

# Carl Rodriguez | Curriculum Vitae

Center for Astrophysics - Harvard-Smithsonian – Cambridge, MA

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## Education and Employment

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<b>Carnegie Mellon University</b> <i>Pittsburgh, PA</i> Assistant Professor of Physics	<b>Professor</b> <i>Begin Fall 2020</i>
<b>Harvard University</b> <i>Cambridge, MA</i> ITC Postdoctoral Fellow	<b>Postdoc</b> <i>2019-2020</i>
<b>Massachusetts Institute of Technology</b> <i>Cambridge, MA</i> Pappalardo Postdoctoral Fellow	<b>Postdoc</b> <i>2016-2019</i>
<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> <i>2010-2016</i>
<b>Reed College</b> <i>Portland, OR</i> Thesis – Accretion Disk Geodesics in Extreme Kerr Geometries Advisor – Joel Franklin	<b>B.A. Physics</b> <i>2006-2010</i>

## Honors, Awards, and Fellowships

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○ ITC Fellowship, Harvard University	2019-2020
○ MIT Spot Award	2017
○ 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

## Grants And Proposals

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<b>Modeling Dense Star Clusters and their Gravitational-wave Sources from Cosmological Simulations</b>	<b>XSEDE</b>
<i>PI: C. L. Rodriguez; 1.1M CPU Hours (\$20,000 Value)</i>	<i>2018</i>

## First Author Papers (with links)

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<b>Black Holes: The Next Generation – Repeated Mergers in Dense Star Clusters and their Gravitational-Wave Properties</b>	<b>PRD</b>
<i>C. L. Rodriguez, M. Zevin, P. Amaro-Seoane, S. Chatterjee, K. Kremer, F. Rasio, S. Ye; Phys. Rev. D, <b>100</b>, 043027</i>	<i>2019</i>

<b>Post-Newtonian Dynamics in Dense Star Clusters: Formation, Masses, and Merger Rates of Highly-Eccentric Black Hole Mergers</b>	<b>PRD</b> 2018
<i>C. L. Rodriguez, P. Amaro-Seoane, S. Chatterjee, K. Kremer, F. Rasio, J. Samsing, S. Ye, M. Zevin; Phys. Rev. D, 98, 123005</i>	
<b>Redshift Evolution of the Black Hole Merger Rate From Globular Clusters</b>	<b>ApJL</b> 2018
<i>C. L. Rodriguez, A. Loeb; ApJL, 865, L5</i>	
<b>A Triple Origin for the Heavy and Low-Spin Binary Black Holes Detected by LIGO/Virgo</b>	<b>ApJ</b> 2018
<i>C. L. Rodriguez, F. Antonini; ApJ, 963, 1, 7</i>	
<b>A New Hybrid Technique for Modeling Dense Star Clusters</b>	<b>CompAC</b> 2018
<i>C. L. Rodriguez, B. Pattabiraman, S. Chatterjee, M. Morscher, F. Rasio, A. Choudhary, W-K. Liao; Computational Astrophysics and Cosmology, 5, 1</i>	
<b>Post-Newtonian Dynamics in Dense Star Clusters: Highly-Eccentric, Highly-Spinning, and Repeated Binary Black Hole Mergers</b>	<b>PRL</b> 2018
<i>C. L. Rodriguez, P. Amaro-Seoane, S. Chatterjee, F. Rasio; Phys. Rev. Lett, 120, 151101</i> - Articles in <i>Boston Globe</i> , <i>MIT News</i> (Links),	
<b>Illuminating Black Hole Binary Formation Channels with Spins in Advanced LIGO</b>	<b>ApJL</b> 2016
<i>C. L. Rodriguez, M. Zevin, C. Pankow, V. Kalogera, F. Rasio; ApJL, 832, L2</i>	
<b>Dynamical Formation of the GW150914 Binary Black Hole</b>	<b>ApJL</b> 2016
<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>Binary Black Hole Mergers from Globular Clusters: Masses, Merger Rates, and the Impact of Stellar Evolution</b>	<b>PRD</b> 2016
<i>C. L. Rodriguez, S. Chatterjee, F. Rasio; Phys. Rev. D, 93, 084029</i>	
<b>Million-Body Star Cluster Simulations: Comparisons between Monte Carlo and Direct <math>N</math>-body</b>	<b>MNRAS</b> 2016
<i>C. L. Rodriguez, M. Morscher, L. Wang, S. Chatterjee, F. Rasio, R. Spurzem; MNRAS 463, 2109</i>	
<b>Binary Black Hole Mergers from Globular Clusters: Implications for Advanced LIGO</b>	<b>PRL</b> 2015
<i>C. L. Rodriguez, M. Morscher, B. Pattabiraman, S. Chatterjee, C.J. Haster, and F. Rasio; Phys. Rev. Lett. 115, 051101</i> - Synopsis by APS in <i>Physics</i> (Link) - Synopsis in popular science blog <i>IFLS</i> (Link)	
<b>Basic Parameter Estimation of Binary Neutron Star Systems by the Advanced LIGO/Virgo Network</b>	<b>ApJ</b> 2014
<i>C. L. Rodriguez, B. Farr, V. Raymond, W. Farr, T. Littenberg, D. Fazi, V. Kalogera; ApJ, 785, 2, 119</i>	
<b>Inadequacies of the Fisher Information Matrix in gravitational-wave parameter estimation</b>	<b>PRD</b> 2013
<i>C. L. Rodriguez, B. Farr, W. Farr, I. Mandel; Phys. Rev. D, 88, 8, 084013</i>	
<b>Verifying the no-hair property of massive compact objects with intermediate-mass-ratio inspirals in advanced gravitational-wave detectors</b>	<b>PRD</b> 2012
<i>C. L. Rodriguez, I. Mandel, J. Gair; Phys. Rev. D, 85, 6, 062002</i>	

