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| CONTACT INFORMATION   | Department of Physics,<br>104 Davey Lab Box C-68,<br>The Pennsylvania State University<br>University Park, PA 16802<br><b>DoB:</b> 8 January 1990  | <b>ORCID:</b> 0000-0002-5700-282X<br><i>E-mail:</i> rahulkashyap411@gmail.com<br>rkk5314@psu.edu<br>Website: <a href="https://rahulkashyap411.github.io/">https://rahulkashyap411.github.io/</a><br>Cell: +1-8146992614 |
| CURRENT POSITION      | Research Assistant Professor in the Institute for Gravitation and Cosmos, Eberly College of Science, Department of Physics, Pennsylvania State University, USA. (since Aug 2022)   |   |
| EDUCATION             | <ul style="list-style-type: none"><li>• <b>Fall 2012 to Spring 2017 : Distinguished Doctoral Fellow</b> at University of Massachusetts Dartmouth, USA working on my PhD thesis, title “<b>Simulations of Type Ia Supernovae</b>” under the supervision of Prof. Robert Fisher.</li><li>• <b>Aug 2007–July 2012 : Dual Degree (Masters and Bachelors of Technology)</b> in Ocean Engineering &amp; Naval Architecture at Indian Institute of Technology Kharagpur, India.</li><li>• <b>Aug 2004–Apr 2006 : Intermediate of Science</b> (<i>equivalent of 11<sup>th</sup> and 12<sup>th</sup> grade</i>) majoring in Mathematics, Physics, Chemistry, Patna Science College, Bihar, India.</li></ul>   |   |
| PROFESSIONAL TRAINING | <ul style="list-style-type: none"><li>• Research Assistant Professor at the Institute of Gravitation and Cosmos and Physics Department at Pennsylvania State University (Sept 2022 - present)</li><li>• Postdoctoral Fellow at the Institute of Gravitation and Cosmos and Physics Department at Pennsylvania State University (Nov 2019 - Aug 2022).</li><li>• Max Planck Prize Postdoctoral Fellow at International Centre for Theoretical Sciences (ICTS), Bengaluru, India (Jul 2017-Oct 2019).</li><li>• Argonne Training Programme in Extreme-Scale Computing (<b>ATPESC</b>) 2016, an advanced program to prepare for exascale computing and its application to sciences and engineering.</li></ul>   |   |
| RESEARCH INTERESTS    | <ul style="list-style-type: none"><li>• Gravitational and electromagnetic wave signals from binary neutron star mergers by detailed GRMHD and radiation hydrodynamics simulations.</li><li>• Hydrodynamical and magnetohydrodynamical modelling of binary white dwarf mergers and resulting transients such as Type Ia Supernovae and accretion-induced collapse events.</li><li>• Developing gravitational waves data analysis pipeline to constrain properties of supranuclear matter as well as exotic compact objects from current and future gravitational wave detectors.</li></ul>  |   |
| SELECTED PUBLICATIONS | <ol style="list-style-type: none"><li>1. <b>The Accuracy of Neutron Star Radius Measurement with the Next Generation of Terrestrial Gravitational-Wave Observatories</b><br/>Rachael Huxford, <b>Rahul Kashyap</b>, Ssohrab Borhanian, Arnab Dhani, B. S. Sathyaprakash,<br/><i>arXiv:2307.05376</i></li><li>2. <b>Cosmic Explorer: A Submission to the NSF MPSAC ngGW Subcommittee</b><br/>Matthew Evans, Alessandra Corsi, ..., <b>Rahul Kashyap</b>, ... <i>arXiv:2306.13745</i><br/><i>Contribution:</i> I contributed by developing neutron star radius error estimates for next-generation detectors for various possible configurations.</li><li>3. <b>Prospects for Direct Detection of Black Hole Formation in Neutron Star Mergers with Next-Generation Gravitational-Wave Detectors</b></li></ol> |   |

Arnab Dhani, David Radice, Jan Schütte-Engel, Susan Gardner, Bangalore Sathyaprakash, Domenico Logoteta, Albino Perego, **Rahul Kashyap**, *arXiv:2306.06177*

