

# 1 Curriculum Vitae of Marcos D. Caballero

**Contact** Marcos D. Caballero  
Department of Physics and Astronomy  
Michigan State University  
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Family: Partner (Jamie), Daughters (Juniper – 5, Evelyn – 3, Olivia –  $\frac{1}{3}$ )

**Education**  
2000–2004 Study of Physics, University of Texas at Austin  
2005–2011 Teaching and research assistant, Georgia Institute of Technology

**Academic Degrees**  
2011 **PhD**, under the supervision of Prof. Michael Schatz  
Georgia Institute of Technology  
2006 **MS**, under the supervision of Prof. Michael Schatz  
Georgia Institute of Technology  
2004 **BS**, University of Texas at Austin

**Positions**  
12/13 – Affiliated Faculty, CREATE for STEM Institute  
Michigan State University, East Lansing, MI  
08/13 – Assistant Professor, Department of Physics and Astronomy  
Michigan State University, East Lansing, MI  
08/11 – 08/13 Postdoctoral Researcher, Department of Physics  
University of Colorado Boulder, Boulder, CO  
08/11 – 08/13 Postdoctoral Affiliate, School of Physics  
Georgia Institute of Technology, Atlanta, GA

**Fellowships and awards**  
2015 Thomas H. Osgood Memorial Awards for Faculty Excellence in Teaching, MSU  
2014 – 2016 STEM Gateway Fellow, College of Natural Science, MSU  
2011 Tower Award, Georgia Institute of Technology  
2010 CETL/BP Outstanding Graduate TA Award Finalist  
Georgia Institute of Technology  
2009 CETL/BP Outstanding Graduate TA Award  
Georgia Institute of Technology  
2007 – 2008 Teaching Assistant of the Year  
American Association of Physics Teachers  
2007 – 2011 Gozuieta Fellow, Georgia Institute of Technology  
2007 Travel Grant, Technical University of Denmark  
2006 Tower Award, Georgia Institute of Technology

**Lifetime Scholarship**  
Peer-reviewed articles: 32; Invited talks: 36; Contributed abstracts: 86

## 2 Research

### 2.1 Grant Funding

*Note: Some collaborative research grants have institutional-level principal investigators.*

Title	Agency	Grant Period	Amount	PI's
Research Experience for Undergraduates in Physics	NSF	06/01/16 - 05/31/21	652,201	S. Tessmer (PI) S. Pratt (Co-PI) M.D. Caballero (Co-PI) G. Westfall (Co-PI)
Learning Science by Doing Science: Project-based Learning through Urban Entomology	Science and Society at State	01/01/16 - 12/31/16	10,000	P. White (PI) D. Stroupe (Co-PI) M.D. Caballero (Co-PI)
Collaborative Research: Integrating Computation into Undergraduate Physics: A Faculty Development Approach to Community Transformation	NSF	09/01/15–08/31/19	1,279,209; 503,977 (MSU Part)	M.D. Caballero (PI, MSU) K. Roos (PI, Bradley) L. Engelhardt (PI, FMU) M. Lopez (PI, St. Thomas) R. Hilborn (PI, AAPT)
Collaborative Research: Fostering integration of computational methods in physics courses: A local communities approach	NSF	07/01/15 – 06/30/17	219,136; 40,526 (MSU Part)	M.D. Caballero (PI, MSU) N. Chonacky (PI, Yale) M. Lopez (PI, St. Thomas) R. Hilborn (PI, AAPT)
Transforming experiences for science and engineering students: Integrating scientific practices into introductory calculus-based mechanics	LPF-CMP 2	01/01/14–12/31/15	200,000	M.D. Caballero (PI) D. Stroupe (Co-PI) S. Tessmer (Co-PI)
InvestigAction: Underrepresented Middle School Youth Becoming Community Engineering Experts	LPF-CMP 2	01/01/14–05/01/15	125,000	A. Calabrese-Barton (PI) S. Calabrese-Barton (Co-PI) M.D. Caballero (Co-PI) B. Geier (Co-PI)
Collaborative Research: Surveying the state of computational physics in courses for physics majors	NSF	01/01/15–12/31/17	126,320; 21,380 (MSU Part)	M.D. Caballero (PI, MSU) N. Chonacky (PI, Yale) R. Hilborn (PI, AAPT)
LEVERS: Leveraging Engagement and Vision to Encourage Retention in STEM	HHMI	09/01/14–08/31/19	1,500,000	S. Chivukula (PI) M.D. Caballero (Co-author & Physics Project Lead)

### 2.2 Published Scholarly Works

#### 2.2.1 Articles

- \*Laverty, J.T., Underwood, S.M., Matz, R.L., Posey, L.A., Carmel, J.H., Caballero, M.D., Fata-Hartley, C.L., Ebert-May, D., Jardeleza, S.E., Cooper, M.M. *Characterizing College Science Assessments: The Three-Dimensional Learning Assessment Protocol*, PLOS One, under review.
- \*Cooper, M.M., Caballero, M.D., Ebert-May, D., Fata-Hartley, C.L., Jardeleza, S.E., Krajcik, J.S., Laverty, J.T., Matz, R.L., Posey, L.A., Underwood, S.M. *Challenge faculty to transform STEM learning*, Science, 350 (6258), 281-282, 2015.
- \*Chasteen, S.V., Wilcox, B.R., Caballero, M.D., Perkins, K.K., Pollock, S.J., Wieman, C.E. *Educational transformation in upper-division physics: The Science Education Initiative model, outcomes, and lessons learned*, Phys. Rev. ST Phys. Educ. Res., 11, 020110 (2015)

