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 Fellowship**[1] *2018*
- **Kavli Summer Fellowship**[2] *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 Collaboration[3] *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

[1] Research Advisor: Dr. Chris Lintott (New College, University of Oxford)
[2] Research 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*
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
CQG **34**, 064003
– Covered by *AAS Press*

Second Author & Featured Contributed Papers (with links)

Black Holes: The Next Generation — *2019*
C. Rodriguez, M. Zevin, P. Amaro-Seoane, S. Chatterjee, K. Kremer, F. A. Rasio, C. S. Ye
PRD (submitted)

Illuminating Black Hole Binary Formation Channels with Spins in Advanced LIGO — **ApJL** *2016*
C. Rodriguez, M. Zevin, C. Pankow, V. Kalogera, F. A. Rasio
ApJL **832**, 1

Contributed Papers (with links)

Classifying the Unknown: Discovering Novel Gravitational-Wave Detector Glitches using Similarity Learning — **PRD** *2019*
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
PRD **99**, 082002

Post-Newtonian Dynamics in Dense Star Clusters: Binary Black Holes in the LISA Band — **PRD** *2019*
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
PRD **99**, 063003

Post-Newtonian Dynamics in Dense Star Clusters: Formation, Masses, and Merger Rates of Highly-Eccentric Black Hole Binaries — **PRD** *2018*
C. L. Rodriguez, P. Amaro-Seoane, S. Chatterjee, K. Kremer, F. A. Rasio, J. Samsing, C. S. Ye, M. Zevin
PRD **98**, 123005

DIRECT: Deep Discriminative Embedding for Clustering of LIGO Data — **ICIP** *2018*
S. Bahaadini, V. Noroozi, N. Rohani, S. Coughlin, M. Zevin, V. Kalogera, A. K. Katsaggelos
IEEE International Conference on Image Processing Proceedings

Machine Learning for Gravity Spy: Glitch Classification and Dataset — **Information Sciences** *2018*
S. Bahaadini, V. Noroozi, N. Rohani, S. Coughlin, M. Zevin, J. R. Smith, V. Kalogera, A. K. Katsaggelos
Information Sciences Journal **444**, 172

Improvements in Gravitational-wave Sky Localization with Expanded Networks of Interferometers — **ApJL** *2018*
C. Pankow, E. A. Chase, S. Coughlin M. Zevin, V. Kalogera
ApJL **854**, L25

Deep Multi-view Models for Glitch Classification — **ICASSP** *2018*
S. Bahaadini, N. Rohani, S. Coughlin, M. Zevin, V. Kalogera, A. K. Katsaggelos
IEEE International Conference on Acoustics, Speech, and Signal Processing Proceedings

Incorporating Current Research into Formal Higher Education Settings using Astrobites — **AJP** *2017*
N. E. Sanders, S. Kohler, C. Faesi, A. Villar, M. Zevin
AJP **85**, 741

Astrophysical Prior Information and Gravitational-Wave Parameter Estimation — **APJ** *2017*
C. Pankow, L. Sampson, L. Perri, E. A. Chase, S. Coughlin M. Zevin, V. Kalogera
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 20152017 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 BinaryBlack-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 LIGOs 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 Virgo[4]
– 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 LIGOs 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 Inspiral[5]
– 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 LVT151012 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 LIGOs 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

[5] ***M. Zevin***: Education and Public Outreach Liaison

Presentations

Invited Talks

CGCA Seminar — **Seminar**
Unveiling the Lives and Deaths of Stars through Compact Object Mergers — *March 2019*
Milwaukee, WI

IGC Seminar — **Seminar**
From the Detected to the Detectors: Using Gravitational Waves to Enable Insights from the Stellar Graveyard & the Next Generation of Citizen Science — *March 2018*
Portsmouth, UK

SPI-MAX Seminar — **Seminar**
From the Detected to the Detectors: Using Gravitational Waves to Enable Insights from the Stellar Graveyard & the Next Generation of Citizen Science — *February 2018*
Oxford, UK

Contributed Talks & Posters

Aspen Winter Conference — **Talk**
Eccentric Black Hole Mergers in Dense Star Clusters: Post-Newtonian Effects & Higher Multiplicity Encounters — *February 2019*
Aspen, CO

AAS 233 — **Talk**
Eccentric Black Hole Mergers in Dense Star Clusters: The Role of Binary-Binary Encounters — *January 2019*
Seattle, WA

NSF Research Traineeship Annual Meeting — **Poster**
Gravity Spy: Integrating Gravitational-Wave Astrophysics, Machine Learning, and Citizen Sciences — *September 2018*
Washington, DC

MODEST-18 — **Talk**
The Role of Binary-Binary Interactions in Inducing Eccentric Black Hole Mergers — *June 2018*
Santorini, Greece

APS April Meeting — **Talk**
On the Progenitor of Binary Neutron Star Merger GW170817 — *April 2018*
Columbus, OH

Detecting the Unexpected: Discovery in the Era of Astronomically Big Data — **Talk**
The Future of Citizen Science: Coupling Crowdsourcing and Machine Learning — *March 2017*
Baltimore, MD

