

**Matthew Argall**  
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## EDUCATION

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**University of New Hampshire** Dec. 2014

*Ph.D.: Physics; Cognate in College Teaching*

- Thesis: Estimating proximity to the X-line of asymmetric magnetic reconnection
- Studied pedagogy, cognition, learning, and various other classroom issues
- Designed an online teaching portfolio: <https://mypages.unh.edu/argallmr>

**University of New Hampshire** Aug. 2009

*Master of Science: Physics*

- Studied electromagnetic ion cyclotron waves and ionospheric ducting
- Built a Super-Ultra-Low-Frequency searchcoil magnetometer

**Augsburg College** May 2006

*Bachelor of Science: Physics; Bachelor of Arts: Mathematics*

- Dean's list and Academic All-Conference

## TEACHING EXPERIENCE

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**University of New Hampshire** Summer 2012

*General Physics II*

- Incorporated inquiry-based learning techniques into the curriculum
- Introduced students to basic computer programming with MATLAB

**Universidad de Costa Rica** Spring 2010 - Spring 2011

*General Physics I & II (Labs)*

- Instructed in Spanish to native Spanish speaking students
- Taught up to 6 sessions per semester, each laboratory having 15 students

**Centro Cultural de Idiomas** Aug. 2009 - Aug. 2010

*ESL Instructor*

- Designed lesson plans for students with English abilities ranging from basic to intermediate
- Create visual aids and activities to elicit new knowledge from students

**University of New Hampshire** Fall 2006 - Spring 2007

*Introduction to Physics I & II (Labs)*

- Supervised laboratories for life science majors

## WORK EXPERIENCE

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**University of New Hampshire** Jun. 2017 - Present

*Research Scientist III*

- Analyze particle energization on kinetic scales using data from the Magnetospheric

Multiscale (MMS) mission.

- Plan scientific operations for the Electron Drift Instrument (EDI) on MMS.
- Design a Faraday rotation ammeter to obtain direct measurements of currents in space.
- Provide technical and scientific support and maintain software for data from the EDI and the merged magnetic field (FSM) data product.

**University of New Hampshire**

May 2015 - Jun. 2017

*Research Scientist II*

- Investigate particle motion within the electron diffusion region of magnetic reconnection.
- Design digital filters and implement signal processing techniques for the FSM dataset.
- Participate in calibration and cross-calibration efforts for all instruments within the FIELDS suite on MMS.

**University of New Hampshire**

Jan. 2015 - May 2015

*Postdoctoral Associate*

- Study dipolarization fronts, sub-aural polarization streams, and ion convection with the Van Allen Probes (VAP) and MMS missions.
- Determine in-situ noise floor and signal gain for the search coil and fluxgate magnetometers on MMS.
- Perform Scientist-in-the-Loop (SITL) duties and help develop SITL software.

**University of New Hampshire**

Aug. 2011 - Dec. 2014

*Graduate Student*

- Study electromagnetic waves and electron distribution functions to understand the evolution of asymmetric magnetic reconnection using Cluster spacecraft data
- Investigate harmonic ion cyclotron waves in the radiation belts with the Van Allen Probes
- Use 2D and 3D simulations to enhance understanding of in-situ observations.
- Develop an algorithm to merge fluxgate and searchcoil magnetometer data products into a single dataset containing both the DC and AC fluctuations
- Perform polarization and spectral analysis for proton and helium pickup ions in the solar wind using ACE and Voyager data.

**University of Costa Rica, Centro de Investigaciones Espaciales**

August 2010 - Dec. 2014

*Honorary Investigator*

- Search for correlations between solar helioseismic modes and earth-based ULF waves.
- Implement digital processing and spectral analysis techniques to reveal correlations between magnetic field data recorded on Earth and in space.

**University of Costa Rica, Centro de Investigaciones Espaciales**

Aug. 2009 - Aug. 2010

*Interim Professor*

- Analyzed type III radio bursts associated with solar coronal holes.

**University of New Hampshire**

May 2007 - May 2009

*Graduate Student*

- Built several induction coil magnetometer systems to study ion cyclotron waves.
- Designed and built a unique magnetometer system to measure helioseismic waves.
- Installed 3 magnetometer systems in Svalbard, Norway; 1 in Sonderstromfjord, Greenland;

and 2 at McMurdo Station, Antarctica.

- Analyzed Pi1B waves and ionospheric ducting of ion cyclotron waves.