13. \*Wilcox, B.R., Caballero, M.D., Baily, C., Sadaghiani, H, Chasteen, S.V., Ryan, Q.X., Pollock, S.J. *Development and Uses of Upper-division Conceptual Assessments*, Phys. Rev. ST Phys. Educ. Res., 11, 020115 (2015)
12. \*Caballero, M.D., Wilcox, B.R., Doughty, L., Pollock, S.J. *Unpacking students' use of mathematics in upper-division physics*, Eur. J. Phys., 36, 065004, 2015
11. \*L. Ding and M.D. Caballero **Uncovering the hidden meaning of cross-curriculum comparison results on the Force Concept Inventory**, Phys. Rev. ST Phys. Educ. Res., 10, 2014
10. \*A.-M. Hoskinson, B. Couch, K. Hinko, B. Zwickl, and M.D. Caballero **Bridging Physics and Biology Teaching through Modeling**, Am. J. Phys., 82, 434, 2014
9. \*M.D. Caballero and S.J. Pollock, *A Model for Incorporating Computation Without Changing the Course: An example from middle-division classical mechanics*, Am. J. Phys., 82, 231, 2014
8. \*M.D. Caballero, J.B. Burk, J.M. Aiken, S.S. Douglas, E.M. Scanlon, B.D. Thoms, and M.F. Schatz, *Integrating Numerical Computation into the Modeling Instruction Curriculum*, Phys. Teach., 52, 38, 2014
7. \*B.R. Wilcox, M.D. Caballero, and S.J. Pollock, *Analytic framework for students' use of mathematics in upper-division physics*, Phys. Rev. ST Phys. Educ. Res. 9, 020119, 2013
6. \*A.-M. Hoskinson, M. D. Caballero, and J. Knight, **Can we improve problem solving in biology? Lessons from 30 years of physics education research**, CBE – LSE, 12, 153, 2013
5. \*S.V. Chasteen, R.E. Pepper, M.D. Caballero, S.J. Pollock, and K.K. Perkins, *The Colorado Upper-Division Electrostatics (CUE) diagnostic: A conceptual assessment for the junior level*, Phys. Rev. ST Phys. Educ. Res. 8, 020108, 2012
4. \*M.D. Caballero, M.A. Kohlmyer, and M.F. Schatz, *Implementing and assessing computational modeling in introductory mechanics*, Phys. Rev. ST Phys. Educ. Res. 8, 020106, 2012
3. \*M.D. Caballero, M.A. Kohlmyer, M.F. Schatz, et al., *Comparing large lecture mechanics curricula using the Force Concept Inventory: A five thousand student study*, Am. J. Phys., 80, 7, 2012
2. \*M.A. Kohlmyer, M.D. Caballero, M.F. Schatz, et al., *A Tale of Two Curricula: Performance of two thousand students in introductory electromagnetism*, Phys. Rev. ST Phys. Educ. Res. 5, 020105, 2009
1. \*A.L. Cochran, E.S. Barker, M.D. Caballero, and J. Gyorgy-Ries, *Placing the Deep Impact Mission into Context: Two Decades of Observations of 9P/Tempel 1 from McDonald Observatory*, Icarus 199 (119), 2009

### 2.2.2 Peer-reviewed Papers from Learned Professional Organizations and Societies

17. \*Caballero, M.D., **Computation across the curriculum: What skills are needed?**, Proceedings of the Physics Education Research Conference, pp. 79-82, 2015
16. \*Irving, P.W., Sawtelle, V., and Caballero, M.D., **Troubleshooting Formative Feedback in P<sup>3</sup> (A group-based learning environment)**, Proceedings of the Physics Education Research Conference, pp. 155-158, 2015
15. \*Laverty, J.T., Cooper, M.M., and Caballero, M.D., **Developing the Next Generation of Physics Assessments**, Proceedings of the Physics Education Research Conference, pp. 187-190, 2015
14. \*Pawlak, A., Irving, P.W., and Caballero, M.D., **Identification of a shared answer-making game in group context**, Proceedings of the Physics Education Research Conference, pp. 255-258, 2015
13. \*Obsniuk, M.J., Irving, P.W., and Caballero, M.D., **A Case Study: Novel Group Interactions through Computational Physics**, Proceedings of the Physics Education Research Conference, pp. 239-242, 2015
12. \*Turnbull, A., Doughty, L., Sawtelle, V. and Caballero, M.D., **Student Ideas around Vector Decomposition in the Upper-Division**, Proceedings of the Physics Education Research Conference, pp. 335-338, 2015

