

# Elias Roland Most

## Research Interests

- **Theoretical Astrophysics.** Relativistic Astrophysics, General Relativity, Neutron Stars, Black Holes, Compact Binary Coalescence, Gravitational Waves, Multi-messenger Astrophysics, Dense Matter Equation of State, Neutron Star Magnetospheres, Relativistic Magnetohydrodynamics, Out-of-Equilibrium Fluid Dynamics.
- **Computational Physics.** Numerical Relativity, Computational Fluid Dynamics and Magnetohydrodynamics, Adaptive Mesh Refinement, High-Performance Computing.

## Caltech

TAPIR 350-17

Pasadena, CA 91125, USA

[emost@caltech.edu](mailto:emost@caltech.edu)

## Current Employment

**Assistant Professor of Theoretical Astrophysics,** **2023–**  
California Institute of Technology, Pasadena, CA, USA.

## Professional Experience

**Visiting Associate in Theoretical Astrophysics,** **2022–2023**  
California Institute of Technology, Pasadena, CA, USA.

**Joint Postdoctoral Prize Fellow,** **2020–2023**  
*Institute for Advanced Study and Princeton University*, Princeton, NJ, USA.  
(2022 – 2023) John Archibald Wheeler Fellow (PCTS)  
(2020 – 2023) Five-year Membership (IAS)  
(2020 – 2023) Associate Research Scholar (PCTS & Gravity Initiative) .

**Predocctoral Fellow (Research Analyst),** **2019–2020**  
*Center for Computational Astrophysics, Flatiron Institute,*  
*Simons Foundation*, New York, NY, USA.  
Five month fellowship. Mentor: Dr. Alexander Philippov

## Education

**Doctorate (Physics),** *Goethe University Frankfurt*, Germany. **2017–2020**  
Thesis title: *Probing dense matter with binary neutron star mergers.*

Adviser: Prof. Luciano Rezzolla Grade: summa cum laude

**Master of Science (Physics),** *Goethe University Frankfurt*, Germany. **2014–2017**  
Thesis title: *Collapse to black holes of rotating magnetised neutron stars.*

Adviser: Prof. Luciano Rezzolla

**Natural Sciences Tripos, Part III,** *University of Cambridge*, UK. **2013–2014**  
Erasmus Student Exchange

Research project: *Investigating the effects of ray-theoretic approximations in seismic tomography.*

Adviser: Dr. David Al-Attar

**Bachelor of Science (Physics),** *University of Göttingen*, Germany. **2010–2013**  
Thesis title: *On models of cosmological inflation using the Higgs field.*

Adviser: Prof. Laura Covi

## Awards

**John Archibald Wheeler Fellowship,** PCTS, Princeton University. **2022**

**Thesis award,** *Goethe University*, Frankfurt am Main, Germany. **2021**  
Awarded for the best PhD thesis in the natural sciences at Goethe University.

**Giersch Excellence Award,** *Giersch Foundation & HGS-HiRe Graduate School*, **2020**  
Frankfurt am Main, Germany.  
Awarded for an excellent doctoral thesis.

**Joint Postdoctoral Prize Fellowship,** **2020**  
*Center for Theoretical Science & Gravity Initiative (Princeton University), School of Natural Sciences ( Institute for Advanced Study).*

**NASA Hubble Fellowship Program: Einstein Fellowship (declined).** **2020**

**Postdoctoral Fellowship (declined),** *Perimeter Institute, Waterloo, Canada.* **2020**

**Flatiron Predoctoral Fellowship,** *Simons Foundation, New York, NY, USA.* **2019**

**Giersch Excellence Grant,** *Giersch Foundation, Frankfurt am Main, Germany.* **2018**  
Awarded for outstanding progress in the doctoral thesis.

**PhD Scholarship,** *HGS-HIRe Graduate School, Frankfurt am Main, Germany.* **2017–2020**

Three year PhD scholarship.

**Scholarship,** *German Academic Scholarship Foundation, Bonn, Germany.* **2010–2016**  
Highly competitive scholarship for academic excellence.

## Grants

**Caltech-JPL PDRDF,** *NASA, co-PI,* **2024-2027**  
(PI: F. Hoffmann (Caltech), X. Zhu (JPL)), Total: **\$398,160.**

IAMS - 101321: *Jupiter's radiation environment: Assimilating data with ML-driven approaches.*

**Astrophysics Theory Program,** *NASA, co-I (PI: A. Beloborodov),* **2024-2027**  
Total: **\$875,064.00,** Subaward (PI: E.R. Most): **\$227,454.**

80NSSC24K1229: *Radiative magnetohydrodynamics of bright transients from neutron stars.*

**Gravitational Physics - Theory,** *NSF, PI,* **2023-2026**  
Total: **\$300,000.**

NSF-PHY2309210: *WoU-MMA: Aspects of Numerical Relativity and Relativistic Astrophysics.*

**Astronomy and Astrophysics Research Grants,** *NSF, PI,* **2023-2026**  
Total: **\$598,710.**

NSF-AST2307394: *Collaborative Research: WoU-MMA: Coherent radio and x-ray precursor transients to gravitational wave events: Simulations in general relativity and kinetic theory.*

**Cyberinfrastructure for Sustained Scientific Innovation,** *NSF,* **2021-2026**  
Senior Investigator (PI: N. Yunes), Total: **\$4,421,367,**  
Subaward (PI: E.R. Most): **\$114,700 (2023-2025).**

NSF-2103680: *Frameworks: MUSES, Modular Unified Solver of the Equation of State.*

## Compute Time Grants

**Compute Time Grant,** *DOE NERSC, PI,* **2024-2025**  
ERCAP0028480: *Microphysics aspects of binary neutron star mergers*

