Postdoctoral Scholar in Experimental Physics at the California Institute of Technology

LIGO Laboratory - California Institute of Technology - MS 100-36 - Pasadena, CA 91125 - USA

jlmciver@caltech.edu

EDUCATION

University of Massachusetts Amherst

- Ph.D. in Physics - 2015
  - *The impact of terrestrial noise on the detectability and reconstruction of gravitational wave signals from core-collapse supernovae*
- M.S. in Physics - 2014

Syracuse University

- B.S. in Physics - College of Arts and Sciences - 2009
- B.S. in Magazine Journalism - S.I. Newhouse School of Public Communications - 2009

RESEARCH POSITIONS

Postdoctoral Scholar in Experimental Physics - Caltech - August 2015 to present

I made significant contributions to the discovery of binary black hole systems with the Advanced LIGO interferometers and the first multi-messenger observation of a neutron star merger. I serve as a leader of the LIGO detector characterization group, charged with characterizing the performance of the Advanced LIGO detectors to enable confident gravitational wave detections and astrophysical parameter estimation. I currently study the effect of known transient noise sources in the LIGO interferometers on the parameter estimation of compact binary coalescence (CBC) gravitational wave sources. I'm interested in maximizing the recovery of transient gravitational-wave signals in advanced detector data, core-collapse supernovae, machine learning, tests of general relativity, and preparing to analyze data from next-generation gravitational wave detectors.

Research Assistant - University of Massachusetts Amherst - August 2009 - August 2015

I investigated the ability of model-agnostic waveform reconstruction techniques to accurately extract gravitational wave signals from core-collapse supernovae. I discovered that even in well-behaved Gaussian noise there is a fundamental limitation to these algorithms in recovering the structure of waveforms with complex structure. This work motivated the development of Bayesian priors that favor the expected structure of astrophysical signals. I also investigated interferometer noise and its impact on the transient astrophysical gravitational wave analyses. I developed expertise with the instrumentation of the Advanced LIGO interferometers, particularly the seismic isolation system. I spearheaded characterizing the performance of the Advanced LIGO detector subsystems ahead of the first observing run.

SELECTED CONFERENCE TALKS

- *Gravitational wave observations* - Fifty-One Erg international supernova workshop, June 2017 - INVITED review talk

- *Gravitational wave search background outliers* - Time Series Analysis for Synoptic Surveys and Gravitational Wave Astronomy meeting in Bangalore, India, March 2017 - INVITED

- *The LIGO detectors* - Astrophysics in the Era of Gravitational Wave and Multimessenger Observations Joint Space-Science Institute (JSI) workshop, November 2016 - INVITED

- *The Advanced LIGO Detectors and a New Era of Astronomy* - SACNAS National Conference, October 2016 INVITED

- *Introduction to gravitational wave interferometers* and *Advanced LIGO challenges* - Astrophysics at Mayacamas, March 2016 - INVITED

- *The road to Advanced LIGO's first observations* - The Numerical and Analytical Relativity and Data Analysis (NARDA) meeting, August 2014 - INVITED

- *Preparing to analyze Advanced LIGO data: from detectors to first observations* - American Physical Society meeting, April 2014 - INVITED

- *Advanced LIGO detector characterization ahead of the first observing run* - LIGO-Virgo Collaboration meeting, August 2015 - PLENARY

- *LIGO detector characterization* - LIGO-Virgo Collaboration meeting, August 2014 - PLENARY

- *Data Quality Studies: Methods and Milestones* - Amaldi 9 and NRDA conference, July 2011 - PLENARY

- *Challenges for LIGO data analysis* - Kavli Summer Program in Astrophysics 2017 in Copenhagen, Denmark, July 2017

- *Transient noise in the LIGO detectors* - The Statistical and Applied Mathematical Sciences Institute ASTRO program transition workshop, May 2017

- *Exploring the impact of Advanced LIGO transient noise on the estimation of astrophysical parameters of binary black hole coalescences* - American Physical Society meeting, April 2017

- *Detector characterization: Lessons learned from O1 and preparing for O2* - LIGO-Virgo Collaboration meeting, August 2016

- *Transient noise in Advanced LIGO's first observing run* - Gravitational Wave Physics and Astronomy Workshop (GWPAW), June 2016

- *Characterization of the Advanced LIGO detectors during their first observing run* - American Physical Society meeting, April 2016

