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# Maren Mossman

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## Education

Washington State University, Pullman, WA

Ph.D. Physics	May 2019
Dissertation: <u>Nonlinear dynamics and shock structures in elongated Bose-Einstein condensates.</u>	
Committee: Prof. Peter Engels (chair), Prof. Michael Forbes and Prof. Brian Saam	
M.S. Physics	Dec 2016
B.S. Physics, Astrophysics option	May 2012

## Appointments and Assistantships

Clare Boothe Luce Assistant Professor of Applied Physics, University of San Diego	Fall 2020
Postdoctoral Research Associate, Fundamental Quantum Physics Lab, Washington State University (PI: Prof. Peter Engels)	2019 – 2020
Graduate Research Assistant, Washington State University (PI: Prof. Peter Engels)	2013 – 2019
Graduate Teaching Assistant, Washington State University	2012 – 2014
Undergraduate Research Assistant, Washington State University (PI: Prof. Guy Worthey)	2011 – 2012
Boeing Scholars Project, Hypersonic vehicle research with mentor Kevin Bowcutt, Washington State University & The Boeing Co.	2010 – 2012

## Honors and Awards

### Graduate

WSU College of Arts and Sciences Ph.D. Student Achievement in the Sciences	2019
WSU Association for Faculty Women Harriett B. Rigas Outstanding Woman in Doctoral Studies Award	2019
WSU GPSA Research Exposition, Physical and Social Sciences Category 3 <sup>rd</sup> place	2019
WSU Golding Family Fellowship in the Sciences	2018
NASA Space Grant Fellowship in Science and Engineering	2016
WSU GPSA Award of Excellence for Outstanding Performance and Lasting Contributions as a Teaching Assistant	2014

### Undergraduate

WSU College of Sciences Distinguished Undergraduate Student Award	2012
Boeing Scholars in Science Scholarship	2010 – 2012
WSU Physics & Astronomy Paul Bender Scholarship	2011
Bilateral Exchange at University of Copenhagen, Denmark	2010 – 2011
WSU Undergraduate President's Honor Roll	5 semesters
WSU Undergraduate Physics Textbook Scholarship	4 semesters

## Research Experience

Postdoctoral Research Assistant, Fundamental Quantum Physics Lab, Washington State University	2019 – 2020
<ul style="list-style-type: none"><li>- Acting head of K-Rb lab.</li><li>- Design, build, and implement dual-species hydrodynamics experiments in the K-Rb lab.</li><li>- Work with and discuss experiments and ideas with external collaborators.</li></ul>	

- Numerically model and plan experiments for implementing with NASA's Cold Atom Lab. Data acquisition and analysis also performed.
- Assist with grant writing and annual grant reports.
- Present experimental findings at conferences and workshops.
- Mentor and train new graduate and undergraduate students.

Graduate Research Assistant, Washington State University

2013 – 2019

- Head graduate researcher in K-Rb lab from 2015-2019.
- Worked closely with theory collaborators to publish experimental findings.
- Designed, built and implemented various electrical and optical systems in lab.
- Student machine shop certification.
- Extensively modeled experimental system and planned experiments for project with NASA's Cold Atom Lab.
- Assisted in writing 2 successful NSF grants and regularly provided text for annual reports for both NSF and NASA grants.

### Professional Associations

American Physical Society (APS)

2009 – Present

International Dark Sky Association (IDA)

2009 – Present

Phi Beta Kappa (ΦBK)

2012 – Present

### Publications

M. E. Mossman, E. S. Delikatny, M. M. Forbes & P. Engels, "Stability in turbulence: The interplay between shocks and vorticity in a superfluid with higher-order dispersion," published in Physical Review A, **102**, 053310 (2020) as an Editors' Suggestion.

M. E. Mossman, Junpeng Hou, Xi-Wang Luo, Chuanwei Zhang & Peter Engels, "Experimental realization of a non-magnetic one-way spin switch," published in Nature Comm. 10, 3381 (2019).

M. E. Mossman, Mark Hofer, Keith Julien, Panos Kevrekidis & Peter Engels, "Turbulence-induced viscous dissipation in a quantum mechanical piston shock," published in Nature Comm. 9(1), 4665 (2018).