(2025–2026) **18,000 gpu node-hours**

(2024–2025) **30,100 gpu node-hours .**

**Compute Time Grant,** *NSF ACCESS/XSEDE, PI,* **2021-2025**

TG-PHY210074: *Pushing Neutron Star Mergers to the Extreme*

(2024–2025) **9,633,788 core-hours**

(2023–2024) **9,365,504 core-hours**

(2022–2023) **4,816,896 core-hours**

(2021–2022) **1,800,000 core-hours .**

**Compute Time Grant,** *DOE OLCF, co-PI (PI: B. Ripperda),* **2024-2025**

AST198: *Radiative MHD of bright transients from neutron stars*

(2024–2025) **500,000 gpu node-hours .**

**Compute Time Grant**, NSF *FRONTERA*, co-PI (PI: A. Philippov), **2020-2025**  
 AST21006: *Simulations of reconnection-powered flares in magnetospheres of magnetars, binary neutron stars and black holes*  
 (2024-2025) **68,442,752 core-hours**  
 (2023-2024) **55,267,408 core-hours**  
 (2022-2023) **44,198,784 core-hours**  
 (2021-2022) **44,706,816 core-hours**  
 (2020-2021) **16,800,000 core-hours** .

## Publications

I have published **59 refereed papers** (25 as first, 16 as second and 18 as contributing author). **8** additional papers are currently under review. As of December 2024, my works have gained **>3,987 citations** with an **h-index 29** (retrieved from Google Scholar). Student-led papers are marked with a (†).

67. A. Moran, L. Sironi, A. Levis, B. Ripperda, **E. R. Most**, S. Selvi. *Effective Resistivity in Relativistic Reconnection: A Prescription based on Fully Kinetic Simulations*. *Astrophys. J. Lett.*, (to appear)
66. Yossef Zenati, Mor Rozner, Julian H. Krolik, **E. R. Most** *Mass transfer in eccentric black hole - neutron star mergers*. *Astrophys. J.*, 978 126, 2025
- 65.† Y. Kim, **E. R. Most**, A. M. Beloborodov, B. Ripperda. *Black hole pulsars and monster shocks as outcomes of black hole-neutron star mergers*. 2412.05760, (submitted)
64. **E. R. Most**, H.-Y. Wang. *Decoupling of a supermassive black hole binary from its magnetically arrested circumbinary accretion disk*. 2410.23264, (submitted)
63. S. M. Ressler, L. Combi, B. Ripperda, **E. R. Most** *Dual Jet Interaction, Magnetically Arrested Flows, and Flares in Accreting Binary Black Holes*. 2410.10944, (*ApJL*, to appear)
- 62.† Carlo Musolino, Luciano Rezzolla, **E. R. Most** *On the impact of neutrinos on the launching of relativistic jets from "magnetars" produced in neutron-star mergers*. 2410.06253, (submitted)
61. J. M. Stone, P. Mullen, D. Fielding, P. Grete, M. Guo, **E. R. Most**, C. J. White, G. N. Wong. *AthenaK: A Performance-Portable Version of the Athena++ AMR Framework*. 2409.16053, (submitted)
- 60.† Y. Kim, **E. R. Most**. *General-relativistic Bondi-Hoyle-Lyttleton accretion in a toroidally magnetized medium*. 2409.12359, (submitted)
59. M. A. Pajkos, **E. R. Most**. *The Influence of Muons, Pions, and Trapped Neutrinos on Neutron Star Mergers*. 2409.09147, (submitted)
58. **E. R. Most**, H.-Y. Wang. *Magnetically Arrested Circumbinary Accretion Flows*. *Astrophys. J. Lett.* 973, L19, 2024
57. **E. R. Most**, Y. Kim, K. Chatziioannou, I. Legred. *Nonlinear Alfvén-Wave Dynamics and Pre-Merger Emission from Crustal Oscillations in Neutron Star Mergers*. *Astrophys. J. Lett.*, 973, L37, 2024
56. N. Deppe et al. (incl. **E. R. Most**). *Binary neutron star mergers using a discontinuous Galerkin-finite difference hybrid method*. *Class.Quant.Grav.*, 41, 245002, 2024
- 55.† S. Xin, **E. R. Most**. *Dark magnetohydrodynamics: Black hole accretion in superradiant dark photon clouds*. 2406.02992, (submitted)
- 54.† J. Wu, **E. R. Most**. *General-Relativistic Gauge-Invariant Magnetic Helicity Transport: Basic Formulation and Application to Neutron Star Mergers*. *Phys. Rev. D* 110, 124046, 2024.
53. **E. R. Most**, A. Haber, S. P. Harris, Z. Zhang, M. G. Alford, J. Noronha. *Emergence of microphysical viscosity in binary neutron star post-merger dynamics*. *Astrophys. J. Lett.*, 967 L14, 2024.
52. **E. R. Most**, A. M. Beloborodov, B. Ripperda. *Monster shocks, gamma-ray bursts and black hole quasi-normal modes from neutron-star collapse*. *Astrophys. J. Lett.*, 974

