

# Elias Roland Most

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## 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.

## 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.

**Postdoctoral Fellow (Associate Research Scholar),** 2020–2023  
**John Archibald Wheeler Fellow,** 2022–2023  
*Princeton Center for Theoretical Science*, Princeton University, NJ, USA.  
Three year fellowship jointly with the Princeton Gravity Initiative.

**Postdoctoral Fellow (Associate Research Scholar),** 2020–2023  
*Princeton Gravity Initiative*, Princeton University, NJ, USA.  
Five year fellowship.

**Postdoctoral Fellow (Long-term Member),** 2020–2023  
*School of Natural Sciences, Institute for Advanced Study*, Princeton, NJ, USA.  
Five year membership in the Astrophysics group.

**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 (Physics),** *University of Cambridge*, 2013–2014  
UK.

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**, *Center for Theoretical Science*, Princeton University. **2022**

**Thesis award**, *Freunde und Förderer der Goethe Universität*, 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*, Frankfurt am Main, Germany. **2020**

Awarded for an excellent doctoral thesis.

**Joint Postdoctoral Prize Fellowship**, **2020**  
*Center for Theoretical Science & Gravity Initiative*, Princeton University.

**Postdoctoral Fellowship**, *Institute for Advanced Study*, Princeton. **2020**

**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**

**James B. Hartle Award**, *International Society on General Relativity and Gravitation*. **2019**

Best student talk (session B2) at GR22/Amaldi13 conference.

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

**Travel Grant**, *Willkomm Foundation*, Frankfurt am Main, Germany. **2018**  
Support for a conference trip to Shanghai.

**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

**Gravitational Physics - Theory**, NSF, PI, Total: **\$300,000**. **2023-2026**  
NSF-PHY2309210: *WoU-MMA: Aspects of Numerical Relativity and Relativistic Astrophysics*.

**Astronomy and Astrophysics Research Grants**, NSF, PI, Total: **2023-2026**  
**\$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 (CSSI)**, **2021-2026**  
NSF,

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**, NERSC, PI, **30,100 gpu node-hours**. **2024-2025**  
ERCAP0028480: *Microphysics aspects of binary neutron star mergers*

**Compute Time Grant**, ACCESS, PI, **9,365,504 core-hours**. **2023-2024**  
TG-PHY210074: *Pushing Neutron Mergers to the Extreme*

**Compute Time Grant**, NSF Frontera, Co-I (PI: A. Philippov), **986,918** **2023-2024** SUs.

AST21006: *Simulations of reconnection-powered flares in magnetospheres of magnetars, binary neutron stars and black holes (renewal)*

**Compute Time Grant**, XSEDE, PI, **4,816,896** core-hours. **2022-2023**

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

**Compute Time Grant**, NSF Frontera, Co-I (PI: A. Philippov), **789,264** **2022-2023** SUs.

AST21006: *Simulations of reconnection-powered flares in magnetospheres of magnetars, binary neutron stars and black holes (renewal)*

**Compute Time Grant**, XSEDE, PI, **1,800,000** core-hours. **2021-2022**

TG-PHY210074: *Pushing Neutron Star-Black Hole Coalescences to the Extreme*

**Compute Time Grant**, XSEDE, PI, **50,000** SUs. **2021-2022**

TG-PHY210053: *Investigating systematic nuclear physics biases in disk mass estimates from compact object coalescence (Startup)*

**Compute Time Grant**, NSF Frontera, Co-I (PI: A. Philippov), **798,336** **2021-2022** SUs.

AST21006: *Simulations of reconnection-powered flares in magnetospheres of magnetars, binary neutron stars and black holes*

**Compute Time Grant**, NSF Frontera, Co-I (PI: A. Philippov), **300,000** **2020-2021** SUs.

AST20008: *Investigating electromagnetic precursors to neutron star merger gravitational wave events*

**Compute Time Grant**, NSF Frontera, Co-I (PI: A. Philippov), **6,000** **2020-2021** SUs.

AST20001: *Investigating electromagnetic precursors to neutron star merger gravitational wave events (Startup)*

**AstroLab Code Optimisation Grant**, LRZ, Garching, Germany. **2019-2020**

12-month high level high-performance computing support for code optimization.

## Publications

I have published **47 refereed papers** (21 as first, 14 as second and 12 as contributing author). **6** additional papers are currently under review. As of April 2024, my works have gained **>3,200 citations** with an **h-index 23** (retrieved from Google Scholar).

53. **E. R. Most**, A. M. Beloborodov, B. Ripperda. *Monster shocks, gamma-ray bursts and black hole quasi-normal modes from neutron-star collapse*. 2404.01456, (submitted)

52. 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*. 2404.01531, (submitted)

51. 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)

50. **E. R. Most**. *Impact of a mean field dynamo on neutron star mergers leading to magnetar remnants*. Phys.Rev.D 108 12,12, 2023

49. **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

48. J. Nättilä, J. Y.-K. Cho, J. W. Skinner, **E. R. Most**, B. Ripperda. *Neutron Star Atmosphere-Ocean Dynamics*. 2306.08186, (submitted)

47. MUSES Collaboration, R. Kumar et al. (incl. **E. R. Most**). *Theoretical and Experimental Constraints for the Equation of State of Dense and Hot Matter*. 2303.17021,

(submitted)