M. A. Kamehchi, Khalid Hossain, M. E. Mossman, Yongping Zhang, Thomas Busch, Michael McNeil Forbes & Peter Engels, "Negative-mass hydrodynamics in a spin-orbit coupled Bose-Einstein condensate," published in Phys. Rev. Lett. 118, 155301 (2017) as an Editor's Choice piece.

Yongping Zhang, Maren Elizabeth Mossman, Thomas Busch, Peter Engels & Chuanwei Zhang, "Properties of Spin-Orbit Coupled Bose-Einstein Condensates," review paper published in Frontiers of Physics 11, 118103 (2016).

M. A. Kamehchi, Chunlei Qu, M. E. Mossman, Chuanwei Zhang & Peter Engels, "Spin-momentum coupled Bose-Einstein condensates with lattice-band pseudospins," published in Nature Comm. 7, 10867 (2016).

### In Preparation:

M. E. Mossman, M. M. Forbes, & P. Engels, "Catastrophe Atom Optics: Direct Observation of Caustics and Fold Diffraction with an Atom Laser," in preparation (2020).

T. M. Bersano, M. E. Mossman, M. M. Forbes, & P. Engels, "Observations of the Cusp Diffraction Catastrophe with an Atom Laser," in preparation (2020).

### Presentations

Maren Mossman & P. Engels, "Observation of hypersonic flow dynamics with Bose-Einstein condensates," talk at the 51st Annual Meeting of the Division of Atomic, Molecular, and Optical Physics, Virtual Conference. (Talk)

4 June 2020

- M. E. Mossman, *Quantum Technologies at WSU: A cold atom unidirectional spin-switch device*, Northwest Quantum Nexus workshop for Quantum Computing, Sensing, and Simulation with Cold Atoms, Pullman, WA. (Invited Talk) 21 Feb 2020
- M. E. Mossman & Peter Engels, *Optically induced hydrodynamics in a spin-orbit-coupled Bose-Einstein condensate*, 50th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics, Milwaukee, WI. (Talk) 29 May 2019
- M. E. Mossman, *Nonlinear dynamics and shock structures in elongated Bose-Einstein condensates*, Ph.D. defense, Pullman, WA. (Defense) 15 April 2019
- M. E. Mossman, R. Chapurin, X. Xie, M. Van de Graaf, J. Ye, J. D’Incao, P. Engels & E. A. Cornell, *Optimized parameter regimes for the investigation of Efimov studies on CAL*, NASA Fundamental Physics and Quantum Technology Workshop, Washington, DC. (Poster) 9 April 2019
- Maren Mossman & Peter Engels, *Experimental demonstration of a unidirectional spin switch in a spintronic device*, WSU GPSA Research Expo and Showcase, Pullman, WA. Prize for 3<sup>rd</sup> place in Physical and Social Science category. (Competition poster) 28 March 2019
- Maren Mossman & Peter Engels, *Dynamics of a spin-orbit coupled Bose-Einstein condensate in the presence of a moving barrier*, 49th Annual Meeting of the APS Division of Atomic, Molecular, and Optical Physics, Fort Lauderdale, FL. (Talk) 31 May 2018
- Maren Mossman, Mark Hoefer & Peter Engels, *Turbulence induced viscous dissipation in a quantum mechanical piston shock*, Coherent Control of Complex Quantum Systems workshop, Okinawa, Japan. (Poster) 18 April 2018
- Maren Mossman, Peter Engels, Jose D’Incao & Eric Cornell, *Quantum Droplets in Microgravity*, NASA Fundamental Physics Workshop, La Jolla, CA. (Poster) 10 April 2018
- Maren Mossman & Peter Engels, *The Quantum Mechanical Piston Shock: Superfluidity and Turbulence in Ultracold Gases*, WSU Academic Showcase, Pullman, WA. (Poster) 29 March 2018
- Maren E. Mossman, *Using Ultracold Atoms to Model Quantum Mechanics*, WSU College of Arts & Sciences 3 Minute Thesis competition, Pullman, WA. (Competition talk) 20 March 2018
- M. E. Mossman, Peter Engels, Jose D’Incao & Eric Cornell, *Microgravity Studies of Few-Body Physics*. 33<sup>rd</sup> Annual Meeting of the ASGSR, Seattle, WA. (Talk) 27 Oct 2017
- Maren Mossman, Mark Hoefer, Keith Julien, Panos Kevrekidis & Peter Engels, *Dissipative hydrodynamics in a quantum-fluid piston shock*. 48<sup>th</sup> Annual DAMOP Meeting, Sacramento, CA. (Talk) 8 June 2017
- Maren Mossman, Jose D’Incao, Peter Engels, Deborah Jin & Eric Cornell, *Modelling Few-Body Physics in Microgravity*. NASA Fund. Phys. Workshop, Santa Barbara, CA. (Poster) 1 June 2017
- Maren Mossman, Peter Engels, Jose D’Incao, Deborah Jin & Eric Cornell, *Efimov studies in an ultracold cloud of K-39 atoms in microgravity*. WSU Academic Showcase, Pullman, WA. (Poster) 31 Mar 2017
- Maren Mossman, Peter Engels, Jose D’Incao, Deborah Jin & Eric Cornell, *Investigation of few-body physics with NASA’s CAL: A precision measurement of Efimov physics in microgravity*. NASA Fund. Phys. Workshop, Dana Point, CA. (Poster) 12 Apr 2016
- Peter Engels, Maren Mossman, Jose D’Incao, Deborah Jin & Eric Cornell, *Few-Body Studies in Microgravity*. NASA/JPL CAL Project Science Concept Review. (Invited talk) 18 Feb 2016
- Maren E. Mossman, M. A. Kamehchi & Peter Engels, *Excitation spectrum of Bose-Einstein condensates with modified dispersion*. 46<sup>th</sup> Annual DAMOP Meeting, Columbus, OH. (Poster) 10 June 2015
- Maren E. Mossman, M. A. Kamehchi & Peter Engels, *Engineering dispersion relations: Floquet-Bloch states in a Bose-Einstein condensate*. 16<sup>th</sup> Annual Meeting of the NW Section of the APS, Pullman, WA. (Talk) 15 May 2015