L12, 2024

- 51.<sup>†</sup> Y. Kim, **E. R. Most**, W. Thrope, S. A. Teukolsky, N. Deppe. *General relativistic force-free electrodynamics with a discontinuous Galerkin-finite difference hybrid method*. Phys.Rev.D 109 12, 123019, 2024
50. D. Mroczek, N. Yao, J. Noronha-Hostler, V. Dexheimer, A. Haber, **E. R. Most**. *Finite-temperature expansion of the dense-matter equation of state*. 2404.01658 , (submitted)
49. **E. R. Most**. *Impact of a mean field dynamo on neutron star mergers leading to magnetar remnants*. Phys.Rev.D 108 12,12, 2023
48. **E. R. Most**, A. A. Philippov. *Electromagnetic precursors to black hole - neutron star gravitational wave events: Flares and reconnection-powered fast-radio transients from the late inspiral*. Astrophys. J. Lett. 956 L33, 2023
47. J. Nättilä, J. Y.-K. Cho, J. W. Skinner, **E. R. Most**, B. Ripperda. *Neutron Star Atmosphere-Ocean Dynamics*. Astrophys. J., 971, 37, 2024.
46. MUSES Collaboration, R. Kumar et al. (incl. **E. R. Most**). *Theoretical and Experimental Constraints for the Equation of State of Dense and Hot Matter*. Living Rev.Rel. 27 1, 3, 2024
45. **E. R. Most**, A. A. Philippov. *Reconnection-powered fast radio transients from coalescing neutron star binaries*. Phys. Rev. Lett., 130, 245201, 2023
44. **E. R. Most** and E. Quataert. *Flares, jets and quasi-periodic outbursts from neutron star merger remnants*. Astrophys. J. Lett., 947 L15, 2023
43. C. A. Raithel and **E. R. Most** *Degeneracy in the inference of phase transitions in the neutron star equation of state from gravitational wave data*. Phys. Rev. Lett., 130, 201403, 2023
42. M. Chabanov, S. D. Tootle, **E. R. Most**, and L. Rezzolla. *Crustal magnetic fields do not lead to large magnetic-field amplifications in binary neutron-star mergers*. Astrophys J. Lett., in press, 2023.
41. J. F. Mahlmann, A. A. Philippov, V. Mewes, B. Ripperda, **E. R. Most**, L. Sironi. *Three-dimensional dynamics of strongly twisted magnetar magnetospheres: Kinking flux tubes and global eruptions* Astrophys. J. Lett., 947 L34, 2023
- 40.<sup>†</sup> A. Hegade K.R., **E. R. Most**, J. Noronha, H. Witek, N. Yunes. *How Do Axisymmetric Black Holes Grow Monopole and Dipole Hair?* Phys. Rev. D, 107, 10, 104047, 2023
- 39.<sup>†</sup> A. Pandya, **E. R. Most**, F. Pretorius. *Causal, stable first-order viscous relativistic hydrodynamics with ideal gas microphysics* Phys. Rev. D, 106, 12, 123036, 2022
38. C. A. Raithel and **E. R. Most** *Tidal Deformability Doppelgangers: II. Implications of a low-density phase transition in the neutron star equation of state*. Phys.Rev.D 108, 023010, 2023.
37. **E. R. Most**, A. A. Philippov. *Electromagnetic precursor flares from the late inspiral of neutron star binaries*. Mon. Not. R. Astron. Soc., 515, 2, 2710–2724, 2022.
36. Y. Yuan, A. M. Beloborodov, A. Y. Chen, Y. Levin, **E. R. Most**, A. Philippov. *Magnetar bursts due to Alfvén wave nonlinear breakout*. Astrophys. J., 933:174, 2022.
35. **E. R. Most**, A. Motornenko, J. Steinheimer, V. Dexheimer, M. Hanauske, L. Rezzolla, H. Stoecker. *Probing neutron-star matter in the lab: Similarities and differences between binary mergers and heavy-ion collisions*. Phys. Rev. D, 107 4, 043034, 2023.
- 34.<sup>†</sup> A. Pandya, **E. R. Most**, F. Pretorius. *Conservative finite volume scheme for first-order viscous relativistic hydrodynamics* Phys. Rev. D 105 12, 123001, 2022.
- 33.<sup>†</sup> A. Hegade K.R., **E. R. Most**, J. Noronha, H. Witek, N. Yunes. *How Do Spherical Black Holes Grow Monopole Hair?* Phys. Rev. D 105, 6, 064041, 2022.
32. C. A. Raithel\* and **E. R. Most**\* *Characterizing the breakdown of quasi-universality in the post-merger gravitational waves from binary neutron star mergers*. Astrophys. J. Lett., 933:L39, 2022
31. L. J. Papenfort, **E. R. Most**, S. Tootle and L. Rezzolla. *Impact of extreme spins and mass ratios on the post-merger observables of high-mass binary neutron stars*. Mon.