11. \*L. Doughty, M.D. Caballero, **Rubric Design for Separating the Roles of Open-Ended Assessments**, Proceedings of the Physics Education Research Conference, pp. 71-74, 2014
10. \*J.T. Lavery, S.H. Tessmer, M.M. Cooper, M.D. Caballero, **Engaging Physics Faculty in Course Transformation**, Proceedings of the Physics Education Research Conference, pp. 147-150, 2014
9. \*S.F. Wolf, L. Doughty, P.W. Irving, E.C. Sayre, M.D. Caballero, **Just Math: A new epistemic frame**, Proceedings of the Physics Education Research Conference, pp. 275-278, 2014
8. \*J.M. Aiken, S. Lin, S.S. Douglas, E.F. Greco, B.D. Thoms, M.D. Caballero, M.F. Schatz, **Student Use of a Single Lecture Video in a Flipped Introductory Mechanics Course**, Proceedings of the Physics Education Research Conference, pp. 19-22, 2014
7. \*S.S. Douglas, S. Lin, J.M. Aiken, B.D. Thoms, E.F. Greco, M.D. Caballero, M.F. Schatz, **Peer Evaluation of Video Lab Reports in a Blended Introductory Physics Course**, Proceedings of the Physics Education Research Conference, pp. 75-78, 2014
6. \*S. Lin, S.S. Douglas, J.M. Aiken, C. Liu, E.F. Greco, B.D. Thoms, M.D. Caballero, M.F. Schatz, **Peer Evaluation of Video Lab Reports in an Introductory Physics MOOC**, Proceedings of the Physics Education Research Conference, pp. 163-166, 2014
5. \*M.D. Caballero and S.J. Pollock, **Assessing Student Learning in Middle-Division Classical Mechanics/Math Methods**, Proceedings of the Physics Education Research Conference, pp. 81-84, 2013
4. \*J.M. Aiken, S. Lin, S.S. Douglas, E.F. Greco, B.D. Thoms, M.F. Schatz, and M.D. Caballero, **The Initial State of Students Taking an Introductory Physics MOOC**, Proceedings of the Physics Education Research Conference, pp. 53-56, 2013
3. \*M.D. Caballero, B.R. Wilcox, R.E. Pepper, and S.J. Pollock, **ACER: A Framework on the Use of Mathematics in Upper-division Physics**, Proceedings of the Physics Education Research Conference, 1513, pp. 90-93, 2012
2. \*B.R. Wilcox, M.D. Caballero, R.E. Pepper, and S.J. Pollock, **Upper-division Student Understanding of Coulomb's Law: Difficulties with Continuous Charge Distributions**, Proceedings of the Physics Education Research Conference, 1513, pp. 418-421, 2012
1. \*J.M. Aiken, M.D. Caballero, S.S. Douglas, J.B. Burk, E.M. Scanlon, B.D. Thoms, and M.F. Schatz, **Understanding Student Computational Thinking with Computational Modeling**, Proceedings of the Physics Education Research Conference, 1513, pp. 46-49, 2012

### 2.2.3 Contributed papers (not peer-reviewed)

2. M.D. Caballero, M.A. Kohlmyer, and M.F. Schatz, **Fostering Computational Thinking**, Proceedings of the Physics Education Research Conference, 2011
1. K.R. Bujak, M.D. Caballero, M.F. Schatz, et al., **Comparing the Matter and Interactions Curriculum with a Traditional Physics Curriculum: A Think Aloud Study**, Proceedings of the 2011 AERA Annual Meeting, New Orleans, LA, 2011

## 2.3 Other scholarly works

### 2.3.1 Contributed talks, posters, workshops, and other abstracts (as primary author)

26. M.D. Caballero, **Computation across the curriculum: What skills are needed?**, Poster for 2015 Physics Education Research Conference, College Park, MD
25. M.D. Caballero, P.W. Irving, S.H. Tessmer, D. Stroupe, **Blending Content and Practice: Designing a New Introductory Mechanics**, Poster for 2014 AAPT Summer Meeting, Minneapolis, MN
24. M.D. Caballero, **Ubiquitous Professional Development with the Global Physics Department**, Michigan Section of the American Association of Physics Teachers Fall Meeting, Roscommon, MI

23. M.D. Caballero, Ubiquitous Professional Development with the Global Physics Department, Colorado/Wyoming Section of the American Association of Physics Teachers Spring Meeting, Highlands Ranch, CO
22. M.D. Caballero, B.R. Wilcox, R.E. Pepper, and S.J. Pollock, *A Framework on the Use of Mathematics in Upper-division Physics*, Poster for Physics Education Research Conference, Philadelphia, PA
21. M.D. Caballero, R.E. Pepper, and S.J. Pollock, *Tapping into Sophomores' Understanding of Classical Mechanics: Developing the Colorado Classical Mechanics/Math Methods Instrument (CCMI)*, Poster for Physics Education Research Conference, Philadelphia, PA
20. M.D. Caballero, B.M. Zwickl, and S.J. Pollock, *Teaching New Tools to Majors: Computational Instruction in Upper-division Physics*, American Association of Physics Teachers Summer Meeting, Philadelphia, PA
19. M.D. Caballero, *Computational Modeling: A tool we can teach*, Colorado/Wyoming Section of the American Association of Physics Teachers Spring Meeting, Aurora, CO
18. M.D. Caballero, R.E. Pepper and S.J. Pollock, *Why are Taylor Series So Tough?*, American Association of Physics Teachers Winter Meeting, Ontario, CA
17. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Fostering Computational Thinking*, Poster for Physics Education Research Conference, Omaha, NE
16. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Measurements of Students' Performance on Computational Exercises in Introductory Mechanics*, Poster for American Association of Physics Teachers Summer Meeting, Omaha, NE
15. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Assessing Student Affect in Learning Computation in Introductory Mechanics*, Poster for American Association of Physics Teachers Summer Meeting, Omaha, NE
14. M.D. Caballero, M.F. Schatz, J.B. Burk and M.A. Kohlmyer, *Fostering Computational Thinking: Computer Modeling Homework in Introductory Mechanics*, Poster for American Association of Physics Teachers Summer Meeting, Omaha, NE
13. M.D. Caballero, M.F. Schatz, J.B. Burk and M.A. Kohlmyer, *Fostering Computational Thinking: Computer Modeling Homework in Introductory Mechanics*, American Association of Physics Teachers Summer Meeting and the Physics Education Research Conference, Omaha, NE
12. M.D. Caballero, B. Suri, M.F. Schatz, and M.A. Kohlmyer, *Computational homework in introductory mechanics: What are the limits?*, Southern Atlantic Coast Section of the American Association of Physics Teachers Fall Meeting, Charleston, SC
11. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Developing, deploying, and evaluating computational homework in introductory mechanics*, Poster for American Association of Physics Teachers Summer Meeting and the Physics Education Research Conference, Portland, OR
10. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Computational homework in introductory mechanics*, American Association of Physics Teachers Summer Meeting, Portland, OR, July 2010
9. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Developing and deploying computational exercises in introductory mechanics*, Southern Atlantic Coast Section of the American Association of Physics Teachers Spring Meeting, Aiken, SC
8. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Computational Exercises in Introductory Mechanics*, American Association of Physics Teachers Winter Meeting, Washington, DC
7. M.D. Caballero, M.F. Schatz, and M.A. Kohlmyer, *Performance of 5000 students in introductory mechanics v.3*, Southeastern Section of the American Physical Society meeting, Atlanta, GA
6. M.D. Caballero, M.F. Schatz, *Introducing computational modeling in introductory physics*, Atlanta Metro Physics Teachers Network meeting, Atlanta, GA
5. M.D. Caballero, M.F. Schatz, *Performance of 5000 students in introductory mechanics v.2*, Southern Atlantic Coast Section of the American Association of Physics Teachers Fall Meeting, Augusta, GA

