

Rodrigo Fernández

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Education

2004 - 2009 Doctor of Philosophy (Astronomy & Astrophysics)
University of Toronto, Canada. Advisor: Dr. Christopher Thompson
1999 - 2003 Licenciado en Astronomía (B.Sc.), Pontificia Univ. Católica de Chile
Advisor: Dr. Andreas Reisenegger

Academic Work Experience

2022 - present Associate Professor, University of Alberta
2016 - 2022 Assistant Professor, University of Alberta
2014 - 2016 Associate Specialist, UC Berkeley
2013 - 2014 Postdoctoral Scholar, UC Berkeley
2009 - 2013 Postdoctoral Fellow, Institute for Advanced Study (IAS, Princeton, NJ)
2003 - 2004 Research Assistant, Pontificia Univ. Católica de Chile
2003 Summer Research Intern (PIA), Cerro Tololo Inter-American Observatory

Scholarships and Awards

2019 Great Supervisor Award, Faculty of Graduate Studies and Research, University of Alberta (nominated by students)
2009 - 2012 NASA Einstein Postdoctoral Fellowship (USA)
2006 - 2009 Ontario Graduate Scholarship (Canada)
2004 Juan Mackenna Cerda Award, Pontificia Univ. Católica de Chile

Funding Grants

2022 - 2027 CAD 140,000 Natural Sciences and Engineering Research Council (NSERC) Discovery Grant (CAD 28,000/yr)
2017 - 2022 CAD 130,000 Natural Sciences and Engineering Research Council (NSERC) Discovery Grant (CAD 26,000/yr)
2016 - 2021 CAD 100,000 Startup funds, Faculty of Science, University of Alberta

Supercomputing Grants

- 2023 - present PI for yearly [Digital Research Alliance of Canada](#) allocation
2023-2024: 12.8M core-hr (CAD 154,573 equivalent)
- 2016 - 2022 PI for yearly [Compute Canada](#) allocation, 5yr-average: 4.8M core-hr/yr,
2022-2023: 13.6M core-hr (CAD 194,904 equivalent)
2021-2022: 4.3M core-hr (CAD 60,618 equivalent)
2020-2021: 5.3M core-hr (CAD 74,582 equivalent)
2019-2020: 0.4M core-hr (CAD 6,452 equivalent)
- 2014 - present PI for yearly [NERSC](#) (US DOE) allocation
2023: 400 node-hr
2022: 2,700 node-hr
2021: 1.7M core-hr
2020: 1.1M core-hr
2019: 1.2M core-hr
- 2010 - 2012 PI for yearly TeraGrid/[XSEDE](#) (US NSF) allocation, average 450k cpu-hr/yr
- 2019 - present Co-I in INCITE allocation at [OLCF Summit](#) (US DOE)
2019: 850k node-hours, 2021: 300k node-hours (PI: Tchekhovskoy)

Telescope Time Grants

- 2018 - Co-I in rolling proposal for [Gemini](#) follow up of LIGO/Virgo sources (PI: Drout)
- 2018 - Co-I in rolling proposal for [CFHT](#) follow up of LIGO/Virgo sources (PI: Ruan)

Teaching Activities

Instructor at the University of Alberta:

ASTRO 120 Astronomy of the Solar System	2021 Fall (266 students)
ASTRO 122 Astronomy of Stars & Galaxies	2020 Winter (228 students) 2019 Winter (160 students) 2018 Winter (234 students) 2017 Winter (180 students)
ASTRO 320 Stellar Astrophysics I	2020 Fall (50 students) 2019 Fall (39 students) 2018 Fall (31 students) 2017 Fall (33 students)
ASTRO 465/565 Stellar Astrophysics II	2021 Fall (15 students)
PHYS 495/595 (co-taught w/ Dr. N. Ivanova) Theoretical Astrophysics (Radiative Processes)	2022 Winter (15 students)

Student Supervision

Graduate Students: Coleman Dean (PhD, UAlberta, 2020 - expected 2024)
 (MSc, UAlberta, 2018-2020, **completed**)
 Steven Fahlman (PhD, UAlberta, 2019-2023, **completed**)
 (MSc, UAlberta, 2017-2019, **completed**)
 Mario Ivanov (MSc, UAlberta, 2018-2020, **completed**)
 co-supervised with Dr. Gregory Sivakoff