### **Center for Remote Sensing, Inc.**

Summers 2005, 2006

#### *Undergraduate Intern*

- Adapted an ionospheric tomography model to reconstruct plasma conditions in Earth's magnetosphere using multi-point satellite measurements.

### **Augsburg College, Space Physics Research Lab**

June 2003 - May 2006

#### *Undergraduate Student Researcher*

- Performed conjunction studies of ground magnetometer and the Polar satellite data.
- Expanded the database of ion cyclotron wave events by ground-based observatories.

## **STUDENTS**

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- MacKenzie Phelps, Physics, 2015
- Jason Sisk, ECE, 2018

## **SKILLS & CERTIFICATES**

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- Digital filter design
- Digital signal processing
- Instrument development
- Instrument calibration
- Science operations planning
- Teaching English as a Foreign Language

## **PROFESSIONAL ACHIEVEMENTS & ORGANIZATIONS**

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- NASA's Group Achievement Award
- Organizer of the [MMS special collection](#) of the Journal of Geophysical Research
- American Geophysical Union member

## **ORAL PRESENTATIONS**

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**Argall, M. R.** (2016) Agyrotropy in the electron diffusion region of asymmetric magnetic reconnection, [Fall 2016 Seminar Series](#), Boston University, Boston, MA, 10 Nov.

**Argall, M.**, et al. (2016), Energy dissipation and scaling of the electron diffusion region by MMS during asymmetric reconnection, Abstract [EGU2016-16207](#) presented at the 2016 meeting, EGU, Vienna, Austria., 17-22 Apr.

**Argall, M. R.**, et al. (2013), Two distinct transition regions within the exhaust during asymmetric magnetopause reconnection, Abstract [SM11C-03](#), American Geophysical Union, San Francisco, CA, 8 December 2013.

## PUBLICATIONS

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- Argall, M. R.**, et al. (in-prep), The fluxgate-searchcoil merged (FSM) data product for MMS, *Space Sci. Rev.*
- Argall, M. R.**, et al. (in-prep), Wave-particle interactions in the flux pile-up region of magnetic reconnection, *J. Geophys. Res. Sp. Phys.*
- Argall, M. R.**, et al. (submitted), Electron dynamics within the electron diffusion region of asymmetric reconnection, *J. Geophys. Res. Sp. Phys.*
- Argall, M. R.**, et al. (accepted), Observation of Magnetic Waves Excited by Newborn Interstellar He<sup>+</sup> Observed by the Voyager 2 Spacecraft at 30AU, *Astrophys. Journal*.
- Alm, L., et al. (2017), EDR signatures observed by MMS in the October 16 Event Presented in a 2D Parametric Space, *J. Geophys. Res. Sp. Phys.*, 3262–3276, [doi:10.1002/2016JA023788](https://doi.org/10.1002/2016JA023788).
- Ergun, R. E., et al. (2017), Drift waves, intense parallel electric fields, and turbulence associated with asymmetric magnetic reconnection at the magnetopause, *Geophys. Res. Lett.*, 44(7), 2978–2986, [doi:10.1002/2016GL072493](https://doi.org/10.1002/2016GL072493).
- Oka, M., et al. (2017), Electron Scattering by High-frequency Whistler Waves at Earth's Bow Shock, *Astrophys. J. Lett.*, 842(2), L11.
- Smith, C. W., et al. (2017), Observations of Low-Frequency Magnetic Waves due to Newborn Interstellar Pickup Ions Using ACE, Ulysses, and Voyager Data, *J. Phys. Conf. Ser.*, 900(1), 12018.
- Shuster, J. R., et al. (2017), Hodographic approach for determining spacecraft trajectories through magnetic reconnection diffusion regions, *Geophys. Res. Lett.*, 44(4), 1625–1633, [doi:10.1002/2017GL072570](https://doi.org/10.1002/2017GL072570).
- Wilder, F. D., et al. (2017), The nonlinear behavior of whistler waves at the reconnecting dayside magnetopause as observed by the Magnetospheric Multiscale mission: A case study, *J. Geophys. Res. Sp. Phys.*, 122(5), 5487–5501, [doi:10.1002/2017JA024062](https://doi.org/10.1002/2017JA024062).
- Yoo, J., et al. (2017), Electron heating and energy inventory during asymmetric reconnection in a laboratory plasma, *J. Geophys. Res. Sp. Phys.*, in press, [doi:10.1002/2017JA024152](https://doi.org/10.1002/2017JA024152).
- Burch, J. L., et al. (2016), Electron-scale measurements of magnetic reconnection in space, *Science (80-. )*, 352(6290), [doi:10.1126/science.aaf2939](https://doi.org/10.1126/science.aaf2939).
- Contel, O Le, et al. (2016), Whistler mode waves and Hall fields detected by MMS during a dayside magnetopause crossing, *Geophys. Res. Lett.*, 43(12), 5943–5952, [doi:10.1002/2016GL068968](https://doi.org/10.1002/2016GL068968).