- Not. R. Astron. Soc., 513, 3, 3646–3662, 2022.
30. **E. R. Most**, J. Noronha, A. A. Philippov. *Modeling general-relativistic plasmas with collisionless moments and dissipative two-fluid magnetohydrodynamics*. Mon. Not. R. Astron. Soc., 514, 4, 4989–5003, 2022.
29. H. Olivares, I. Peshkov, **E. R. Most**, F. Guercilena, L. J. Papenfort. *A new first-order formulation of the Einstein equations exploiting analogies with electrodynamics*. Phys. Rev. D., 105 12, 124038, 2022.
28. **E. R. Most**, J. Noronha. *Dissipative Magnetohydrodynamics for Non-Resistive Relativistic Plasmas: An implicit second-order flux-conservative formulation with stiff relaxation*. Phys. Rev. D, 104, 10, 103028, 2021.
- 27.<sup>†</sup> S. D. Tootle, L. J. Papenfort, **E. R. Most**, L. Rezzolla. *Quasi-universal behaviour of the threshold mass in unequal-mass, spinning binary neutron-star mergers*. Astrophys. J. Lett., 922:L19, 2021.
26. **E. R. Most**<sup>\*</sup>, C. A. Raithel<sup>\*</sup>. *Impact of the nuclear symmetry energy on the post-merger phase of a binary neutron star coalescence*. Phys. Rev. D, 104, 12, 124012, 2021, (\*: equal contribution).
25. **E. R. Most**, S. P. Harris, C. Plumberg, M. G. Alford, J. Noronha, J. Noronha-Hostler, F. Pretorius, H. Witek, N. Yunes. *Projecting the likely importance of weak-interaction-driven bulk viscosity in neutron star mergers*. Mon. Not. R. Astron. Soc., 509 (1), 1096–1108, 2022.
24. **E. R. Most**, L. J. Papenfort, S. Tootle, L. Rezzolla. *On accretion disks formed in MHD simulations of black hole-neutron star mergers with accurate microphysics*. Mon. Not. R. Astron. Soc., 506 (3), 3511–3526, 2021.
- 23.<sup>†</sup> V. Skoutnev, **E. R. Most**, A. Bhattacharjee, A. A. Philippov. *Scaling of Small-Scale Dynamo Properties in the Rayleigh-Taylor Instability*. Astrophys. J., 921:75, 2021.
22. B. Ripperda, J. F. Mahlmann, A. Chernoglazov, J. M. TenBarge, **E. R. Most**, J. Juno, Y. Yuan, A. A. Philippov, A. Bhattacharjee. *Weak Alfvénic turbulence in relativistic plasmas I: asymptotic solutions*. J. Plasma Phys., 87:905870512, 2021.
21. J. M. TenBarge, B. Ripperda, A. Chernoglazov, A. Bhattacharjee, J. F. Mahlmann, **E. R. Most**, J. Juno, Y. Yuan, A. A. Philippov. *Weak Alfvénic turbulence in relativistic plasmas I: asymptotic solutions*. J. Plasma Phys., 87:905870614, 2021.
20. L. J. Papenfort, S. D. Tootle, P. Grandclement, **E. R. Most**, and L. Rezzolla. *A new public code for initial data of unequal-mass, spinning compact-object binaries*. Phys. Rev. D 104, 024057, 2021.
19. **E. R. Most**, L. J. Papenfort, S. Tootle, L. Rezzolla. *Fast ejecta as a potential way to distinguish black holes from neutron stars in high-mass gravitational-wave events*. Astrophys. J., 912:1, 80, 2021.
18. A. Nathanail, **E. R. Most**, and L. Rezzolla. *GW170817 and GW190814: tension on the maximum mass*. Astrophys. J. Lett, 908 L28, 2021, *Featured in AAS Nova*.
17. **E. R. Most**, L. J. Papenfort, L. R. Weih, L. Rezzolla. *A lower bound on the maximum mass if the secondary in GW190814 was once a rapidly spinning neutron star*. Mon. Not. R. Astron. Soc. Lett., 499 (1), L82-L86, 2020.
16. **E. R. Most**, L. R. Weih, L. Rezzolla. *The heavier the better: how to constrain mass ratios and spins of high-mass neutron-star mergers*. Mon. Not. R. Astron. Soc. Lett., 496, L16-L21, 2020.
15. **E. R. Most** and A. A. Philippov. *Electromagnetic precursors to gravitational wave events: Numerical simulations of flaring in pre-merger binary neutron star magnetospheres*. Astrophys. J. Lett., 893, L6, 2020. *Featured in AAS Nova*.
14. **E. R. Most**, L. J. Papenfort, V. Dexheimer, M. Hanauske, H. Stöcker, and L. Rezzolla. *On the deconfinement phase transition in neutron-star mergers*. Eur. Phys. J. A , 56:59, 2020.
13. **E. R. Most**, L. J. Papenfort, and L. Rezzolla. *Beyond second-order convergence in simulations of magnetised binary neutron stars with realistic microphysics*.



- Mon. Not. R. Astron. Soc., 490:3588–3600, 2019.
12. **E. R. Most**, L. J. Papenfort, A. Tsokaros, and L. Rezzolla. *Impact of High Spins on the Ejection of Mass in GW170817*. *Astrophys. J.* 884:40, 2019.
  11. **E. R. Most**, L. J. Papenfort, V. Dexheimer, M. Hanauske, S. Schramm, H. Stöcker, and L. Rezzolla. *Signatures of Quark-Hadron Phase Transitions in General-Relativistic Neutron-Star Mergers*. *Phys. Rev. Lett.*, 122:061101, 2019,
  10. H. Olivares, O. Porth, J. Davelaar, **E. R. Most**, C.M. Fromm, Y. Mizuno, Z. Younsi, L. Rezzolla. *Constrained transport and adaptive mesh refinement in the Black Hole Accretion Code*. *Astron. & Astrophys.* 629, A61, 2019.
  9. B. Ripperda, F. Bacchini, O. Porth, **E. R. Most**, H. Olivares, A. Nathanail, L. Rezzolla, J. Teunissen, R. Keppens. *General relativistic resistive magnetohydrodynamics with robust primitive variable recovery for accretion disk simulations*. *Astrophys. J. Supp.* 244:1, 2019.
  8. M. Hanauske, J. Steinheimer, A. Motornenko, V. Vovchenko, L. Bovard, **E. R. Most**, L.J. Papenfort S. Schramm, H. Stöcker. *Neutron Star Mergers: Probing the EoS of Hot, Dense Matter by Gravitational Waves*. *Particles* 2:1,44-56, 2019.
  7. V. Dexheimer, C. Constantinou, **E. R. Most**, L. J. Papenfort, M. Hanauske, S. Schramm, H. Stöcker, and L. Rezzolla. *Neutron-Star-Merger Equation of State*. *Universe*, 5:5, 129, 2019.
  6. L. R. Weih, **E. R. Most**, and L. Rezzolla. *Optimal neutron-star mass ranges to constrain the equation of state of nuclear matter with electromagnetic and gravitational-wave observations*. *Astrophys. J.*, 881:73, 2019.
  5. **E. R. Most**, L. R. Weih, L. Rezzolla, and J. Schaffner-Bielich. *New Constraints on Radii and Tidal Deformabilities of Neutron Stars from GW170817*. *Phys. Rev. Lett.*, 120(26):261103, 2018,
  4. **E. R. Most**, A. Nathanail, L. Rezzolla. *Electromagnetic Emission from Blizzars and Its Impact on Non-repeating Fast Radio Bursts*. *Astrophys. J.*, 864:117, 2018.
  3. L. Rezzolla, **E. R. Most**, and L. R. Weih. *Using Gravitational-wave Observations and Quasi-universal Relations to Constrain the Maximum Mass of Neutron Stars*. *Astrophys. J. Lett.*, 852:L25, 2018,
  2. L. R. Weih, **E. R. Most**, and L. Rezzolla. *On the stability and maximum mass of differentially rotating relativistic stars*. *Mon. Not. R. Astron. Soc.*, 473:L126–L130, 2018.
  1. A. Nathanail, **E. R. Most**, and L. Rezzolla. *Gravitational collapse to a Kerr-Newman black hole*. *Mon. Not. R. Astron. Soc.*, 469:L31–L35, 2017.