4. M.D. Caballero, M.F. Schatz, *Performance of 5000 students in introductory mechanics*, American Association of Physics Teachers Summer Meeting, Ann Arbor, MI
3. M.D. Caballero, M. A. Kohlmyer, M. F. Schatz, *Performance of 2000 Students on BEMA*, Matter and Interactions Summer Workshop, Atlanta, Ga
2. M.D. Caballero and M. F. Schatz, *Bouncers, Walkers and Virtual Drops [2.0]*, APS Division of Fluid Dynamics Annual Meeting, Salt Lake City, UT
1. M.D. Caballero and M. F. Schatz, *Bouncers, Walkers and Virtual Drops*, Complex Motion in Fluids Summer School, Humlebæk, Denmark

### 2.3.2 Contributed talks, posters, workshops, and other abstracts (as advisor or collaborator)

56. Michael J. Obsniuk, Paul W. Irving, Marcos D. Caballero, **A Case Study: Novel Group Interactions through Introductory Computational Physics**, CREATE for STEM Miniconference, East Lansing, MI (Poster)
55. Alanna Pawlak, Paul W. Irving, Marcos D. Caballero, **Students' engagement in modes of collaboration while solving problems in groups**, CREATE for STEM Miniconference, East Lansing, MI (Poster)
54. James T. Lavery, Rebecca L. Matz, Sonia M. Underwood, Sarah E. Jardeleza, Justin H. Carmel, Cori L. Fata-Hartley, Lynmarie Posey, Joseph S. Krajcik, Diane Ebert-May, Marcos D. Caballero, and Melanie M. Cooper, **Investigating Assessments in Gateway College Science Courses**, CREATE for STEM Miniconference, East Lansing, MI (Poster)
53. James Brian Hancock II, Vashti Sawtelle, Marcos D. Caballero, Alicia Alonzo, **Perceptions of Learning and Teamwork: Practice-based Introductory Physics**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster)
52. James T. Lavery, Melanie M. Cooper, Marcos D. Caballero, **Developing the Next Generation of Physics Assessments**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster/Talk)
51. Alanna Pawlak, Paul W. Irving, Marcos D. Caballero, **Students' Engagement in Modes of Collaboration While Solving Problems in Groups**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster)
50. Alanna Pawlak, Paul W. Irving, Marcos D. Caballero, **Identification of a shared answer-making game in group context**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster)
49. Paul W. Irving, Vashti Sawtelle, Marcos D. Caballero, **Troubleshooting Formative Feedback in P3 (A group-based learning environment)**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster/Talk)
48. Michael J. Obsniuk, Paul W. Irving, Marcos D. Caballero, **A Case Study: Novel Group Interactions through Introductory Computational Physics**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster/Talk)
47. Anna Turnbull, Leanne Doughty, Vashti Sawtelle, Marcos D. Caballero, **Student ideas around vector decomposition at the upper-division**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster/Talk)
46. Leanne Doughty, Marcos D. Caballero, **Examining student talk around the Dirac delta function in upper-division E&M**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster/Talk)
45. May Lee, Alicia C. Alonzo, Vashti Sawtelle, Marcos D. Caballero, and David Stroupe, **Positioning peers during group work in introductory mechanics**. Summer AAPT Meeting/PERC 2015, College Park, MD (Poster/Talk)
44. James T. Lavery, Sonia M. Underwood, Melanie M. Cooper, Marcos D. Caballero, Diane Ebert-May, Joseph S. Krajcik, Cori Fata-Hartley, Rebecca L. Matz, Lynmarie Posey, Sarah Jardeleza, **Characterizing Assessments Using the Three-Dimensional Learning Assessment Protocol (3D-LAP)**, NARST, Chicago, IL, Spring 2015 (Talk)