- Synopsis in *Astrobites* (Link)

## Second Author Papers (with links)

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- 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. Katz, S. Larson, F. Rasio, J. Samsing, S. Ye, M. Zevin*; Phys. Rev. D , **99**, 063003
- Precessional Dynamics of Black Hole Triples: Binary Mergers with near-zero Effective Spin** MNRASL  
2018  
*F. Antonini, C. L. Rodriguez, C. Petrovich, C. Fischer*; MNRAS Letters, **480**, 1, L58
- Binary Black Holes in Dense Star Clusters: Exploring the Theoretical Uncertainties** ApJ  
2017  
*S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJ, **834**, 1, 68
- 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
- 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

## Contributing Author (with links)

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- Millisecond Pulsars and Black Holes in Globular Clusters** 2019  
*C. Ye, K. Kremer, S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJ (submitted)
- The fate of binaries in the Galactic Center: The Mundane and the Exotic** 2019  
*S. Alexander, S. Naoz, A. Ghez, M. Morris, A. Ciurlo, T. Do, K. Breivik, S. Coughlin, C. L. Rodriguez*; ApJL (submitted)
- Eccentric Black Hole Mergers in Dense Star Clusters: The Role of Binary-Binary Encounters** ApJ  
2018  
*M. Zevin, J. Samsing, C. L. Rodriguez, C. Haster, E. Ramirez-Ruiz*; ApJ, **871**, 1
- Predicting Stellar-mass Black Hole Populations in Globular Clusters** ApJ  
2018  
*N. Weatherford, S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJ, **864**, 13
- How initial size governs core collapse in globular clusters** ApJ  
2018  
*K. Kremer, S. Chatterjee, C. Ye, C. L. Rodriguez, F. Rasio*; ApJ, **871**, 38
- LISA Sources in Milky Way Globular Clusters** PRL  
2018  
*K. Kremer, S. Chatterjee, K. Breivik, C. L. Rodriguez, S. Larson, F. Rasio*; PRL, **120**, 19
- How Black Holes Shape Globular Clusters: Modeling NGC 3201** ApJL  
2018  
*K. Kremer, C. Ye, S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJL, **855**, 15
- Low-mass X-ray binaries ejected from globular clusters** 2018  
*K. Kremer, S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJ (submitted)
- Accreting Black Hole Binaries in Globular Clusters** ApJ  
2017  
*K. Kremer, S. Chatterjee, C. L. Rodriguez, F. Rasio*; ApJ, **852**, 29
- Constraining Models of Binary Black Hole Formation with Gravitational-Wave Observations** ApJ  
2017  
*M. Zevin, C. Pankow, C. L. Rodriguez, L. Sampson, E. Chase, V. Kalogera, F. Rasio*; ApJ, **846**, 82Z