- Eastwood, J. P., et al. (2016), Ion-scale secondary flux ropes generated by magnetopause reconnection as resolved by MMS, *Geophys. Res. Lett.*, 43(10), 4716–4724, [doi:10.1002/2016GL068747](https://doi.org/10.1002/2016GL068747).
- Ergun, R. E., et al. (2016), Magnetospheric Multiscale observations of large-amplitude, parallel, electrostatic waves associated with magnetic reconnection at the magnetopause, *Geophys. Res. Lett.*, 43(11), 5626–5634, [doi:10.1002/2016GL068992](https://doi.org/10.1002/2016GL068992).
- Erickson, P. J., et al. (2016), Multipoint MMS observations of fine-scale SAPS structure in the inner magnetosphere, *Geophys. Res. Lett.*, 43(14), 7294–7300, [doi:10.1002/2016GL069174](https://doi.org/10.1002/2016GL069174).
- Farrugia, C. J., et al. (2016), Magnetospheric Multiscale Mission observations and non-force free modeling of a flux transfer event immersed in a super-Alfvénic flow, *Geophys. Res. Lett.*, 43(12), 6070–6077, [doi:10.1002/2016GL068758](https://doi.org/10.1002/2016GL068758).
- Fisher, M. K., et al. (2016), A survey of magnetic waves excited by newborn interstellar He<sup>+</sup> observed by the ACE spacecraft at 1 AU, *Astrophys. J.*, 830(1), 47.
- Khotyaintsev, Yu. V., et al. (2016), Electron jet of asymmetric reconnection, *Geophys. Res. Lett.*, 43(11), 5571–5580, [doi:10.1002/2016GL069064](https://doi.org/10.1002/2016GL069064).
- Lavraud, B., et al. (2016), Currents and associated electron scattering and bouncing near the diffusion region at Earth's magnetopause, *Geophys. Res. Lett.*, 43(7), 3042–3050, [doi:10.1002/2016GL068359](https://doi.org/10.1002/2016GL068359).
- Matsui, H., et al. (2016), Dipolarization in the inner magnetosphere during a geomagnetic storm on 7 October 2015, *Geophys. Res. Lett.*, 43(18), 9397–9405, [doi:10.1002/2016GL070677](https://doi.org/10.1002/2016GL070677).
- Nakamura, R., et al. (2016), Transient, small-scale field-aligned currents in the plasma sheet boundary layer during storm time substorms, *Geophys. Res. Lett.*, 43(10), 4841–4849, [doi:10.1002/2016GL068768](https://doi.org/10.1002/2016GL068768).
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- Argall, M. R.**, et al. (2015), ACE observations of magnetic waves arising from newborn interstellar pickup helium ions, *Geophys. Res. Lett.*, 42(22), 9617–9623, [doi:10.1002/2015GL066374](https://doi.org/10.1002/2015GL066374).

Torbert, R. B., et al. (2015), The Electron Drift Instrument for MMS, *Space Sci. Rev.*, 199(1), 283–305, [doi:10.1007/s11214-015-0182-7](https://doi.org/10.1007/s11214-015-0182-7).

Shuster, J. R., et al. (2015), Spatiotemporal evolution of electron characteristics in the electron diffusion region of magnetic reconnection: Implications for acceleration and heating, *Geophys. Res. Lett.*, 42(8), 2586–2593, [doi:10.1002/2015GL063601](https://doi.org/10.1002/2015GL063601).

Shuster, J. R., et al. (2014), Highly structured electron anisotropy in collisionless reconnection exhausts, *Geophys. Res. Lett.*, 41(15), 5389–5395, [doi:10.1002/2014GL060608](https://doi.org/10.1002/2014GL060608).

**Argall, M. R.** (2014), Estimating Proximity to the Asymmetric Reconnection X-line, University of New Hampshire, [Ph.D. thesis](#).