

# Gabriel Herczeg

## RESEARCH EXPERIENCE

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CURRENT, FROM SEPT 2012

UC Davis

*Classical and Quantum Gravity*

Dissertation research focused on various theoretical aspects of black holes in classical and quantum gravity. Research interests include shape dynamics, black hole thermodynamics and statistical mechanics, black hole/CFT correspondence, loop quantum gravity and mathematical physics. The primary focus of this research was to understand black holes in shape dynamics, which differ from their GR counterparts within their event horizons and which may circumvent the information loss paradox. This research was conducted under the guidance of Steve Carlip.

CURRENT, FROM SEPT 2016

UC Davis

*Contact Geometry and Quantum Mechanics*

Developed a reformulation of quantum mechanics in terms of the geometry of “phase-spacetime”—an odd dimensional manifold coordinatized by generalized position, momentum and time variables. Classical dynamics is determined by a choice of contact structure on phase-spacetime. BRST quantization leads to a totally constrained system with elements of the physical Hilbert space satisfying a parallel transport condition. This research was conducted in collaboration with Andrew Waldron.

## PUBLICATIONS

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- Contact Quantization: 2018  
Quantum Mechanics = Parallel Transport.  
G. Herczeg, A. Waldron.  
Archivum Mathematicum (Brno). \*\*IN PRESS\*\*.  
arXiv:1805.11731.
- Contact Geometry and Quantum Mechanics. 2018  
G. Herczeg, A. Waldron.  
Physics Letters B 781 (2018) 312-315  
arXiv:1709.04557. DOI: 10.1016/j.physletb.2018.04.008
- A Tour Through Shape Dynamic Black Holes. 2017  
G. Herczeg.  
Dissertation. arXiv:1709.04557.
- Parity Horizons in Shape Dynamics. 2016  
G. Herczeg.  
Classical and Quantum Gravity 33 (2016) no.22, 225002.  
arXiv:1508.06704. DOI: 10.1088/0264-9381/33/22/225002.
- Towards Black Hole Entropy in Shape Dynamics. 2015  
G. Herczeg, V. Shyam.  
Classical and Quantum Gravity 32 (2015) no.21, 215019.  
arXiv:1410.4248. DOI:10.1088/0264-9381/32/21/215019
- A Rotating Black Hole Solution for Shape Dynamics. 2014  
H. Gomes, G. Herczeg.  
Classical and Quantum Gravity 31 (2014) 175014.  
arXiv:1310.6095. DOI:10.1088/0264-9381/31/17/175014.

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## EDUCATION

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- 2017 **Doctor of Philosophy**  
PHYSICS  
*UC Davis*
- 2012 **Master of Science**  
PHYSICS  
*UC Davis*
- 2010 **Bachelor of Science (Honors)**  
PHYSICS  
*CUNY, Brooklyn College*
- 2010 **Bachelor of Science (Honors)**  
MATHEMATICS  
*CUNY, Brooklyn College*

## AWARDS & DISTINCTIONS

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- 2015 **Featured**  
*Centennial anniversary of general relativity special issue of Scientific American.*
- 2015 **Spring Travel Award**  
*Graduate Student Association UC Davis*
- 2014 **Spring Travel Award**  
*Graduate Student Association UC Davis*
- 2014 **FQXi Minigrant MGA-1404**  
*Foundational Questions Institute*
- 2009 **TA Smits Memorial Award**  
*CUNY, Brooklyn College*
- 2008 **TA Smits Memorial Award**  
*CUNY, Brooklyn College*
- 2008 **Ida and Philip Klein Scholarship**  
*CUNY, Brooklyn College*

## TEACHING EXPERIENCE

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2017-2018

Lecturer, UC Davis

*Department of Mathematics*

Developed curriculum and materials for various introductory calculus courses, as well as linear algebra and introduction to abstract mathematics. Prepared and presented lectures, managed TAs, organized all aspect of the course (enrollment varied from ~80 to ~275).

2016-2017

Associate Instructor, UC Davis

*Department of Physics*

Developed curriculum and materials including lecture slides, problem sets and exams for introductory algebra-based mechanics course. Prepared and presented lectures, managed TAs, organized all aspect of the course (enrollment ~175).

SEPT 2010 – JUNE 2016

Teaching Assistant, UC Davis

*Department of Physics*

Served as a teaching assistant for a wide range of courses, including several quarters of experience with introductory physics courses for both STEM majors and non-STEM majors in both lab and discussion. Also served as a teaching assistant for some upper division undergraduate courses and graduate courses in general relativity and quantum gravity.

## SERVICE AND LEADERSHIP

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2015 (FALL & SPRING), 2016, & 2017

Referee

*Classical and Quantum Gravity*

2018

Referee

*Annals of Physics*

SPRING 2016

Organizer

*Entanglement entropy journal club*

SPRING 2015

Organizer

*Black hole evaporation journal club*

CURRENT FROM 2013

Member

*American Physical Society*

2016 - 2017

Member

*UC Davis Diversity and Inclusion in Physics, graduate student group*

## INVITED TALKS

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2015 **Black Holes and the Shape of Space**  
*Brooklyn College physics department colloquium*  
November 24<sup>th</sup>. Brooklyn, New York, US.

2015 **Parity Horizons and Chronology  
Protection in Shape Dynamics**  
*SD@Convergence workshop*  
*Perimeter Institute for Theoretical Physics*  
June 25<sup>th</sup>. Waterloo, Ontario, CA.  
[View here.]

2014 **Shape Dynamic Black Holes and Horizons**  
*Atlantic General Relativity  
and Shape Dynamics Workshop*  
*University of New Brunswick, Fredericton*  
May 8<sup>th</sup>. Fredericton, New Brunswick, CA.

2014 **Shape Dynamic Black Holes**  
*High energy physics seminar*  
*Radbout Universiteit*  
April 12<sup>th</sup>. Nijmegen, NL.

## OTHER TALKS

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2016 **Parity Horizons in Shape Dynamics**  
*American Physical Society, April Meeting*  
April 13<sup>th</sup>. Salt Lake City, Utah, US.

2015 **Parity Horizons in Shape Dynamics**  
*Loops '15 Conference*  
*Institute for Quantum Gravity*  
*Friedrich-Alexander-Universität*  
July 7<sup>th</sup>. Erlangen-Nürnberg, Germany.

2015 **CPT Horizons and Chronology  
Protection in Shape Dynamics**  
*31<sup>st</sup> Pacific Coast Gravity Meeting*  
*University of Oregon, Eugene*  
March 14<sup>th</sup>. Eugene, Oregon, US.

2013 **Rotating Black Holes in Shape Dynamics**  
*American Physical Society*  
*Far-West section meeting*  
*Sonoma State University*  
November 1<sup>st</sup>. Sonoma, California, US.