<b>Black Hole Mergers and Blue Stragglers from Hierarchical Triples Formed in Globular Clusters</b>	<b>ApJ</b> 2016
<i>F. Antonini, S. Chatterjee, C. L. Rodriguez, M. Morscher, B. Pattabiraman, V. Kalogera, F. Rasio; ApJ, 816, 2, 65</i>	
<b>The Dynamical Evolution of Stellar Black Holes in Globular Clusters</b>	<b>ApJ</b> 2015
<i>M. Morscher, B. Pattabiraman, C. L. Rodriguez, F. Rasio, S. Umbreit; ApJ, 800, 1, 21</i>	
<b>Parameter estimation for compact binaries with ground-based gravitational-wave observations using the LALInference software library</b>	<b>PRD</b> 2015
<i>J. Veitch, V. Raymond, B. Farr, W. Farr, P. Graff, S. Vitale, B. Aylott, K. Blackburn, N. Christensen, M. Coughlin, W. Del Pozzo, F. Feroz, J. Gair, C.J. Haster, V. Kalogera, T. Littenberg, I. Mandel, R. O'Shaughnessy, M. Pitkin, C. L. Rodriguez, C. Röver, T. Sidery, R. Smith, M. Van Der Sluys, A. Vecchio, W. Vousden, L. Wade; Phys. Rev. D, 91, 4, 042003</i>	
<b>Comparison of Gravitational Wave Detector Network Sky Localization Approximations</b>	<b>PRD</b> 2014
<i>K. Grover, S. Fairhurst, B. Farr, I. Mandel, C. L. Rodriguez, T. Sidery, A. Vecchio; Phys. Rev. D, 89, 4, 042004</i>	
<b>Estimating parameters of coalescing compact binaries with proposed advanced detector networks</b>	<b>PRD</b> 2012
<i>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</i>	
<b>Mock data challenge for the Einstein Gravitational-Wave Telescope</b>	<b>PRD</b> 2012
<i>T. Regimbau, T. Dent, W. Del Pozzo, S. Giampanis, T.G.F. Li, C. Robinson, C. Van Den Broeck, D. Meacher, C. L. Rodriguez, B.S. Sathyaprakash, K. Wójcik; Phys. Rev. D 86, 122001</i>	
<b>Lateral alignment of InGaAs quantum dots as function of spacer thickness</b>	<b>APL</b> 2009
<i>Z. Wang, C. L. Rodriguez, S. Seydmohamadi, Y. I. Mazur, G. Salamo; Appl. Phys. Lett. 94, 083107</i>	
<b>Controlling fluorescence intermittency of a single colloidal CdSe/ZnS quantum dot in a half cavity</b>	<b>PRB</b> 2008
<i>Y. Zhang, V. Komarala, C. L. Rodriguez, M. Xiao; Phys. Rev. B 78, 241301(R)</i>	

## Collaboration Papers

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**Coauthor on 23 Collaboration Papers as a Member of the LIGO Scientific Collaboration**

*Click ([Here](#)) for Full List of Citations*

2011-2015

## Invited Talks/Seminars

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**University of Colorado Astronomy and Planetary Science Colloquium**  
Boulder, CO

**Colloquium**  
2019

**UCLA Astrophysics Colloquium**  
Los Angeles, CA

**Colloquium**  
2019

**Vanderbilt Physics Colloquium**  
Nashville, TN

**Colloquium**  
2019

<b>Syracuse Physics Colloquium</b> <i>Syracuse, NY</i>	<b>Colloquium</b> 2019
<b>Carnegie-Mellon Astrophysics Colloquium</b> <i>Pittsburgh, PA</i>	<b>Colloquium</b> 2019
<b>UIUC Gravitation Seminar</b> <i>Urbana-Champaign, IL</i>	<b>Seminar</b> 2019
<b>UIUC Astronomy Colloquium</b> <i>Urbana-Champaign, IL</i>	<b>Colloquium</b> 2018
<b>Perimeter Institute Strong Gravity Seminar</b> <i>Waterloo, Canada</i>	<b>Seminar</b> 2018
<b>Stanford KIPAC Cosmology Seminar</b> <i>Palo Alto, CA</i>	<b>Seminar</b> 2018
<b>University of Cambridge IoA Galaxy Discussion</b> <i>Cambridge, UK</i>	<b>Seminar</b> 2018
<b>University of Surrey Astrophysics Seminar</b> <i>Guildford, UK</i>	<b>Seminar</b> 2018
<b>Harvard CfA Galaxy and Cosmology Seminar</b> <i>Cambridge, MA</i>	<b>Seminar</b> 2018
<b>CalTech Astronomy Colloquium</b> <i>Pasadena, CA</i>	<b>Colloquium</b> 2018
<b>Harvard Particle Theory Seminar</b> <i>Cambridge, MA</i>	<b>Seminar</b> 2018
<b>Columbia Astrophysics Colloquium</b> <i>New York, NY</i>	<b>Colloquium</b> 2017
<b>Harvard ITC Lunch Seminar</b> <i>Cambridge, MA (<a href="#">Link</a>)</i>	<b>Seminar</b> 2017
<b>Strong Gravity and Binary Dynamics with Gravitational Wave Observations</b> <i>Oxford, MS</i>	<b>Invited Talk</b> 2017
<b>UCSC Flash Seminar</b> <i>Santa Cruz, CA</i>	<b>Seminar</b> 2017
<b>April APS Meeting</b> <i>Washington, DC</i>	<b>Invited Talk</b> 2017
<b>JSI Fall Workshop: Astrophysics in the Era of Grav. Wave Observations</b> <i>Annapolis, MD</i>	<b>Invited Talk</b> 2016
<b>KITP Rapid Response Workshop on Gravitational Waves</b> <i>Santa Barbara, CA</i>	<b>Invited Talk</b> 2016
<b>Compton Lecture Series</b> <i>Chicago, IL (<a href="#">Link</a>)</i>	<b>Guest Seminar</b> 2016

