

Michael J. Zevin || Curriculum Vitae

Northwestern University/CIERA, — 2145 Sheridan Road, F226 — Evanston, IL 60208

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Ph.D. candidate in physics and astronomy at Northwestern University, studying gravitational-wave astrophysics, compact objects, stellar evolution, and star cluster dynamics. Heavily involved in citizen science and science communication.

Education

Academic Qualifications

Northwestern University **Ph.D.**, *Matriculating Spring 2020*
Evanston, IL **M.S.**, *Fall 2016*

Thesis — Unveiling the Lives and Deaths of Stars through Gravitational Waves and Stellar Explosions
Advisor — Vicky Kalogera

University of Illinois **B.S.**, *Spring 2012*

Champaign, IL
Majors in Astronomy and Physics, Minor in Music Performance

Fellowships

- ▷ NSF IDEAS Fellowship 2016–Present
- ▷ Illinois Space Grant Consortium Fellowship 2017–Present
- ▷ NSF GK12 Fellowship 2017–2018
- ▷ Oxford Centre for Cosmological Studies Balzan Fellowship¹ 2018
- ▷ Kavli Summer Fellowship² 2017

Publications

First Author & Chaired Papers (with links)

Can Neutron-Star Mergers Explain the r-process Enrichment in Globular Clusters? 2019
M. Zevin, K. Kremer, D. M. Siegel, S. Coughlin, B. T.-H. Tsang, C. P. L. Berry, V. Kalogera
ApJ (submitted)

Eccentric Black Hole Mergers in Dense Star Clusters: The Role of Binary-Binary Encounters ApJ
M. Zevin, J. Samsing, C. L. Rodriguez, C. J. Haster, E. Ramirez-Ruiz 2019
ApJ **871**, 1
– Article in AAS Nova

On the Progenitor of Binary Neutron Star Merger GW170817 ApJL
The LIGO Scientific Collaboration and Virgo Collaboration³ 2017
ApJ **850**, L40

Constraining Formation Models of Binary Black Holes with Gravitational-Wave Observations ApJ
M. Zevin, C. Pankow, C. R. Rodriguez, L. Sampson, E. Chase, V. Kalogera, F. A. Rasio 2017
ApJL **846**, 82

¹Research Advisor: Dr. Chris Lintott (New College, University of Oxford)

²Research Advisor: Dr. Enrico Ramirez-Ruiz (University of California Santa Cruz)