46. **E. R. Most**, A. A. Philippov. *Reconnection-powered fast radio transients from coalescing neutron star binaries*. Phys. Rev. Lett., 130, 245201, 2023
45. **E. R. Most** and E. Quataert. *Flares, jets and quasi-periodic outbursts from neutron star merger remnants*. Astrophys. J. Lett., 947 L15, 2023
44. 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
43. 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.
42. 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
41. 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
40. 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
39. 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.
38. **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*. arXiv:2207.00442, (submitted).
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. 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. 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. 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\***, C. A. Raithel \*. *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. 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. **Citations: 126.**
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, **Citations: 310.** *Featured as Editors' suggestion.*
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, **Citations: 615.**
4. **E. R. Most**, A. Nathanail, L. Rezzolla. *Electromagnetic Emission from Blizars 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, **Citations: 711.**
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. **Citations: 50.**
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. **Citations: 43.**

## Colloquia and Seminars

- University of Nevada, Las Vegas, NV.** **03/2023**  
**Invited colloquium** Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.
- Flatiron Institute, CCA, New York, NY.** **03/2023**  
**Invited seminar** on *Dynamos and Jets in Neutron star mergers.*
- Columbia University, New York, NY.** **03/2023**  
**Invited colloquium** Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.
- Caltech, Pasadena, CA.** **03/2023**  
**Invited colloquium** Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.
- Case Western, Cleveland, OH.** **02/2023**  
**Invited seminar** on *Neutron star mergers: From gravity to nuclear and plasma physics.*
- Kent State University, Kent, OH.** **02/2023**  
**Invited seminar** on *Neutron star mergers: Impact of magnetic fields.*
- University of Toronto, Toronto, Canada.** **11/2023**  
**Invited colloquium** Neutron Star Mergers: Frontiers in Computational Relativistic Astrophysics.
- 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 *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

**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, Flatiron Institute, New York, NY, USA. 10/2020  
Invited talk on *Update on resistive GRMHD and force-free strategies* (jointly with J. Mählmann & 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

<b>Lecturer</b> , <i>Caltech</i> , Pasadena, CA. Ay/Ph104 Relativistic Astrophysics.	<b>2024</b>
<b>Faculty TA</b> , <i>Caltech</i> , Pasadena, CA. Physics 1b (Practical track)- Electric and Magnetic fields.	<b>2024</b>
<b>Faculty TA</b> , <i>Caltech</i> , Pasadena, CA. Physics 1a - Mechanics.	<b>2023</b>
<b>Lecturer</b> , <i>ICERM, Brown University</i> , Providence, RI. Two day course on <i>Relativistic Hydrodynamics</i> at the Numerical Relativity Community Summer School.	<b>2022</b>
<b>Tutor(TA)</b> , <i>Institute for Theoretical Physics</i> , Frankfurt am Main, Germany. Supervisions for the course <i>Advanced Introduction to C++, Scientific Computing and Machine Learning</i> .	<b>2018</b>
<b>Tutor(TA)</b> , <i>Institute for Theoretical Physics</i> , Frankfurt am Main, Germany. Supervisions for the course <i>Theoretical Physics I</i> .	<b>2016</b>
<b>Tutor(TA)</b> , <i>Institute for Theoretical Physics</i> , Göttingen, Germany. Supervisions for the course <i>Mathematics for Physicists I</i> .	<b>2013</b>
<b>Tutor(TA)</b> , <i>Institute for Theoretical Physics</i> , Göttingen, Germany. One-week revision course for <i>Mathematics for Physicists I</i> , included preparation of course materials.	<b>2012</b>

## Mentoring Experience

I have collaborated and worked with several graduate students on a variety of topics.

### Caltech:

- **Sarah Habib** (adviser: S.A. Teukolsky), topic: Advanced Riemann Solvers for Relativistic Hydrodynamics and Magnetohydrodynamics, on-going.
- **Arden Shao** (undergrad) , topic: Neutron star merger simulations, on-going.
- **Ian Johnson** (undergrad) , topic: Neutron star – black hole mergers, on-going.
- **Jiaxi Wu** , topic: Helicity in neutron star mergers, on-going.
- **Haiyang Wang** , topic: Topics in black hole accretion, on-going.
- **Yuan Feng** , topic: Relativistic Superfluids, on-going.
- **Tuojin Yin** (Cal-Bridge, WAVE Fellow), topic: Lifetime of post-merger remnants, on-going.
- **Yoonsoo Kim** (adviser: S.A. Teukolsky), topic: General-relativistic force-free electrodynamics using discontinuous galerkin methods, on-going.

### Princeton:

- **Lawrence Edmond IV** (Simons-National Society of Black Physicists Fellow), topic: Gravitational waves from neutron star – black hole mergers, 2022.
- **Goni Halevi** (adviser: J. Stone), topic: Neutron star – black hole post-merger disks, 2021-2023.
- **Abhishek Hegade** (adviser: N. Yunes), topic: Understanding the entropy evolution and scalar hair growth during the collapse of neutron stars in modified theories of gravity, 2021-2022.
- **Alex Pandya** (adviser: F. Pretorius), topic: First-order conformal relativistic viscous fluid dynamics, 2021-2023.
- **Valentin Skoutnev** (adviser: A. Bhattacharjee), topic: Rayleigh-Taylor dynamo in neutron star mergers, 2020-2021.

**Frankfurt:**

- **Samuel Tootle** (adviser: L. Rezzolla), topic: Binary neutron star mergers with spin, 2020-2021.

## Leadership and Service

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

Three day international workshop.

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

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

One week summer school for graduate students and junior postdocs.

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

Four day international (hybrid) workshop.

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

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

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

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

**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.

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