

# Peter Hammond

POSTDOCTORAL RESEARCH FELLOW · NP3M COLLABORATION

Pennsylvania State University, State College, PA · University of New Hampshire, Durham, NH

☎ +18148528326 | ✉ pph5189@psu.edu

## Profile

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Postdoctoral research fellow with the Nuclear Physics for Multi Messenger Mergers (NP3M) collaboration, specialising in the development of code for, and the performance of, large-scale state-of-the-art numerical relativity simulations of Binary Neutron Star (BNS) mergers. Detail-oriented and resourceful, and keen to take on new challenges. Looking to continue research on cutting edge physics within BNS merger simulations.

## Education

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### University of Southampton

Southampton

#### PHD MATHEMATICAL SCIENCES

Sept 2018 - Sept 2022

- Supervisors: Prof. Nils Andersson, Prof. Ian Hawke
- Thesis title: Numerical Evolution of Binary Neutron Star Mergers

### University of Southampton

Southampton

#### MPHYS PHYSICS (1:1)

Sept 2013 - June 2017

- Final year project: The Gravitational Wave Signal from First Order Phase Transitions in the Primordial Universe
- Selected relevant modules: Numerical Methods, Gravitational Waves, Modelling with Differential Equations, and Relativity, Black Holes & Cosmology.

## Experience

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### NP3M collaboration

PSU, UNH

#### POSTDOCTORAL RESEARCH FELLOW

Oct 2022 - present

- Oct 2022 - Jul 2024: supervised by Prof. David Radice at the Pennsylvania State University
- Aug 2024 - present: supervised by Prof. Francois Foucart at the University of New Hampshire

## Publications

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### ARTICLES

Espino, P. L. et al. “Neutrino trapping and out-of-equilibrium effects in binary neutron-star merger remnants”. *Physical Review Letters*, 132(21), May 2024

Hammond, P., Hawke, I., and Andersson, A. “Impact of nuclear reactions on gravitational waves from neutron star mergers”. *Physical Review D*, 107(4), Feb 2023

Celora, T. et al. “Formulating bulk viscosity for neutron star simulations”. *Physical Review D*, 105(10), May 2022

Hammond, P., Andersson, N., and Hawke, I. “Thermal aspects of neutron star mergers”. *Physical Review D*, 104(10), Nov 2021

### UNPUBLISHED

Cook, W. et al. “GR-Athena++: General-relativistic magnetohydrodynamics simulations of neutron star spacetimes”. *The Astrophysical Journal Supplement*, accepted. arXiv: 2311.04989 [gr-qc]

Daszuta, B. et al. “Numerical relativity simulations of compact binaries: comparison of cell- and vertex-centered adaptive meshes”. *Physical Review D*, submitted. arXiv: 2406.09139 [gr-qc]

Hammond, P. C. et al. “Not-Quite-Transcendental Functions For Logarithmic Interpolation of Tabulated Data”. *The Astrophysical Journal Supplement*, submitted. arXiv: 2501.05410 [physics.comp-ph]

## Presentations

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### SELECTED CONTRIBUTED PRESENTATIONS

- Oct. 2024 **Investigating the impact of high-order QCD phase transitions on BNS mergers** APS DNP Fall Meeting 2024, Boston.
- April. 2024 **Supplementing BNS Simulations with Artificial Neural Networks** APS April Meeting 2024, Sacramento.
- Jan. 2024 **Simulating composition dependent effects in binary neutron star mergers** NP3M Collaboration Meeting, UTK.
- Jan. 2024 **Neutrino trapping and out-of-equilibrium effects in binary neutron star merger remnants** CMA Meeting, PSU.
- Sept. 2023 **Supplementing BNS Simulations with Artificial Neural Networks** MICRA 2023, Trento.
- July 2022 **Detectability of nuclear reactions in neutron star mergers through gravitational waves** FNR 2022, Jena.
- March 2022 **Out of  $\beta$ -equilibrium effects in BNS merger signals** ET OSB meeting for the Nuclear Physics Division, Online.
- Jan. 2022 **Advancing Binary Neutron Star Merger Simulations** NP3M Postdoctoral Seminar, Online.
- Dec. 2022 **Beta Equilibrium in Binary Neutron Star Merger Simulations** NR community call, Online.
- Aug. 2021 **Thermal Effects in Binary Neutron Star Merger Simulations** A Virtual Tribute to Quark Confinement and the Hadron Spectrum Conference, Online.
- May 2020 **Temperature in Neutron Star Merger Simulations** STAG Neutron Star Group Meeting, University of Southampton.
- July 2019 **Con2Prim: Recovery of Primitive Variables in Numerical Relativistic Hydrodynamics** Workshop on Relativistic Fluids, University of Southampton.