4. **Neutron star-black hole mergers in next generation gravitational-wave observatories**  
Ish Gupta, Ssohrab Borhanian, Arnab Dhani, Debatri Chattopadhyay, **Rahul Kashyap**, V. Ashley Villar, B.S. Sathyaprakash, *arXiv:2301.08763*
5. **Snowmass 2021 Cosmic Frontier White Paper: The Dense Matter Equation of State and QCD Phase Transitions**  
Slavko Bogdanov, Emmanuel Fonseca, **Rahul Kashyap**, Alekski Kurkela, James M. Lattimer, Jocelyn S. Read, Bangalore S. Sathyaprakash, H. Thankful Cromartie, Tim Dietrich, Arnab Dhani, Timothy Dolch, Tyler Gorda, Sebastien Guillot, Wynn C. G. Ho, Rachael Huxford, Frederick K. Lamb, Philippe Landry, Bradley W. Meyers, M. Coleman Miller, Joonas Nättilä, Risto Paatelainen, Chanda Prescod-Weinstein, Saga Säppi, Ingrid H. Stairs, Nikolaos Stergioulas, Ingo Tews, Alekski Vuorinen, Zorawar Wadiasingh, Anna L. Watts, *arXiv:2209.07412*  
*Contribution:* I provide figure and text for the typical scenario and method to constraint the maximum mass using my previous work on the threshold mass formula from numerical relativity simulations. I provide projected radius errors for the next generation GW detectors.
6. **Systematic errors due to quasi-universal relations in binary neutron stars and their correction for unbiased model selection**  
**Rahul Kashyap**, Arnab Dhani, Bangalore Sathyaprakash, *arxiv:2209.02757, PRD*
7. **3D Hydrodynamical Simulations of Helium-Ignited Double-degenerate White Dwarf Mergers**  
Niranjan Roy, Vishal Tiwari, Alexey Bobrick, Daniel Kosakowski, Robert Fisher, Hagai B. Perets, **Rahul Kashyap**, Pablo Lorén-Aguilar, Enrique García-Berro, *arXiv:2204.09683, ApJL 932 L24 2022*
8. **Probing the incompressibility of nuclear matter at ultra-high density through the prompt collapse of asymmetric neutron star binaries**  
A. Perego, D. Logoteta, D. Radice, S. Bernuzzi, **R. Kashyap**, A. Das, S. Padamata, A. Prakash *arxiv:2112.05864, Phys. Rev. Lett. 129, 032701*
9. **Numerical relativity simulations of prompt collapse mergers: threshold mass and phenomenological constraints on neutron star properties after GW170817**  
**Rahul Kashyap**, Abhishek Das, David Radice, Surendra Padamata, Aviral Prakash, Domenico Logoteta, Albino Perego, Daniel A. Godzieba, Sebastiano Bernuzzi, Ignazio Bombaci, Farrukh J. Fattoyev, Brendan T. Reed, André da Silva Schneider, *arXiv:2111.05183, Phys. Rev. D 105, 103022*
10. **Radiation hydrodynamics modeling of kilonovae with SNEC**  
Zhenyu Wu, Giacomo Ricigliano, **Rahul Kashyap**, Albino Perego, David Radice, *MNRAS, Volume 512, Issue 1, 2022*
11. **GWTC-3: Compact Binary Coalescences Observed by LIGO and Virgo During the Second Part of the Third Observing Run**  
B.P. Abbott et al., *arXiv:2111.03606, 2021*  
**Citations:** 935
12. **Signatures of Deconfined Quark Phases in Binary Neutron Star Mergers**  
Aviral Prakash, David Radice, Domenico Logoteta, Albino Perego, Vsevolod Nedora and Bombaci, Ignazio Bombaci, **Rahul Kashyap**, Sebastiano Bernuzzi and Andrea Endrizzi, *Phys. Rev. D 104, 083029, 2021*

