

# Carl Rodriguez | Curriculum Vitae

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Pappalardo Fellow at MIT studying the dynamics of black holes in dense star clusters. Research interests include computational astrophysics, black hole formation, dynamics, and gravitational-wave astronomy. Strongly interested in the applications of astrophysics to STEM education and outreach.

## Education

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### Academic Qualifications.....

<b>Northwestern University</b> <i>Evanston, IL</i> Thesis – Modeling Dense Star Clusters and Their Implications for Advanced LIGO Advisor – Frederic Rasio	<b>Ph.D. Physics</b> 2016
<b>Reed College</b> <i>Portland, OR</i> Thesis – Accretion Disk Geodesics in Extreme Kerr Geometries Advisor – Joel Franklin	<b>B.A. Physics</b> 2010

### Honors and Awards.....

○ MIT Pappalardo Fellowship	2016-2019
○ NSF Graduate Research Fellowship	2011-2016
○ NSF GK12 Fellowship	2013-2014
○ Illinois Space Grant Consortium Fellowship	2010-2011, 2015-2016
○ NSF STEM Scholar	2008-2010

## First Author Papers (with links)

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<b>Illuminating Black Hole Binary Formation Channels with Spins in Advanced LIGO</b> <i>C. L. Rodriguez, M. Zevin, C. Pankow, V. Kalogera, F. Rasio; ApJL, 832, L2</i>	<b>ApJL</b> 2016
<b>Dynamical Formation of the GW150914 Binary Black Hole</b> <i>C. L. Rodriguez, C.-J. Haster, S. Chatterjee, V. Kalogera, F. Rasio; ApJL, 824, L8</i> - Articles in <i>New Scientist</i> , <i>Sky News</i> (Links), - Synopsis in <i>Astrobites</i> (Link)	<b>ApJL</b> 2016
<b>Binary Black Hole Mergers from Globular Clusters: Masses, Merger Rates, and the Impact of Stellar Evolution</b> <i>C. L. Rodriguez, S. Chatterjee, F. Rasio; Phys. Rev. D, 93, 084029</i>	<b>PRD</b> 2016
<b>Million-Body Star Cluster Simulations: Comparisons between Monte Carlo and Direct N-body</b> <i>C. L. Rodriguez, M. Morscher, L. Wang, S. Chatterjee, F. Rasio, R. Spurzem; MNRAS 463, 2109</i>	<b>MNRAS</b> 2016
<b>A New Hybrid Technique for Modeling Dense Star Clusters</b> <i>C. L. Rodriguez, B. Pattabiraman, S. Chatterjee, M. Morscher, F. Rasio, A. Choudhary, W-K. Liao; ApJS (submitted)</i>	2015

- Binary Black Hole Mergers from Globular Clusters: Implications for Advanced LIGO** PRL  
2015  
*C. L. Rodriguez, M. Morscher, B. Pattabiraman, S. Chatterjee, C.J. Haster, and F. Rasio*; Phys. Rev. Lett. **115**, 051101  
 - Synopsis by APS in *Physics* (Link)  
 - Synopsis in popular science blog *IFLS* (Link)
- Basic Parameter Estimation of Binary Neutron Star Systems by the Advanced LIGO/Virgo Network** ApJ  
2014  
*C. L. Rodriguez, B. Farr, V. Raymond, W. Farr, T. Littenberg, D. Fazi, V. Kalogera*; ApJ, **785**, 2, 119
- Inadequacies of the Fisher Information Matrix in gravitational-wave parameter estimation** PRD  
2013  
*C. L. Rodriguez, B. Farr, W. Farr, I. Mandel*; Phys. Rev. D, **88**, 8, 084013
- Verifying the no-hair property of massive compact objects with intermediate-mass-ratio inspirals in advanced gravitational-wave detectors** PRD  
2012  
*C. L. Rodriguez, I. Mandel, J. Gair*; Phys. Rev. D, **85**, 6, 062002  
 - Synopsis in *Astrobites* (Link)

