

Michael P. Ross (707) 362-3824
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Experimental physicist interested in a wide variety of precision measurement including gravitational wave observation, dark matter searches, tests of gravity, and rotational seismology

Education

University of Washington	Seattle, WA
- Ph.D. Physics	2020
Dissertation: <i>Precision Mechanical Rotation Sensors for Terrestrial Gravitational Wave Observatories</i>	
- M.S. Physics	2017
Elective Coursework: quantum computing, machine learning, high performance computing, data analysis, seismology	
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Humboldt State University	Arcata, CA
- B.S. Physics	2015
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College of the Redwoods	Eureka, CA
- A.A. Science	2013
- A.A Science Exploration	2013

Research Experience

University of Washington	Seattle, WA
Center for Experimental Nuclear Physics and Astrophysics (CENPA) Eöt-Wash Experimental Gravity Group	
- Postdoctoral Scholar	July 2020 - Present
- Research Assistant	Jan 2017 - June 2020
- Laboratory Technician	Aug 2015 - Sep 2016

The Eöt-Wash group specializes in cutting-edge tests of gravity and searches for new physics utilizing precision mechanical systems (torsion balances and beam balances). I was involved in a wide-range of projects but focused on instrumentation for the LIGO gravitational wave observatories and various torsion balance tests of gravity.

LIGO	Livingston, LA
Livingston Observatory	
- LIGO Scientific Collaboration Fellow	Feb 2018 - May 2018

As a LSC fellow, I built four precision ground rotation sensors and implemented the sensors in the observatory's seismic isolation system to correct the contamination of seismometer signals due to wind-driven tilts.

Humboldt State University	Arcata, CA
Gravity Lab	
- Undergraduate Researcher	Sep. 2013 - May 2015

The HSU Gravity Lab is constructing a torsion balance experiment to test both the inverse square law and equivalence principle. As a student researcher, I operated and maintained the apparatus, led the fabrication of the pendulum, the mechanical and electrostatic controls, and the in-vacuum attractor mass assembly.

Teaching Experience

Humboldt State University
Department of Physics & Astronomy
- Lecturer
- Instructional Student Assistant

Arcata, CA
Jan 2021 – May 2021
Sep 2013 – May 2015

Remotely taught an upper division modern physics course. Graded homework for algebra-based electromagnetism and modern physics courses.

University of Washington
Department of Physics
- Directed Reading Instructor
- Teaching Assistant

Seattle, WA
May 2019 – Dec 2019
Sep 2016 – Dec 2016

Taught a one-on-one reading course for undergraduates that covered the basics of gravitational wave theory and contemporary subjects in gravitational wave astronomy. As a teaching assistant, I taught an algebra-based heat and electromagnetism lab and an introductory level calculus-based mechanics tutorial, assisted in exam grading for the introductory mechanics course, and tutored in an open lab study center.

College of the Redwoods
Department of Mathematics
- Peer Tutor

Eureka, CA
Aug 2011 – May 2013

Tutored students in an open lab that were enrolled in courses ranging from basic arithmetic to multivariable calculus.

Non-Academic Experience

Scuba Diver – PADI Open Water Diver + Dry Suit Certification, comfortable diving in low temperature and low visibility conditions

Hazmat Removal – Assisted in the removal and disposal of 3.5 tons of oxidized depleted uranium from decommissioned experiment

Android Software Development – Developed and published an Android app (now defunct) to display the data from personal weather stations

Outdoorsman – Avid hiker, paddleboarder, climber, and archer. Experienced in bushcraft, foraging, and navigating rugged terrain

Research Interests

More details (mpross.net)

Gravitational wave astronomy: Compact binary coalescence, Stochastic gravitational wave background, Measurements of Hubble's constant, Black hole populations, Neutron star equation of state

Tests of Gravity: Tests of the inverse square law, Equivalence principle verification, Searches for ultra-light dark matter, Gravitational wave tests of General Relativity

Instrumentation: Torsion balances, Beam balances, Precision angle sensing, Interferometric angle sensing, Gravitational calibration, Seismic isolation