## Selected Conference Attendance

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|------------|---|-------------------|
| Oct. 2024  | <b>APS DNP Fall Meeting 2024</b>                                      | <i>Boston</i>     |
| Apr. 2024  | <b>APS April Meeting 2024</b>   | <i>Sacramento</i> |
| Jan. 2024  | <b>NP3M Collaboration Meeting 2024</b>                                | <i>Knoxville</i>  |
| Sept. 2023 | <b>Microphysics In Computational Relativistic Astrophysics</b>        | <i>Trento</i>     |
| Jan. 2023  | <b>NP3M Collaboration Meeting 2023</b>                                | <i>Knoxville</i>  |
| July 2022  | <b>Frontiers in Numerical Relativity 2022</b>                         | <i>Jena</i>       |
| June 2022  | <b>TCAN Meeting 2022: BNS/BH-NS Merger Workshop</b>                   | <i>Online</i>     |
| Aug. 2021  | <b>Virtual Tribute to Quark Confinement and the Hadron Spectrum</b>   | <i>Online</i>     |
| July 2021  | <b>North American Einstein Toolkit Workshop</b>                       | <i>Online</i>     |
| July 2021  | <b>TCAN Meeting 2021: BNS/BH-NS Merger Workshop</b>                   | <i>Online</i>     |
| Aug. 2020  | <b>North American Einstein Toolkit Workshop</b>                       | <i>Online</i>     |
| Dec. 2019  | <b>Texas Symposium on Relativistic Astrophysics</b>                   | <i>Portsmouth</i> |
| Sept. 2019 | <b>European Einstein Toolkit Meeting</b>                              | <i>London</i>     |
| July 2019  | <b>Microphysics In Computational Relativistic Astrophysics</b>        | <i>Jena</i>       |
| July 2019  | <b>International Conference on General Relativity and Gravitation</b> | <i>Valencia</i>   |

## Teaching/Administrative Experience

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- Spring 2021 **Multivariable Calculus** Upkeep and maintenance of distance learning platform
- Fall 2020 **Multivariable Calculus** Code verification and checking
- Spring 2020 **Multivariable Calculus** Creation of distance learning platform using STACK
- Spring 2020 **Operational Research I and Mathematical Computing** Demonstrating
- Fall 2019 **Mathematics for Electronics & Electrical Engineering Part II** Marking
- Spring 2019 **Operational Research I and Mathematical Computing** Demonstrating
- Spring 2019 **Multivariable Calculus** Marking
- Fall 2018 **Mathematics for Electronics & Electrical Engineering Part II** Marking

## References

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### **Prof. David Radice**

Associate Professor of Physics and Astronomy and Astrophysics, Pennsylvania State University

Email: david.radice@psu.edu

### **Prof. Francois Foucart**

Associate Professor of Physics and Astronomy and Integrated Applied Mathematics, University of New Hampshire

Email: Francois.Foucart@unh.edu

### **Prof. Andrew Steiner**

Associate Professor of Theoretical Nuclear Astrophysics and Director of NP3M, University of Tennessee, Knoxville

Email: awsteiner@utk.edu