## Contributing Author (with links)

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- Constraining Models of Binary Black Hole Formation with Gravitational-Wave Observations** 2017  
*M. Zevin, C. Pankow, C. L. Rodriguez, L. Sampson, E. Chase, V. Kalogera, F. Rasio*; ApJ (submitted)
- Dynamical Formation of Low-mass Merging Black Hole Binaries like GW151226** ApJL  
2017  
*S. Chatterjee, C. L. Rodriguez, V. Kalogera, F. Rasio*; ApJL, **836**, L26
- Binary Black Holes in Dense Star Clusters: Exploring the Theoretical Uncertainties** ApJ  
2017  
*S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJ, **834**, 1, 68
- Distinguishing Between Formation Channels for Binary Black Holes with LISA** ApJL  
2016  
*K. Breivik, C. L. Rodriguez, S. Larson, V. Kalogera, F. Rasio*; ApJL, **830**, L18
- Black Hole Mergers and Blue Stragglers from Hierarchical Triples Formed in Globular Clusters** ApJ  
2016  
*F. Antonini, S. Chatterjee, C. L. Rodriguez, M. Morscher, B. Pattabiraman, V. Kalogera, F. Rasio*; ApJ, **816**, 2, 65
- The Dynamical Evolution of Stellar Black Holes in Globular Clusters** ApJ  
2015  
*M. Morscher, B. Pattabiraman, C. L. Rodriguez, F. Rasio, S. Umbreit*; ApJ, **800**, 1, 21
- Comparison of Gravitational Wave Detector Network Sky Localization Approximations** PRD  
2014  
*K. Grover, S. Fairhurst, B. Farr, I. Mandel, C. L. Rodriguez, T. Sidery, A. Vecchio*; Phys. Rev. D, **89**, 4, 042004
- Estimating parameters of coalescing compact binaries with proposed advanced detector networks** PRD  
2012  
*J. Veitch, I. Mandel, B. Aylott, B. Farr, V. Raymond, C. L. Rodriguez, M. van der Sluys, V. Kalogera, A. Vecchio*; Phys. Rev. D **85**, 104045

## Invited Talks/Seminars

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- ITC Lunch Seminar** Seminar  
2017  
*Identifying Binary Black Holes formed in Dense Stellar Environments*  
 Cambridge, MA ([Link](#))

<b>Strong Gravity and Binary Dynamics with Gravitational Wave Observations</b> <i>Binary Black Holes from Dense Star Clusters</i> Oxford, MS	<b>Workshop</b> 2017
<b>UCSC Flash Seminar</b> <i>Binary Black Holes from Dense Star Clusters</i> Santa Cruz, CA	<b>Seminar</b> 2017
<b>April APS Meeting</b> <i>Binary Black Holes from Dense Star Clusters</i> Washington, DC	<b>Invited Talk</b> 2017
<b>JSI Fall Workshop: Astrophysics in the Era of Grav. Wave Observations</b> <i>Binary Black Holes from Dense Star Clusters</i> Annapolis, MD	<b>Invited Talk</b> 2016
<b>KITP Rapid Response Workshop</b> <i>Dense Star Clusters as Binary Black Hole Factories</i> Santa Barbara, CA	<b>Invited Talk</b> 2016
<b>Compton Lecture Series</b> <i>Dense Star Clusters as Binary Black Hole Factories</i> Chicago, IL ( <a href="#">Link</a> )	<b>Guest Seminar</b> 2016
<b>Stellar N-body Conference</b> <i>Monte Carlo Methods: Recent Results and Future Work</i> Sexten, Italy	<b>Invited Talk</b> 2014
<b>Center for Relativistic Astrophysics, Georgia Tech</b> <i>Verifying the No-Hair Property of Massive Compact Objects in Advanced LIGO</i> Atlanta, GA	<b>Seminar</b> 2011

## Contributed Talks/Posters

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<b>Aspen Center for Physics: Dawning Era of Gravitational-Wave Astrophysics</b> <i>Distinguishing BBH Formation Channels with Eccentricity and Spin</i> Aspen, CO	<b>Talk</b> 2017
<b>APS Meeting</b> <i>Binary Black Holes from Globular Clusters in the Advanced LIGO Era</i> Salt Lake City, UT	<b>Talk</b> 2016
<b>Midwest Relativity Meeting</b> <i>Binary Black Hole Mergers from Globular Clusters: Implications for Advanced LIGO</i> Evanston, IL	<b>Talk</b> 2015
<b>April APS Meeting</b> <i>Binary Black Holes Produced in Globular Clusters</i> Baltimore, MD	<b>Talk</b> 2015
<b>IAU Meeting</b> <i>Modeling Black Hole Dynamics within Globular Clusters</i> Beijing, China	<b>Talk</b> 2014
<b>AAS Head Meeting</b> <i>Simulating Black Holes in Star Clusters: A Hybrid N-body/Monte Carlo Approach</i> Chicago, IL	<b>Poster</b> 2014
<b>LIGO Scientific Collaboration Meeting</b> <i>Basic Parameter Estimation of Binary Neutron Star Systems</i> Bethesda, MD	<b>Talk</b> 2013