## Colloquia and Seminars

- |  |                |
|--|----------------|
| <b>Black Hole Initiative, Harvard, Cambridge, MA.</b>  | <b>02/2025</b> |
| <b>Invited colloquium</b> on Spacetime in Turmoil: Merging black holes and neutron stars with computational relativistic astrophysics. |                |
| <b>SCEECS Seminar, virtual.</b>  | <b>10/2024</b> |
| <b>Invited seminar</b> Plasma and gravitational wave physics: Updates from Caltech.  |                |
| <b>University of Nevada, Las Vegas, NV.</b>  | <b>03/2024</b> |
| <b>Invited colloquium</b> Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.                                  |                |
| <b>Flatiron Institute, CCA, New York, NY.</b>  | <b>03/2024</b> |
| <b>Invited seminar</b> on <i>Dynamos and Jets in Neutron star mergers</i> .  |                |
| <b>Columbia University, New York, NY.</b>  | <b>03/2024</b> |
| <b>Invited colloquium</b> Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.                                  |                |
| <b>Caltech, Pasadena, CA.</b>  | <b>03/2024</b> |
| <b>Invited colloquium</b> Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.                                  |                |
| <b>Case Western, Cleveland, OH.</b>  | <b>02/2024</b> |

**Invited seminar** on *Neutron star mergers: From gravity to nuclear and plasma physics.*  
**Kent State University, Kent, OH.** **02/2024**  
**Invited seminar** on *Neutron star mergers: Impact of magnetic fields.*  
**University of Toronto, Toronto, Canada.** **11/2023**  
**Invited colloquium** on *Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.*  
**Los Alamos National Lab, Los Alamos, NM.** **11/2023**  
**Invited seminar** on *Simulating Extreme Plasmas in Neutron Star Mergers.*  
**Brandeis Physics Colloquium, Brandeis University, Boston, MA.** **02/2023**  
**Invited colloquium** on *Neutron star mergers: From gravity to nuclear and plasma physics.*  
**VandyGRAF Seminar, Vanderbilt University, Nashville, TN .** **11/2022**  
**Invited seminar** on *Neutron star mergers: From gravity to nuclear and plasma physics.*  
**Astrophysics Seminar, New York University, New York, NY .** **09/2022**  
**Invited seminar** on *Neutron star mergers: From gravity to nuclear and plasma physics.*  
**Astrophysics Seminar, University of Milano-Bicocca, (virtual) .** **03/2022**  
**Invited seminar** on *Neutron star mergers: Probes of dense matter and electromagnetic precursors*  
**Special Physics Colloquium, Cornell University, Ithaca, NY.** **03/2022**  
**Invited colloquium** on *Neutron star mergers: From gravitational waves to the most extreme plasmas in the universe.*  
**LEPP Seminar, Cornell University, Ithaca, NY.** **03/2022**  
**Invited seminar** on *Deciphering the engine of multi-messenger gravitational wave events.*  
**LIGO Seminar, Caltech, Pasadena, CA (virtual).** **02/2022**  
**Invited seminar** on *Modeling the engine of multi-messenger gravitational wave events.*  
**Astroplasma Seminar, Princeton University, Princeton, NJ.** **12/2021**  
**Invited seminar** on *Modeling dissipative effects in general-relativistic plasmas and beyond.*  
**Nuclear Physics Seminar, University of Illinois, Urbana, IL.** **11/2021**  
**Invited seminar** on *Neutron star mergers: Massive stars, symmetry energy and cosmic collisions in the lab.*  
**STAG Seminar, University of Southampton, Southampton, UK (virtual).** **11/2021**  
**Invited seminar** on *Neutron star mergers: Fast ejecta, magnetic fields and dense matter.*  
**Nuclear Physics Seminar, Kent State University, Kent, OH (virtual).** **11/2021**  
**Invited seminar** on *Neutron star mergers: Nuclear matter and out-of-equilibrium dynamics.*  
**CITA Seminar, University of Toronto, Toronto, Canada (virtual).** **11/2021**  
**Invited seminar** on *Neutron star mergers: Fast ejecta, magnetic fields and dense matter.*  
**Physics & Astronomy Colloquium, West Virginia University, Morgantown, WV (virtual).** **10/2021**  
**Invited colloquium** on *Probing dense matter with binary neutron star mergers.*  
**Theoretical Physics Seminar, Friedrich-Schiller-University, Jena, Germany (virtual).** **10/2021**  
**Invited seminar** on *Neutron star mergers: Fast ejecta, magnetic fields and dense matter.*  
**Theoretical Particle Physics Seminar, Johns Hopkins University, Baltimore, USA.** **09/2021**  
**Invited seminar** on *Probing dense matter with binary neutron star mergers.*  
**Astroparticle Seminar, Niels-Bohr-Institute, Copenhagen, Denmark (virtual).** **09/2021**  
**Invited seminar** on *Probing dense matter with binary neutron star mergers.*  
**Informal Seminar Series, Institute for Advanced Study, Princeton, NJ, USA.** **03/2021**

**Invited seminar** *On the maximum mass of neutron stars and electromagnetic precursor emission from inspiralling neutron star binaries.*

