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Academic Qualifications

2012-2016 **PhD in Mathematics** from the University of Southampton (GB) and Albert Einstein Institute (Hannover, DE). Thesis title: "Timing variations in neutron stars: models, inference, and their implications for gravitational waves". Awarded 29th July 2016.

2008-2012 **Master of Physics**, 1st class (Hons), University of Southampton (GB)

Career History

2021-pres. **Lecturer:** Department of Physics at Royal Holloway, University of London (RHUL)
- Building a new Astronomy research group
- Delivering courses in Special Relativity, Advanced Python, and Gravitational-wave Astronomy

2021-2021 **Research Fellow**: Institute for Cosmology and Gravitation, University of Portsmouth
- Research Fellow in gravitational-wave astrophysics.

2020-2021 **Teaching Fellow:** Centre for the Development of Academic Skills RHUL
- Lecturer, Foundation Year Mathematics (Calculus, Linear Algebra, Probability and Statistics)
- Supervised two BSc undergraduate research projects in Astro-statistics

2018-2020 **Assistant Lecturer:** School of Physics and Astronomy, Monash University (Melbourne, AU)
- Researcher in gravitational-wave astronomy and neutron-star astrophysics
- Supervised 1 PhD student and four undergraduate research projects.
- Assistant Lecturer for first-year physics "Classical Physics and Relativity" and "Fields and Quantum Physics" with over 200 students enrolled per year

2016-2018 **Research Scientist:** Albert Einstein Institute (Hannover, DE)
- Researcher in the search for gravitational waves from isolated, rapidly-rotating neutron stars.
- Analysis of large datasets, Markov-Chain Monte-Carlo methods, and distributed computing.

Research Interests

My research interest is the relativistic astrophysics of black holes and neutron stars. Highlights include:

- **Finding the first evidence that neutron stars have three distinct shells**. This work applied a novel analysis method to model the dynamical evolution of a radio pulsar during a "glitch", an event where the star is observed to increase its rotation rate. Coordinating a team of theorists and observers, we discovered a hitherto unseen phenomenon that provided the first evidence of a distinct third shell in the star. The work was published in Nature Astronomy [15] (citation numbers refer to table below) with international press coverage.
- **A pivotal role in analysing the first observed neutron-star black-hole collision [29] and the second neutron star collision [17]**. As a member of the LIGO Scientific Collaboration, I was significantly involved in these ground-breaking papers published in Astrophysical Journal Letters; My roles are described in the table below.
- ***Developing a new approach to modelled searches for coincident signals from multiple messengers.*** Astronomical observations are massively enhanced when we can see the same event in multiple different ways. For example, different bands of the electromagnetic spectrum or different kinds of data (electromagnetic, gravitational waves, neutrinos, and cosmic rays). The latter of these is referred to as multimessenger astronomy. However, a problem arises when we see large numbers of background events: how can we discern if we have genuinely seen the same event? I developed a new modelled approach to solve this problem [9] which has been adopted across the field, leading to new types of multimessenger searches.
- ***Leading the development of flagship software used to analyse all observed gravitational-wave signals***. I led the development of the Bilby inference library [14], adopted by the LIGO Collaboration, to analyse all events from the third observing run onwards. I have since led a team of PhD students to demonstrate the validity of Bilby [24] and enhanced the algorithm to improve measurements by the use of massive computational parallelisation [22] and new stochastic sampling methods [31].

Publications

Below I detail the 40 published articles to which I have made significant contributions.[1] These include 17 articles in which I am the lead author, 2 articles for which I am the joint first author and 3 large-collaboration papers where I have explicitly described my role alongside the title. The publications listed here have been cited over 2000 times and have a refereed h-index of 17; my first author publications have been cited 500 times and have an h-index of 11.

