A., and Dorfman, S. Alfvénic oscillations of the electron distribution function: Linear theory and experimental measurements, *American Institute of Physics Conference Series* **1689**: 030001 (2015).

Drake, D. J., **Schroeder, J. W. R.**, Shanken, B. C., Howes, G. G., Skiff, F., Kletzing, C. A., Carter, T. A., and Dorfman, S. D. Analysis of magnetic fields in inertial Alfvén wave collisions, *IEEE Transactions of Plasma Science* **42**: 10 (2014).

Howes, G. G., Nielson, K. D., Drake, D. J., **Schroeder, J. W. R.**, Skiff, F., Kletzing, C. A., and Carter, T. A. Alfvén Wave Collisions, The Fundamental Building Block of Plasma Turbulence III: Theory for Experimental Design, *Physics of Plasmas* **20**: 072304 (2013).

Drake, D. J., **Schroeder, J. W. R.**, Howes, G. G., Kletzing, C. A., Skiff, F., Carter, T. A., and Auerbach, D. W. Alfvén Wave Collisions, The Fundamental Building Block of Plasma Turbulence IV: Laboratory Experiment, *Physics of Plasmas* **20**: 072901 (2013).

HONORS AND AWARDS	2018	National Research Council Postdoctoral Fellowship - Naval Research Laboratory - Declined to accept faculty position at Wheaton College
	2015	Pfeiffer Family Space Physics Scholarship - University of Iowa
	2013	Graduate Research Fellowship - National Science Foundation (NSF)
	2013	NASA Earth and Space Science Fellowship - Declined to accept NSF fellowship
	2013	Best Student Presentation - International Workshop on the Interrelationship Between Plasma Experiments in the Laboratory and in Space (IPELS) - Nagano, Japan.
	2011	Presidential Fellowship - University of Iowa
	2009	Scholastic Honor Society - Wheaton College
	2008	National Undergraduate Fellowship - Summer Research at the Princeton Plasma Physics Laboratory (PPPL) - U.S. Department of Energy
	2008	Outstanding Undergraduate Poster Award - American Physical Society Division of Plasma Physics - Dallas, Texas
	2008	Physics Merit Scholarship - Wheaton College

MENTORING Austin Richardson: Summer research building vacuum system for a new plasma physics experiment at Wheaton. Summer 2019.

Walker Kennedy: Independent study reviewing literature and performing calculations to design a helicon plasma source for a new plasma physics experiment at Wheaton. Fall 2019.

Jonathan Barrett: Studying benchmark comparison data from wave absorption and energy analyzer measurements of the electron distribution in the Space Physics Simulation Chamber. 2021.

FUNDING *A feasibility study to explore establishing a mentoring program in STEM for underrepresented students.* Wheaton College Alumni Faculty Development Grant. \$5,200 total funding.

*Supporting Structures: Innovative Collaborations to Enhance STEM Research at CCCU Member Institutions.* Collaborative proposal in which I am one of three Wheaton College faculty members granted a pre-tenure research sabbatical. \$167,952 total funding and \$25,784 in funding for research sabbatical.

Wheaton College Aldeen Grant. Four-hour course release funded for collaborative research with the Naval Research Laboratory. Fall 2021. \$5,500 total funding.

*Investigating Magnetospheric Whistler-Mode Chorus Features Using SPSC Laboratory Experiments.* NASA Heliophysics Technology and Instrument Development. Co-investigator, 2020-2022. \$972,000 total funding, sub-contract of \$121,000.

Wheaton College Faculty Travel Grant. Funding to attend American Physical Society Division of Plasma Physics. October 2019. \$1,500 total funding.

PRESENTATIONS June 2021 American Astronomical Society, Laboratory Astrophysics Division Online  
Contributed Talk - *The Alfvén wave acceleration of auroral electrons: laboratory measurement, theory, and simulation.*

September 2020 Princeton University Heliophysics Seminar  
Online  
**Invited Seminar** - *Studying the Alfvén wave acceleration of auroral electrons in the laboratory using field-particle correlations*

October 2019 American Physical Society - Division of Plasma Physics - Student Day  
Fort Lauderdale, FL  
**Invited Tutorial** - *Alfvén wave turbulence and wave particle interactions*

October 2019 American Physical Society - Division of Plasma Physics  
Fort Lauderdale, FL  
Contributed Talk - *A comparison of electron velocity distribution measurements in the SPSC*

March 2019 NSF/DoE review of UCLA's user facility the Large Plasma Device  
Online session highlighting user research  
**Invited Talk** - *Progress toward laboratory measurements of the acceleration of auroral electrons by Alfvén waves*

November 2018 American Physical Society - Division of Plasma Physics  
Portland, OR  
Contributed Talk - *Progress toward laboratory measurements of the acceleration of auroral electrons by Alfvén waves*

June 2018 International Congress of Plasma Physics  
Vancouver, BC  
**Invited Talk** - *Using field-particle correlations to study wave-particle interactions in the LAPD*