Undergraduates: Chahat Jolly ([NSERC USRA](#), UAlberta, Summer 2021)
 ([NSERC USRA](#), UAlberta, Summer 2020)
 Nicole Mulyk ([NSERC USRA](#), UAlberta, Summer 2021)
 (Research Assistant, UAlberta, Summer 2020)
 Noah Baker ([NSERC USRA](#), UAlberta, Summer 2021)
 Sareena Butt (Research Assistant, UAlberta, Summer 2020)
 co-supervised with Dr. Sharon Morsink
 Ruslan Timchenko ([Mitacs Globalink](#), UAlberta, Summer 2018)
 Koushik Sen ([UARE](#), UAlberta, Summer 2017)
 Rohith Sekar ([UARE](#), UAlberta, Summer 2017)
 Navin Sridhar ([Mitacs Globalink](#), UAlberta, Summer 2017)
 Can Lyu (PHYS 499, UAlberta, Winter 2017)

Service Activities

I. Peer Review

Grants:

Review panel member, Compute Canada Resource Allocation Competition
 Review panel member, U.S. National Science Foundation
 Reviewer of individual grants for the Israel Science Foundation,
 Dutch Research Council (NWO), European Research Council (ERC),
 National Killam Program (Canada)

Fellowships:

Reviewer of NASA Postdoctoral Program applications

Journals:

Referee for The Astrophysical Journal, The Astrophysical Journal Letters (US), Astronomy & Astrophysics (Europe), Monthly Notices of the Royal Astronomical Society (UK), Physical Review D (US), Physical Review Letters (US)

II. Departmental (UAlberta Physics)

2019 - 2022 Colloquium Coordinator
 2017 - 2021 Graduate Recruitment Committee
 2023 - 2024
 2017 - 2021 Graduate Admissions Committee

III. Meeting organization

- 2020 - 2021 Member, Online Organizing Committee, Canadian Astronomical Society Annual General Meeting 2021 (May 2021)
- 2015 - 2017 Lead Organizer, program *Electromagnetic Signatures of R-process Nucleosynthesis in Neutron Star Binary Mergers*, Institute for Nuclear Theory, University of Washington (July 24 - Aug 18 2017)
- 2017 Member, Local Organizing Committee, Canadian Astronomical Society Annual General Meeting 2017 (Edmonton, AB, May 2017)
- 2008 Member of Organizing Committee, *Workshop on Parallel Computing in Astrophysics*, Canadian Institute for Theoretical Astrophysics and Univ. of Toronto

IV. Other Leadership and Service Activities

- 2021 - 2025 Council Member, Canadian Institute for Theoretical Astrophysics
- 2021 - 2023 Evaluation Committee Member, ICTP-SAIFR Prize in Classical Gravity and Applications
- 2019 - 2022 Member, Awards Committee, Canadian Astronomical Society
- 2014 Member, Science Team, PoSTAR (NASA Small Explorer candidate)
- 2014 - 2015 Co-Organizer, Theoretical Astrophysics Center Seminars, UC Berkeley
- 2011 - 2012 Co-Organizer, Princeton University - IAS Transients Discussion Group
- 2010 - 2011 Co-Organizer, IAS Astrophysics Seminars
- 2009 - 2010 Co-Organizer, IAS Astrophysics Coffee Discussion (Journal Club)
- 2007 - 2009 Member of Computing Committee, Canadian Inst. for Theoretical Astrophysics
- 2007 - 2008 President, Graduate Astronomy Students Association, University of Toronto

V. Membership in Professional Organizations

- since 2023 Sociedad Chilena de Astronomía (SOCHIAS)
- since 2018 CITA Inc. (Canadian Institute for Theoretical Astrophysics)
- since 2017 Theoretical Physics Institute, University of Alberta
- since 2016 Canadian Astronomical Society (CASCA)
- since 2016 Canadian Association of Physicists (CAP)
- since 2005 American Physical Society (APS)
- since 2004 American Astronomical Society (AAS)

