

Nikhil Sarin

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Education

Ph.D., Astrophysics, Feb 2018-Oct 2021
Thesis: “The observational signatures of nascent neutron stars”
Supervisors: Prof. Paul Lasky and Dr. Greg Ashton.
Fields: neutron star mergers, gamma-ray bursts, gravitational waves

Honours (1st class), Astrophysics 2017
Thesis: “Gamma-ray burst afterglows and gravitational waves”
Supervisors: Prof. Paul Lasky and Dr. Letizia Sammut.

BSc, Major in Astrophysics and Geology 2014-2016

Academic experience

- **Institute for Astronomy, Kavli Institute for Cosmology**
Kavli Senior Fellow, Cambridge University, August 2025 - Ongoing
- **Nordita Institute/Stockholm University**
Nordita/OKC Postdoctoral Fellow, Nordita Institute and Department of Physics, Stockholm University, November 2021 - July 2025

Awards and Fellowships

- **Kavli Senior Fellowship**
Senior Fellowship, Cambridge University, 2025-2030
- **Nordita Fellowship/OKC Postdoctoral Fellowship**
Postdoctoral Fellowship, Nordita Institute and Stockholm University, 2021-2025
- **Vice-Chancellor’s Commendation for Doctoral Thesis Excellence**
One prize awarded across the Science Faculty for Doctoral Thesis Excellence, 2021
- **Robert Street Doctoral Prize**
Best PhD thesis in Monash University School of Physics and Astronomy, 2021
- **Research Training Scheme, Australian Postgraduate Award**
PhD Scholarship, Australian Research Council, 2018-2021
- **MoCA prize**
Best Honours student in Astrophysics, Monash University, 2017

Grants

- **LINCC Incubator (PI)**
Grant to support the development of Redback for use with LSST in 2025/2026. Software development time from 4 software developers at 0.5 FTE and ~ 30 k USD for equipment, travel, and salary support.
- **Royal Swedish Academy of Science Travel grant (PI)**
Travel Grant to attend various conferences in 2025, ≈ 4000 Euro
- **Kavli Visitor Grant (PI)**
Grant to support a ≈ 3 week visit to the Kavli Institute for Cosmology at the University of Cambridge in 2024, ≈ 3000 GBP.
- **Infravis, Visualisation Grant (Co-PI)**
Software development time and equipment from multiple software developers from the Data visualisation company, Infravis, ≈ 10000 Euro
- **OzGrav Visitor Grant (PI)**
Grant to support an extended visit to Australia in 2023, ≈ 4000 AUD

Teaching and Supervision

- Ellen Lindsjö - Masters project on supernovae, 2024-2025 (sole supervisor)
- Wendy Wallace - Masters project on kilonovae and GRB afterglows, 2023 (sole supervisor)
- Marcell Ziegler - High school student working with me on GRBs through the Rays for Excellence program, 2023.
- Antoine Gilles-Lordet - Masters project on linking large-scale structure to supernovae, 2023
- Teagan Clarke - Undergraduate research project on fast radio bursts, 2019
- Nico Keeghan - Undergraduate research project on millisecond pulsars, 2021
- Teaching Associate, 2017-2021.

Professional Activities

- Diversity, Equity and Inclusion committee member at the Nordita Institute, 2022-2024.
- Nordita Astronomy seminar co-organiser, 2022-2023.
- Nordita astrophysics group meeting co-organiser, 2022-2023.
- Time Allocation Committee review for Gemini, Liverpool Telescope proposals
- Referee - Nature Astronomy, Physical Review D, Physical Review Letters, Astrophysical Journal, Astrophysical Journal Letters, Astronomy and Astrophysics, Monthly Notices of the Royal Astronomical Society, internal LIGO peer reviewer
- SOC - Parameter estimation workshop, LIGO India, 2020
- Gravitational-wave group meeting organiser, Monash University, 2018-2019
- LOC - Parameter estimation face-to-face, Monash University, 2018. ZTF meeting, Stockholm, 2023

Publications

Listed below are only publications for which I have made significant contributions. I am an author on numerous other publications as a member of the LIGO Scientific Collaboration where my contributions vary.

