Alexander Grant

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Citizenship: USA & Canada

Academic Employment

Research Fellow University of Southampton
September 2023 — Present

Supervisor: Adam Pound

Postdoctoral Research Associate University of Virginia
September 2020 — August 2023

Supervisor: David Nichols

Teaching and Research Assistant Cornell University
August 2014 — August 2020

Research Supervisor: Éanna Flanagan

Education

Ph.D. in Physics Cornell University
August 2014 — August 2020

Advisor: Éanna Flanagan

Dissertation title: *Angular Momentum in General Relativity*

Date awarded: August 17th, 2020

B.A. in Physics University of Chicago
September 2009 — June 2013

Honors degree

Dean's List (2009 — 2013)

Teaching Experience

Graduate Lecturer Cornell University
Responsibilities: Instructor of record, designing all course materials, lecturing, grading exams

Summer 2020: PHYS 1112 (Mechanics)

Co-instructor (Undergraduate courses) Cornell University
Responsibilities: Designing $\sim 1/3$ of the lectures, all problem sets, and $\sim 2/3$ of the final exam; running discussion sections; grading

Fall 2018: PHYS 3323 (Intermediate Electromagnetism)

Substitute Lecturer (Graduate courses) University of Southampton
Responsibilities: Giving a handful of lectures per semester

Spring 2024: MATH 6139 (Advanced General Relativity)

Teaching Assistant (Undergraduate courses) Cornell University
Responsibilities: Running discussion section(s) and lab(s) (if applicable), grading
[*] *Giving 1-2 lectures per semester*
[†] *Redesigning labs*
[‡] *Only running labs, designing* $\sim 1/2$ *of the final exam*

Fall 2016: PHYS 4445 (General Relativity)

Spring 2017[*,†], 2018[*], 2020[*,‡]: PHYS 2217 (Honors Electromagnetism)

Fall 2015, 2017, 2019[*]: PHYS 1116 (Honors Mechanics)

Spring 2019: PHYS 2214 (Waves and Optics)

Spring 2015, 2016: PHYS 1112 (Mechanics)

Fall 2014: PHYS 2207 (Mechanics for the Life Sciences)

Tutorial Group Leader University of Southampton
Responsibilities: Running tutorial/discussion sections

Fall 2023: MATH 1006 (Mathematical Methods for Physical Scientists 1A)

Teaching Assistant Training Cornell University

Summer 2016, 2017: Led training sessions for incoming graduate students

MENTORING

Benjamin Wade (Advisor: David Nichols) March 2021 — present
Project: Dark matter halos in intermediate mass-ratio systems

Siddhant Siddhant (Advisor: David Nichols) September 2022 — present
Projects: Gravitational wave memory effects (post-Newtonian, Yang-Mills, and detection)

PRE-GRADUATE RESEARCH EXPERIENCE

University of Chicago Mathematics REU June 2012 — September 2012
Project: Preissman's theorem, connecting Riemannian geometry and algebraic topology.

Harvard-Smithsonian CfA (Supervisor: Saeqa Vrtilek) June 2010 — September 2010
Project: Optical reduction and production of maximum-entropy Doppler tomograms for images of black hole and neutron star systems.

NON-ACADEMIC EMPLOYMENT

System Administrator Cornell Physics Education Computing Facility
February 2016 — January 2020

Software Engineer Basis Technology Corporation
June 2013 — July 2014

Geometry Textbook Typesetter Commonwealth School
June 2010 — September 2010

Software Engineering Intern Basis Technology Corporation
June 2009 — September 2011 (summers)

AWARDS

Hartman Memorial Teaching Award 2014

OUTREACH

Cornell "Ask an Astronomer" May 2019 — February 2020
Answered astrophysics-related questions at http://curious.astro.cornell.edu/

Cornell Reunion Physics Demo Show June 2015 — 2016, 2018 — 2019
Acted as an assistant during the show, and explained a collection of smaller demos to alumni and their children before and after

Cornell Presidential Inauguration August 2017
Gave demonstrations as part of a booth associated with the physics department

ORGANIZING

The Southampton Self-Force Seminar 2024 — present
Organized biweekly seminar of external speakers

UVA Gravity Seminar 2021 — 2023
Co-organized biweekly seminar of external speakers, hosting $\sim 1/2$ *of the speakers*

Cornell Summer STEM Colloquium 2015
Co-organized weekly seminar with non-physics departments

SERVICE

Capra Equity, Diversity, and Inclusion Committee 2022 — present
December 2023 — present: Co-Chair

Peer review 2020 — present
Nature Astronomy (1)
Physical Review D (11)
Classical and Quantum Gravity (5)

SKILLS

Programming languages: C/C++, Python, Bash, Make
Libraries: GNU Scientific Library, NumPy, SciPy, LALSuite
Computer algebra systems: Mathematica, Maxima
Markup languages: LaTeX (with TikZ), HTML, Markdown
Languages: English (native)

Software packages

Creator

GWForecasts https://gitlab.com/alex_grant/forecasts
Python library/software package for predicting the ability for gravitational wave detectors to measure the gravitational wave memory effect

Talks

Invited

New Frontiers in Strong Gravity III (Benasque) July 2024
Higher memory effects

Center for Astrophysics and Relativity Seminar (DCU) March 2024
Flux-balance laws from the Hamiltonian formulation of self-force

Gravitational Memory Effects: from Theory to Observation (QMUL) June 2023
Persistent observables: a class of memory-like effects

Perimeter Institute Strong Gravity Group Meeting December 2022
Memory-like effects and their measurement by ground-based detectors