43. Rebecca L. Matz, James T. Lavery, Sarah Jardeleza, Claire M. Morrison, Zachary D. Nusbaum, Sonny A. Ly, Diane Ebert-May, Joseph S. Krajcik, Marcos D. Caballero, Melanie M. Cooper, **Investigating Change in Classroom Instruction of Scientific Practices, Crosscutting Concepts, and Core Ideas**, NARST, Chicago, IL, Spring 2015 (Talk)
42. Anna Turnbull, Leanne Doughty, Vashti Sawtelle, Marcos D. Caballero. **Students about vector decomposition in the upper-division**. MIAAPT Spring 2015 (Talk)
41. Sonny A. Ly, Sarah E. Jardeleza, Rebecca L. Matz, James T. Lavery, Sonia M. Underwood, Cori L. Fata-Hartley, Lynmarie Posey, Joseph S. Krajcik, Diane Ebert-May, Marcos D. Caballero, Melanie M. Cooper, **Questions in the Classroom: How Often do Students Respond?**, 2015 University Undergraduate Research and Arts Forum (UURAF), Michigan State University, East Lansing, MI (Poster)
40. Anna Turnbull, Leanne Doughty, Vashti Sawtelle, Marcos D. Caballero. **Rubrics design for separating the roles of open-ended assessments**. 2015 CREATE for STEM mini-conference, East Lansing, MI. (Poster)
39. Alanna Pawlak, Paul Irving, Marcos D. Caballero. **How students play the answer-making epistemic game while solving problems in groups**. 2015 CREATE for STEM mini-conference, East Lansing, MI. (Poster)
38. Lee, M., Sawtelle, V., Stroupe, D., Irving, P. W., Obsniuk, M. J., & Caballero, M. D.. **Negotiating positions within small groups in introductory physics**. 2015 CREATE for STEM mini-conference, East Lansing, MI. (Poster)
37. Michael J. Obsniuk, Paul W. Irving, Stuart H. Tessmer, David Stroupe, Marcos D. Caballero. **Blending Content and Practice: Designing a new introductory mechanics course**, 2015 CREATE for STEM Mini-Conference, East Lansing, MI (Poster)
36. James T. Lavery, Sonia M. Underwood, Rebecca L. Matz, Sarah E. Jardeleza, Cori L. Fata-Hartley, Lynmarie Posey, Joseph S. Krajcik, Diane Ebert-May, Marcos D. Caballero, Melanie M. Cooper, **Designing Three-Dimensional Learning Assessments for Introductory College Science Courses**, CREATE for STEM Mini-Conference, East Lansing, MI, Spring 2015 (Poster)
35. Zachary D. Nusbaum, Sonny A. Ly, Claire M. Morrison, Keenan L. Noyes, Sarah E. Jardeleza, Rebecca L. Matz, James T. Lavery, Sonia M. Underwood, Cori L. Fata-Hartley, Lynmarie Posey, Joseph S. Krajcik, Diane Ebert-May, Marcos D. Caballero, Melanie M. Cooper, **Comparing Teaching Activities in Gateway Science Courses**, CREATE for STEM Mini-Conference, East Lansing, MI, Spring 2015 (Poster)
34. Stephanie V. Chasteen, Marcos D. Caballero, Katherine K. Perkins, Carl E. Wieman. ***The CU Science Education Initiative: Examining the Model and its Impacts***. Summer AAPT Meeting/PERC 2014 (poster).
33. Alanna Pawlak, Paul W. Irving, Marcos D. Caballero. **How Students Use Visual Representations When Solving Charge Distribution Problems**. Summer AAPT Meeting/PERC 2014 (poster).
32. Leanne Doughty, Marcos D. Caballero. **The Multiple Roles of Assessment: Rubric Design in the Upper-Division**. Summer AAPT Meeting/PERC 2014 (poster).
31. James T. Lavery, Marcos D. Caballero. **Integrating Practices and Core Ideas in Introductory Physics Courses**. Summer AAPT Meeting/PERC 2014 (poster).
30. Steven F. Wolf, Ying Chen, Paul W. Irving, Eleanor Sayre, Marcos D. Caballero. **It's "Just Math": A New Epistemic Frame**. Summer AAPT Meeting/PERC 2014 (poster).
29. J.M. Aiken, S. Lin, S.S. Douglas, E.F. Greco, B.D. Thoms, M.D. Caballero, M.F. Schatz. ***Student Use of a Single Lecture Video in a Flipped Introductory Mechanics Course***. Summer AAPT Meeting/PERC 2014 (poster/talk).
28. S.S. Douglas, S. Lin, J.M. Aiken, B.D. Thoms, E.F. Greco, M.D. Caballero, M.F. Schatz. ***Peer Evaluation of Video Lab Reports in a Blended Introductory Physics Course***. Summer AAPT Meeting/PERC 2014 (poster/talk).