January 2018 International Union of Radio Science - Commission H  
Boulder, CO  
**Invited Talk** - *A study of auroral electron acceleration in the LAPD*

October 2017 American Physical Society - Division of Plasma Physics  
Milwaukee, WI  
Contributed Talk - *Using field-particle correlations to study auroral electron acceleration in the LAPD*

October 2017 American Physical Society - Division of Plasma Physics  
Milwaukee, WI  
Poster Presentation - *Exploring the Alfvén-wave acceleration of auroral electrons in the laboratory*

October 2017 Naval Research Laboratory Seminar  
Washington, DC  
**Invited Seminar** - *Exploring the Alfvén-wave acceleration of auroral electrons in the laboratory*

June 2017 International Workshop on the Interrelationship between Plasma Experiments in the Laboratory and in Space (IPELS)  
San Diego, CA  
**Invited Talk** - *Measurement of electron acceleration by inertial Alfvén waves in the LAPD*

February 2017 Grinnell College Physics Seminar  
Grinnell, IA  
**Invited Seminar** - *Clear with a chance of electron precipitation*

January 2017 International Union of Radio Science - Commission H  
Boulder, CO  
**Invited Talk** - *Electron oscillations associated with inertial Alfvén waves*

October 2016 American Physical Society- Division of Plasma Physics  
San Jose, CA  
Poster Presentation - *Progress towards a laboratory test of Alfvénic electron acceleration*

- May 2016 University of Iowa - Plasma Physics Seminar  
Iowa City, IA  
Departmental Seminar - *Laboratory investigation of Alfvén wave-particle interactions in the magnetosphere*
- November 2015 American Physical Society - Division of Plasma Physics  
Savannah, GA  
**Invited Talk** - *Laboratory measurements of linear electron acceleration by inertial Alfvén waves*
- April 2015 Radio Frequency Power in Plasmas  
Lake Arrowhead, CA  
**Invited Talk** - *Experimental measurements of the electron distribution function using whistler wave absorption*
- April 2015 École de Physique des Houches - Turbulence, Magnetic Fields and Self Organization in Laboratory and Astrophysical Plasmas  
Les Houches, France  
Poster - *Kinetic signatures of inertial Alfvén waves: theory and laboratory experiments*
- October 2014 American Physical Society - Division of Plasma Physics  
New Orleans, LA  
Poster - *Measurements of the linear kinetic plasma response to inertial Alfvén waves*
- February 2014 University of Iowa - Plasma Physics Seminar  
Iowa City, IA  
Talk - *Study of auroral electron acceleration in the laboratory*
- November 2013 American Physical Society - Division of Plasma Physics  
Denver, CO  
Poster - *Study of auroral electron acceleration in the laboratory*
- July 2013 International Workshop on the Interrelationship Between Plasma Experiments in the Laboratory and in Space (IPELS)  
Nagano, Japan  
Talk - *Analysis of magnetic fields in Alfvén wave collisions*
- November 2012 American Physical Society - Division of Plasma Physics  
Providence, RI  
Poster - *Experimental measurement of the nonlinear interaction between counterpropagating Alfvén waves in the LAPD*
- November 2008 American Physical Society - Division of Plasma Physics  
Dallas, TX  
Poster - *Study of effects of external drive on MRX reconnection*

#### MEDIA

- June 2021 *Auroras form when electrons from space ride waves in Earth's magnetic field*, Science News ([article](#))
- June 2021 *The northern lights are caused by electrons hurtling toward Earth—and now we know how they get there*, The Academic Times ([article](#))
- June 2021 *The mystery behind what powers the Northern Lights has now been solved*, MSN ([article](#))
- June 2021 *Electrons surfing on Alfvén waves*, Nature Astronomy Community ([blog](#))
- June 2021 *Making heaven in a lab: Scientists solve aurora mystery*, Daily Maverick, South Africa ([article](#))
- June 2021 *Physicists have finally proven how aurora borealis, northern lights, occur*, KCBS San Francisco ([radio interview](#))
- June 2021 *We finally know what sparks the Northern Lights*, Popular Science ([article](#))

- June 2021 *What Causes The Northern Lights? Scientists Finally Know For Sure*, NPR ([article](#))
- June 2021 *The mysterious origin of the northern lights has been proven*, CNN ([article](#))
- June 2021 *Wheaton Professor Discovers the Force Behind Northern Lights*, Wheaton College press release ([press release](#))
- June 2021 *American Astronomical Society Press Conference*, Press conference presenting measurements showing that Alfvén waves can accelerate auroral electrons ([press conference video](#))
- June 2021 [An extended list of media coverage is available here](#)
- March 2017 *A step toward deciphering auroras*, Physics Today article about experimental results in my thesis ([article](#), [cached version](#))
- April 2016 *Bringing Earth's light show down to earth*, Iowa Now article about my research of auroral physics in the laboratory ([article](#), [cached version](#))