³*M. Zevin*: Chair of paper-writing team and analysis lead

Gravity Spy: Integrating Advanced LIGO Detector Characterization, Machine Learning, and Citizen Science	CQG 2017
<i>M. Zevin, S. Coughlin, S. Bahaadini, E. Besler, N. Rohani, S. Allen, M. Cabero, K. Crowston, A. K. Katsaggelos, S. L. Larson, T. K. Lee, C. Lintott, T. B. Littenberg, A. Lundgren, C. Østerlund, J. R. Smith, L. Trouille, V. Kalogera</i>	
CQG 34 , 064003	
– Covered by AAS Press	
Second Author & Featured Contributed Papers (with links)	
Black Holes: The Next Generation	
<i>C. Rodriguez, M. Zevin, P. Amaro-Seoane, S. Chatterjee, K. Kremer, F. A. Rasio, C. S. Ye</i>	2019
PRD (submitted)	
Illuminating Black Hole Binary Formation Channels with Spins in Advanced LIGO	ApJL 2016
<i>C. Rodriguez, M. Zevin, C. Pankow, V. Kalogera, F. A. Rasio</i>	
ApJL 832 , 1	
Contributed Papers (with links)	
Classifying the Unknown: Discovering Novel Gravitational-Wave Detector Glitches using Similarity Learning	PRD 2019
<i>S. Coughlin, S. Bahaadini, N. Rohani, M. Zevin, O. Patane, M. Harandi, C. Jackson, V. Noroozi, S. Allen, J. Areeda, M. Coughlin, P. Ruiz, C. P. L. Berry, K. Crowston, A. K. Katsaggelos, A. Lundgren, C. Østerlund, J. R. Smith, L. Trouille, V. Kalogera</i>	
PRD 99 , 082002	
Post-Newtonian Dynamics in Dense Star Clusters: Binary Black Holes in the LISA Band	PRD 2019
<i>K. Kremer, C. L. Rodriguez, P. Amaro-Seoane, K. Breivik, S. Chatterjee, M. L. Katz, S. Larson, F. A. Rasio, J. Samsing, C. S. Ye, M. Zevin</i>	
PRD 99 , 063003	
Post-Newtonian Dynamics in Dense Star Clusters: Formation, Masses, and Merger Rates of Highly-Eccentric Black Hole Binaries	PRD 2018
<i>C. L. Rodriguez, P. Amaro-Seoane, S. Chatterjee, K. Kremer, F. A. Rasio, J. Samsing, C. S. Ye, M. Zevin</i>	
PRD 98 , 123005	
DIRECT: Deep Discriminative Embedding for Clustering of LIGO Data	ICIP 2018
<i>S. Bahaadini, V. Noroozi, N. Rohani, S. Coughlin, M. Zevin, V. Kalogera, A. K. Katsaggelos</i>	
IEEE International Conference on Image Processing Proceedings	
Machine Learning for Gravity Spy: Glitch Classification and Dataset	Information Sciences 2018
<i>S. Bahaadini, V. Noroozi, N. Rohani, S. Coughlin, M. Zevin, J. R. Smith, V. Kalogera, A. K. Katsaggelos</i>	
Information Sciences Journal 444 , 172	
Improvements in Gravitational-wave Sky Localization with Expanded Networks of Interferometers	ApJL 2018
<i>C. Pankow, E. A. Chase, S. Coughlin, M. Zevin, V. Kalogera</i>	
ApJL 854 , L25	
Deep Multi-view Models for Glitch Classification	ICASSP 2018
<i>S. Bahaadini, N. Rohani, S. Coughlin, M. Zevin, V. Kalogera, A. K. Katsaggelos</i>	
IEEE International Conference on Acoustics, Speech, and Signal Processing Proceedings	
Incorporating Current Research into Formal Higher Education Settings using Astrobites	AJP 2017
<i>N. E. Sanders, S. Kohler, C. Faesi, A. Villar, M. Zevin</i>	
AJP 85 , 741	
Astrophysical Prior Information and Gravitational-Wave Parameter Estimation	APJ 2017
<i>C. Pankow, L. Sampson, L. Perri, E. A. Chase, S. Coughlin, M. Zevin, V. Kalogera</i>	
ApJ 834 , 2	

Collaboration Papers (as part of the LIGO Scientific Collaboration, 2015–Present)

