

# Curriculum Vitae: John Caleb Speirs

## BRIEF EDUCATION SUMMARY

Doctorate of Physics (Expected), University of Maine, December 2018  
Research Area: Physics Education Research

Masters of Applied Physics, Colorado School of Mines, May 2012  
Research Areas: Optical Engineering, Laser Physics

Bachelor of Science, Engineering Physics, Colorado School of Mines, May 2011

## RESEARCH PUBLICATIONS, PRESENTATIONS AND AWARDS

### Publications

J. Caleb Speirs, William N. Ferm, MacKenzie R. Stetzer, Beth A. Lindsey, "Probing Student Ability to Construct Reasoning Chains: A New Methodology", 2016 Physics Education Research Conference Proceedings.

E. Hoover et. al. "Eliminating the Scattering Ambiguity in multifocal, multimodal multiphoton imaging systems", J. Biophotonics **5** (5-6), 425-436, May 2012

D. G. Winters, J. Speirs, E. Block, R. Bartels and J. A. Squier, "High-Speed Two-Dimensional Multiphoton Microscope using Spatial Modulation", CLEO: Science and Innovations, San Jose, CA. May 6, 2012. Nonlinear Microscopy (JW3G)

### Presentations

*(Future) Invited Talk:* J. Caleb Speirs, RiSE Summer Conference 2018, June 25<sup>th</sup>, 2018.

*Presented:* J. Caleb Speirs, MacKenzie R. Stetzer, Beth A. Lindsey, "Investigating Student Reasoning Patterns via Dual-Process Theory", 2018 University of Maine Student Symposium, April 17<sup>th</sup>, 2018.

*Invited Talk:* J. Caleb Speirs, "Investigating and supporting student reasoning in physics: New methodologies", Spring 2018 Meeting of the Western Pennsylvania Section of the AAPT, March 17, 2018.

*Presented:* Caleb Speirs, "Probing Student Ability to Construct Reasoning Chains in a Physics Context", RiSE Center Colloquium, University of Maine, Feb 12, 2018.

*Presented:* J. Caleb Speirs, MacKenzie R. Stetzer, Beth A. Lindsey, Mila Kryjevskaja, "Using Johnson-Laird's mental models framework to examine student reasoning", 2017 AAPT Summer Meeting.

*Poster:* J. Caleb Speirs, MacKenzie R. Stetzer, Beth A. Lindsey, Eric Brewé, "Investigating Student Reasoning Chains via Network Analysis", Physics Education Research Conference 2017.

*Presented:* J. Caleb Speirs, William N. Ferm, MacKenzie R. Stetzer, Beth A. Lindsey, "Probing Student

Ability to Construct Reasoning Chains: A New Methodology", 2016 AAPT Summer Meeting.

*Invited Talk:* Caleb Speirs, "A new way to examine student reasoning in physics... and its implications for instruction", 36th Annual High School Physics and Physical Science Teachers Meeting, May 27, 2016

*Poster:* J. Caleb Speirs "Probing Student Ability to Construct Reasoning Chains: A New Methodology", Center for Research in STEM Education 2016 National Summer Conference, June 26-28, 2016.

*Thesis:* John Caleb Speirs, *Extended Source Geometries for Multiphoton Microscopy: Eliminating the Scattering Ambiguity*, Colorado School of Mines, 2012

*Presented:* Caleb Speirs, "Extended Source Geometries for Multiphoton Microscopy: Eliminating the Scattering Ambiguity", Physics Department Colloquium, Colorado School of Mines, May 1, 2012.

*Presented:* John Caleb Speirs, "Characterizing Single Quantum Dots with a Multiphoton Microscope", SPS Zone Meeting, Grand Junction, CO, Oct 1, 2011.

## Workshops

(Future) Co-organizer and Co-leader: RiSE Summer Conference 2018, June 25-26<sup>th</sup>, 2018.

Co-organizer and Co-leader, "Investigating and supporting student reasoning approaches in STEM." Maine STEM Partnership Fall Summit 2017. November 18, 2017

Co-organizer and Co-leader, "New methodologies for investigating the relationships among intuition, reasoning, and conceptual understanding, and how they might hold in the classroom." 2016 RiSE Summit. November 19, 2016

Co-organizer and Co-leader, "Examining the Relationships among Intuition, Reasoning, and Conceptual Understanding in Physics", Center for Research in STEM Education 2016 National Summer Conference, June 26-28, 2016.

Co-organizer and Co-leader, "Examining the Relationships among Intuition, Reasoning, and Conceptual Understanding in Physics", 36th Annual High School Physics and Physical Science Teachers Meeting, May 27, 2016

## Fellowships and Awards

Signature and Emerging Area of Excellence Graduate Fellowship, University of Maine: October 4<sup>th</sup>, 2016.

First Place Graduate Education Research Presentation Award at the 2018 University of Maine Student Research Symposium: April 17<sup>th</sup>, 2018.