First-author publications

17. **Sarin**, Moriya, Singh et al. (2025), *Surrogate models for lightcurves and photosphere properties of Type II supernovae*. Submitted to MNRAS.
16. **Sarin**, Clarke, Magnall et al. (2024), *The origin of the coherent radio flash potentially associated with GRB 201006A*. Accepted in ApJL.
15. **Sarin**, & Rosswog (2024), *Cautionary tales on heating-rate prescriptions in kilonovae*. Accepted in ApJL.
14. **Sarin**, Peiris, Alsing et al. (2024), *Measuring the nuclear equation of state with neutron star-black hole mergers*. Accepted in PRD.
13. **Sarin**, Hübner, Omand et al. (2024), *REDBACK: A Bayesian inference software package for electromagnetic transients*. Accepted in MNRAS.
12. **Sarin** & Metzger (2024), *Tidal Disruption Events through the Lens of the Cooling Envelope Model*. ApJL 961 L19.
11. **Sarin**, Brandenburg & Haskell (2023), *Confronting the neutron star population with inverse cascades*. ApJL 952 21S
10. **Sarin**, Lasky & Nathan (2023), *Missed opportunities: GRB 211211A and the case for continual gravitational-wave coverage with a single observatory*. MNRAS, 518:4.
9. **Sarin**, Omand, Margalit et al. (2022), *On the diversity of magnetar-driven kilonovae*. MNRAS, 516:4
8. **Sarin**, Hamburg, Burns et al. (2022), *Low-efficiency long gamma-ray bursts: A case study with AT2020bht*. MNRAS, 512:1
7. **Sarin**, Lasky, Vivanco et al. (2022), *Linking the rates of neutron star binaries and short gamma-ray bursts*. Physical Review D, 105:083004
6. **Sarin** & Lasky. (2022), *Multimessenger astronomy with a kHz-band gravitational-wave observatory*. PASA 39:e007. **Editor's Pick 2022**
5. **Sarin** & Lasky (2021), *The evolution of binary neutron star post-merger remnants: a review*. General Relativity and Gravitation 53:59. **Invited review.**
4. **Sarin**, Lasky & Ashton (2020), *Interpreting the X-ray afterglows of gamma-ray bursts with radiative losses and millisecond magnetars*. MNRAS, 499:4
3. **Sarin**, Lasky & Ashton (2020), *Gravitational waves or deconfined quarks: What causes the premature collapse of neutron stars born in short gamma-ray bursts?*, Physical Review D, 101:063021
2. **Sarin**, Lasky & Ashton (2019), *X-ray afterglows of short gamma-ray bursts: Magnetar or Fireball?*, ApJ, 872:114
1. **Sarin**, Lasky, Sammut & Ashton (2018), *X-ray guided gravitational-wave search for binary neutron star merger remnants*, Physical Review D, 98:043011.