27. S. Lin, S.S. Douglas, J.M. Aiken, C. Liu, E.F. Greco, B.D. Thoms, M.D. Caballero, M.F. Schatz. *Peer Evaluation of Video Lab Reports in an Introductory Physics MOOC*. Summer AAPT Meeting/PERC 2014 (poster/talk).
26. James T. Lavery, Steven F. Wolf, Marcos D. Caballero. **Integrating Practices and Core Ideas into Introductory Physics Courses**. MIAAPT Spring 2014 (Workshop)
25. Leanne Doughty, Alanna Pawlak, May Lee, and Marcos D. Caballero. **Mechanistic Reasoning in Introductory University Physics**. MIAAPT Spring 2014 (Talk)
24. Alanna Pawlak, Leanne Doughty, and Marcos D. Caballero. **How students choose and use visual representations in electricity and magnetism**. MIAAPT Spring 2014 (Talk)
23. James T. Lavery, Stuart H. Tessmer, Marcos D. Caballero. **Practices and Core Ideas into MSU's Introductory Physics Courses**. MIAAPT Spring 2014 (Poster)
22. Alanna Pawlak, Leanne Doughty, and Marcos D. Caballero. **How students choose and use productive visual representations when solving problems about charge distributions**. CREATE for STEM MiniConference Spring 2014 (Poster)
21. James T. Lavery, Melanie Cooper, Diane Ebert-May, Marcos D. Caballero, Joseph Krajcik. **Creating a Coherent Gateway for STEM Teaching and Learning at MSU**. CREATE for STEM MiniConference Spring 2014 (Poster)
20. James T. Lavery, Stuart H. Tessmer, Marcos D. Caballero. **Practices and Core Ideas into MSU's Introductory Physics Courses**. CREATE for STEM MiniConference Spring 2014 (Poster)
19. Shih-Yin Lin, John M. Aiken, Scott Douglas, Edwin F. Greco, Brian D. Thoms, Marcos D. Caballero, Michael F. Schatz. *Peer Evaluations of Video Lab Reports by Introductory Physics Students*. Winter AAPT 2014 (Poster/Talk)
18. John M. Aiken, Shih-Yin Lin, Marcos D. Caballero, Brian D. Thoms, Michael F. Schatz. *Describing Student Participation and Performance in an Introductory MOOC*. Winter 2014 AAPT meeting (talk).
17. B. Wilcox, M.D. Caballero, D. Rehn, S. Pollock. *An Analytic Framework for Students' Use of Mathematics in Upper-division Physics*, Global Physics Department - 2013, globalphysicsdept.org (Talk)
16. James T. Lavery, Marcos D. Caballero. **The First Steps to Transforming Introductory Physics at Michigan State**. MIAAPT Fall 2013 (Talk)
15. John M. Aiken, Shih-Yin Lin, Brian D. Thoms, Michael F. Schatz. *Computational Modeling Activities for High School*. Fall 2013 NCS-SACS AAPT meeting (talk).
14. Shih-Yin Lin, John M. Aiken, Scott Douglas, Edwin F. Greco, Brian D. Thoms, Marcos D. Caballero, Michael F. Schatz. *Evaluations of Video Lab Reports in an Introductory Physics MOOC*. Summer AAPT/PERC 2013 (Poster/Talk)
13. Scott S. Douglas, John M. Aiken, Shih-Yin Lin, Edwin F. Greco, Michael F. Schatz, Marcos D. Caballero. *Implementation of an Introductory Physics MOOC with a Lab*. Summer AAPT/PERC 2013 (poster)
12. S. Pollock, C. Baily, B. Wilcox, M.D. Caballero. *Helping Students acquire functional knowledge in upper-level physics courses*. 2013 Physics Education Research Conference (Poster Symposium)
11. John M. Aiken, Shih-Yin Lin, Scott S. Douglas, Brian D. Thoms, Marcos D. Caballero, Michael F. Schatz. *Computational Modeling Activities Designed in a Two Week Teacher Workshop*. Summer AAPT meeting 2013 (poster, talk).
10. John M. Aiken, Scott S. Douglas, Edwin Greco, Michael F. Schatz. *Intro Physics MOOC with a Real Lab*. Georgia Tech MOOC Showcase (Talk).



9. B. Wilcox, M.D. Caballero, R. Pepper, S. Pollock. *Upper-division Student Understanding of Coulomb's Law: Difficulties with Continuous Charge Distributions*. 2012 Physics Education Research Conference, Philadelphia, PA (Poster)
8. B. Wilcox, M.D. Caballero, S. Chasteen, B. Zwickl, C. Baily, S. Pollock. *Resources for Research-based Instruction in Upper-Division Physics*. American Association of Physics Teachers 2012 Summer Meeting, Philadelphia, PA (Talk)
7. Scott S. Douglas, Marcos D. Caballero, John M. Aiken, Michael F. Schatz. *Computational Modeling as a Promoter of Cognitive Transfer: Pilot Study*. Summer AAPT 2012. (poster, talk)
6. John M. Aiken, Marcos D. Caballero, John B. Burk, Scott S. Douglas, Michael F. Schatz, Erin M. Scanlon, Brian D. Thoms (2012), *Embedding Numerical Computation in the Modeling Instruction Curriculum*, Physics Education Research Conference 2012 (Poster).
5. John M. Aiken, John B. Burk, Marcos D. Caballero, Scott S. Douglas, Michael F. Schatz, Brian D. Thoms (2012), *Extending Modeling Instruction with Computational Modeling: A Pilot Study*, AAPT Summer Meeting (Talk, Poster).
4. John M. Aiken, John B. Burk, Scott S. Douglas, Marcos D. Caballero, Michael F. Schatz, Erin Scanlon, Brian D. Thoms (2012), *Implementing and Assessing Computational Modeling in Modeling Instruction Curriculum*, Spring SACS-AAPT Meeting (Talk).
3. John M. Aiken, Michael F. Schatz, John B. Burk, Scott S. Douglas, Marcos D. Caballero, Erin Scanlon, Brian D. Thoms (2012), *Assessing the Integration of Computational Modeling and ASU Modeling Instruction in the High School Physics Classroom*, APS April Meeting (Talk).
2. John M. Aiken, Michael F. Schatz, John B. Burk, Marcos D. Caballero, Brian D. Thoms (2012), *Computational Modeling Integrated with ASU Modeling Instruction: Implementation and Assessment*, AAPT Winter Meeting (Talk, poster).
1. John M. Aiken, John B. Burk, Marcos D. Caballero, Michael F. Schatz, Brian D. Thoms (2011), *Exploring the Integration of Computational Modeling in the ASU Modeling Curriculum*, Fall SACS-AAPT Meeting (Talk, poster).