- *The impact of non-stationary ground motion on transient h(t) noise during O1* - LIGO-Virgo Collaboration meeting, March 2016

- *Reconstructing core-collapse supernovae waveforms with advanced era interferometers* - American Physical Society meeting, April 2015

- *Characterizing the aLIGO seismic isolation system* - LIGO-Virgo Collaboration meeting, August 2015

- *Recent seismic isolation detector characterization* - LIGO-Virgo Collaboration meeting, August 2014

- *Single interferometer burst pipeline comparison* - LIGO-Virgo Collaboration meeting, March 2013

- *Update on investigations by the detector characterization working group on the Advanced LIGO seismic isolation subsystem* - LIGO-Virgo collaboration meeting, September 2013
- *LIGO burst data quality* - LIGO-Virgo collaboration meeting, March 2010

SELECTED LIST OF PUBLICATIONS

- GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral. B.P. Abbott et al. PRL 119, 161101 (2017) - PAPER WRITING TEAM MEMBER
- *The impact of transient noise on the parameter estimation of gravitational waves from binary black holes.* J. McIver et al. In prep.
- *Effects of transients in LIGO suspensions on searches for gravitational waves.* M. Walker, T. D. Abbott, S. M. Aston, G. González, D. M. Macleod, J. McIver, et al. Submitted to Review of Scientific Instruments. (2017)
- *Characterization of transient noise in Advanced LIGO relevant to gravitational wave signal GW150914.* B. P. Abbott et al. Class. Quantum Grav. 33 134001 (2016) - LEAD AUTHOR
- *Upper limits on the rates of binary neutron star and neutron-star--black-hole mergers from Advanced LIGO's first observing run.* B.P. Abbott et al. Ap. J. Letters 832, 2. (2016)
- *Multi-messenger Observations of a Binary Neutron Star Merger.* B.P. Abbott et al. Ap. J. Letters 848, 2. (2017)
- *Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A.* B.P. Abbott et al. Ap. J. Letters 848, 2 (2017)
- *A gravitational-wave standard siren measurement of the Hubble constant.* B.P. Abbott et al. Nature doi: 10.1038/nature24471 (2017)
- *GW170814: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence.* B.P. Abbott et al. PRL 119, 141101 (2017)
- *GW170104: Observation of a 50-Solar-Mass Binary Black Hole Coalescence at Redshift 0.2.* B. P. Abbott et al. Phys. Rev. Lett. 118, 221101 (2017)
- *Observation of Gravitational Waves from a Binary Black Hole Merger.* B. P. Abbott et al. PRL 116, 061102 (2016)
- *GW151226: Observation of Gravitational Waves from a 22 Solar-mass Binary Black Hole Coalescence.* B. P. Abbott et al. PRL 116, 241103 (2016)
- *Binary Black Hole Mergers in the first Advanced LIGO Observing Run.* B. P. Abbott at al. Phys. Rev. X 6, 041015 (2016)
- *GW150914: First results from the search for binary black hole coalescence with Advanced LIGO.* B. P. Abbott et al. Phys. Rev. D 93, 122003 (2016)
- *Upper limits on the rates of binary neutron star and neutron-star--black-hole mergers from Advanced LIGO's first observing run.* B.P. Abbott et al. Ap. J. Letters, 832, 2. (2016)
- *All-sky search for short gravitational-wave bursts in the first Advanced LIGO run.* B.P. Abbott et al. Phys. Rev. D 95, 042003 (2017)

- *Observing gravitational-wave transient GW150914 with minimal assumptions.* B. P. Abbott et al. Phys. Rev. D 93, 122004 (2016)

- *Improving the data quality of Advanced LIGO based on early engineering run results.* L. Nuttall et al. Class. Quant. Grav. 32 (2015)

- *Characterization of the LIGO detectors during their sixth science run.* J. Aasi, et. al. Class. Quant. Grav. 32 115012 (2015)

- *Seismic isolation of Advanced LIGO: Review of strategy, instrumentation and performance.* F. Matichard et al. Class. Quant. Grav. 32 185003 (2015)

- *Data quality studies of enhanced interferometric gravitational wave detectors.* Jessica McIver, for the LIGO Scientific Collaboration and the Virgo Collaboration. Class. Quant. Grav. 29 124010 (2012)

- *All-sky search for gravitational-wave bursts in the second joint LIGO-Virgo run.* J. Abadie et al. Phys. Rev. D 85, 122007 (2012)