Co-authored publications

39. Swain et al. (2025), *GRB 250704B: An Off-axis Short GRB with a Long-Lived Afterglow Plateau*. Submitted to ApJL.
My contribution: I contributed to the astrophysical interpretation.
38. Jonker et al. (2025), *EP250207b is not a collapsar fast X-ray transient. Is it due to a compact object merger?*. Submitted to MNRAS.
My contribution: I contributed to the lightcurve modelling, interpretation, and paper writing.
37. Wise, Perley, **Sarin** et al. (2025), *AT2019cmw: A highly luminous, cooling featureless TDE candidate from the disruption of a high mass star in an early-type galaxy*. Submitted to MNRAS.
My contribution: I contributed to the lightcurve modelling, interpretation, and paper writing.
36. Das et al. (2025), *Low-Luminosity Type IIP Supernovae from the Zwicky Transient Facility Census of the Local Universe. II: Lightcurve Analysis*. Submitted to ApJ.
My contribution: I contributed to the astrophysical interpretation.
35. Gangopadhyay et al. (2025), *SN 2023xgo: Helium rich Type Icn or Carbon-Flash Type Ibn supernova?*. Submitted to MNRAS.
My contribution: I contributed to the lightcurve modelling, interpretation, and paper writing.
34. Schulze et al. (2025), *A cosmic formation site of silicon and sulphur revealed by a new type of supernova explosion*. Accepted in Nature.
My contribution: I contributed to the lightcurve modelling and interpretation.
33. Levan et al. (2025), *The fast X-ray transient EP240315a: a $z \sim 5$ gamma-ray burst in a Lyman continuum leaking galaxy*. Accepted in Nature Astronomy
My contribution: I contributed to the astrophysical interpretation of this transient.
32. Srinivasaragavan et al. (2025), *EP250108a/SN 2025kg: A Broad-Line Type Ic Supernova Associated with a Fast X-ray Transient Showing Evidence of Extended CSM Interaction*. Submitted to ApJL.
My contribution: I contributed to lightcurve modelling, theoretical interpretation and paper writing.
31. Wallace & **Sarin** (2025), *A detailed dive into fitting strategies for GRB afterglows with contamination: A case study with kilonovae*. Accepted in MNRAS.
This publication was a result of Wendy's master's thesis that she performed under my supervision.
30. Rastinejad et al. (2025), *EP 250108a/SN 2025kg: Observations of the most nearby Broad-Line Type Ic Supernova following an Einstein Probe Fast X-ray Transient*. Accepted in ApJL.
My contribution: I contributed to lightcurve modelling, theoretical interpretation and paper writing.
29. Rob-Eyles et al. (2025), *The kangaroo's first hop: the early fast cooling phase of EP250108a/SN 2025kg*. Accepted in ApJL.
My contribution: I contributed to lightcurve modelling, theoretical interpretation and paper writing.
28. Lamb et al. (2025), *Prompt Periodicity in the GRB 211211A Precursor: Black-hole or magnetar engine?*. Accepted in MNRAS.
My contribution: I contributed to the statistical analysis framework, astrophysical interpretation, and paper writing.
27. Miller et al. (2025), *The La Silla Schmidt Southern Survey*. Submitted to PASP.
My contribution: I contributed to the survey strategy and the science case for this survey.
26. Cooper et al. (2025), *Joint Radiative and Kinematic Modelling of X-ray Binary Ejecta: Energy Estimate and Reverse Shock Detection*. Accepted in MNRAS.
My contribution: I contributed to the statistical analysis framework and paper writing.

25. Brennan et al. (2025), *Precursor Activity Preceding Interacting Supernovae I: Bridging the Gap with SN 2022mop*. Submitted to A&A.
My contribution: I contributed to the astrophysical interpretation and paper writing.
24. Jiang et al. (2025), *EP240801a/XRF 240801B: An X-ray Flash Detected by the Einstein Probe and Implications of its Multiband Afterglow*. Submitted to ApJ.
My contribution: I contributed to the astrophysical interpretation.
23. Clarke, **Sarin**, Howell et al. (2025), *Quantifying the coincidence between gravitational waves and fast radio bursts from neutron star–black hole mergers*. Accepted in PRD.
22. Omand, **Sarin** et al. (2025), *Multi-Peaked Non-Thermal Light Curves from Magnetar-Powered Gamma-Ray Bursts*. Accepted in MNRAS.
21. van-Dalen et al. (2025), *The Einstein Probe transient EP240414a: Linking Fast X-ray Transients, Gamma-ray Bursts and Luminous Fast Blue Optical Transients*. Accepted in ApJL.
My contribution: I contributed to the lightcurve modelling, theoretical interpretation, and paper writing.
20. Rosswog, **Sarin** et al. (2025), *Fast dynamic ejecta in neutron star mergers*. Accepted in MNRAS.
19. Srinivasaragavan et al. (2025), *Multi-Wavelength Analysis of AT 2023sva: a Luminous Orphan Afterglow With Evidence for a Structured Jet*. Accepted in MNRAS.
My contribution: I contributed to the lightcurve modelling, theoretical interpretation, and paper writing.
18. Andreoni et al. (2024), *Rubin ToO 2024: Envisioning the Vera C. Rubin Observatory LSST Target of Opportunity program*. Submitted to ApJS.
My contribution: I contributed to the writing and simulations of kilonova lightcurves for different follow-up strategies with Vera Rubin.
17. Magnall, Goode, **Sarin**, et al. (2024), *Directly inferring cosmology and the neutron-star equation of state from gravitational-wave mergers*. Submitted to PRD.
16. Li et al. (2024), *The Nature of Optical Afterglows Without Gamma-ray Bursts: Identification of AT2023lcr and Multiwavelength Modeling*. Accepted in ApJ.
My contribution: I contributed to the lightcurve modelling and interpretation of the different Afterglow observations.
15. Gkini et al. (2024), *Eruptive mass-loss less than a year before the explosion of superluminous supernovae: I. The cases of SN 2020xga and SN 2022xgc*. Accepted in A&A.
My contribution: I contributed to the lightcurve modelling, theoretical interpretation, and paper writing.
14. Townsend et al. 2024, *Candidate strongly-lensed Type Ia supernovae in the Zwicky Transient Facility archive*. Accepted in A&A
My contribution: I contributed to the lightcurve modelling of potential lensed supernovae candidates.
13. Srinivasaragavan et al. (2024), *Optical and Radio Analysis of Systemically Classified Broad-lined Type Ic Supernovae from the Zwicky Transient Facility*. Accepted in ApJ.
My contribution: I contributed to the lightcurve modelling and interpretation of all candidates.
12. Omand, **Sarin**, Temim (2024), *SN 1054 as a Pulsar-Driven Supernova: Implications for the Crab Pulsar and Remnant Evolution*. Accepted in MNRAS.
11. Rosswog et al. (2024), *Mergers of double neutron stars with one high-spin component: brighter kilonovae and fallback accretion, weaker gravitational waves*. Accepted in MNRAS
My contribution: I contributed to the astrophysical implications of the numerical results, including making detailed predictions for kilonovae, kilonova afterglows, and writing of the implication for electromagnetic and gravitational-wave signature including gamma-ray bursts and post-merger gravitational waves.