<b>Midwest Relativity Meeting</b> <i>Inadequacies of the Fisher Information Matrix in gravitational-wave parameter estimation</i> Chicago, IL	<b>Talk</b> 2012
<b>Gravitational-Wave Physics and Astronomy Workshop</b> <i>Usefulness of the Fisher Matrix in the advanced-detector era</i> Hannover, Germany - 3rd place award for best poster	<b>Poster</b> 2012
<b>Gravitational-Wave Burst Workshop</b> <i>Usefulness of the Fisher Matrix in the Advanced-Detector Era</i> Tobermory, Scotland	<b>Talk</b> 2012
<b>Midwest Relativity Meeting</b> <i>Detecting off-Kerr Perturbations with IMRIs in the Advanced LIGO Era</i> Urbana, IL	<b>Talk</b> 2011
<b>Gravitational-Wave Physics and Astronomy Workshop</b> <i>Testing the No-Hair Theorem with IMRIs in Advanced LIGO</i> Milwaukee, WI	<b>Talk</b> 2011

## Public Lectures

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<b>MIT Independent Activities Period</b> <i>The era of Gravitational-wave Astronomy</i> ; Cambridge, MA	<b>Public Talk</b> 2017
<b>Compton Lecture Series</b> <i>Dense Star Clusters as Binary Black Hole Factories</i> ( <a href="#">Link</a> ) Chicago, IL	<b>Guest Seminar</b> 2016
<b>TEDxNorthwesternU</b> <i>Listening to Einstein's Final Symphony</i> ( <a href="#">Link</a> ) Evanston, IL	<b>TEDx Talk</b> 2016
<b>Conversations with an Astronomer</b> Series of Public Lectures at Adler Planetarium Chicago, IL	<b>Lecture Series</b> 2011–2016
<b>Film Submission: Jackson Hole Science Media Festival</b> <i>Black Holes and Globular Clusters</i> ( <a href="#">Link</a> )	<b>Short Film</b> 2014
<b>Perseid Meteor Shower</b> Illinois Science Council in coordination with Chicago Parks Department Chicago, IL	<b>Public Talk</b> 2013
<b>Public Lecture at North Central Purdue University</b> <i>Catching Gravitational Waves with LIGO</i> Westville, IN	<b>Public talk</b> 2011

## Teaching/Education Activities

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<b>General Relativity</b> <i>Guest Lecturer and TA</i> ; Northwestern University, Evanston, IL	<b>Lecture/TA</b> 2015
<b>GK12 Fellowship</b> <i>Reach for the Stars</i> ; Highland Park, IL Co-taught weekly in math department of Highland Park High School Developed mathematics lessons, visualizations, and applets for high-school students ( <a href="#">Link</a> )	<b>Teaching</b> 2013–2014

**Mentoring Telescope Interns**

Teaching High School Summer Interns at Adler Planetarium; Chicago, IL

**Mentoring**  
2013

**Einstein and the 20th Century**

Guest Lecturer and TA; Northwestern University, Evanston, IL

**Lecture/TA**  
2013

**Science Club Mentor**

Weekly after-school science program at Boys and Girls Club; Chicago, IL

**Mentoring**  
2012–2013

**Visualization Creation**

Produced for Adler Planetarium Space Visualization Lab and; Chicago, IL  
Black Hole Dynamics in Core of Globular Cluster N-Body Simulation ([Link](#))  
Binary Black Holes Emitting Gravitational Waves ([Link](#))

**Visualizations**  
2011–2016

## Service Work

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**Peer Reviewer for:**

- - Physical Review Letters
- Physical Review D
- Astrophysical Journal Letters
- Astrophysical Journal
- Monthly Notices of the Royal Astronomical Society

2015–Present

**IAP Co-Organizer**

MIT Independent Activities Period; Cambridge, MA

**Organizer**  
2017

**Co-Organizer**

Astronomy On Tap – Boston; Cambridge, MA

**Organizer**  
2016–Present