- *Search for gravitational waves from binary black hole inspiral, merger, and ring-down in LIGO- Virgo data from 2009-2010.* J. Aasi et. al. Phys. Rev. D 87, 022002 (2012)

- *A hierarchical method for vetoing noise transients in gravitational-wave detectors.* J.R. Smith, T. Abbott, E. Hirose, N. Leroy, D. Macleod, J. McIver, P. Saulson, P. Shawhan. Class. Quantum Grav. 28 235005 (2011)

PUBLIC PRESENTATIONS, SEMINARS, and COLLOQUIA

- *GW170817: gravitational waves from the merger of two neutron stars* - Caltech/JPL Association for Gravitational-Wave Research (CaJAGWR) seminar, October 2017

- *Einstein, black holes, and gravitational waves* - The 2017 Mandel Lecture at the Rio Theatre in Santa Cruz sponsored by the UC Santa Cruz department of astronomy, June 2017

- *Gravitational waves and a new era of astrophysics* - Doc Morris John D. Schopp Memorial Lecture Public Lecture at San Diego State University, April 2017

- *Gravitational wave astronomy with Advanced LIGO: beyond the first observing run* - invited public colloquium at Embry-Riddle Aeronautical University, October 28, 2016

- *LIGO and the future of gravitational wave astronomy* - invited public colloquium at the Rochester Institute of Technology, September 22, 2016

- *LIGO and the beginning of gravitational wave astronomy* - invited public colloquium at Brookhaven National Lab, September 18 2016

- *Gravitational Wave Burst Analysis* - Caltech Gravitational Wave Astrophysics School, July 2015

- *Characterizing the Advanced LIGO interferometers for transient gravitational waves* - seminar at the University of Florida, November 2014

- *An Advanced LIGO seismic isolation and suspensions tutorial for data analysts tutorial* - Syracuse University, February 2014

- *Spacetime, black holes, and cosmic explosions!* - Geeks Night Out public talk at the Amherst Brewing Company, Fall 2014

- *Gravitational Waves, LIGO, and Communicating Science* - public seminar at Mohonasen High School, May 2013
- *Advanced LIGO Seismic Isolation* - Physics Graduate Student Organization Seminar, September 2012
- *Communication in Science* - Draper Middle School, December 2012
- *Gravitational Waves and LIGO* - Draper Middle School, December 2012
- *Data Quality Studies on LIGO interferometers* - Physics Graduate Student Organization seminar, August 2011

LEADERSHIP

- Served as the co-chair of the LIGO Detector Characterization (DetChar) working group, one of the major data analysis working groups within the LIGO Scientific Collaboration, since March 2017. The DetChar group works at the interface between astrophysics and LIGO instrumentation. Detector characterization enables the robust identification of gravitational wave signals and accurate inference of their physical parameters by evaluating and mitigating source of noise harmful to the astrophysical analyses, and is also responsible for vetting gravitational wave signal candidates and helping to produce high-quality data.
- Served as the instrument subgroup lead of the detector characterization group and liaison to Instrument scientists and commissioners from January 2014 through March 2017. Responsible for interfacing between the Detector Characterization group and the LIGO lab and for the standardization of Advanced LIGO subsystem characterization.
- Served as the seismic isolation subsystem lead to the detector characterization group and liaison to the seismic isolation instrumental scientists from May 2012 to June 2016. Mentored the suspensions subsystems leads in their positions since May 2013.
- Served as the data quality shift co-lead since July 2016, responsible for guiding those tasked with assessing the quality of LIGO data during observing and engineering runs.
- Served in the LIGO Scientific Collaboration's Executive Committee leadership body as a non-voting member since March 2017.
- Served on the LIGO-Virgo (LVC) allies coordination team since March 2016. [lvcallies.org]
- Elected to serve on the Executive Committee of the American Physical Society's Division of Gravitational Physics (DGRAV) as a student member for 2014-2016.
- Founding member and elected executive chair of the Graduate Women in STEM (GWIS) organization at UMass Amherst. GWIS grew to serve a community of over a thousand graduate students in the College of Natural Sciences and the College of Engineering by providing professional development, mentoring, and outreach opportunities. [blogs.umass.edu/gwis]
- Representative of GWIS and the graduate student women of UMass to an advisory body charged with maximizing UMass's recent institutional AWIS affiliation from 2013-2015.
- Served the physics department at UMass as a graduate student representative to that graduate program committee from 2013-2014.
- Elected as the president of the Women and Minorities in Physics (WMP) organization in the UMass Amherst department of physics from 2010-2012.