10. Omand & **Sarin** (2024), *A Generalized Semi-Analytic Model for Magnetar-Driven Supernovae*. MNRAS, 527:3.
9. Levan et al. (2023), *Heavy element production in a compact object merger observed by JWST*. Nature 626, 8000
My contribution: I contributed to the astrophysical interpretation and modelling of the multi-wavelength data with joint afterglow and kilonova models.
8. Anand et al. (2023), *Collapsars as Sites of r-process Nucleosynthesis: Systematic Near-Infrared Follow-up of Type Ic-BL Supernovae*. ApJ, 962, 1.
My contribution: I contributed to the validation of inference results from fitting multiple supernovae and helped build the emulator for the collapsar model.
7. Schulze et al. (2023), *1100 Days in the Life of the Supernova 2018ibb – the Best Pair-Instability Supernova Candidate, to date*. Accepted in A&A.
My contribution: I contributed to the astrophysical interpretation and fitting of the multi-wavelength data with several supernovae models using REDBACK.
6. Strang, Melatos, **Sarin** & Lasky (2021), *Exploring properties of neutron stars born in short gamma-ray bursts with a plerion-like X-ray plateau*. MNRAS, 507:2
5. Ackley et al. (2020), *Neutron Star Extreme Matter Observatory: A kilohertz-band gravitational-wave detector in the global network*. PASA 37:e047
My contribution: As a member of OzGrav, the Australian Research Council Centre of Excellence for gravitational-wave discovery, I have been involved in developing the science case for a dedicated high-frequency gravitational-wave detector. In particular, focusing on the ability of such a detector to unequivocally identify the fate of a binary neutron star merger.
4. Romero-Shaw et al. (2020), *Bayesian inference for compact binary coalescences with BILBY: Validation and application to the first LIGO–Virgo gravitational-wave transient catalogue*. MNRAS, 499:3
My contribution: As one of the developers for the Bilby package, I performed the review of core features in preparation for Bilby to become the standard inference software for the LIGO Scientific Collaboration.
3. Ashton et al. (2019), *Bilby: A user-friendly Bayesian inference library for gravitational-wave astronomy*, ApJS 241:2
My contribution: As one of the developers for the Bilby package, my key contributions have been to implement Monte-Carlo Gaussian noise realisations, the reduced-order quadrature likelihood for compact binary coalescence’s, unit tests alongside other features.
2. **The LIGO-Virgo Scientific Collaboration**, Abbott et al. (2019), *Search for Gravitational Waves from a Long-lived Remnant of the Binary Neutron Star Merger GW170817*. ApJ, 875:2
My contribution: I was on the paper writing team, contributing significantly to the writing of the introduction and waveform sections. I contributed to the astrophysical interpretation of the results, and calculated detection thresholds for similar signals with third-generation detectors.
1. **The LIGO-Virgo Scientific Collaboration**, Abbott et al. (2017), *Search for post-merger gravitational waves from the remnant of the binary neutron star merger GW170817* ApJL, 851, L16.
My contribution: I helped develop the waveform models that were used to set the upper-limit on potential gravitational-wave emission.