**Astrophysics seminar**, Cornell University, Ithaca, NY, USA, (virtual). **03/2021**

**Invited seminar** on *Binary neutron star mergers: Fast ejecta and prospects for electromagnetic precursor signals.*

**Houston/UIUC/Kent Nuclear Physics Journal Club**, (virtual meeting). **01/2021**

**Invited seminar** on *Fast ejecta as a potential way to distinguish black holes from neutron stars in high-mass gravitational-wave events.*

**Princeton Gravity Initiative Lunch Talk**, Princeton University, Princeton, NJ, USA. **09/2020**

**Invited seminar** on *Neutron star mergers: On the impact of high spins in multi-messenger gravitational wave events.*

**Princeton Center for Theoretical Science Lunch Talk**, Princeton University, Princeton, NJ, USA. **09/2020**

**Invited seminar** on *Probing dense matter with neutron star mergers.*

**Stavanger Virtual Seminar**, University of Stavanger, Stavanger, Norway. **09/2020**

**Invited seminar** on *Neutron star mergers: What recent gravitational wave events have taught us about the equation of state.*

**Computational Relativity Seminar**, Max-Planck-Institute for Gravitational Physics, Potsdam, Germany. **02/2020**

**Invited seminar** on *Constraints on nuclear physics and electromagnetic precursors from neutron star mergers.*

**Astrophysics, Gravitation and Cosmology Seminar**, University of Illinois at Urbana/Champaign, Urbana, IL, USA. **02/2020**

**Invited seminar** on *Constraints on nuclear physics and electromagnetic precursors from neutron star mergers.*

**Nuclear Physics Seminar**, Kent State University, Kent, OH, USA. **02/2020**

**Invited seminar** on *Constraints on nuclear physics from neutron star mergers.*

**HEP Seminar**, Columbia University, New York, NY, USA. **12/2019**

**Invited seminar** on *Constraints on nuclear physics and electromagnetic precursors from neutron star mergers.*

**Bahcall Lunch Talk**, Institute for Advanced Study, Princeton, NJ, USA. **12/2019**

**Invited talk** on *Electromagnetic precursors from neutron star mergers.*

**Princeton Gravity Initiative Lunch Talk**, Princeton University, Princeton, NJ, USA. **12/2019**

**Invited seminar** on *Constraints on nuclear physics and electromagnetic precursors from neutron star mergers.*

**Strong Gravity Seminar**, Perimeter Institute, Waterloo, Canada. **11/2019**

**Invited seminar** on *How neutron star mergers can be used to study hadron-quark phase transitions.*

**HEP Seminar**, Penn State University, State College, PA, USA. **11/2019**

**Invited seminar** on *How neutron star mergers can be used to study hadron-quark phase transitions.*

**String Theory Seminar**, Institute for Theoretical Physics, Utrecht, The Netherlands. **03/2019**

**Invited seminar** on *First-order phase transitions in neutron star mergers.*

## Conferences and Workshops

**EFTs, Gravity and Hydrodynamics**, Urbana-Champaign, IL. **12/2024**

**Invited talk** on *Gravity and Hydrodynamics.*



**The Formation and Early Evolution of Supermassive Black Holes**, 11/2024  
 Baltimore, MD.  
 Contributed talk on *Magnetically Arrested Circumbinary Accretion Disks*.

**3rd TDAMM Workshop**, Baton Rouge, LA. 09/2024  
 Invited session organizer and talk on *Plasma Physics for TDAMM*.

**High-energy plasma phenomena in astrophysics**, Munich, Germany. 09/2024  
 Invited talk on *Magnetically Arrested Circumbinary Accretion Flows*.

**Multi-messenger workshop Aspen Physics Center**, Aspen, CO. 08/2024  
 Invited talk on *Magnetic bursts from compact binary mergers*.

**Simulating Extreme Spacetimes with SpEC and SpECTRE**, Brown Univ., Providence, RI. 08/2024  
 Invited lecture on *Relativistic Hydrodynamics*.

**Solving the Boltzmann Equation for Neutrino Transport in Relativistic Astrophysics**, Brown Univ., Providence, RI. 07/2024  
 Invited talk on *From small to large and back: Microphysics in neutron star mergers*.

**Gravitational Wave Physics and Astronomy Workshop (GWPAW) 2024**, Birmingham, UK. 05/2024  
 Invited talk and panelist on *Neutron star mergers for future gravitational wave science*.

**MUSES Meeting**, UIUC, IL. 05/2024  
 Invited discussion on *Future directions and use cases of equation of state physics in neutron star mergers and beyond*.

**Relativistic Plasma Astrophysics Meeting**, Purdue, IN. 05/2024  
 Invited talk on *Flares, Jets and Shocks from Neutron star mergers*.

**APS April Meeting 2024**, Sacramento, CA. 04/2024  
 Contributed talk on *Neutron Star Mergers: Dynamos and Monster Shocks*.

**Simons Collaboration Meeting on Extreme Electrodynamics: Collaboration Meeting**, New York, NY. 02/2024  
 Invited talk *Neutron Star Mergers: Dynamos, Jets and Monster Shocks*.

**32nd Texas Symposium on Relativistic Astrophysics**, Shanghai, China. 12/2023  
 Invited plenary *Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics*.

**Modeling Plasmas around Black Holes**, Leiden, Netherlands. 09/2023  
 Invited talk on *Modeling dynamos and kinetic physics in GRMHD simulations*.

**Astrophysics of Fast Radio Bursts II**, New York, NY. 09/2023  
 Invited talk on *Fast Radio Transients from merging neutron star binaries*.

**Einstein Toolkit Workshop 2023**, Rochester, NY. 07/2023  
 Invited talk on *Simulating extreme plasmas in neutron star mergers*.

**INT Neutron Rich Matter on Heaven and Earth**, Seattle, WA. 07/2023  
 Invited talk on *Kilohertz QPOs in short gamma-ray bursts: A hypermassive neutron star origin?*.

**ASTRONUM 2023: International Conference on Numerical Modeling of Space Plasma Flows**, Pasadena, CA. 06/2023  
 Invited talk on *Simulating extreme plasmas in neutron star mergers*.