<u>Maren Mossman</u> & Peter Engels, <i>The Coldest Place in Space: Ultracold Science on the ISS</i> . OSA/SPIE Graduate Student Lecture Series, Pullman, WA. (Invited talk)	13 Mar 2015
<u>Maren Mossman</u> , Jose D’Incao, Deborah Jin, Peter Engels & Eric Cornell, <i>The Coldest Place in Space: Bose-Einstein Condensates on the ISS</i> . WSU Wiley Research Competition, Pullman, WA. (Competition talk)	20 Feb 2015
<b>Professional Development Workshops and Trainings</b>	
<b>Post-doc Grant Writing Workshop</b> <i>Organized and facilitated by the WSU Office of Research Advancements and Partnerships (ORAP)</i>	21 Nov 2019
<b>Equity 101: Defining and Cultivating Inclusive Excellence at WSU</b> <i>Organized by the WSU Office of Outreach and Education</i> <i>Facilitated by the Office of Outreach and Education and the Gender Identity/Expression and Sexual Orientation Resource Center (GIESORC)</i>	13 Nov 2019
<b>Graduate Recruitment Summit</b> <i>Organized and facilitated by the WSU Graduate School</i>	25 Sept 2019
<b>Intro to Office of Research and Life Cycle of a Grant</b> <i>Organized and facilitated by the WSU Office of Research Advancements and Partnerships (ORAP)</i>	12 Sept 2019
<b>Discrimination, Sexual Harassment, and Sexual Misconduct Prevention</b> <i>Organized and facilitated by WSU Human Resources</i>	21 Dec 2018
<b>Service, Outreach, Leadership, and Science Communication Efforts</b>	
<b>USD Honors Program Liaison</b> <i>Serve as the faculty liaison between the University’s Honors Program and the Department of Physics and Biophysics.</i>	Fall 2020 - Present
<b>Department of Physics and Biophysics Tutoring Advisor</b> <i>Organize and help facilitate tutoring services for undergraduate students taking lower level physics courses at USD.</i>	Fall 2020 - Present
<b>Skype-a-Scientist Outreach</b> <i>Answer student questions about physics, astronomy and cold atom research from elementary, middle and high school students via video chat. As of November 2019, this program has connected me with over 350 students across the US from grades 3 to 12.</i>	2018 - Present
<b>CUWiP Planning Committee</b> <i>Key member of the committee to plan the first NW CUWiP conference at WSU. Designed the logo. Created and maintained all social media outlets for the event, including webpage development. Organized speakers and workshop/panel sessions for the event. Developed the program CUWiP Kids, designed to allow faculty and student parents the option of attending a weekend conference.</i>	Spring 2019 – Spring 2020
<b>North Central Idaho Career Mentoring Day</b> <i>Volunteered for a high school student with disabilities to shadow my lab work and discuss career opportunities in physics. Program organized by the Disability Action Center in Moscow, Idaho.</i>	12 Nov 2019
<b>Committee for the Recruitment and Retention of Women in Physics at WSU</b> <i>Initiated and headed the committee with an aim to recruit more women and under-represented minority graduate students in physics and bring in more diverse speakers for colloquia.</i>	Fall 2019 – Present
<b>STREAM Team (Science, Technology, Restoration, Engineering, Arts, and Math)</b> <i>Lead a spectroscopy lab for girls in grades 6-9, followed by a lab tour.</i>	31 July 2019
<b>Interview with a Scientist</b> <i>Met with elementary students during an academic summer camp for “formal” interviews.</i>	29 July 2019
<b>Preview for Juniors Academic Fair</b>	20 April 2019

