David Vartanyan

Curriculum Vitæ

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Personal Data

Carnegie Observatories
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Scientific Education & Employment

9/2022 – current	NASA Hubble-Einstein Fellow Carnegie Observatories
9/2019 – 9/2022	Theoretical Astrophysics Postdoctoral Fellow Joint, Lawrence Berkeley Laboratory & U.C. Berkeley Hubble Einstein Fellow, 2022
8/2016 – 8/2019	Ph.D. Astrophysical Science, Princeton University, 08/2019 Advisor: Adam Burrows
8/2014 – 7/2016	M.A. Astrophysical Science, Princeton University
8/2010 – 6/2014	B.S. Astrophysical Science, California Institute of Technology Advisor: Christian Ott

Awards and Grants

- 2022 Hubble Einstein Fellow
- NERSC Early-Career High Performance Computing Achievement Awards: High Impact Scientific Achievement, "For contributions to unraveling the secrets of the mechanism and characteristics of core-collapse supernova explosions", 2021
- Impact Award for an interdisciplinary science-through-dance public performance of my PhD: From Stellar Death to Chemical Rebirth, Princeton Research Day, 2019
- American Astronomical Society Roger Doxsey Dissertation Honorable Mention, 2019
- Princeton Graduate Teaching Recognition, 2016
- Kiyo and Eiko Tomiyasu Scholarship, 2013
- Goldwater Nominee, 2013
- National Merit Scholar, 2010
- National Elks Most Valuable Scholar, 2010

Computing Time

- 2022 DOE Mission Science, PI, 20,000 GPU node-hours on Perlmutter at the National Energy Research Scientific Computing Center (NERSC)
- 2022 Leadership Resource Allocation (LRAC), co-I, 3.2 million node-hours on the petascale Frontera supercomputer in the Texas Advanced Computing Center (TACC)
- 2022 Innovative and Novel Computational Impact on Theory and Experiment (INCITE): Next-Generation 3D Core-Collapse Supernova Simulations, co-I, 2 million node-hours on Theta and Polaris at the Argonne Leadership Computing Facility
- Frontera LRAC, PI, TACC, 8.4 million cpu-hours, 2021
- Frontera Large-Scale Community Partnership Award (LSCP), TACC, 28 million cpu-hours, PI, 2020, renewable over 3 years

Outreach

- Member of Armenian Engineers and Scientists of America (AESA), 2018 –
- Academic mentor to post-baccalaureate students, 2015 –
- Scientific speaker at retirement homes, youth and science clubs, and under-served communities

- *Stellar Death to Elemental Birth*
  Invited Speaker, STAR Amateur Astronomy Club, Monmouth Junction, NJ, Feb. 2019
- *Supernovae to Black Holes: From Stellar Death to Chemical Rebirth*, Invited Speaker, Eastern Chapter of Armenian Engineers and Scientists of America (AESA), Fordham University, NY, Dec. 2018
- *Supernovae to Black Holes: From Stellar Death to Chemical Rebirth*, Invited Speaker, Princeton Windrows Retirement Home, Plainsboro NJ, Nov. 2018
- *The Stars in Us and the Cosmic Chemicals Around Us*
  Invited speaker to engage primary school students in astronomy at the National Chemistry Week: *Chemistry is Out of This World* Activities Night, Princeton University, Princeton, NJ, Oct. 2018

Multimedia

- SIAM: Gravitational Wave and Neutrino Signatures Reveal Details about Supernovae
- Quanta and Wired: Core-Collapse Explosion Theory
- Pop Sci: Rare Merger Supernova
- Dancing Your PhD: From Stellar Death to Chemical Rebirth
- The Most Energetic Event in the Universe (that we know of)

Teaching Experience

2/2017 – 6/2017	AST 204: Topics in Modern Astronomy Assistant Instructor, Princeton University
9/2015 – 1/2016	AST 205: Planets in the Universe Assistant Instructor, Princeton University Princeton Graduate Teaching Recognition