## TEACHING EXPERIENCE

*Face to Face:*

PHYSICS 2: Algebra-based Physics II, Instructor  
Spring 2017 College of the Atlantic

PHY 121: Calculus-based Physics I, Teaching Assistant  
Spring 2015, Fall 2015, Spring 2016 University of Maine

PHY 211: Calculus-based Physics I, Instructor  
Fall 2014 Red Rocks Community College

PHY 212: Calculus-based Physics II, Instructor  
Summer 2014, Fall 2014 Red Rocks Community College

PHY 211: Calculus-based Physics I, Instructor  
Spring 2013, Fall 2013, Spring 2014 Arapahoe Community College

PHY 111: Algebra-based Physics I, Instructor  
Fall 2012 Arapahoe Community College  
Spring 2014 Community College of Denver  
Summer 2014 Community College of Denver

PHY 112: Algebra-based Physics II, Instructor  
Spring 2014 Community College of Denver

SCI 155: Integrated Science, Instructor  
Fall 2013 Arapahoe Community College

PHGN 326: Advanced Lab II, Teaching Assistant  
Spring 2012 Colorado School of Mines  
Instructor: Lawrence Wiencke, Ph.D.

PHGN 315: Modern Physics Lab, Teaching Assistant  
Fall 2011 Colorado School of Mines  
Instructor: Frank Kowalski, Ph.D.

*Online Teaching:*

Physics I for Health Professionals  
Spring 2018 University of New England (Online)

PHY 211: Calculus-based Physics I, Instructor  
Fall 2013 CCCOnline

PHY 111: Algebra-based Physics I, Instructor  
Summer 2013 CCCOnline

PHYS 1401: General Physics I, Course Developer and Instructor  
Spring 2013 Sul Ross State University, Alpine

PHYS 1402: General Physics II, Course Developer and Instructor  
Spring 2013 Sul Ross State University, Alpine

*Tutoring:*

PHY 454 Electricity and Magnetism I – University of Maine  
High School Physics I and II – D'Evlyn High School, Jefferson CO, Colorado

## EDUCATION

Doctorate of Physics (Expected)  
University of Maine, December 2018

**Thesis:** John Caleb Speirs, *Probing Student Reasoning Skills: New Methodologies*, University of Maine, 2018

**Research Areas:** Student reasoning, cognitive science, social computational modelling, network analysis.

Masters of Applied Physics  
Colorado School of Mines, May 2012

**Thesis:** John Caleb Speirs, *Extended Source Geometries for Multiphoton Microscopy: Eliminating the Scattering Ambiguity*, Colorado School of Mines, 2012

**Thesis Description:** Utilizing spatial frequency-modulated imaging in two-photon microscopy, I developed, constructed and characterized a two-photon microscope capable of using a single-element detector with line-cursor illumination geometry.

**Research Areas:** Multiphoton multifocal microscopy, lens and optical apparatus design, nonlinear optics, laser design and construction, ultrafast optics, spatio-temporal focusing.

Bachelor of Science, Engineering Physics  
Colorado School of Mines, May 2011

**Senior Design Research Project:** Responsible for the design and construction of a high-resolution multi-photon laser microscope capable of imaging a single quantum dot.

**Objective Design Project:** Working with MOABC at CSM, designed a long working-distance high NA objective with constraints specific to multi-photon microscopy.

**CSM EPICS II team project** for Dr. David Wu of the Chemical Engineering department of CSM.

- Project team leader
- Simulation of a self-assembling virus capsid. Required use of C++, Microsoft Visual Studio, and various programming techniques

## ACTIVITIES AND MEMBERSHIPS

### Organization Memberships:

American Association of Physics Teachers, 2012-Present  
American Physical Society, 2010-2012  
National Society of Physics Students, 2010-2012

### Volunteer Activity:

Workshop Organizer and Leader, "Einstein's Kitchen: Measuring the Speed of Light with Common Household Utensils (and a Protractor)", 4H @ UMaine: Connecting Kids to Campus, May 20-21<sup>st</sup>, 2016

Co-Organizer, STEM Summer Boot Camp, Arapahoe Community College, Summer 2014

- Helped develop a theme and coordinate a week-long summer camp for middle/high school students.
- Developed a day-long (4 hours) workshop regarding mechanical energy transfer and electric generators.

Informal Advisor, Physics Research Club, Arapahoe Community College, Fall 2013.

- Led student research club focused on improving presentation skills and summarizing current research in physics.
- Monthly meetings with ~5 students.

School Programs Education Assistant, Denver Museum of Nature and Science, September 2013 – May 2014

- Orient groups and support professional Museum Educators to deliver awe-inspiring programs for students, preschool through grade 8, their teachers, and adult chaperones.
- Support and assist with the delivery of School Programs (45-minute classes; 90-minute labs) at the Museum.
  - Set up and clean up required class materials within scheduled time-frame.
  - Apply effective teaching principles that incorporate dynamic, interactive and age-appropriate techniques to help create memorable learning experiences.
  - Guide students to complete hands-on and observational activities, including an organ dissection for certain labs.
- Assist with care and maintenance of program materials.
- Assist with office work as needed.

Treasurer, Society of Physics Students (SPS) Colorado School of Mines Chapter, Apr 2010 – Apr 2011

- Responsible for the proper use and management of over \$5,000 in funds from the CSM Board of Student Organizations, the Department of Physics at CSM, and from donations and gifts from SPS National Office and the APS National Office.
- Recipient of the Marsh White Outreach Award for 2010 and 2011, in recognition of our outreach programs to local elementary, middle, and high schools.
- Recipient of the Outstanding Chapter Award for 2010 and 2011.
- Managed a demo library of over 30 physics demos. During my tenure, we significantly expanded our demo collections from 10 to 30.