### 2.3.3 Workshops Delivered at National/Regional Meetings

7. Apr 2016, *Integrating Computation Across the Curriculum*, workshop delivered with M. Lopez del Puerto at 2016 Spring Chesapeake Section of the AAPT meeting, Ashford, VA
6. Apr 2016, *Integrating Computation Across the Curriculum*, workshop delivered with L. Englehardt at 2016 Spring SACS-AAPT meeting, Atlanta, GA
5. Jan 2016, *Projects and Practices in Physics: Inquiry-based computational instruction*, workshop offered with P.W. Irving & M.J. Obsniuk at 2016 AAPT Winter Meeting, New Orleans, LA
4. July 2014, *Interactive Engagement in the Upper-division: Methods and Materials from CU-Boulder*, workshop offered with S.J. Pollock (CU Boulder) at 2014 AAPT Summer Meeting, Minneapolis, MN
3. July 2013, *Interactive Engagement in the Upper-division: Methods and Materials from CU-Boulder*, workshop offered with S.J. Pollock (CU Boulder) at 2013 AAPT Summer Meeting, Portland, OR
2. Jan 2013, *VPython-based Video Games to Teach Physics*, workshop offered with A. Titus (High Point University) at 2013 AAPT Winter Meeting, New Orleans, LA
1. July 2012, *Computation and the Modeling Curriculum*, workshop offered with M.F. Schatz (Georgia Tech) at 2012 AAPT Summer Meeting, Philadelphia, PA

## 2.4 Talks

### 2.4.1 Conference Invited Talks

8. American Association of Physics Teachers Summer Meeting, Sacramento, CA, Jul 2016
7. APS Division of Atomic, Molecular, and Optical Physics Meeting, Providence, RI, May 2016
6. American Association of Physics Teachers Winter Meeting, New Orleans, LA, Jan 2016
5. American Association of Physics Teachers Summer Meeting, College Park, MD, July 2015
4. American Association of Physics Teachers Winter Meeting, San Diego, CA, Jan 2015
3. American Association of Physics Teachers Summer Meeting, Minneapolis, MN, Jul 2014
2. American Association of Physics Teachers Winter Meeting, Orlando, FL, Jan 2014
1. American Association of Physics Teachers Winter Meeting, Ontario, CA, Feb 2012

### 2.4.2 Colloquium and Seminars

28. Departmental Colloquium, Texas State University, San Marcos, TX, Apr 2016
27. Departmental Colloquium, Central Michigan University, Mt. Pleasant, MI, Mar 2016
26. Departmental Colloquium, University of St. Thomas, St. Paul, MN, Feb 2016
25. Research Seminar, The Ohio State University, Columbus, OH, Apr 2015
24. Departmental Colloquium, Saginaw Valley State University, University Center, MI, Feb 2015
23. Teaching Essentials Workshop, Michigan State University - College of Natural Science, East Lansing, MI, Feb 2015
22. Research Seminar, Wayne State University, Detroit, MI, Jan 2015
21. Research Seminar, Michigan State University - Dept. of Physics and Astronomy, East Lansing, MI, Jan 2015
20. Research Seminar (w/ C. Schwarz and T. Long), Michigan State University - CREATE For STEM, East Lansing, MI, Nov 2014
19. Research Seminar (w/ V. Sawtelle), Michigan State University - Dept. of Physics and Astronomy, East Lansing, MI, Aug 2014
18. Research Seminar (w/ D. Stroupe), Michigan State University - CREATE For STEM, East Lansing, MI, Apr 2014
17. Departmental Colloquium, University of Maine, Orono, ME, Apr 2014
16. Research Seminar, Purdue University, West Lafayette, IN, Feb 2014
15. Departmental Colloquium, Indiana University Purdue University Indianapolis, Indianapolis, IN, Feb 2014
14. Research Seminar, American Natural History Museum, Dec 2013
13. Research Seminar, Global Physics Department, [globalphysicsdept.org](http://globalphysicsdept.org), Dec 2013
12. Keynote address, University of Edinburgh, Edinburgh, UK, May 2013
11. Research Seminar, University of Colorado Boulder, Boulder, CO, Apr 2013
10. Departmental Colloquium, University of Colorado Boulder, Boulder, CO, Mar 2013
9. Research Seminar, Michigan State University, East Lansing, MI, Mar 2013
8. Departmental Colloquium, Rochester Institute of Technology, Rochester, NY, Jan 2013

7. Research Seminar, Global Physics Department, [globalphysicsdept.org](http://globalphysicsdept.org), Sep 2012
6. Research Seminar, Global Physics Department, [globalphysicsdept.org](http://globalphysicsdept.org), Apr 2011
5. Departmental Colloquium, Georgia State University, Atlanta, GA, Apr 2011
4. Research Seminar, University of Colorado PER group, Boulder, CO, Mar 2011
3. Research Seminar, Massachusetts Institute of Technology RELATE group, Cambridge, MA, Feb 2011
2. Research Seminar, University of Minnesota PER group, Minneapolis, MN, Feb 2011
1. Departmental Colloquium, Spelman College, Atlanta, GA, Apr 2010

## **3 Teaching**

### **3.1 Post-doctoral associates**

#### **3.1.1 Main Supervisor**

1. William Martinez, August 2015 –
2. Paul W. Irving, May 2014 –
3. James T. Lavery, August 2013 –
4. Leanne Dougherty, January 2014 – January 2016  
(Postdoctoral Researcher, University of Colorado Denver)
5. Steven F. Wolf (25%), August 2013 – August 2014  
(Assistant Professor of Physics, Eastern Carolina University)

#### **3.1.2 Co-supervised Post-doctoral associates**

1. Brian Danielak, August 2015 – (w/ Brian O'Shea & Vashti Sawtelle)

### **3.2 Graduate Students**

#### **3.2.1 Graduate Students (Main Supervisor)**

1. Alanna Pawlak (2013 – )
2. Michael Obsniuk (2013 – )

#### **3.2.2 Graduate Students (Co-supervisor)**

1. Kelsey Funkhouser (2015 – , w/ Asst. Prof. Vashti Sawtelle; has not selected advisor yet)
2. Abhilash Nair (2015 – , w/ Asst. Prof. Vashti Sawtelle; has not selected advisor yet)
3. John Aiken (Georgia State, Master's Thesis, 2013)