- Searches for Gravitational Waves from Known Pulsars at Two Harmonics in 2015–2017 LIGO Data
- Search for gravitational waves from Scorpius X-1 in the second Advanced LIGO observing run with an improved hidden Markov model
- All-sky search for long-duration gravitational-wave transients in the second Advanced LIGO observing run
- All-sky search for short gravitational-wave bursts in the second Advanced LIGO and Advanced Virgo run
- First Measurement of the Hubble Constant from a Dark Standard Siren using the Dark Energy Survey Galaxies and the LIGO/Virgo Binary Black-hole Merger GW170814
- Search for sub-solar mass ultracompact binaries in Advanced LIGO’s second observing run
- Low-latency Gravitational-wave Alerts for Multimessenger Astronomy during the Second Advanced LIGO and Virgo Observing Run
- Search for Gravitational Waves from a Long-lived Remnant of the Binary Neutron Star Merger GW170817
- Searches for Continuous Gravitational Waves from 15 Supernova Remnants and Fomalhaut b with Advanced LIGO
- Search for Transient Gravitational-wave Signals Associated with Magnetar Bursts during Advanced LIGO’s Second Observing Run
- All-sky search for long-duration gravitational-wave transients in the second Advanced LIGO observing run
- Directional limits on persistent gravitational waves using data from Advanced LIGO’s first two observing runs
- Tests of General Relativity with the Binary Black Hole Signals from the LIGO-Virgo Catalog GWTC-1
- A search for the isotropic stochastic background using data from Advanced LIGO’s second observing run
- All-sky search for continuous gravitational waves from isolated neutron stars using Advanced LIGO O2 data
- Constraining the p -Mode- g -Mode Tidal Instability with GW170817
- Narrow-band search for gravitational waves from known pulsars using the second LIGO observing run
- Properties of the Binary Neutron Star Merger GW170817
- A Fermi Gamma-Ray Burst Monitor Search for Electromagnetic Signals Coincident with Gravitational-wave Candidates in Advanced LIGO’s First Observing Run
- Search for Multimessenger Sources of Gravitational Waves and High-energy Neutrinos with Advanced LIGO during Its First Observing Run, ANTARES, and IceCube
- Search for Subsolar-Mass Ultracompact Binaries in Advanced LIGO’s First Observing Run
- Binary Black Hole Population Properties Inferred from the First and Second Observing Runs of Advanced LIGO and Advanced Virgo⁴
- GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs
- Tests of General Relativity with GW170817
- GW170817: Measurements of Neutron Star Radii and Equation of State
- Search for Tensor, Vector, and Scalar Polarizations in the Stochastic Gravitational-Wave Background
- Full band all-sky search for periodic gravitational waves in the O1 LIGO data
- Constraints on cosmic strings using data from the first Advanced LIGO observing run
- Prospects for observing and localizing gravitational-wave transients with Advanced LIGO, Advanced Virgo and KAGRA
- GW170817: Implications for the Stochastic Gravitational-Wave Background from Compact Binary Coalescences
- Effects of data quality vetoes on a search for compact binary coalescences in Advanced LIGO’s first observing run
- All-sky search for long-duration gravitational wave transients in the first Advanced LIGO observing run
- First Search for Nontensorial Gravitational Waves from Known Pulsars
- First narrow-band search for continuous gravitational waves from known pulsars in advanced detector data
- First low-frequency Einstein@Home all-sky search for continuous gravitational waves in Advanced LIGO data
- GW170608: Observation of a 19 Solar-mass Binary Black Hole Coalescence
- Search for Post-merger Gravitational Waves from the Remnant of the Binary Neutron Star Merger GW170817
- Estimating the Contribution of Dynamical Ejecta in the Kilonova Associated with GW170817
- Search for High-energy Neutrinos from Binary Neutron Star Merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory
- On the Progenitor of Binary Neutron Star Merger GW170817
- A gravitational-wave standard siren measurement of the Hubble constant
- Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A
- Multi-messenger Observations of a Binary Neutron Star Merger