13. **GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo during the First Half of the Third Observing Run**  
B.P. Abbott et al., *arXiv:2010.14527, PRX*, 2021  
**Citations:** 738
14. **Constraining black hole mimickers with gravitational wave observations**  
Nathan K. Johnson-McDaniel, Arunava Mukherjee, **Rahul Kashyap**, Parameswaran Ajith, Walter Del Pozzo, Salvatore Vitale, *Phys. Rev. D* 102, 123010, 2020
15. **Tests of General Relativity with Binary Black Holes from the second LIGO-Virgo Gravitational-Wave Transient Catalog**  
B.P. Abbott et al., *PRD*, 2020
16. **Tests of general relativity with the binary black hole signals from the LIGO-Virgo catalog GWTC-1**  
B.P. Abbott et al., *Phys. Rev. D* 100, 104036, 2019  
*Contribution:* For the two LIGO testing GR papers, I have contributed to the Inspiral-Merger-Ringdown pipeline of testing GR. Performing the IMR test for BBH events observed in O1/O2. Later I served as a reviewer for the same test performed on the events observed during the O3 observing run.
17. **Can Kilonova Light Curves Be Standardized?**  
**Rahul Kashyap**, Gayathri Raman, and Parameswaran Ajith, *ApJL* 886 L19, 2019
18. **Double-Degenerate Carbon-Oxygen and Oxygen-Neon White Dwarf Mergers: A New Mechanism for Faint and Rapid Type Ia Supernovae**  
**Rahul Kashyap**, Tazkera Haque, Pablo Lorén-Aguilar, Enrique García-Berro, Robert T. Fisher *ApJ* 869 140, 2018
19. **Constraining the Single-degenerate Channel of Type Ia Supernovae with Stable Iron-group Elements in SNR 3C 397**  
Pranav Dave, **Rahul Kashyap**, Robert Fisher, Dean Townsley, Chris Byrohl, *The Astrophysical Journal*, Volume 841, Issue 1, article id. 58, 15 pp. (2017)
20. **One-armed Spiral Instability in Double-degenerate Post-merger Accretion Disks**  
**Rahul Kashyap**, Robert Fisher, Enrique García-Berro, Gabriela Aznar-Siguán, Suoqing Ji, Pablo Lorén-Aguilar, *The Astrophysical Journal*, Volume 840, Issue 1, article id. 16, 10 pp. (2017)
21. **Light Curves and Spectra from a Thermonuclear Explosion of a White Dwarf Merger**  
Daniel R. van Rossum, **Rahul Kashyap**, Robert Fisher, Enrique García-Berro, Gabriela Aznar-Siguán, Suoqing Ji, Pablo Lorén-Aguilar, *The Astrophysical Journal*, Volume 827, Issue 2, article id. 128, 14 pp. (2016)
22. **Spiral Instability Can Drive Thermonuclear Explosions in Binary White Dwarf Mergers**  
**Rahul Kashyap**, Robert Fisher, Enrique García-Berro, Gabriela Aznar-Siguán, Suoqing Ji, Pablo Lorén-Aguilar, *The Astrophysical Journal Letters*, Volume 800, Issue 1, article id. L7, 6 pp. (2015)

PROFESSIONAL  
SERVICES

- Peer reviewer for **Nature Communications**, **Physical Review Letters**, **Astrophysical Journal**, and **Monthly Notices of Royal Astronomical Society (MNRAS)**  
( <https://www.webofscience.com/wos/author/record/3626338> )
- LIGO Member since October 2017, active in the group responsible for published results of testing general relativity using gravitational wave observations by LIGO-Virgo collaborations.
- Member and one of the authors of **Cosmic Explorer Horizon Study**.
- Public outreach of LIGO during the first BNS merger press release.
- Involved in various review and analysis activities for collaboration papers from LIGO.