Conference Proceedings

2. **Sarin**, Lasky & Ashton (2020), *The premature collapse of neutron stars born in short gamma-ray bursts*. Conference Proceedings of the Yokohama Yamada conference.
1. Lasky, P., **Sarin** & Ashton (2019), *Neutron Star Merger Remnants: Braking Indices, Gravitational Waves, and the Equation Of State*. Conference Proceedings of the Xiamen-CUSTIPEN Workshop

Open-source software

- **REDBACK**: A Bayesian inference software package for simulating and fitting electromagnetic transients. Available at <https://github.com/nikhil-sarin/redback>
- **REDBACK_SURROGATES**: Unified interface for surrogate models for various electromagnetic transients. Available at https://github.com/nikhil-sarin/redback_surrogates
- **BILBY**: A Bayesian inference library for gravitational waves. Available at <https://github.com/bilby-dev/bilby>

Other software and code is available at <https://github.com/nikhil-sarin>

Talks

Since beginning my PhD in 2018, I have given over 35 invited seminars at various institutions/conferences across the world and many other seminars and talks at various conferences. Below is a select list of talks and seminars.

ICESUN Seminar September 2025, Chinese Academy of Sciences, Yunnan (remote). (**Invited**)

Rattle and shine conference on BNS mergers. September 2025, Hamburg, Germany. (**Invited**)

Wetton Workshop on gravitational-wave multi-messenger astronomy. September 2025, Oxford, U.K. (**Invited**)

EAS 2025 European Astronomical Society meeting. Two talks. June 2025, Cork, Ireland. (**Invited**)

Shaping the Future of Time-Domain Astronomy with LSST. May 2025, Rio de Janeiro, Brazil.

BIRS Detection and Analysis of Gravitational Waves in the era of Multi-Messenger Astronomy conference at Banff Research Station. November 2024, Banff, Canada. (**Invited**)

Leicester-Liverpool John Moores Joint Department Seminar. October 2024, Liverpool, UK. (**Invited**)

Oxford University SPIMAX Seminar. October 2024, Oxford, UK. (**Invited**)

Astrocolibiri workshop Workshop on multi-messenger astronomy. September 2024, Paris. (**Invited**)

Swedish Academy of Sciences Conference on gravitational-wave astronomy. June 2024 (**Invited**)

Uppsala University Joint nuclear physics and astrophysics seminar. May 2024 (**Invited**)

Australian National University Joint CGA-RSAA Seminar. February 2024 (**Invited**)

Lund University 2-day conference on chemical enrichment of the Universe at Lund. October 2023 (**Invited**)

OKC Seminar, Stockholm University Department Colloquium at the Oskar Klein Centre, Stockholm University. October 2023 (**Invited**)

OKC@15 3 day conference to celebrate the 15 year anniversary of the Oskar Klein Centre. October 2023. Contributed Talk.

Radboud Colloquium Department Colloquium at Radboud University. October 2023 (**Invited**)

Colloquium, Hamburg University Department Colloquium at Hamburg University. October 2023 (**Invited**)

Engrave Webinar Virtual seminar to the Engrave collaboration. June 2023 (**Invited**)

Humboldt University of Berlin Ready, set, go! conference on preparations for O4 LIGO-Virgo-KAGRA observing run. May 2023 (**Invited**)

University of Wisconsin-Milwaukee Centre of Gravitation, Cosmology & Astrophysics Seminar. October 2022 (**Invited**)

Flatiron Institute CCA Gravitational-wave and compact objects group meeting. June 2022. (**Invited**)

Aspen Center for Physics Challenges for multi-messenger astronomy. Workshop on next-generation gravitational-wave instruments. June 2022. (**Invited**)

Institut d'Astrophysique de Paris Multi-messenger Astronomy virtual seminar. Feb 2022 (**Invited**)

Transients workshop, Oskar Klein Centre Virtual workshop. January 2022 (**Invited**)

Caltech, Pasadena, USA. Virtual seminar. November 2020 (**Invited**)

University of Leicester, Leicester, U.K. Virtual seminar. July 2020 (**Invited**)

University of Coimbra, Coimbra, Portugal. Virtual seminar. June 2020 (**Invited**)

University of Western Australia, Perth, Australia. Virtual seminar. June 2020 (**Invited**)