MENTORING

- Co-mentored two student projects at the Kavli Summer Program in Astrophysics 2017; one investigating novel tests of general relativity with gravitational wave signals, and the other exploring the supernova rate local to the Earth within the Milky Way and associated probes of supernova physics using gravitational waves.

- Mentored a LIGO Summer Undergraduate Research Fellow (SURF) student at Caltech on a project studying nonlinear seismic noise the the Advanced LIGO detectors in summer 2016, and assisted in mentoring two SURF student projects in summer 2017.

- Mentored and trained graduate students and postdocs serving as LSC fellows at the LIGO Livingston detector in fall 2015. The LSC fellows program is intended to support the astrophysical searches by embedding scientists with diverse specialties at the detector to improve the quality of the data.

- Mentored and trained data quality shifters, volunteers from LIGO data analysis and instrument science charged with monitoring evaluating the impact of noise on the astrophysical analyses throughout the first Advanced LIGO observing run.

- Mentored graduate students and postdocs working on LIGO detector characterization by suggesting projects, guiding investigations, and advising on dissemination of their results.

- Mentored, directly supervised, and developed the research projects of six undergraduate students at the University of Massachusetts Amherst and remotely.

TEACHING EXPERIENCE at the UNIVERSITY OF MASSACHUSETTS AMHERST

Introductory Physics II Laboratory, Fall 2009

Lectured and supervised introductory physics laboratory course on optics, electromagnetism, and atomic physics for science majors.

From the Big Bang to Black Holes, Spring 2011

Teaching assistant for a writing-based general education course covering popular physics from quantum mechanics to cosmology aimed at students studying the humanities.

Seeing the Light, Fall 2011 and Fall 2012

Teaching assistant for a general education course addressing the physics of light focusing on applications such as lighting in theatre design and photography.

Introductory Physics I - Flipped Classroom, Spring 2014

Part of a team of faculty and teaching assistants that developed content for and executed a flipped classroom course in which the students watched video lectures outside of class and allotted lecture time was used for active learning through interactive team-based problem solving.

Introductory Physics I - Traditional Lecture, Fall 2012

Held open office hours and contributed to lecture preparation for an introductory mechanics course for science majors outside of physics.

Writing in Physics for Majors, Spring 2014

Used my background in writing and communication to help upper level physics major hone their technical writing skills — included a wide variety of target audiences and advanced physics topics.

OTHER TEACHING EXPERIENCE

The ABCs of course design - Caltech, November 2017

Attended a short course sponsored by the Caltech Center for Teaching, Learning and Outreach. We covered "backwards" course design, learning outcomes, incorporating active learning, developing assessments, inclusive teaching, and class structure.

Workshop on inclusive teaching practices - Caltech, April 2017

Gave an hour-long workshop on strategies for fostering a welcoming environment for a diverse student population, including first-generation college students, to fellow postdocs at Caltech.

Lectures on data analysis techniques - Caltech, July 2016

Lectured students attending the LIGO SURF program on basic signal processing, discretized functions, frequency transforms, and gravitational wave data analysis techniques.

Invited lecture on gravitational wave burst data analysis - Caltech, July 2015

Gave a lecture on the recovery of arbitrary short-duration gravitational wave burst waveforms from the data of terrestrial interferometers at the Caltech Gravitational Wave Astrophysics School. https://www.cgwas.org/lectures_and_handson.html

Invited lectures series on detector characterization - KAIST in Daejeon, Korea, July 2015

Delivered a three pedagogical lectures on the characterization of the Advanced LIGO detectors to improve the sensitivity of the transient astrophysical analyses and enable confidence source detection and accurate parameter estimation at the 2015 International School on Numerical Relativity and Gravitational Waves.

The Situation Room: Teaching for Every Classroom workshop - Amherst, Massachusetts, 2014

Participated in a master class format workshop simulating common university science teaching settings: laboratory, small advanced lecture, large introductory lecture, and discussion section.

Teaching at teaching-intensive institutions workshop - Boston, Massachusetts, 2014

Attended the regional teaching workshop hosted by Bridgewater State University. Acquired skills for using a culturally inclusive pedagogy in teaching science and how to effectively mentor student researchers.