**KITP Workshop on Relativistic Fluids**, Santa Barbara, CA. 06/2023  
 Invited talk on *Two-fluid formulations of relativistic dissipative plasmas*.

**MUSES Collaboration workshop**, Urbana, IL. 05/2023  
 Invited participant for *the MUSES users groups*.

**Multi-messenger Modeling of Neutron Star Mergers**, Princeton, NJ. 05/2023  
 Invited talk on *Flares, jets and quasi-periodic outbursts from neutron star mergers*.

**APS April Meeting 2023**, Minneapolis, MN. 04/2023  
Contributed talk on *Electromagnetic precursors from the late inspiral of black hole - neutron star binaries.*

**DSA-2000 Science Conference**, Pasadena, CA. 03/2023  
Contributed talk on *Fast-Radio Precursor Transients to Neutron Star Mergers.*

**PCTS Workshop: Improving Black Hole Accretion Models with Plasma Theory**, Princeton, NJ. 02/2023  
Invited talk on *Beyond ideal: Towards the inclusion of kinetic effects in GRMHD simulations.*

**APS Division of Plasma Physics Meeting 2022**, Spokane, WA, (virtual). 10/2022  
Contributed talk on *Formulating two-fluid dissipative magnetohydrodynamics for general-relativistic plasmas.*

**GSI Post-merger workshop**, Darmstadt, Germany. 10/2022  
Invited talk on *Neutron star mergers: Aspects of nuclear and plasma physics.*

**CIPANP 2022: Intersections of Particle and Nuclear Physics**, Orlando, FL. 08/2022  
Invited talk on *Neutron star mergers: From gravity to nuclear physics.*

**PAX 2022**, Cambridge, MA. 07/2022  
Panel convener and panelist for *Nuclear physics with next-generation ground-based gravitational wave detectors.*

**Plasmas in Strong Gravity Workshop**, Aspen, CO. 07/2022  
Invited discussion on *MHD simulations of compact objects.*

**INT Neutron Rich Matter on Heaven and Earth**, Seattle, WA. 07/2022  
Invited talk on *Simulations of neutron star mergers.*

**GR23**, Beijing, China, (virtual). 07/2022  
Contributed talk on *Reconnection-powered radio transients from binary neutron star coalescence.*

**INT r-process and EOS workshop**, Seattle, WA, (virtual). 05/2022  
Invited talk on *Bulk viscosity in neutron star mergers.*

**ICASU inaugural workshop**, Urbana, IL. 05/2022  
Invited talk on *Simulations of compact binary mergers: From gravity to nuclear physics.*

**MUSES Collaboration workshop**, Urbana, IL. 05/2022  
Invited participant for *the MUSES users groups.*

**APS April Meeting 2022**, New York, NY. 04/2022  
Invited talk on *Simulating extreme plasmas in neutron star mergers and beyond.*

**APS Division of Plasma Physics Meeting 2021**, Pittsburgh, PA . 11/2021  
Contributed talk on *Dissipative magnetohydrodynamics for non-resistive relativistic plasmas.*

**APS Division of Nuclear Physics Meeting 2021**, (virtual) . 10/2021  
Invited talk on *Unraveling the Properties of Ultradense Matter with Neutron Star Merger Simulations.*

**APS Division of Nuclear Physics Meeting 2021**, (virtual) . 10/2021  
Contributed talk on *Dissipative magnetohydrodynamics for non-resistive relativistic plasmas.*

**A Virtual Tribute to Quark Confinement and the Hadron Spectrum 2021**, Stavanger (virtual) . 08/2021  
Contributed talk on *Probing the slope of the nuclear symmetry energy with neutron star mergers.*

**Probing Nuclear Physics With Neutron Star Mergers, ECT\*** . 07/2021  
Contributed talk on *Assessing the impact of bulk viscosity on neutron star merger.*

**Marcel Grossmann Meeting 2021**. 07/2021  
Contributed talk on *Fast ejecta as a potential way to distinguish neutron stars from black holes in the lower mass gap.*

**Aspen Workshop**. 06/2021

Participant in *Exploring Extreme Matter in the Era of Multimessenger Astronomy: from the Cosmos to Quarks*.

**APS April Meeting 2021.** 04/2021

Contributed talk on *Fast ejecta as a potential way to distinguish neutron stars from black holes*.

**Workshop of the APS Topical Group on Hadron Physics.** 04/2021

Invited talk on *The role of exotic hadronic degrees of freedom in neutron-star mergers*.

**CompOSE (PHAROS WG1+WG2) Workshop,** Barcelona (virtual meeting). 02/2021

Invited panelist on *WHAT WE NEED for an improvement of our CompOSE data base for the equation of state and transport properties of neutrons stars*.

**AAS237,** virtual meeting. 01/2021

Contributed talk on *Electromagnetic precursors to neutron star mergers*.

**Athena Developer Workshop,** Center for Computational Astrophysics, Flat-iron Institute, New York, NY, USA. 10/2020

Invited talk on *Update on resistive GRMHD and force-free strategies* (jointly with J. Mahlmann & B. Ripperda).

**Midwest Relativity Meeting,** Notre Dame University, virtual meeting. 10/2020

Contributed talk on *Electromagnetic precursors to neutron star mergers*.

**From heavy-ion collisions to neutron stars,** Illinois Center for Advanced Studies of the Universe, virtual meeting. 08/2020

Invited panelist on *Dynamical phenomena in ultradense matter*.

**GR22/Amaldi13 International Conference,** Valencia, Spain. 07/2019

Contributed talk on *Signatures From First-Order Phase Transitions In Neutron Star Mergers*.

**The Radiating Universe Workshop,** Tsung-Dao Lee Institute, Shanghai, China. 05/2019

Invited talk on *Multi-messenger aspects of gravitational wave sources*.