Journal Referee

ApJ, MNRAS, PTEP, PRD — 13 papers total; 2019 –

Invited and Selected Talks

1. *Core-Collapse Supernovae: From the Last Decade to the Next*
   Invited Speaker, TAPIR Seminar, Caltech, February 2023
2. *Core-Collapse Supernovae: From the Last Decade to the Next*
   Invited Speaker, SuperVirtual 2022, November 2022
3. *Revival of the Fittest: Recent Developments in Core-Collapse Supernovae*
   Invited Speaker, INT 21-3 W: Radionuclides: Nuclear Physics, Astrophysical Models, and Observations, Institute of Nuclear Theory, University of Washington, October 2021
4. *Developments in Core-Collapse Supernovae Simulations*
   Invited Speaker, INT-21-79W: New Directions in Neutrino Flavor Evolution in Astrophysical Systems, Institute of Nuclear Theory, WA, September 2021
5. *Revival of the Fittest: Exploding Core-Collapse Supernova*
   Invited Speaker, NERSC Early Career Seminar, Lawrence Berkeley National Laboratory, September 2021
6. *Core-Collapse in 3D: Moving Beyond Spherically-Symmetric Single Stars* TEAMS SciDAC Collaboration, August 2021
7. *Core-Collapse Supernovae: From Simulations to Observations*
   Invited Speaker, Nuclear Theory Group Seminar, Lawrence Berkeley National Laboratory, April 2021
8. *3D CCSNe Simulations: Physical Insight into the Explosion Mechanism from Neutrino Gravitational Wave Signatures*

Invited Speaker, SIAM Conference on Computational Science and Engineering, Fort Worth, TX March 2021, featured on SIAM

9. *The Landscape of Supernovae Observations from Detailed Simulations*, TEAMS SciDAC Collaboration, June 2021

10. *Exploding Supernovae in 3D*
Invited Speaker, SETI Supernovae & Dust Tele-Talk, April 2020

11. *3D Simulations of CCSNe Populations*
Invited Speaker, The Evolution of Massive Stars and Formation of Compact Stars: from the Cradle to the Grave, Waseda University, February 2020

12. *3D Simulations of CCSNe Populations*
Invited Speaker, MICRA Conference, Jena, Germany, August 2019

13. *The Nature of Supernovae*
Invited Speaker, Astronomy Advisory Council, Princeton, NJ, May 2019

14. *Opacities and Rotation in the Revival of the Fittest*
Wilhelm und Else Heraeus-Seminar: Supernovae - From Simulations to Observations and Nucleosynthetic Fingerprint, Physikzentrum, Bad Honnef, Germany, Jan. 2018

15. *The Interplay of Opacities and Rotation in Promoting the Explosion of Core-Collapse Supernovae*
Princeton Research and Computing, Princeton University, NJ, Nov. 2017

Contributed Talks

16. *Understanding Core-Collapse Supernovae: Simulations and Observations*
American Astronomical Society (AAS) Meeting #237, Jan 2021

17. *3D Simulations of CCSNe Populations*
AAS Meeting #235, Honolulu, HI, Jan. 2020

18. *Exploding Core-Collapse Supernovae in 3D*
AAS Meeting #233, Seattle, WA, Jan. 2019

19. *The Interplay of Opacities and Rotation in Promoting the Explosion of Core-Collapse Supernovae*
AAS Meeting #231, Washington, D.C., Jan. 2018

20. *Exploding Duds: Reviving Stalled Supernovae*
Mid-Atlantic States American Physical Society (APS) Annual Meetings, Newark, NJ, Nov. 2017

21. *The Interplay of Opacities and Rotation in Promoting the Explosion*
Princeton Research Computing Seminar, Princeton, NJ, Nov. 2017

22. *Critical Resolution and Physical Dependencies of Supernovae: Stars in Heat and Under Pressure*
AAS Meeting #229, Grapevine TX, Nov. 2017

26 publications – citations: 1600+; h-index: 21

Publications

[1] **D. Vartanyan**, A. Burrows, T. Wang,M. Coleman, C. .J. White, *The Gravitational-Wave Signature of Core-Collapse Supernovae*, submitted to Physical Review D, 2023

[2] B. Tsang, **D. Vartanyan**A. Burrows. *Applications of Machine Learning to Predicting Core-collapse Supernova Explosion Outcomes*, The Astrophysical Journal Letters, 937, L15, (2022), arxiv:2208.01661; citations: 3

[3] T. Wang, **D. Vartanyan**, A. Burrows. *The essential character of the neutrino mechanism of core-collapse supernova explosions*, Monthly Notices of the Royal Astronomical Society, 517 543-550,c(2022), arxiv:2207.02231; citations: 5