⁴**M. Zevin:** Education and Public Outreach Liaison

- GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral⁵
- GW170814: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence
- All-sky search for periodic gravitational waves in the O1 LIGO data
- Upper Limits on Gravitational Waves from Scorpius X-1 from a Model-based Cross-correlation Search in Advanced LIGO Data
- Search for high-energy neutrinos from gravitational wave event GW151226 and candidate IVT151012 with ANTARES and IceCube
- Search for intermediate mass black hole binaries in the first observing run of Advanced LIGO
- GW170104: Observation of a 50-Solar-Mass Binary Black Hole Coalescence at Redshift 0.2
- Search for gravitational waves from Scorpius X-1 in the first Advanced LIGO observing run with a hidden Markov model
- Search for Gravitational Waves Associated with Gamma-Ray Bursts during the First Advanced LIGO Observing Run and Implications for the Origin of GRB 150906B
- Effects of waveform model systematics on the interpretation of GW150914
- Search for continuous gravitational waves from neutron stars in globular cluster NGC 6544
- First Search for Gravitational Waves from Known Pulsars with Advanced LIGO
- Directional Limits on Persistent Gravitational Waves from Advanced LIGO's First Observing Run
- Upper Limits on the Stochastic Gravitational-Wave Background from Advanced LIGO's First Observing Run
- Calibration of the Advanced LIGO detectors for the discovery of the binary black-hole merger GW150914
- All-sky search for short gravitational-wave bursts in the first Advanced LIGO run
- Exploring the sensitivity of next generation gravitational wave detectors
- Exploring the sensitivity of next generation gravitational wave detectors
- The basic physics of the binary black hole merger GW150914
- Supplement: The Rate of Binary Black Hole Mergers Inferred from Advanced LIGO Observations Surrounding GW150914 (2016, ApJL, 833, L1)
- The Rate of Binary Black Hole Mergers Inferred from Advanced LIGO Observations Surrounding GW150914
- Upper Limits on the Rates of Binary Neutron Star and Neutron Star-Black Hole Mergers from Advanced LIGO's First Observing Run
- Results of the deepest all-sky survey for continuous gravitational waves on LIGO S6 data running on the Einstein@Home volunteer distributed computing project
- First targeted search for gravitational-wave bursts from core-collapse supernovae in data of first-generation laser interferometer detectors
- Binary Black Hole Mergers in the First Advanced LIGO Observing Run
- Improved Analysis of GW150914 Using a Fully Spin-Precessing Waveform Model
- Directly comparing GW150914 with numerical solutions of Einstein's equations for binary black hole coalescence
- Comprehensive all-sky search for periodic gravitational waves in the sixth science run LIGO data
- Characterization of transient noise in Advanced LIGO relevant to gravitational wave signal GW150914
- Supplement: Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914 (2016, ApJL, 826, L13)
- Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914
- GW151226: Observation of Gravitational Waves from a 22-Solar-Mass Binary Black Hole Coalescence
- Properties of the Binary Black Hole Merger GW150914
- Tests of General Relativity with GW150914
- High-energy neutrino follow-up search of gravitational wave event GW150914 with ANTARES and IceCube
- Search for transient gravitational waves in coincidence with short-duration radio transients during 2007-2013
- Observing gravitational-wave transient GW150914 with minimal assumptions
- GW150914: First results from the search for binary black hole coalescence with Advanced LIGO
- GW150914: The Advanced LIGO Detectors in the Era of First Discoveries
- GW150914: Implications for the Stochastic Gravitational-Wave Background from Binary Black Holes
- All-sky search for long-duration gravitational wave transients with initial LIGO
- Astrophysical Implications of the Binary Black-hole Merger GW150914
- Observation of Gravitational Waves from a Binary Black Hole Merger
- Prospects for Observing and Localizing Gravitational-Wave Transients with Advanced LIGO and Advanced Virgo

⁵M. Zevin: Education and Public Outreach Liaison

Presentations

Invited Talks

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| CGCA Seminar
<i>Unveiling the Lives and Deaths of Stars through Compact Object Mergers</i>
Milwaukee, WI | Seminar
March 2019 |
| IGC Seminar
<i>From the Detected to the Detectors: Using Gravitational Waves to Enable Insights from the Stellar Graveyard & the Next Generation of Citizen Science</i>
Portsmouth, UK | Seminar
March 2018 |
| SPI-MAX Seminar
<i>From the Detected to the Detectors: Using Gravitational Waves to Enable Insights from the Stellar Graveyard & the Next Generation of Citizen Science</i>
Oxford, UK | Seminar
February 2018 |