<b>Stellar N-body Conference</b> <i>Sexten, Italy</i>	<b>Invited Talk</b> 2014
<b>Georgia Tech Center for Relativistic Astrophysics</b> <i>Atlanta, GA</i>	<b>Seminar</b> 2011

## Contributed Talks/Posters

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<b>Triple Evolution and Dynamics Trendy-2</b> <i>Leiden, Netherlands</i>	<b>Talk</b> 2018
<b>Aspen Center for Physics: Dawning Era of Gravitational-Wave Astrophysics</b> <i>Aspen, CO</i>	<b>Talk</b> 2017
<b>APS Meeting</b> <i>Salt Lake City, UT</i>	<b>Talk</b> 2016
<b>Midwest Relativity Meeting</b> <i>Evanston, IL</i>	<b>Talk</b> 2015
<b>April APS Meeting</b> <i>Baltimore, MD</i>	<b>Talk</b> 2015
<b>IAU Meeting</b> <i>Beijing, China</i>	<b>Talk</b> 2014
<b>AAS Head Meeting</b> <i>Chicago, IL</i>	<b>Poster</b> 2014
<b>LIGO Scientific Collaboration Meeting</b> <i>Bethesda, MD</i>	<b>Talk</b> 2013
<b>Midwest Relativity Meeting</b> <i>Chicago, IL</i>	<b>Talk</b> 2012
<b>Gravitational-Wave Physics and Astronomy Workshop</b> <i>Hannover, Germany</i> - 3rd place award for best poster	<b>Poster</b> 2012
<b>Gravitational-Wave Burst Workshop</b> <i>Tobermory, Scotland</i>	<b>Talk</b> 2012
<b>Midwest Relativity Meeting</b> <i>Urbana, IL</i>	<b>Talk</b> 2011
<b>Gravitational-Wave Physics and Astronomy Workshop</b> <i>Milwaukee, WI</i>	<b>Talk</b> 2011

## Public Lectures

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<b>MIT Independent Activities Period</b> <i>The era of Gravitational-wave Astronomy; Cambridge, MA</i>	<b>Public Talk</b> 2017, 2018
<b>Compton Lecture Series</b> <i>Dense Star Clusters as Binary Black Hole Factories (<a href="#">Link</a>)</i> Chicago, IL	<b>Guest Seminar</b> 2016
<b>TEDxNorthwesternU</b> <i>Listening to Einstein's Final Symphony (<a href="#">Link</a>)</i>	<b>TEDx Talk</b> 2016

Evanston, IL

**Conversations with an Astronomer**

Series of Public Lectures at Adler Planetarium  
Chicago, IL

**Lecture Series**  
2011–2016

**Film Submission: Jackson Hole Science Media Festival**

*Black Holes and Globular Clusters* ([Link](#))

**Short Film**  
2014

**Perseid Meteor Shower**

Illinois Science Council in coordination with Chicago Parks Department  
Chicago, IL

**Public Talk**  
2013

**Public Lecture at North Central Purdue University**

*Catching Gravitational Waves with LIGO*  
Westville, IN

**Public talk**  
2011

## Teaching/Education Activities

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**General Relativity**

*Guest Lecturer and TA*; Northwestern University, Evanston, IL

**Lecture/TA**  
2015

**GK12 Fellowship**

*Reach for the Stars*; Highland Park, IL  
Co-taught weekly in math department of Highland Park High School  
Developed mathematics lessons, visualizations, and applets for high-school students ([Link](#))

**Teaching**  
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

## Student Mentored and Co-Mentored

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**Halston Lim**

Triple Systems in Galactic Nuclei; MIT

**Grad Student**  
2018–present

**Caitlin Fischer**

Spinning Black Hole Triples; MIT Undergraduate Research Opportunities Program

**Undergraduate**  
2017–2018

**Michael Zevin**

Binary-Binary Scatterings in Globular Clusters; KSPI Summer Program

**Grad Student**  
2017–2018

**Joshua Fuhrman**

Merging Binary Black Holes in Open Clusters; Northwestern REU

**Undergraduate**  
2016

## Service Work

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Peer Reviewer (15 manuscripts) for:

Referee

- - Physical Review Letters *2015-Present*
- Physical Review D
- Astrophysical Journal Letters
- Astrophysical Journal
- Monthly Notices of the Royal Astronomical Society

**Proposal Reviewer for:**

- US-Israel Binational Science Foundation

**Referee**  
*2018-Present*

**IAP Co-Organizer**

MIT Independent Activities Period; Cambridge, MA

**Organizer**  
*2017*

**Co-Organizer**

Astronomy On Tap – Boston; Cambridge, MA

**Organizer**  
*2016-Present*