Holography & Gravitational Waves (IFPU) July 2022
Persistent observables: a generalization of the gravitational wave memory effect

The Southampton Self-Force Seminar February 2022
Flux-balance laws in self-force theory

Caltech TAPIR Seminar December 2020
Angular momentum in Einstein-Maxwell theory

Contributed

Capra Meeting June 2024
Flux-balance laws in the Hamiltonian formulation

BritGrav April 2024
Nonlinearities in the observation of memory-like effects

Edoardo Amaldi Conference on Gravitational Waves July 2023
Outlook for detecting gravitational wave memory effects with ground-based detectors

Capra Meeting July 2023
Flux-balance laws from an effective stress-energy tensor

APS April Meeting April 2023
Outlook for detecting gravitational wave memory effects with current and future gravitational wave detectors

Capra Meeting June 2022
Flux-balance laws for spacetime isometries

APS April Meeting April 2022
Forecasting the detection of gravitational wave memory by current and future gravitational wave detectors

Marcel Grossman Meeting July 2021
Memory-like effects due to relative velocity and acceleration

Capra Meeting June 2021
Flux-balance laws in the Kerr spacetime

APS April Meeting April 2021
Memory-like effects arising from relative velocity and acceleration

APS April Meeting April 2020
Persistent gravitational wave observables in nonlinear plane wave spacetimes

APS April Meeting & Eastern Gravity Meeting April/May 2019
Persistent gravitational wave observables

APS April Meeting & Eastern Gravity Meeting April/May 2018
Gravitational wave memory observables

Eastern Gravity Meeting June 2017
Generalization of gravitational wave memory

APS April Meeting January 2017
Conserved currents for electromagnetic fields in the Kerr spacetime

APS April Meeting & Eastern Gravity Meeting April/May 2016
A new conserved current for linearized gravity in the Kerr spacetime

Eastern Gravity Meeting May 2015
Non-Conservation of Carter in Black Hole Spacetimes

PUBLICATIONS

Published/Refereed

A. M. Grant, *Persistent gravitational wave observables: Nonlinearities in (non-)geodesic deviation*, Class. Quant. Grav. **41**, 175004 (2024) [arXiv:2401.00047]

A. M. Grant, K. Mitman, *Higher Memory Effects in Numerical Simulations of Binary Black Hole Mergers*, Class. Quant. Grav. **41**, 175003 (2024) arXiv:2312.02295

D. A. Nichols, B. A. Wade, **A. M. Grant**, *Secondary accretion of dark matter in intermediate mass-ratio inspirals: Dark-matter dynamics and gravitational-wave phase*, Phys Rev. D **108**, 124062 (2023) [arXiv:2309.06498]

A. M. Grant, J. Moxon, *Flux-balance laws in scalar self-force theory*, Phys. Rev. D **108**, 104029 (2023) [arXiv:2209.13829]

A. M. Grant, D. A. Nichols, *Outlook for detecting the gravitational wave displacement and spin memory effects with current and future gravitational wave detectors*, Phys. Rev. D **107**, 064056 (2023) [arXiv:2210.16266]

A. M. Grant, A. Saffer, L. C. Stein, S. Tahura, *Gravitational-wave energy and other fluxes in ghost-free bigravity*, Phys. Rev. D **107**, 044041 (2023) [arXiv:2208.02123]

A. M. Grant, K. Prabhu, I. Shehzad, *The Wald-Zoupas prescription for asymptotic charges at null infinity in general relativity*, Class. Quantum Grav. **39 8** 085002 (2022) [arXiv:2105.05919]

A. M. Grant, D. A. Nichols, *Persistent gravitational wave observables: Curve deviation in asymptotically flat spacetimes*, Phys. Rev. D **105**, 024056 (2022) [arXiv:2109.03832]

A. M. Grant, É. É. Flanagan, *A class of conserved currents for linearized gravity in the Kerr spacetime*, Class. Quant. Grav. **38 5**, 055004 (2021) [arXiv:2005.04547]

A. M. Grant, É. É. Flanagan, *Conserved currents for electromagnetic fields in the Kerr spacetime*, Class. Quant. Grav. **37 18**, 185021 (2020) [arXiv:1910.08645]

É. É. Flanagan, **A. M. Grant**, A. I. Harte, D. A. Nichols, *Persistent gravitational wave observables: Nonlinear plane wave spacetimes*, Phys. Rev. D **101**, 104033 (2020) [arXiv:1912.13449]

B. Bonga, **A. M. Grant**, K. Prabhu, *Angular momentum at null infinity in Einstein-Maxwell theory*, Phys. Rev. D **101**, 044013 (2020) [arXiv:1911.04514]

É. É. Flanagan, **A. M. Grant**, A. I. Harte, D. A. Nichols, *Persistent gravitational wave observables: General framework*, Phys. Rev. D **99**, 084044 (2019) [arXiv:1901.00021]

A. Grant, É. É. Flanagan, *Non-Conservation of Carter in Black Hole Spacetimes*, Class. Quant. Grav. **32 15**, 157001 (2015) [arXiv:1503.05164]

Pre-prints

A. M. Grant, *Flux-balance laws for spinning bodies under the gravitational self-force*, arXiv:2406.10343

S. Siddhant, **A. M. Grant**, D. A. Nichols, *Higher memory effects and the post-Newtonian calculation of their gravitational-wave signals*, arXiv:2403.13907

Miscellaneous

A. M. Grant, P. D. Lasky, K. Mitman, D. A. Nichols, L. C. Stein, S. Tiwari, *Gravitational-Wave Memory Effects in XG Observatories*, Cosmic Explorer Science Letter CE-L2300012