# Monica Rizzo

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## Research

**Interests**: Multimessenger astronomy, data mining, code development, gravitational wave astronomy, physics education and outreach

**Graduate Research Assistant** — Evanston, IL
CIERA at Northwestern University — September 2018 - Current

Currently, supervised by Shane Larson, I work on characterizing the spectral structure of gravitational waveforms from extreme mass ratio inspirals. As a member of Dr. Vicky Kalogera's LIGO group, I developed, ran, and tested various gravitational wave data analysis codes.

**Undergraduate Research Assistant** — Rochester, NY
RIT Center for Computational Relativity and Gravitation — August 2017 - May 2018

Supervised by Dr. Richard O'Shaughnessy, I tested, improved, and optimized rapid parameter estimation techniques for use on gravitational wave data from LIGO. Additionally, I participated in the prelimary analysis of GW170817, and contributed to developing the set of tools used to produce the results presented in the GW170817 companion paper on dynamical ejecta contributions to the associated kilonova.

**REU Student** — Evanston, IL
CIERA at Northwestern University — June 2017 - August 2018

Under Dr. Vicky Kalogera and Dr. Chris Pankow, I created a set of routines based on existing literature to calculate the amount of ejected matter and resulting kilonova light curve for neutron star-black hole and binary neutron star merger events. I then assessed the effect of different nuclear equations of state on the ejecta mass distributions and light curves.

**Undergraduate Research Assistant** — Rochester, NY
RIT Center for Computational Relativity and Gravitation — May 2016 - August 2016

Under Dr. Joshua Faber I modelled inspiralling binary neutron stars using a smoothed-particle hydrodynamics code (Starcrash) to study how the amount of matter they eject is affected by their physical parameters.

**Undergraduate Research Assistant** — Rochester, NY
RIT Center for Computational Relativity and Gravitation — May 2015 - August 2016

With Dr. Richard O'Shaughnessy, I modelled gravitational waveforms from inspiralling binary neutron stars using two different approximants to compare their robustness.

## Work Experience

**Grader** — Evanston, IL
Northwestern University Department of Physics and Astronomy — September 2019 - December 2019

Graded homeworks for PHYS-441 (Statistical Methods for Physicists and Astronomers)

**Freelance Data Analyst**
Upwork — May 2018 - June 2018

Developed Python code to fulfill a data wrangling contract

**Note Taker** Rochester, NY
RIT Disability Services Office March 2016 - May 2016

Took clear and detailed notes in Numerical Linear Algebra (MATH 412) and provided notes to the Disability Services Office for use by other students.

**Cashier** Rochester, NY
Home Depot July 2016 - December 2016

Assisted customers at item checkout and operated point-of-sale system.

## Education

**Northwestern University** Evanston, IL
Ph.D. in Astronomy, Advisor: Shane Larson September 2018–Current

**Northwestern University** Evanston, IL
M.S. in Astronomy, GPA: 3.80/4.00 September 2018–September 2020

**Rochester Institute of Technology** Rochester, NY
B.S. in Physics, GPA: 3.57/4.00 August 2014–May 2018

- Thesis: "Inferring Neutron Star Equation of State Parameters from Gravitational Wave Observations"

## Teaching

**CIERA High School Summer Research Mentor/Instructor** Evanston, IL
Northwestern CIERA June–August 2019

- Lectured summer research students on using various regression and interpolation functions in SciPy
- Mentored two high school students and supervised their completion of a research project on gravitational wave data analysis

**Teaching Assistant** Rochester, NY
RIT Physics/Math Department September 2015–December 2017

- PHYS-211: Assisted in teaching and grading (September-December 2017)
- MATH-171: Assisted in teaching and grading weekly workshops (September-December 2016)
- PHYS-211/PHYS-216: Assisted in teaching and grading weekly quizzes (September 2015-May 2016)

## Presentations

### Conference Talks

- *Mapping Astrophysical Parameter Space with EMRI Spectroscopy*, LISA Symposium XIII, Hosted Virtually, September 2020
- *Placing Constraints on a Neutron Star Equation of State using Heirarchical Population Inference*, APS April Meeting, Columbus, OH, April 2018
- *Measuring Ejecta from Inspiralling Binary Neutron Stars using Smoothed-particle Hydrodynamics*, RIT Undergraduate Research Symposium, Rochester, NY, August 2016
- *Parameter Estimation of Binary Neutron Star Gravitational Wave Signals using Effective One Body Model*, RIT Undergraduate Research Symposium, Rochester, NY, August 2015

### Conference Posters

- *Equation of State Effects on Binary Neutron Star and Neutron Star-Black Hole Merger Ejecta*, AAS Meeting, National Harbor, MD, January 2018
- *Measuring Ejecta from Inspiralling Binary Neutron Stars using Smoothed-particle Hydrodynamics*, APS April Meeting, Washington, DC, January 2017
- *Parameter Estimation of Binary Neutron Stars using an Effective One Body Model Including Tidal Interactions*, APS April Meeting, Salt Lake City, UT, April 2016

## Publications

[1] C. Pankow, **M. Rizzo**, K. Rao, C. P. L. Berry, and V. Kalogera, *Localization of compact binary sources with second generation gravitational-wave interferometer networks*, 2019. eprint: arXiv:1909.12961.

[2] J. Lange, R. O'Shaughnessy, and **M. Rizzo**, *Rapid and accurate parameter inference for coalescing, precessing compact binaries*, 2018. eprint: arXiv:1805.10457.

## Awards

- IDEAS NSF Fellow — 2019 –2020, 2020–2021
- RIT Undergraduate Research Scholar — 2018

## Public Outreach

**CUWiP Panelist** — Rochester, NY
2018 Conference for Undergraduate Women in Physics — December 2018

- Lead discussion in panels on starting undergraduate research and current topics in physics

**Imagine RIT Exhibitor** — Rochester, NY
Imagine RIT Festival — April 2015 - 2018

- April 2018, 2017: Participated in the RIT Society of Physics Students' exhibit featuring various physics demonstrations. Presented a handmade brachistochrone curve demonstration and Van de Graaff generator
- April 2016: Participated in the Center for Computational Relativity and Gravitation's exhibit on gravitational waves
- April 2015: Presented a home-made Van de Graaff generator as a member of Computer Science House's group exhibit

## Organizations

- Northwestern Center for Interdisciplinary Exploration and Research in Astrophysics — 2018 –Current
- Northwestern IDEAS Program — 2018 –Current
- LIGO Scientific Collaboration — 2015 –2020
- Society of Physics Students, *Executive Board: Webmaster* — 2015 –2018
- RIT Center for Computational Relativity and Gravitation — 2015 –2018
- RIT Computer Science House — 2014 –2016

## Computational Skills

- **Languages:** Proficient: Python, C#, C++, Mathematica, Bash, LaTex, HTML/CSS
  Familiar: Javascript, Matlab, Visual Basic, Fortran, C
- **Software:** Microsoft Office, Starcrash (J. Faber et. al.), Autodesk Maya, Photoshop, Gimp, Creo Parametric, MESA (B. Paxton et. al.), Gnuplot, SpecTECH
- **Code Packages:** BILBY (Ashton et. al.), LALSuite (LIGO Scientific Collaboration), Scikit-Learn (Pedregosa et. al.), Keras (Chollet et. al.)