#### **3.2.3 PhD students on temporary projects (summer etc)**

1. Thomas Finzell (FAST Fellowship, 2013 – 2014)
2. Adam Fritsch (FAST Fellowship, 2013 – 2014)

#### **3.2.4 Collaborating PhD students (Other Departments)**

1. May Lee (Teacher Education, 2013 – )
2. James Brian Hancock II (Teacher Education, 2013 – )

#### **3.2.5 Ph.D. Thesis Committee service (not supervised/co-supervised students)**

1. Thomas Finzell (Astronomy, Observational)
2. Forrest Phillips (Physics, High Energy)
3. Christopher Minter (Chemistry, Education)
4. May Lee (Teacher Education)

### **3.3 Undergraduate Students**

#### **3.3.1 Undergraduate Students supervised on research**

1. Kristy Griswold (MSU, Spring 2016)
2. Nathaniel Hawkins (MSU, Fall 2015, Spring 2016)
3. Anna Turnbull (MSU, Fall 2014, Spring 2015, Summer 2015, Fall 2015, Spring 2016)
4. Paul Hamerksi (REU – Carnegie Mellon University, Summer 2015, Fall 2015, Spring 2016)
5. Laura Hunter (REU – Mt. Holyoke College, Summer 2015)
6. Sonny Ly (MSU, Spring 2014, Summer 2014, Fall 2014, Spring 2015, Fall 2015, Spring 2016)
7. Claire Morrison (MSU, Fall 2013, Spring 2014, Summer 2014, Fall 2014, Spring 2015, Fall 2015, Spring 2016)
8. Keenan Noyes (MSU, Fall 2013, Spring 2014, Fall 2014, Spring 2015)
9. Zach Nusbaum (MSU, Fall 2013, Spring 2014, Summer 2014, Fall 2014, Spring 2015)

10. Brandon Ewert (MSU, Spring 2014)
11. Max Smith (MSU, Fall 2013, Spring 2014)

### **3.3.2 Undergraduate Students supervised on teaching**

1. Madelyn Klinkoski (Fall 2015)
2. Brandon Bilinski (Fall 2015)
3. Lauren Constantini (Fall 2015)
4. Brandon Roek (Fall 2015)
5. Ashley O'Brien (Fall 2015)
6. Steven Collareno (Spring 2015, Fall 2015)
7. Katherine Wampler (Spring 2015, Fall 2015)
8. Melissa Buchelli (Spring 2015)
9. Tyler Hoffman (Spring 2015)
10. Karen Davidge (Spring 2014, Spring 2015)
11. Stephanie Schmidt (Spring 2015)

## 4 Service

### 4.1 University Committees

- MSU, University Committee on Undergraduate Education, Fall 2016 –
- MSU Dept. of Physics and Astronomy, Lyman-Briggs/PA Faculty Search Committee, Fall 2015 – Spring 2016
- MSU Dept. of Physics and Astronomy, Algebra-based Physics Review committee, Spring 2014 –
- MSU Dept. of Physics and Astronomy, Calculus-based Physics Review committee, Spring 2014 –
- MSU Dept. of Physics and Astronomy, Undergraduate Program committee, Fall 2013 –
- MSU Dept. of Physics and Astronomy, Instructor Search Committee, Fall 2014 – Spring 2015
- MSU Dept. of Physics and Astronomy, Qualifying Exam committee, Fall 2013 – Spring 2014
- MSU Dept. of Physics and Astronomy, Advising committees (other than own graduate students) for May Lee (Teacher Education)
- Thesis committee for John Aiken, Georgia State University, Atlanta, GA (Fall 2013)

### 4.2 National or International Advisory Committees other than Conferences

- Chair-Elect, Group on Physics Education Research for the American Physical Society (Fellowship Sub-committee), Winter 2016 –
- Vice-Chair, Group on Physics Education Research for the American Physical Society, Winter 2015 – Winter 2016
- Member, Research in Physics Education Committee for the American Association of Physics Teachers, Winter 2015 –
- Chair of the Educational Technologies Committee for the American Association of Physics Teachers, Winter 2013 – Winter 2014 (Written report has shaped AAPT’s educational technology initiatives.)
- American Journal of Physics, Five Year Review Committee, 2012–2013 (Written report is shaping the journal’s online presence.)
- Educational Technologies Committee for the American Association of Physics Teachers, Winter 2010–Winter 2014

### 4.3 Conference Planning and Advisory Committees

- Michigan AAPT Section Spring Meeting, East Lansing, MI (2015).
- Physics Education Research Conference, Minneapolis, MN (2014).
- MSP Summer Science Academies Concepts in Physical Science (2011).
- Atlanta Metro Physics Teachers Network, Atlanta, GA (2011).
- Atlanta Metro Physics Teachers Network, Atlanta, GA (2010).
- MSP Summer Science Academies Concepts in Physical Science (2009).
- MSP Summer Science Academies Concepts in Physical Science (2008).

### 4.4 Review Panels, Referee

- Referee for Physical Review Special Topics - Physics Education Research, American Journal of Physics, The Physics Teacher, Computers and Education
- Referee for Physics Education Research Conference proceedings

### 4.5 Outreach Activities

- Physics and Astronomy Day, Impression 5 Science Museum, East Lansing, MI (2016)
- MSU Department of Physics & Astronomy, Physics Education Research Seminar coordinator (2014–).
- MSU Department of Physics & Astronomy, Graduate Teaching Assistant Workshop coordinator (2014–).
- Science Olympiad, Session coordinator, East Lansing, MI (2014–).
- Grandparent’s University at MSU, Session coordinator, East Lansing, MI (2014).