Publications - Rodrigo Fernández

I. Refereed journal articles

- Total: 50 articles in refereed journals, 6 student-led, 23 as first author
- h-index / total citations as of November 2023: 32 / 3714 ([NASA ADS](#)), 33 / 4417 ([Google Scholar](#))
- Impact factors (2022) [ARNPS](#): 12.4, [ApJ Letters](#): 7.9 [ApJ](#): 4.9, [PRD](#): 5.0, [MNRAS](#): 4.8, [CQG](#): 3.5

The journals I publish in are non-profit and the standard for astrophysics, belonging to professional societies: the American Astronomical Society (ApJ, ApJL), the American Physical Society (PRD), and the Royal Astronomical Society (MNRAS). I have also published in review journals (Annual Reviews) and specialized journals (CQG). The standard author ordering in astronomy is such that whoever did the most work goes first, and subsequent author positions indicate smaller contributions.

Students working under my supervision are in marked in **bold**.

50. **Fahlman, S.**, & Fernández, R. 2023, *Secular outflows from 3D MHD hypermassive neutron star accretion disc systems*, MNRAS, 526, 952
49. Haddadi, M., Duez, M. D., Foucart, F., Ramirez, T., Fernández, R., Knight, A., Jesse, F., Hébert, F., Kidder, L. E., Pfeiffer, H. P., & Scheel, M. A., 2023, *Late-time post-merger modeling of a compact binary: effects of relativity, r-process heating, and treatment of transport*, CQG, 40, 085008
48. Vieira, N., Ruan, J. J., Haggard, D., Ford, N., Drout, M. R., Fernández, R., & Badnell, N. R. 2023, *Spectroscopic r-Process Abundance Retrieval for Kilonovae I: The Inferred Abundance Pattern of Early Emission from GW170817*, ApJ, 944, 123
47. Fernández, R., Richers, S., **Mulyk, N.**, **Fahlman, S.**, 2022, *Fast flavor instability in hypermassive neutron star disk outflows*, PRD, 106, 103003
46. Caiazzo, I., González-Caniulef, D., Heyl, J., Fernández, R., 2022, *Probing magnetar emission mechanisms with X-ray spectropolarimetry*, MNRAS, 514, 5024
45. **Fahlman, S.**, Fernández, R., 2022, *Long-term 3D MHD simulations of black hole accretion discs formed in neutron star mergers*, MNRAS, 513, 2689
44. Klion, H., Tchekhovskoy, A., Kasen, D., Kathirgamaraju, A., Quataert, E., Fernández, R., 2022, *The impact of r-process heating on the dynamics of neutron star merger accretion disc winds and their electromagnetic radiation*, MNRAS, 510, 2968
43. Raaijmakers, G., Nissanke, S., Foucart, F., Kasliwal, M. M., Bulla, M., Fernández, R., (plus 9 more authors), 2021, *The Challenges Ahead for Multimessenger Analyses of Gravitational Waves and Kilonova: A Case Study on GW190425*, ApJ, 922, 269
42. **Dean, C.**, Fernández, R., & Metzger, B. D., 2021, *Resolving the fastest ejecta from binary Neutron Star mergers: implications for electromagnetic counterparts*, ApJ, 921, 161
41. Metzger, B. D., & Fernández, R., 2021, *From Neutrino- to Photon-Cooled in Three Years: Can fallback Accretion Explain the X-ray Excess in GW170817?*, ApJ Letters, 916, L3
40. **Ivanov, M.**, & Fernández, R., 2021, *Mass ejection in failed supernovae: equation of state and neutrino loss dependence*, ApJ, 911, 1
39. Holmbeck, E. M., Frebel, A., McLaughlin, G. C., Surman, R., Fernández, R., Metzger, B. D., Mumpower, M. R., & Sprouse, T. M., 2021, *Reconstructing Masses of Merging Neutron Stars from Stellar r-Process Abundance Signatures*, ApJ, 909, 21