Seismology/Seismic Noise Sources: Rotational seismology, Seismometer tilt contamination, Atmospheric-ground tilt coupling, Newtonian-noise subtraction, Elasto-gravity observation

Gravitational Wave Astronomy:

Limits on the stochastic gravitational wave background and prospects for single-source detection with GRACE Follow-On, M.P. Ross, C.A. Hagedorn, E.A. Shaw, A.L. Lockwood, B.M. Iritani, J.G. Lee, K. Venkateswara, J.H. Gundlach - Physical Review D, 2020

GW190521: A Binary Black Hole Merger with a Total Mass of $150 M_{\odot}$, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2020

GW190814: gravitational waves from the coalescence of a 23 solar mass black hole with a 2.6 solar mass compact object, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- The Astrophysical Journal Letters, 2020

GW190412: Observation of a binary-black-hole coalescence with asymmetric masses, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review D, 2020

GW190425: Observation of a compact binary coalescence with total mass $\sim 3.4 M_{\odot}$, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- The Astrophysical Journal Letters, 2020

GWTC-1: a gravitational-wave transient catalog of compact binary mergers observed by LIGO and Virgo during the first and second observing runs, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review X, 2019

GW170608: Observation of a 19 solar-mass binary black hole coalescence, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review X, 2017

A gravitational-wave standard siren measurement of the Hubble constant, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Nature, 2017

GW170817: observation of gravitational waves from a binary neutron star inspiral, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2017

Multi-messenger Observations of a Binary Neutron Star Merger, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- The Astrophysical Journal Letters, 2020

GW170104: observation of a 50-solar-mass binary black hole coalescence at redshift 0.2, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2017

Tests of Gravity:

A torsion-balance search for ultra low-mass bosonic dark matter, E. A. Shaw, M. P. Ross, C. A. Hagedorn, E. G. Adelberger, J. H. Gundlach - Physical Review D, 2021

Tests of general relativity with the binary black hole signals from the LIGO-Virgo catalog GWTC-1, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review D, 2019

Tests of general relativity with GW170817, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2019

Experimental Progress Towards Testing the Behavior of Gravity at the 20-micron Distance Scale
Authors - M.P. Ross, J.S. Johnson, I.S. Guerrero, H.F. Leopardi, C.D. Hoyle - Journal of Undergraduate Research and Scholarly Excellence, 2018

Tests of Short-Range Gravity with a Novel Parallel-Plate Torsion Pendulum, M.P. Ross - NCUR Proceedings, 2015

Instrumentation:

A modified Michelson interferometer to measure sub-milliradian changes in angle, C. K. LeDesma, M. P. Ross, B. E. Daly, C. D. Hoyle, and M. M. Mola - AIP Advances, 2022

A cryogenic torsion balance using a liquid-cryogen free, ultra-low vibration cryostat, S. M. Fleischer, M. P. Ross, K. Venkateswara, C. A. Hagedorn, E. A. Shaw, E. Swanson, B. R. Heckel, and J. H. Gundlach - Review of Scientific Instruments, 2022

Initial Results from the LIGO Newtonian Calibrator, M.P. Ross, T. Mistry, L. Datrier, J. Kissel, K. Venkateswara, C. Weller, K. Kumar, C. Hagedorn, E. Adelberger, J. Lee, E. Shaw, P. Thomas, D. Barker, F. Clara, B. Gateley, T. M. Guidry, E. Daw, M. Hendry, J. Gundlach - Physical Review D, 2021

A Low-Frequency Torsion Pendulum with Interferometric Readout, M.P. Ross, K. Venkateswara, C.A. Hagedorn, C.J. Leupold, P.W.F. Forsyth, J.D. Wegner, E.A. Shaw, J.G. Lee, J.H. Gundlach - Review of Scientific Instruments, 2021

Precision Mechanical Rotation Sensors for Terrestrial Gravitational Wave Observatories, M.P. Ross - University of Washington, 2020

Particle swarming of sensor correction filters, J.J. Carter, S.J. Cooper, E. Thrift, J. Briggs, J. Warner, M.P. Ross, C.M. Mow-Lowry - Classical and Quantum Gravity, 2020