Physics coach for Introductory Physics II discussions - Syracuse University, 2006-2008

Worked directly with students to help them solve challenging electromagnetism problems in the format of a flipped-classroom setting.

OUTREACH

- Served as a STEM Superstar for the Project STEM program aimed at middle-school-aged girls interested in science. Did demos on spacetime and waves and discussed the recent gravitational wave detections, June 2016 and June 2017.

- Currently participating in 2017 Northwestern program to reach minority-serving schools by speaking about gravitational wave research and careers with students, physics departments, and their local community.

- Gave talks on gravitational wave astrophysics to four classes of Earth Science students at Mohonasen Senior High School, December 2016.

- Ran a coding workshop on how to build a website for high school girls at Mohonasen Senior High School, December 2016.

- Gave a talk on LIGO and the GW150914 discovery to a high school physics class at Cobleskill-Richmondville High School, December 2016.

- Gave an invited lecture at the WISRD Community Lecture Series at Wildwood School on General Relativity, gravitational waves, the LIGO detectors, and the GW150914 discovery, May 2016.

- Authored the blog piece for CQG+ 'How do we know LIGO detected gravitational waves?' that accompanied the detector characterization companion paper to the GW150914 discovery.

- Volunteered at Science Saturday at the LIGO Livingston detector, guiding visitors on a tour of the facility and answering questions about the science of gravitational waves and LIGO, February 2016.

- Participated in a live Google Hangout event on LIGO & Gravitational Waves for the Future in Space series, February 2016.

- Designed a data analysis workshop for K-12 exploring search algorithms and finding weak signal in noisy data. Given at Mohonasen High School in May 2014, and Cobleskill-Richmondville High School in May 2015.

- Developed a day-long event exploring waves, sound, light, gravity, and LIGO research at a summer science program for incoming fifth grade girls at Bard College at Simon's Rock, June 2012.

- As an officer in Women and Minorities in Physics (WMP) at UMass I secured funding to support the WMP library, sponsored student seminar talks, hosted an invited speaker from the UMass psychology department for a workshop on social bias in academia, and organized meetings to discuss issues important for women and minorities in the physics department.

- Through my work with the Graduate Women in STEM (GWIS) organization I have planned and participated in stellar outreach programs like Eureka!, which supported middle-school-aged girls from inner-city Holyoke to spend a month on the UMass campus participating in hands-on science and math workshops. I have also helped plan and implement faculty luncheons for women graduate students: opportunities to connect with faculty members.

AWARDS

- Princess of Asturias Awards for Technical and Scientific Research awarded by His Majesty the King of Spain to to the LIGO Scientific Collaboration in 2017
- Bruno Rossi Prize awarded by the High Energy Astrophysics Division of the American Astronomical Society in 2017 to the LIGO Scientific Collaboration
- UK Royal Astronomical Society 2017 Group Achievement Award in Astronomy awarded to the LIGO team
- Special Breakthrough Prize in Fundamental Physics awarded to contributors to the gravitational wave discovery in 2016
- 2016 Gruber Foundation Cosmology Prize awarded to the LIGO team
- Distinguished Science Award awarded by the National Space Club - Huntsville Chapter to the LIGO team in 2016
- American Physical Society Gravitation and General Relativity Travel Award, 2014
- Arthur Quinton award for outstanding teaching assistants, 2010
- Best data analysis poster award for *The Detchar Times* at the March 2010 LIGO-Virgo Collaboration meeting

GRANTS and GRANT WRITING

- Co-investigator of Indo-US Virtual Networked Centre proposal entitled "Pragadh: Indo-US Centre for Pan-Astronomical Deep Learning" submitted to the Indo-US science and Technology Forum. FUNDED.
- University of Massachusetts Amherst Graduate School Dissertation Research Grant, 2013
- As the leader of the Graduate Women in STEM (GWIS), I played a major role in successfully acquiring funding from the College of Natural Sciences, College of Engineering, College of Information and Computer Sciences, College of Social and Behavioral Sciences, and the Graduate School. GWIS later expanded funding sources to other colleges at the university as well as external grants, such as the Women for UMass Fund.
- Physics Graduate Student Travel Grant, 2012 and 2013
- Experience with the NSF FastLane system.
- Participated in UMass Office of Professional Development workshops: Introduction to Grant Searching and Introduction to Grant Writing.
- Assisted in writing NSF grant proposals for Laura Cadonati's research groups at Georgia Tech and the University of Massachusetts Amherst.