38. Fernández, R., Foucart, F., & Lippuner, J. 2020, *The landscape of disk outflows from neutron star - black hole mergers*, MNRAS, 497, 3221
37. Vieira, N., et al. (13 authors including Fernández, R.), 2020, *A Deep CFHT Optical Search for a Counterpart to the Possible Neutron Star – Black Hole Merger GW190814*, ApJ, 895, 96
36. Christie, I. M., Lalakos, A., Tchekhovskoy, A., Fernández, R., Foucart, F., Quataert, E., & Kasen, D. 2019, *The Role of Magnetic Field Geometry in the Evolution of Neutron Star Merger Accretion Disks*, MNRAS, 490, 4811
35. Fernández, R., Margalit, B., & Metzger, B. D. 2019, *Nuclear Dominated Accretion Flows in Two Dimensions. II. Ejecta dynamics and Nucleosynthesis for CO and ONe White Dwarfs*, MNRAS, 488, 259
34. Fernández, R., Tchekhovskoy, A., Quataert, E., Foucart, F., & Kasen, D. 2019, *Long-term GRMHD Simulations of Neutron Star Merger Accretion Disks: Implications for Electromagnetic Counterparts*, MNRAS, 482, 3373
33. **Fahlman, S.**, & Fernández, R., 2018, *Hypermassive neutron star disk outflows and blue kilonovae*, ApJ Letters, 869, 3
32. **Sen, K.**, Fernández, R., & Socrates, A. 2018, *Sub-photospheric fluctuations in magnetized radiative envelopes: contribution from unstable magnetosonic waves*, MNRAS, 477, 2286
31. Fernández, R., Quataert, E., Kashiyama, K., & Coughlin, E. C. 2018, *Mass ejection in failed supernovae: variation with stellar progenitor*, MNRAS, 476, 2366
30. Coughlin, E. C., Quataert, E., Fernández, R., & Kasen, D. 2018, *A physical model of mass ejection in failed supernovae*, MNRAS, 477, 1225
29. Fernández, R., Foucart, F., Kasen, D., Lippuner, J., Desai, D., & Roberts, L. F. 2017, *Dynamics, nucleosynthesis, and kilonova signature of black hole - neutron star merger ejecta*, CQG, 34, 154001
28. Lippuner, J., Fernández, R., Roberts, L. F., Foucart, F., Kasen, D., Metzger, B., & Ott, C. 2017, *Signatures of hypermassive neutron star lifetimes on r-process nucleosynthesis in the disk ejecta from neutron star mergers*, MNRAS, 472, 904
27. Fernández, R. & Metzger, B. D. 2016, *Electromagnetic Signatures of Neutron Star Mergers in the Advanced LIGO Era*, ARNPS, 66, 23
26. Wu, M.-R., Fernández, R., Martínez-Pinedo, G. & Metzger, B. D. 2016, *Production of the entire range of r-process nuclides by black hole accretion disc outflows from neutron star mergers*, MNRAS, 463, 2323
25. Quataert, E., Fernández, R., Kasen, D., Klion, H. & Paxton, B. 2016, *Super-Eddington stellar winds driven by near surface energy deposition*, MNRAS, 458, 1214
24. Krawczynski, H. et al. (51 co-authors, including Fernández, R.) 2016, *X-Ray Polarimetry with the Polarization Spectroscopic Telescope Array*, Astroparticle Physics, 75, 8
23. Richers, S., Kasen, D., O'Connor, E., Fernández, R., & Ott, C. 2015, *Monte Carlo Neutrino Transport through Remnant Disks from Neutron Star Mergers*, ApJ, 813, 38
22. Fernández, R., 2015, *Three-dimensional simulations of SASI- and Convection-dominated core-collapse supernovae*, MNRAS, 452, 2071
21. Kasen, D., Fernández, R., & Metzger, B. D. 2015, *Kilonova Light Curves from the Disk Wind Outflows of Compact Object Mergers*, MNRAS, 450, 1777