	Title	Authors	Journal	Cites
40	Gaussian processes for glitch-robust gravitational-wave astronomy	**Ashton**	MNRAS	1
39	Subtracting glitches from gravitational-wave detector data during the third LIGO-Virgo observing run	Davis et al.	CQG	12
38	A follow-up on intermediate-mass black hole candidates in the second LIGO-Virgo observing run with the Bayes Coherence Ratio	Vajpeyi et al.	MNRAS	1
37	Parameterised population models of transient non-Gaussian noise in the LIGO gravitational-wave detectors	**Ashton** et al.	CQG	11
36	Does nonstationary noise in LIGO and Virgo affect the estimation of H0?	Mozzon, **Ashton**, et al.	PRD	4
35	The use of hypermodels to understand binary neutron star collisions	Ashton & Dietrich	Nature Astronomy	4
34	Nested sampling for physical scientists. Note: this paper has an alphabetic author list. I co-wrote the section application of Nested Sampling to gravitational-wave data analysis.	Ashton et al.	Nature Methods	5
33	Optimised localisation for gravitational waves from merging binaries	You, **Ashton**, et al.	MNRAS	1
32	Current observations are insufficient to confidently associate the binary black hole merger GW190521 with AGN J124942.3+344929	**Ashton** et al.	MNRAS	47
31	BILBY-MCMC: an MCMC sampler for gravitational-wave inference	**Ashton** & Talbot	MNRAS	15
30	Prospects of Gravitational Wave Detections from Common Envelope Evolution with LISA	Renzo et al.	ApJ	8
29	Observation of Gravitational Waves from Two Neutron Star-Black Hole Coalescences. Role: I led the collaboration review of the source property analyses, which provided the only means to determine that the source contained a black hole and neutron star. Review is a prestigious activity within the Collaboration that sets the reviewer as the expert member charged with ensuring that results are reproducible, accurate, and meet the gold standards of the field.	Abbott et al.	APJL	410
28	PyFstat: a Python package for continuous gravitational-wave data analysis	Keitel, Tenorio, **Ashton**, Prix	JOSS	15
27	Standard-siren Cosmology Using Gravitational Waves from Binary Black Holes	You, Zhu, **Ashton**, et al.	ApJ	30
26	Identification of a Local Sample of Gamma-Ray Bursts Consistent with a Magnetar Giant Flare Origin	Burns et al.	ApJL	28

[1] All citation metrics taken from NASA ADS on 27/02/23. Journal abbreviations are Astrophysical Journal (ApJ), Astrophysical Journal Letters (ApJL), Astrophysical Journal Supplement Series (ApJS), Classical and Quantum Gravity (CQG), Journal of Magnetism and Magnetic Materials (JMMM), Journal of Open Source Software (JOSS), Monthly Notices of the Royal Astronomical Society (MNRAS), Physics Review D (PRD), Physical Review Letters (PRL), and Publications of the Astronomical Society of Australia (PASA).

25	Interpreting the X-ray afterglows of gamma-ray bursts with radiative losses and millisecond magnetars	Sarin, Lasky, **Ashton**	MNRAS	11
24	Bayesian inference for compact binary coalescences with BILBY: validation and application to the first LIGO-Virgo gravitational-wave transient catalogue	Romero-Shaw, Talbot, Biscoveanu, D'Emilio, **Ashton**	MNRAS	178
23	Neutron Star Extreme Matter Observatory: A kilohertz-band gravitational-wave detector in the global network	Ackley et al.	PASA	94
22	Massively parallel Bayesian inference for transient gravitational-wave astronomy	Smith, **Ashton** et al.	MNRAS	97
21	The astrophysical odds of GW151216	**Ashton** et al.	MNRAS	10
20	Characterizing Astrophysical Binary Neutron Stars with Gravitational Waves	Zhu & **Ashton**	ApJL	7
19	Multiwaveform inference of gravitational waves	**Ashton** & Khan	PRD	21
18	Gravitational waves or deconfined quarks: What causes the premature collapse of neutron stars born in short gamma-ray bursts?	Sarin, Lasky, **Ashton**	PRD	33
17	GW190425: Observation of a Compact Binary Coalescence with Total Mass $\sim 3.4\ M_{\odot}$. Role: I led the analysis of the event source properties; this was critical to the interpretation of the data since the system mass puts it at odds with the observed galactic binary neutron star population. I was a member of the paper writing team, made crucial contributions to the astrophysical interpretation, and presented the results to the Collaboration.	Abbott et al.	ApJL	1010
16	Gravitational wave detection without boot straps: A Bayesian approach	**Ashton** et al.	PRD	14
15	Rotational evolution of the Vela pulsar during the 2016 glitch	**Ashton** et al.	Nature Astronomy	54
14	BILBY: A User-friendly Bayesian Inference Library for Gravitational-wave Astronomy	Lasky, Sarin, **Ashton**	ApJS	433
13	X-Ray Afterglows of Short Gamma-Ray Bursts: Magnetar or Fireball?	Sarin, Lasky, **Ashton**	ApJ	20
12	Faster search for long gravitational-wave transients: GPU implementation of the transient F-statistic	Keitel & **Ashton**	CQG	12
11	A semicoherent glitch-robust continuous-gravitational-wave search method	**Ashton**, Prix, Jones	PRD	12
10	X-ray guided gravitational-wave search for binary neutron star merger remnants	Sarin, Lasky, Sammut, **Ashton**	PRD	26
9	Coincident Detection Significance in Multimessenger Astronomy	**Ashton** et al.	ApJ	25
8	Hierarchical multistage MCMC follow-up of continuous gravitational wave candidates	**Ashton** & Prix	PRD	28
7	First low-frequency Einstein@Home all-sky search for continuous gravitational waves in Advanced LIGO data. Role: I significantly contributed to the data analysis, studying possible candidates and verifying they were not of astrophysical origin.	Abbott et al.	PRD	65
6	Statistical characterisation of pulsar glitches and their potential impact on searches for continuous gravitational waves	**Ashton**, Prix, Jones	PRD	44