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| ACHIEVEMENTS<br>AND AWARDS              | <ul style="list-style-type: none"> <li>• Awarded 9 million service units (SU) by XSEDE for the proposal –“Numerical Simulations of Neutron Star and White Dwarf Mergers” as co-PI with PI, David Radice.</li> <li>• Best talk award by American Physical Society at the Eastern Gravity Meeting, June 2017.</li> <li>• Distinguished Doctoral Fellow at the University of Massachusetts Dartmouth for 2012-2016.</li> <li>• Indian Academy of Sciences Research Fellowship Program (SRFP) 2009.</li> </ul>  |
| SELECTED<br>TALKS                       | <ul style="list-style-type: none"> <li>• APS April Meeting 2023: Title: “Systematic errors due to quasi-universal relations in binary neutron stars and their correction for unbiased model selection”</li> <li>• APS April Meeting 2022: Title: “What can we learn from prompt collapse events in binary neutron star mergers? A numerical study”</li> <li>• LIGO Matter group: Effectiveness of universal relations in measuring Neutron Star radius and EOS in 3G GW Detectors</li> <li>• Second Chennai Symposium on Gravitation and Cosmology (CSGC 2022), February 2-5, 2022:</li> <li>• Fundamental Theory Seminar, IGC, Penn State: Sept 2021: Impact of prompt and delayed collapse of remnants following binary neutron star mergers.</li> <li>• APS April Meeting, 2021: Prompt Collapse during Binary Neutron Star Mergers</li> <li>• Invited talk as Fundamental Theory Seminar on the numerical study of prompt and delayed collapse from BNS mergers at Institute of Gravitation and Cosmos (IGC) at Pennsylvania State University Sept, 2021.</li> <li>• Prompt Collapse and their implications for properties of NS, APS April Meeting, 2021.</li> <li>• Standardization of kilonovae and their application cosmology in GR22/Amaldi, Valencia, Spain 2019.</li> <li>• Short talk and poster presentation on kilonovae standardization and implications on cosmology in GWPAW, University of Maryland, College Park, USA, Dec 2018.</li> <li>• Standardization of kilonovae in PAX meeting, IUCAA, Pune, India, March, 2018</li> <li>• Tidal deformability tests of binary black hole mimickers at LVC Meeting Mar 2018, Sonoma State University, California, USA and Sept 2018 Maastricht, Netherlands.</li> <li>• Summer School on Gravitational Wave Astronomy, ICTS, Bengaluru, July 2017</li> <li>• Supernovae, Hypernovae and Binary Driven Hypernovae - Adriatic Workshop, ICRANet, Pescara, Italy.</li> <li>• <i>The Transient Sky</i>, The Ninth Harvard-Smithsonian Conference on Theoretical Astrophysics, Sackler Meeting, CfA, Harvard, 2016: Poster Presentation</li> <li>• Joint Fall Meeting of the APS and AAPT New England Sections, Dartmouth College: Talk</li> <li>• Fifty-One Erg, 2015, University of North Carolina, Raleigh: A short talk and poster presentation.</li> <li>• Spring 2015 Meeting of the APS New England Section, Boston University.</li> <li>• <i>The Unquiet Universe</i>, INAF - Astronomical Observatory of Rome, Cefalu, June, 2014 :Poster Presentation.</li> </ul> |
| TEACHING AND<br>MENTORING<br>EXPERIENCE | <ul style="list-style-type: none"> <li>• Research advisor for three pre-graduate students at ICTS, Bengaluru, India – Pinaki Roy, Sumedha Biswas (now at University of Amsterdam), Abinaya Swaruba (now at Max Planck Institute of Astrophysics).</li> <li>• Reading course for graduate students on Blackhole Astrophysics at ICTS, Bengaluru, India.</li> <li>• Full instructor for Precalculus Class to STEM major students in Fall 2016 and Finite Mathematics to business majors in Spring 2017, UMASS Dartmouth.</li> <li>• Led sections as an instructor (from Spring 2013 to Spring 2016) to physics undergraduates for topics including electrodynamics, waves, optics and modern physics, UMASS Dartmouth.</li> </ul>   |
| SCIENCE<br>OUTREACH                     | <ul style="list-style-type: none"> <li>• Demonstration on the formation of cloud to high school students at ICTS, Bengaluru, and at Indian Institute of Science, Bengaluru on National Science Day, 2018 based on one of my undergraduate experimental research works.</li> <li>• Outreach article covering our work on massive binary white dwarf mergers (check <a href="#">here</a> and <a href="#">here</a>).</li> <li>• Translation of LIGO public release in Hindi for the popularization of gravitational wave science to high school</li> </ul>   |

students in India.

- Contributor to the science matter in *Cosmic Zoom*, an outreach program to demonstrate the physics active at different length scales

COMPUTATIONAL  
SKILLS

- **Gravitational Wave Data Analysis Tools:** LALInference, `gwbench`, Bilby
- **Astrophysical Simulation Tools:** FLASH, Einstein Toolkit, Whisky-THC, Athena++, GRATHENA++, MESA
- **Data Analysis and Visualization Tools:** yt, VisIt
- **HPC Skills:** extensive experience in MPI/OpenMP implementations in FORTRAN and Python usage on large supercomputing clusters such as Stampede.