**First EPS Conference on Gravitation,** La Sapienza University, Rome, Italy. 02/2019

Contributed talk on *What neutron star mergers and their gravitational wave signal can teach us about matter under extreme conditions*.

**Pharos WG1+WG2 meeting,** University of Coimbra, Portugal. 09/2018

Contributed talk on *Constraining the equation of state with GW170817*.

**The Exploding Universe Workshop,** Tsung-Dao Lee Institute, Shanghai, China. 05/2018

Invited talk on *Binary neutron star mergers: A status report from Frankfurt*.

**Fire and Ice Workshop,** Saariselkä, Finland. 04/2018

Invited talk on *Constraints on neutron star properties from GW170817*.

**MICRA Meeting 2017,** Michigan State University, East Lansing, USA. 07/2017

Contributed talk on *Neutrino and magnetic effects on neutron star mergers*.

**NewCompStar Conference 2017,** Polish Academy of Sciences, Warsaw, Poland. 03/2017

Contributed talk on *Fast radio bursts from collapsing neutron stars*.

○ Attended six summer schools on gravitational wave and neutron star physics. Participated in 10 workshops on high-performance computing at various German supercomputing centers.

## Teaching Experience

**At Caltech:**

○ 2024, Lecturer, Ph136a Applications of Classical Physics.

- 2024, Lecturer, Ay/Ph104 Relativistic Astrophysics.
- 2024, Faculty TA, Physics 1b (Practical track).
- 2023, Faculty TA, Physics 1a.

**Summer Schools:**

- 2024, Lecturer, ICERM (Brown University), Relativistic Hydrodynamics.
- 2022, Lecturer, ICERM (Brown University), Relativistic Hydrodynamics.

## Mentoring Experience

I have collaborated and worked with several undergraduate and graduate students, as well as postdocs on a variety of topics.

**At Caltech:**

**Graduate students:**

- (2023 – ongoing) **Yuan Feng**
- (2023 – ongoing) **Haiyang Wang**
- (2023 – ongoing) **Jiayi Wu**
- (2022 – ongoing) **Yoonsoo Kim**
- (2023 – ongoing) **Sarah Habib** (adviser: S.A. Teukolsky)

**Undergraduate students:**

- (2024–ongoing) **Siddarth Boyeneni**
- (2024) **Arden Shao**
- (2023) **Ian Johnson**

**Summer Undergraduate Students:**

- (2024) **Anuranj Roy** (CalBridge, WAVE Fellow).
- (2024) **Ananda Smith** (WAVE Fellow).
- (2023) **Tuojin Yin** (CalBridge, WAVE Fellow).

**Postdocs:**

- (2024 – ongoing) **Samuel Dunham** (Postdoctoral Research Scholar).
- (2024 – ongoing) **Aris Lalakos** (Caltech/CITA Postdoctoral Fellow).
- (2024 – ongoing) **Yici Zhong** (Caltech/Columbia Postdoctoral Prize Fellow).
- (2023 – ongoing) **Michael Pajkos** (Postdoctoral Research Scholar, primary mentor: S. Teukolsky).

**At other institutions:**

**Graduate students:**

- (2023 – ongoing) **Shuo Xin** (adviser: L. Dixon, Stanford/SLAC)
- (2023 – 2024) **Carlo Musolino** (adviser: L. Rezzolla, Frankfurt)
- (2021 – 2023) **Goni Halevi** (adviser: J. Stone, Princeton).
- (2021 – 2022) **Abhishek Hegade** (adviser: N. Yunes, UIUC).
- (2021 – 2023) **Alex Pandya** (adviser: F. Pretorius, Princeton).
- (2020 – 2021) **Valentin Skoutnev** (adviser: A. Bhattacharjee, Princeton).
- (2020 – 2021) **Samuel Tootle** (adviser: L. Rezzolla, Frankfurt)

**Post-Baccalaureate:**

- (2022) **Lawrence Edmond IV** (Simons-National Society of Black Physicists Fellow).

## Leadership and Service

**Co-organizer**, *Nuclear Physics in Mergers - Going Beyond the Equation of State*, **2025**  
Institute for Nuclear Theory, University of Washington.

One week international workshop.

**Session co-organizer**, *International conference on General Relativity*, Glasgow, **2025**  
UK.

Co-organizer of Relativistic Astrophysics session.

**Session co-organizer**, *3rd TDAMM Workshop*, Baton Rouge, LA. **2024**

Co-organizer of Plasma Physics session.

**Co-organizer**, *Multi-messenger Modeling of Neutron Star Mergers*, PCTS, Prince- **2023**  
ton University.

Three day international workshop.

**Co-organizer**, *Numerical Relativity Community Call*. **2022–**

**Co-organizer**, *Numerical Relativity Community Summer School*, ICERM, Brown **2022**  
University.

One week summer school for graduate students and junior postdocs.

**Co-organizer**, *Neutron star physics workshop (Connecting Surface flows and* **2022**  
*observation)*, PCTS, Princeton University.

Four day international (hybrid) workshop.

**Undergraduate Mentor**, *Physics Department*, Princeton University. **2021–2023**

**Co-organizer**, *Princeton Gravity Initiative Seminar Series*, Princeton **2021–2022**  
University.

**Co-organizer**, *Plasma Physics Learning Seminar*, Institute for Advanced Study. **2021**

**Co-organizer**, *Gravitational Waves Learning Seminar*, Institute for Ad- **2020–2021**  
vanced Study.

**Student tour guide**, *Einstein Inside Exhibition*, Goethe University Frankfurt. **2016**  
Giving guided tours to local high school students.

**Alternative civilian service (Zivildienst)**, *Dieburg*. **2009-2010**

Nine month assistant position at a local high school for children with special needs.

**Funding Panels**: ERC, NSF, SNSF.

**Referee**: ApJ, ApJL, CQG, MNRAS, MNRASL, PRD, PRL.