[4] H. Nagakura **D. Vartanyan**. *Efficient method for estimating the time evolution of the proto-neutron star mass and radius from a supernova neutrino signal*, Monthly Notices of the Royal Astronomical Society, 512, 2806-2816, (2021), arxiv:2111.05869; citations: 6

[5] C. J. White, A. Burrows, M. Coleman, **D. Vartanyan**. *On the Origin of Pulsar and Magnetic Fields*, The Astrophysical Journal, 926, ,111, (2021), arxiv:2111.01814; citations: 7

[6] **D. Vartanyan**, M. Coleman, A. Burrows. *The Collapse and Three-Dimensional Explosion of Three-Dimensional, vis à vis One-Dimensional, Massive-star Supernova Progenitor Models*, Monthly Notices of the Royal Astronomical Society, 510, 4689-4705, (2022), arxiv:2104.03317; citations: 15

[7] **D. Vartanyan**, E. Laplace, M. Renzo, Y. Götberg, A. Burrows, S.E. de Mink. *Binary-Stripped Stars as Core-Collapse Supernovae Progenitors*, The Astrophysical Journal Letters, 916, L5 (2021), arxiv:2104.03317; citations: 20

[8] E. Laplace, S. Justham, M. Renzo, Y. Gøtberg, R. Farmer, **D. Vartanyan**, S.E. de Mink. *Different to the Core: the Pre-supernova Structures of Massive Single and Binary-Stripped Stars*, accepted to Astronomy & Astrophysics, (2021), arxiv:2104.03317; citations: 38

[9] H. Nagakura, A. Burrows, **D. Vartanyan**. *Supernova neutrino signals based on long-term axisymmetric simulations*, Monthly Notices of the Royal Astronomical Society, 506, 1462-1479, (2021), arxiv:2102.11283; citations: 21

[10] A. Burrows, **D. Vartanyan**, *Core Collapse Explosion Theory*, Nature 589, 7840, 29-39, (2020), arxiv:2009.1415, featured on cover of Quanta and Wired; citations: 143

[11] **D. Vartanyan**, A. Burrows, *Gravitational Waves from Neutrino Asymmetries in Core-Collapse Supernovae*, The Astrophysical Journal, 501, 1, 696-717, (2020), arxiv:2007.07261; citations: 27

[12] H. Nagakura, A. Burrows, **D. Vartanyan**, D. Radice. *Core-Collapse Supernova Neutrino Emission and Detection Informed by State-of-the-Art Three-Dimensional Numerical Models*, Monthly Notices of the Royal Astronomical Society, 500, 696-717, (2020), arxiv:2007.05000; citations: 34

[13] H. Nagakura, A. Burrows, D. Radice, **D. Vartanyan**. *A Systematic Study of Proto-Neutron Star Convection in Three-Dimensional Core-Collapse Supernova Simulations*, Monthly Notices of the Royal Astronomical Society, 492, 5764-5779, (2020), arxiv:1912.07615; citations: 43

[14] M. A. Sedda, C. P. L. Berry,...**D. Vartanyan**... *The Missing Link in Gravitational-Wave Astronomy: Discoveries waiting in the decihertz range*, Classical and Quantum Gravity, 37, 21, (2020), arxiv:1908.11375; citations: 82

[15] A. Burrows, D. Radice, **D. Vartanyan**, H. Nagakura, M. A. Skinner, J. D. Dolence. *The Overarching Framework of Core-Collapse Supernova Explosions as Revealed by 3D Fornax Simulations*, Monthly Notices of the Royal Astronomical Society 492, 2715-2735,(2019), arxiv:1909.04152; citations: 130

[16] H. Nagakura, A. Burrows, D. Radice, **D. Vartanyan**. *Towards an Understanding of the Resolution Dependence of Core-Collapse Supernova Simulations*, Monthly Notices of the Royal Astronomical Society, 490, 4622-4637, (2019), arxiv:1905.03786; citations: 34

[17] V. Srivastava, S. Ballmer, D. Brown, C. Afle, A. Burrows, D. Radice, **D. Vartanyan**. *Detection Prospects of Core-Collapse Supernovae with Supernova-Optimized Third-Generation Gravitational-Wave Detectors*, Physical Review D, 400 (2019) arxiv:1906.00084; citations: 24