20. Fernández, R., Quataert, E., Schwab, J., Kasen, D., & Rosswog, S., 2015, *The interplay of disk wind and dynamical ejecta in the aftermath of neutron star – black hole mergers*, MNRAS, 449, 390
19. Fernández, R., Kasen, D., Metzger, B. D., & Quataert, E. 2015, *Outflows from accretion disks formed in neutron star mergers: effect of black hole spin*, MNRAS, 446, 750
18. Metzger, B. D. & Fernández, R. 2014, *Red or blue? A potential kilonova imprint of the delay until black hole formation following a neutron star merger*, MNRAS, 441, 3444
17. Fernández, R., Müller, B., Foglizzo, T. & Janka, H.-Th. 2014, *Characterizing SASI- and Convection-Dominated Core-Collapse Supernova Explosions in Two Dimensions*, MNRAS, 440, 2763
16. Guilet, J. & Fernández, R. 2014, *Angular Momentum Redistribution by SASI Spiral Modes and Consequences for Neutron Star Spins*, MNRAS, 441, 2782
15. Fernández, R. & Metzger, B. D. 2013, *Delayed Outflows from Black Hole Accretion Tori Following Neutron Star Binary Coalescence*, MNRAS, 435, 502
14. Fernández, R. & Socrates, A. 2013, *Nonlinear Evolution of the Radiation-Driven Magneto-Acoustic Instability (RMI)*, ApJ, 767, 144
13. Kushnir, D., Katz, B., Dong, S., Livne, E., and Fernández, R. 2013, *Head-on collisions of white dwarfs in triple systems could explain Type Ia Supernovae*, ApJ, 778, L37
12. Fernández, R. & Metzger, B. D. 2013, *Nuclear Dominated Accretion Flows in Two Dimensions. I. Torus Evolution with Parametric Microphysics*, ApJ, 763, 108
11. Fernández, R. 2012, *Hydrodynamics of Core-Collapse Supernovae at the Transition to Explosion. I. Spherical Symmetry*, ApJ, 749, 142
10. Fernández, R. & Davis, S. W. 2011, *The X-ray Polarization Signature of Quiescent Magnetars: Effect of Magnetospheric Scattering and Vacuum Polarization*, ApJ, 730, 131
9. Fernández, R. 2010, *The Spiral Modes of the Standing Accretion Shock Instability*, ApJ, 725, 1563
8. Fernández, R. & Thompson, C., 2009, *Dynamics of a Spherical Accretion Shock with Neutrino Heating and Alpha Particle Recombination*, ApJ, 703, 1464
7. Fernández, R., & Thompson, C. 2009, *Stability of a Spherical Accretion Shock with Nuclear Dissociation*, ApJ, 697, 1827
6. Fernández, R., & Thompson, C. 2007, *Resonant Cyclotron Scattering in Three Dimensions and the Quiescent Nonthermal X-ray Emission of Magnetars*, ApJ, 660, 615
5. Fernández, R., Brandeker, A., & Wu, Y. 2006, *Braking the Gas in the β Pictoris Disk*, ApJ, 643, 509
4. Reisenegger, A., Jofré, P., Fernández, R., Kantor, E. 2006, *Rotochemical Heating of Neutron Stars: Rigorous Formalism with Electrostatic Potential Perturbations*, ApJ, 653, 568
3. Jofré, P., Reisenegger, A., & Fernández, R. 2006, *Constraining a Possible Time Variation of the Gravitational Constant through “Gravitochemical Heating” of Neutron Stars*, Phys. Rev. Lett., 97, 131102
2. Fernández, R., & Reisenegger, A. 2005, *Rotochemical Heating in Millisecond Pulsars: Formalism and Nonsuperfluid Case*, ApJ, 625, 291
1. Fernández, R., Monteiro, H., & Schwarz, H. E. 2004, *Proper Motion and Kinematics of the Ansa in NGC 7009*, ApJ, 603, 595

II. White Papers

4. Fernández, R., Herwig, F., & Babul, A., et al. 2020, *Large-parallel supercomputer simulations: frontiers in Canadian research*, White paper for the New Digital Research Infrastructure Organization (now Digital Research Alliance of Canada), available at [this URL](#).
3. Fernández, R., Herwig, F., & Safi-Harb, S., et al. 2019, *The cosmic origin and evolution of the elements*, White paper for the Candian Long Range Plan in Astronomy 2020, [arXiv:1910.09712](#)
2. Ruan, J. J. et al. (20 co-authors, including Fernández, R.) 2019, *A Vision for Canadian Leadership in Multi-Messenger Astrophysics in the Next Decade*, White paper for the Candian Long Range Plan in Astronomy 2020, available at [this URL](#).
1. Foley, R. J. et al. (112 co-authors, including Fernández, R.) 2019, *Gravity and Light: Combining Gravitational Wave and Electromagnetic Observations in the 2020s*, White paper for the US Decadal Survey of Astronomy and Astrophysics 2020, [arXiv:1903.04553](#)