APS April Meeting — **Talk**
Discriminating Formation Channels of Binary Black Hole Systems with Advanced LIGO — *January 2017*
Washington, DC

AAS 229 — **Talk**
Discriminating Formation Channels of Binary Black Hole Systems with Advanced LIGO — *January 2017*
Grapevine, TX

AAS 229 — **Workshop & Poster**
Astrobites: Engaging Undergraduate Science Majors with Current Astrophysical Research — *January 2017*
Grapevine, TX

AAS 228 — **Talk**
Gravity Spy — Integrating aLIGO detector characterization, machine learning, and citizen science — *June 2016*
San Diego, CA

Northwestern Computational Research Exposition **Poster**
Integrating aLIGO detector characterization, machine learning, and citizen science *April 2016*
Evanston, IL
– Awarded first prize in poster competition

Midwest Relativity Meeting **Talk**
LIGO glitch classification through the combination of machine learning and citizen science *September 2015*
Evanston, IL

Teaching

Northwestern University **Lecture/TA**
Introduction to Astronomy, Stellar Astrophysics, Data-Driven Research in Astronomy *2015–Present*
– Guest lectured, developed assignments, graded, and ran telescope observing sessions

GK12 Fellowship **Teaching**
Reach for the Stars; Evanston, IL *2017–2018*
– Co-taught astronomy classes at Evanston Township High School
– Developed curriculum, coding-based lessons, and visualizations for high-school students

Kids Science Labs **Teaching**
Lead Teacher; Chicago, IL *2013–2015*
– Taught classes of 3-12 year old students in hands-on, experiential science classes
– Designed curriculum for science summer camps

Adler Planetarium **Teaching**
Science Leadership Corps Instructor, Mission Specialist; Chicago, IL *2012–2014*
– 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

Outreach

Science Communication

Astrobites **Blog**
Author, Administrator, & Leadership Team *2014–Present*
– 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

ComSciCon **Workshop**
Organizer, Attendee *2017–Present*
– National graduate-student run science communication workshop for graduate students in STEM fields

Astronomy on Tap **Public Event**
Co-founder, organizer, host, speaker *2015–Present*
– 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

Rapid Fire Research **Departmental Event**
Founder, Chair *2016–Present*
– Annual research presentation event for graduate and undergraduate students in Northwestern Department of Physics and Astronomy

Machine Learning Meetups **Public Event**
Organizer, Host *2016–2018*
– Quarterly interdisciplinary colloquia on data science and machine learning topics

Chicagoland Science Penpals **Event**
Participant *2017*
– 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**
Adler Planetarium, Space Visualization Laboratory *2014–Present*
– Monthly public presentations at the Adler Planetarium for museum guests

Astronomer Evenings **Lecture Series**
Northwestern University, Dearborn Observatory *2016–Present*
– Presentations during public observing hours at the Dearborn Observatory

Chipping Norton Amateur Astronomy Group **Keynote Lecture**
Chipping Norton, UK *February 2018*

Take Our Children to Work Day **Lecture**
Northwestern University *April 2016, 2018*

Haven Midde School **Invited Speaker**
Evanston, IL *April 2017, 2018*

Chicago Astronomical Society **Keynote Lecture**
Adler Planetarium *May 2017*

Avery Coonley School **Invited Speaker**
Downers Grove, IL *May 2017*

Seven Minutes of Science: An Interdisciplinary Symposium **Public Talk**
Northwestern University *April 2017*

Highcrest Elementary **Invited Speaker**
Wilmette, IL *March 2017*

Einstein Evenings **Lecture Series**
Northwestern University, Dearborn Observatory *2015–2016*
– Monthly presentations during observing hours on LIGO discoveries in celebration of the 100th anniversary of General Relativity

Nettlehorst Elementary **Invited Speaker**
Chicago, IL *February 2016*

Publications

Astrobites **Blog**
Authored over 20 blog posts on current research in astrophysics (**Link**) *2014–Present*

LIGO Science Summary **Article**
Companion science summary to the LIGO-Virgo O2 Populations paper (**Link**) *November 2018*

LIGO Magazine **Magazine Article**
The Gravity Spy Project - Machine Learning and Citizen Science (**Link**) *March 2017*

Helix Magazine **Magazine Article**
The Legacy of Scientific Discovery (**Link**) *March 2017*

Awards & Honors

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

Affiliations & Leadership Positions

- **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 **Undergraduate**
Pair Instability Supernova Prescriptions in Binary Population Synthesis; CIERA REU Student *2019*

Jared Machtinger **High School**
Population properties of binary black holes detected by LIGO; CIERA Summer Student *2019*

Danai Abdela **High School**
Population properties of binary black holes detected by LIGO; CIERA Summer Student *2019*

Ethan Marx **Undergraduate**
Offset distributions of short gamma-ray bursts; CIERA REU Student *2018*

Yuqi Yun **Undergraduate**
Gaussian Process regression of black hole mass distributions; CIERA REU Student *2016*

Sophie Haight **High School**
Gaussian Process regression of binary stellar evolution sequences; CIERA Summer Student *2016*

Service Work

Peer Reviewer for: *2017–Present*
- *The Astrophysical Journal*
- *The Astrophysical Journal Letters*
- *Astronomy and Astrophysics*