Observation of a potential future sensitivity limitation from ground motion at LIGO Hanford, J. Harms, E.L. Bonilla, M.W. Coughlin, J. Driggers, S.E. Dwyer, D.J. McManus, M.P. Ross, B.J.J. Slagmolen, K. Venkateswara - Physical Review D, 2020

Quantum correlations between light and the kilogram-mass mirrors of LIGO, Haocun Yu, L. McCuller, M. Tse, N. Kijbunchoo, L. Barsotti, N. Mavalvala, et. al. (The LIGO Scientific Collaboration Instrument Science Authors) - Nature, 2020

Quantum-Enhanced Advanced LIGO Detectors in the Era of Gravitational-Wave Astronomy, M. Tse et al. (The LIGO Scientific Collaboration Instrument Science Authors) - Physical Review Letters, 2019

Seismology/Seismic Noise Sources:

Towards windproofing LIGO: Reducing the effect of wind-driven floor tilt by using rotation sensors in active seismic isolation, M.P. Ross, K. Venkateswara, J. Warner, C. Mow-Lowry, B. Lantz, J. Kissel, H. Radkins, T. Shaffer, R. Mittleman, S. Cooper, A. Pele, J. Gundlach - Classical and Quantum Gravity, 2020

Implications of dedicated seismometer measurements on Newtonian-noise cancellation for advanced LIGO, M.W. Coughlin, J. Harms, J. Driggers, D.J. McManus, N. Mukund, M.P. Ross, B.J.J. Slagmolen, K. Venkateswara - Physical Review Letters, 2018

Low-Frequency Tilt Seismology with a Precision Ground-Rotation Sensor, MP Ross, K Venkateswara, CA Hagedorn, JH Gundlach, JS Kissel, J Warner, H Radkins, TJ Shaffer, MW Coughlin, P Bodin - Seismological Research Letters, 2018

Presentations

Detecting Gravitational Waves on a Shaking Earth, Seminar, Seattle University. 2022

University of Washington Eöt-Wash Group Overview, Gravitational Wave Astronomy Northwest Meeting, LIGO Hanford Observatory. 2022

Rotation Sensor Installation on the Stanford ETF Platform, LVK Collaboration Meeting, Remote. 2022

University of Washington Seattle Group Overview, Gravitational Wave Astronomy Northwest Meeting, Remote. 2021

In-Vacuum Inertial Rotation Sensors, Low-frequency Workshop, Remote. 2021

LIGO NCal Update, LIGO/Virgo collaboration meeting, Remote. 2021

Recent Discoveries in Gravitational Wave Astrophysics, CENPA Seminar, Remote. 2020

LIGO Newtonian Calibrator, LIGO/Virgo collaboration meeting, Remote. 2020

University of Washington LIGO Group Overview, Gravitational Wave Astronomy Northwest Meeting, Remote. 2020

Compact-BRS Update, LIGO/Virgo collaboration meeting, Warsaw, Poland. 2019

Development and deployment of beam rotation sensors for the LIGO seismic isolation system, Gravitational Wave Astronomy Northwest Meeting, LIGO Hanford Observatory. 2019

Development and deployment of beam rotation sensors for the LIGO seismic isolation system, Applied Physics Lab Seminar, University of Washington. 2019

Development and deployment of beam rotation sensors for the LIGO seismic isolation system, SeismoLunch Seminar, University of Washington. 2019

Integration of Beam Rotation Sensors to seismic isolation, A. Pele, M.P. Ross - Low-frequency sensing and control for aLIGO workshop, University of Birmingham, United Kingdom. 2018

Beam Rotation Sensor Update, LIGO/Virgo collaboration meeting, Sonoma State University. 2018

Tests of Short-range Gravity with a Novel Parallel Plate Torsion Pendulum, National Conference on Undergraduate Research, Eastern Washington University. 2015

Experimental Progress on Tests of Gravity at 20 microns with a Parallel-Plate Torsion Pendulum, 31st Pacific Coast Gravity Meeting, University of Oregon. 2015

Experimental Progress on Tests of Gravity at 20 microns. M.P. Ross and C. Cardenas - APS Far West Section Meeting, University of Nevada, Reno. 2014