Contributed Talks & Posters

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| Aspen Winter Conference
<i>Eccentric Black Hole Mergers in Dense Star Clusters: Post-Newtonian Effects & Higher Multiplicity Encounters</i>
Aspen, CO | Talk
February 2019 |
| AAS 233
<i>Eccentric Black Hole Mergers in Dense Star Clusters: The Role of Binary-Binary Encounters</i>
Seattle, WA | Talk
January 2019 |
| NSF Research Traineeship Annual Meeting
<i>Gravity Spy: Integrating Gravitational-Wave Astrophysics, Machine Learning, and Citizen Sciences</i>
Washington, DC | Poster
September 2018 |
| MODEST-18
<i>The Role of Binary-Binary Interactions in Inducing Eccentric Black Hole Mergers</i>
Santorini, Greece | Talk
June 2018 |
| APS April Meeting
<i>On the Progenitor of Binary Neutron Star Merger GW170817</i>
Columbus, OH | Talk
April 2018 |
| Detecting the Unexpected: Discovery in the Era of Astronomically Big Data
<i>The Future of Citizen Science: Coupling Crowdsourcing and Machine Learning</i>
Baltimore, MD | Talk
March 2017 |
| APS April Meeting
<i>Discriminating Formation Channels of Binary Black Hole Systems with Advanced LIGO</i>
Washington, DC | Talk
January 2017 |
| AAS 229
<i>Discriminating Formation Channels of Binary Black Hole Systems with Advanced LIGO</i>
Grapevine, TX | Talk
January 2017 |
| AAS 229
<i>AstroBites: Engaging Undergraduate Science Majors with Current Astrophysical Research</i>
Grapevine, TX | Workshop & Poster
January 2017 |
| AAS 228
<i>Gravity Spy — Integrating aLIGO detector characterization, machine learning, and citizen science</i>
San Diego, CA | Talk
June 2016 |

Northwestern Computational Research Exposition

Integrating aLIGO detector characterization, machine learning, and citizen science
Evanston, IL

- Awarded first prize in poster competition

Poster

April 2016

Midwest Relativity Meeting

LIGO glitch classification through the combination of machine learning and citizen science
Evanston, IL

Talk

September 2015

Teaching

Northwestern University

Introduction to Astronomy, Stellar Astrophysics, Data-Driven Research in Astronomy

- Guest lectured, developed assignments, graded, and ran telescope observing sessions

Lecture/TA

2015–Present

GK12 Fellowship

Reach for the Stars; Evanston, IL

- Co-taught astronomy classes at Evanston Township High School
- Developed curriculum, coding-based lessons, and visualizations for high-school students

Teaching

2017–2018

Kids Science Labs

Lead Teacher; Chicago, IL

- Taught classes of 3-12 year old students in hands-on, experiential science classes
- Designed curriculum for science summer camps

Teaching

2013–2015

Adler Planetarium

Science Leadership Corps Instructor, Mission Specialist; Chicago, IL

- Designed educational programming
- Facilitated exhibits, performed experiments, and gave astronomy talks to the public
- Led under-represented students in designing experiments for high-altitude balloon launches

Teaching

2012–2014

Outreach

Science Communication

AstroBites

Author, Administrator, & Leadership Team

- Astronomy blog partnered with the AAS, provides daily summaries of recent astronomy research articles
- Initiated the “Beyond” series, which covers topics on career advice, graduate school applications, and diversity, equity, and inclusivity in astronomy

Blog

2014–Present

ComSciCon

Organizer, Attendee

- National graduate-student run science communication workshop for graduate students in STEM fields

Workshop

2017–Present

Astronomy on Tap

Co-founder, organizer, host, speaker

- Co-founded the Chicago branch of Astronomy on Tap, which hosts astronomy talks and space-based trivia at bars and breweries in the Chicago-land area

Public Event

2015–Present

Rapid Fire Research

Founder, Chair

- Annual research presentation event for graduate and undergraduate students in Northwestern Department of Physics and Astronomy

Departmental Event

2016–Present

Machine Learning Meetups

Organizer, Host

- Quarterly interdisciplinary colloquia on data science and machine learning topics

Public Event

2016–2018

Chicagoland Science Penpals	Event
<i>Participant</i>	<i>2017</i>
– Correspondence with students in Chicago public schools about scientific research and science as a profession, using handwritten letters	