Department representative. Spoke with interested high school Juniors and parents about opportunities in physics and at WSU.

**Research Extravaganza** 30 Nov 2018

Department representative. Spoke with undergrads about research in Physics at WSU.

**Meet Your Major Fair** 26 Sept 2018

Department representative. Spoke with undergrads about opportunities in Physics at WSU.

**Science-A-Thon Campaign / Day-Of-Science** 14 May 2018

Social media campaign to share about science

**SPIE #FacesOfPhotonics Campaign** 19 – 23 March 2018

Featured scientist for the week, shared science and advice

**Solar Derby at Franklin Elementary Science Fair** 2018 & 2019

Assisted elementary students build solar powered cars. Materials and organization of the activity provided by Prof. Brian Collins.

**WSU CAS 3 Minute Thesis** 20 March 2018

Department representative. Competed in the science communication competition.

**Superwomen in Science Podcast, 3-minute summary** 14 Feb 2018

Provided description of research for outreach podcast.

**Celebrating Women Campaign** 29 Nov 2017

Featured woman in the #CelebratingWoman campaign

**WSU Physics and Astronomy Graduate Brochure** Fall 2017

Helped to design, tailor, and organize new brochure for grad students.

**WSU CAS Eclipse Viewing Party** 21 Aug 2017

Served as announcer and local expert for the event.

**WSU Physics and Astronomy Outreach Page** 2017-Present

Developed and help manage social media page.

**WSU Dare-To-Dream Program** Summer 2017

Developed curriculum and taught Dreamers in Washington state to earn high school math credits.

**WSU Cougar Quest** Summer 2015

Developed curriculum, taught lessons to middle school and high school students attending academic camp at WSU.

**WSU Mom's Weekend Laser Maze** Spring 2015

Successfully attained funding through SPIE International Year of Light Activity Grant in the amount of \$1654 to develop demos, posters, and laser maze for the public. Built curriculum for annual event and assisted with the building of demos and laser maze equipment.

**Efforts for Graduate Parents in Physics at WSU** 2014

Lobbied and attained funding for changing tables in Webster. Catalyzed founding of "Mother's Room" in Webster.

**OSA/SPIE Outreach for Girls Scouts of America** 12 Aug 2014

Developed and taught curriculum to GSA troops in Northern Idaho and Eastern Washington centered around learning the scientific method and finding how to make the best bubbles.

**OSA/SPIE Outreach efforts at local schools** 2014 – 2015

Developed and taught curriculum centered around light and spectroscopy to local primary and secondary schools.

**OSA/SPIE Head Grant Writer** 2013 – 2015

*Organized and delegated grant writing efforts for the graduate student club. Responsibilities also included writing yearly reports for SPIE, biannual reports for OSA, and grant requests for OSA, SPIE and the WSU GPSA.*

**GPSA Senator**

2013 – 2015

*Department representative.*

**CAS Student Ambassador Program**

2011 – 2012

*One of two representatives from the College of Sciences to assist in the formation, organization, and evaluation of the program during the College of Arts and College of Science merger.*

**International Student Peer Mentor**

2011 – 2012

*Mentored new international students during their first year at WSU.*