[18] A. Burrows, D. Radice, **D. Vartanyan**. *Three-Dimensional Supernova Explosion Simulations of 9-, 10-, 11-, 12-, and 13-$M_\odot$ Stars*, Monthly Notices of the Royal Astronomical Society, 485, 3153-3168 (2019), arxiv:1902.00547; citations: 74

[19] **D. Vartanyan**, A. Burrows, D. Radice. *Temporal and Angular Variations of 3D Core-Collapse Supernova Emissions and Their Physical Correlations*, Monthly Notices of the Royal Astronomical Society, 489, 2227–2246 (2019), arxiv:1906.08787; citations: 64

[20] D. Radice, V. Morozova, A. Burrows, **D. Vartanyan**, H. Nagakura. *Characterizing the Gravitational Wave Signal from Core-collapse Supernovae*, The Astrophysical Journal, 861, 10 (2018), arXiv:1812.07703; citations: 87

[21] S. Seadrow, A. Burrows, **D. Vartanyan**, D. Radice, M. A. Skinner, *Neutrino Signals of Core-Collapse Supernovae in Underground Detectors*, Monthly Notices of the Royal Astronomical Society, 480, 4710−4731 (2018), arXiv:1804.00689; citations: 34

[22] **D. Vartanyan**, A. Burrows, D. Radice, M. A. Skinner, J. C. Dolence. *A Successful 3D Core-Collapse Supernova Explosion Model*, Monthly Notices of the Royal Astronomical Society, 482, 351−369.arxiv:1809.05106; citations: 105

[23] E. O'Connor, R. Bollig, A. Burrows, S. Couch, T. Fischer, H. T. Janka, K. Kotake, E. J. Lentz, M. Liebendörfer, O. E. B. Messer, A. Mezzacappa, T. Takiwaki, **D. Vartanyan**, *Global Comparison of Core-Collapse Supernova Simulations in Spherical Symmetry*, Journal of Physics G Nuclear Physics, 45, 10, 104001, arXiv:1806:04175; citations: 80

[24] V. Morozova, D. Radice, A. Burrows, **D. Vartanyan**, *The Gravitational Wave Signal from Core-collapse Supernovae*, The Astrophysical Journal, 861, 10 (2018), arXiv:1801.019149; citations: 85.

[25] **D. Vartanyan**, A. Burrows, D. Radice, M. A. Skinner, J. C. Dolence. *Revival of the Fittest: Exploding Core-Collapse Supernovae from 12 to 25* $M_{\odot}$, Monthly Notices of the Royal Astronomical Society, 477, 3091 −3108 (2018), arXiv:1801.08148; citations: 62

[26] A. Burrows, **D. Vartanyan**, J.C. Dolence, J.C. M. A. Skinner, D. Radice, *Crucial Physical Dependencies of the Core-Collapse Supernova Mechanism*, Space Sciences Reviews 214, 33 (2018), arXiv:1611.05859; citations: 99.

[27] M. A. Skinner, J. C. Dolence, A. Burrows, D. Radice, **D. Vartanyan**, *Fornax: a Flexible Code for Multiphysics Astrophysical Simulations*, The Astrophysical Journal Supplement, 241 (2018), arXiv:1806.07390; citations: 57

[28] D. Radice, A. Burrows, **D. Vartanyan, D**, M. A. Skinner, J. C. Dolence, *Electron-capture and Low-mass Iron-core-collapse Supernovae: New Neutrino-radiation-hydrodynamics Simulations*, The Astrophysical Journal 850, 43 (2018), arXiv:1702.03927; citations: 88

[29] **D. Vartanyan**, J. A. Garmilla, R. R. Rafikov,*Tatooine Nurseries: Structure and Evolution of Circumbinary Protoplanetary Disks*, The Astrophysical Journal, 816, 94 (2016), arXiv:1509.07254; citations: 11

White Papers

[30] F. Timmes, C. Fryer, Chris, ...**D. Vartanyan**... *Catching Element Formation In The Act; The Case for a New MeV Gamma-Ray Mission: Radionuclide Astronomy in the 2020s* Astro2020: Decadal Survey on Astronomy and Astrophysics, white paper arXiv:1902.02915; citations: 15