III. Media Coverage

- 2021 [Video Interview](#) on AAS YouTube channel, highlighting “*From Neutrino- to Photon Cooling...*” by Metzger & Fernandez 2021 (refereed journal article #41 above).
- 2019 [Lawrence Berkeley Lab Press Release](#) on “*The Role of Magnetic Field Geometry...*” by Christie et al. 2019 (refereed journal article #36 above).
- 2018 Press release on “*Long-term GRMHD simulations...*” by Fernández et al. 2019 (refereed journal article #34 above). Initiated via [UALberta Faculty of Science Communications Office](#), picked up by the [StarMetro Edmonton](#), and by the [Lawrence Berkeley Lab \(NERSC\) Press Office](#)

Presentations

I. Recent conference/workshop talks

Total since 2006: 19 invited and 28 contributed talks. Presenting author in all cases listed.

- 2023 **[Invited]** *Multi-Messenger Modeling of Neutron Star Mergers*, May 8-10, Princeton, NJ
[Contributed] *Focus Workshop on Collective Oscillations and Chiral Transport of Neutrinos*, March 14-17, Taipei, Taiwan
- 2022 **[Invited]** (discussion session lead) *Kilonova: Multimessenger and Multiphysics* - Heraeus Seminar, Nov 28 - Dec 1, Bad Honnef, Germany
[Invited] *CaNPAN Annual Meeting 2022*, October 31 - November 2, Online
- 2021 [Contributed] *Canadian Astronomical Society AGM 2021*, May 10-14, Online
[Contributed] *American Physical Society (APS) April Meeting 2021*, April 17-20, Online
- 2020 [Contributed] *Canadian Multi-Messenger Astrophysics Workshop*, Jan 28-30, Montréal, QC
- 2019 **[Invited]** *Black holes and neutron stars with gravitational waves*, Oct 7-11, Kyoto, Japan
[Contributed] *Fifty-One-Ergs 2019*, May 20-24, Raleigh, NC
[Contributed] *American Physical Society (APS) April Meeting 2019*, April 13-16, Denver, CO

II. Recent Seminars and Colloquia

- 2023 Niels Bohr Institute (Denmark - remote)
Academia Sinica Institute of Astronomy and Astrophysics (Taiwan)
Academia Sinica Institute of Physics (Taiwan)
National Tsing Hua University (Taiwan)
Universidad de Concepción (Chile)
- 2022 Oskar Klein Centre, Stockholm University (Sweden)
GRAPPA, University of Amsterdam (The Netherlands)
Technical University Darmstadt (Germany)
Universidad Nacional Autónoma de México (Mexico - remote)
- 2021 University of Alberta - Physics Department (Canada)
AEI, Max Planck Institute for Gravitational Physics (Germany - remote)
- 2020 Washington State University (USA - remote)
University of British Columbia (Canada - remote)
McGill University (Canada)
- 2019 Academia Sinica Institute of Physics (Taiwan)
MacEwan University (Canada)

III. Recent Presentations by students working under my supervision

- 2023 **Dean, C.**, contributed talk at *Microphysics in Relativistic Astrophysics*, Sep 9-15, Trento, Italy
Dean, C., contributed talk at *Astrophysical neutrinos and the origin of the elements*, Jul 24-28, Seattle, WA (USA)
- 2022 **Fahlman, S.**, invited talk at *EMMI+IReNA Workshop*, Oct 17-20, Darmstadt (Germany)
Dean, C., contributed talk at *INT Workshop 20R-1b*, May 23-27, Seattle, WA (USA)
Fahlman, S., contributed talk at *INT Workshop 20R-1b*, May 23-27, Seattle, WA (USA)
- 2021 **Dean, C.**, contributed poster at *CASCA AGM 2021*, Online
Fahlman, S., contributed poster at *CASCA AGM 2021*, Online
Dean, C., contributed talk at *APS April Meeting 2021*, Online
Fahlman, S., contributed talk at *APS April Meeting 2021*, Online
Ivanov, M., contributed talk at *APS April Meeting 2021*, Online
- 2019 **Fahlman, S.**, contributed talk at *Fifty-One-Ergs 2019*, May 20-24, Raleigh, NC (USA)
Fahlman, S., contributed talk at *APS April Meeting 2019*, Denver, CO (USA)
Dean, C., contributed poster at *APS April Meeting 2019*, Denver, CO (USA)