Public Talks & Lectures

Astronomer Conversations	Lecture Series
<i>Adler Planetarium, Space Visualization Laboratory</i>	<i>2014–Present</i>
– Monthly public presentations at the Adler Planetarium for museum guests	
Astronomer Evenings	Lecture Series
<i>Northwestern University, Dearborn Observatory</i>	<i>2016–Present</i>
– Presentations during public observing hours at the Dearborn Observatory	
Chipping Norton Amateur Astronomy Group	Keynote Lecture
<i>Chipping Norton, UK</i>	<i>February 2018</i>
Take Our Children to Work Day	Lecture
<i>Northwestern University</i>	<i>April 2016, 2018</i>
Haven Midde School	Invited Speaker
<i>Evanston, IL</i>	<i>April 2017, 2018</i>
Chicago Astronomical Society	Keynote Lecture
<i>Adler Planetarium</i>	<i>May 2017</i>
Avery Coonley School	Invited Speaker
<i>Downers Grove, IL</i>	<i>May 2017</i>
Seven Minutes of Science: An Interdisciplinary Symposium	Public Talk
<i>Northwestern University</i>	<i>April 2017</i>
Highcrest Elementary	Invited Speaker
<i>Wilmette, IL</i>	<i>March 2017</i>
Einstein Evenings	Lecture Series
<i>Northwestern University, Dearborn Observatory</i>	<i>2015–2016</i>
– Monthly presentations during observing hours on LIGO discoveries in celebration of the 100th anniversary of General Relativity	
Nettlehorst Elementary	Invited Speaker
<i>Chicago, IL</i>	<i>February 2016</i>

Publications

Astrobitess	Blog
<i>Authored over 20 blog posts on current research in astrophysics (Link)</i>	<i>2014–Present</i>
LIGO Science Summary	Article
<i>Companion science summary to the LIGO-Virgo O2 Populations paper (Link)</i>	<i>November 2018</i>
LIGO Magazine	Magazine Article
<i>The Gravity Spy Project - Machine Learning and Citizen Science (Link)</i>	<i>March 2017</i>
Helix Magazine	Magazine Article
<i>The Legacy of Scientific Discovery (Link)</i>	<i>March 2017</i>

Awards & Honors

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| ▷ Avery Coonley School, Graduate Keynote Speaker | June 2018 |
| ▷ American Astronomical Society, Media Intern | June 2016 |
| ▷ Breakthrough Prize in Fundamental Physics (<i>as part of the LIGO-Virgo Collaboration</i>) | May 2016 |
| ▷ First Place, Poster Competition (<i>Computational Research Day, Northwestern University</i>) | April 2016 |
| ▷ High Distinction in Physics (<i>University of Illinois Urbana-Champaign</i>) | May 2012 |

Affiliations & Leadership Positions

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| ▷ Astrobites: Administrator, Author | 2014–Present |
| ▷ ComSciCon National: Organizer | 2017–Present |
| ▷ LIGO Scientific Collaboration: Member | 2015–Present |
| ▷ American Astronomical Society: Junior Member | 2016–Present |
| ▷ American Physical Society: Member | 2016–Present |
| ▷ CIERA Compact Objects Coffee: Founder, chair | 2018–Present |
| ▷ Physics and Astronomy Graduate Student Council: Quality of Life Chair | 2016–2018 |
| ▷ Rapid Fire Research: Founder, chair | 2016–2018 |
| ▷ Caltech Gravitational Wave Astrophysics School: Participant | 2015 |
| ▷ Chicago Metropolitan Symphony Orchestra: Double Bassist | 2014–Present |
| ▷ Draft Week (rock band): Bass Guitarist & Keyboardist | 2009–Present |

Students Mentored

Michael Kurkowski <i>Pair Instability Supernova Prescriptions in Binary Population Synthesis; CIERA REU Student</i>	Undergraduate 2019
Jared Machtinger <i>Population properties of binary black holes detected by LIGO; CIERA Summer Student</i>	High School 2019
Danai Abdela <i>Population properties of binary black holes detected by LIGO; CIERA Summer Student</i>	High School 2019
Ethan Marx <i>Offset distributions of short gamma-ray bursts; CIERA REU Student</i>	Undergraduate 2018
Yuqi Yun <i>Gaussian Process regression of black hole mass distributions; CIERA REU Student</i>	Undergraduate 2016
Sophie Haight <i>Gaussian Process regression of binary stellar evolution sequences; CIERA Summer Student</i>	High School 2016

Service Work

Peer Reviewer for:	2017–Present
– <i>The Astrophysical Journal</i>	
– <i>The Astrophysical Journal Letters</i>	
– <i>Astronomy and Astrophysics</i>	