5	Implications of the Occurrence of Glitches in Pulsar Free Precession Candidates	Jones, **Ashton**, Prix	PRL	10
4	On the free-precession candidate PSR B1828-11: Evidence for increasing deformation	**Ashton**, Jones, Prix	MNRAS	16
3	Proposal of a micromagnetic standard problem for ferromagnetic resonance simulations	Baker, Beg, **Ashton** et al.	JMMMM	31
2	Comparing models of the periodic variations in spin-down and beamwidth for PSR B1828-11	**Ashton**, Jones, Prix	MNRAS	13
1	Effect of timing noise on targeted and narrow-band coherent searches for continuous gravitational waves from pulsars	**Ashton**, Jones, Prix	PRD	19

Invited Presentations at International Workshops and Conferences

1. Key results from ground-based gravitational-wave detectors, Gravitational Wave Physics and Astronomy Workshop, Dec 2022. (Melbourne, Australia)
2. Inferring the properties of gravitational-wave signals using Bayesian Inference, 9th KAGRA International Workshop, Shanghai, China, Jun 2022. (Virtual)
3. Advances in Gravitational Wave Inference, Detection and Analysis of Gravitational Waves in the era of Multi-Messenger Astronomy, Casa Matematica Oaxaca, Mexico, Nov 2021. (Virtual)
4. Bystander Awareness Training (on behalf of the Equity and Diversity committee), OzGrav Annual Retreat, Melbourne, Australia, Nov 2019.
5. GW190425: A Binary Neutron-Star Coalescence observed by LIGO and Virgo, LIGO Scientific Virgo and KAGRA Collaboration meeting, Warsaw, Poland, Jul 2019.
6. Introduction to Bayesian Data Analysis, Masterclass in Relativistic Fluid Dynamics, University of Southampton, Southampton, UK.
7. Continuous Wave Parameter Estimation and Non-standard Signal Follow Up, INT-18-71W, Institute for Nuclear Theory, Seattle, US, Apr 2018.
8. Neutron Stars as Continuous Gravitational Wave Emitters, 11th Neutron Star workshop (Bonn, DE).
9. Continuous Gravitational Waves, Aspen Centre for Physics, Aspen, US, Jun 2017.

Invited Presentations at National Workshops and Seminars

1. Early career researcher perspective, SEPNet EDI workshop: Revisiting the leaky pipeline short term contracts and career planning, University of Sussex, UK, Dec 2021.
2. Flickering of the Vela pulsar, Nicolaus Copernicus Astronomical Centre, Warsaw, PO, Feb 2021.
3. The Deepening Mystery of the Vela Glitch, Bar-Ilan University, Bar-Ilan, Israel, Jan 2021.
4. Turning Wiggles into Science, Royal Holloway Department of Physics, London, UK, Nov 2020.
5. Transient Gravitational-Wave Astronomy, UCL Astrophysics, London, UK, Jul 2020.
6. Maximising the Science of GW observatories, Stockholm University, Stockholm, Sweden, Jun 2020.
7. Astrophysical Inference, Astrophysics Colloquium, University of Melbourne, Australia, Oct 2018.
8. Statistical Characterisation of Pulsar Glitches, Glasgow University, UK, Mar 2017.

Student Supervision

I have supervised one PhD candidate to completion, co-supervised two PhD candidates yet to complete, seven undergraduate projects, and acted as an external examiner on one PhD defence. The details are listed below with dates for the (expected) project completion or degree award.

	Student and Project	Role
Exp: 2025	Mattia Emma	Primary supervisor
Exp: 2024	Rowina Nathan: Shapelet analyses of radio pulsars	External supervisor
Exp: 2022	Zhi-Qiang You: Optimized localization for gravitational waves from merging binaries	Co-supervisor for study-abroad at Monash

May 2022	Dr Fergus Hayes: Advanced Techniques in Gravitational-Wave Signal Detection and Multimessenger Astronomy	External PhD examiner: University of Glasgow
Apr 2022	Rahmah Mackie: Model selection in gravitational-wave astronomy gravitational-wave astronomy.	BSc research project supervisor: RHUL
Oct 2021	Dr Nikhil Sarin: The observational consequences of neutron star post-merger remnants	PhD supervisor (50% for 4 years): Monash
Apr 2021	Thomas Saunders and Dharumvir Maharaj: Developing novel methods for gravitational-wave astrophysics.	BSc research project supervisor: RHUL
May 2020	Rowina Nathan: Analysing radio pulsar pulses using machine learning	Research project supervisor: Monash
Feb 2020	Kshipraa Athar: Optimising tools for gravitational-wave astronomy.	Summer research supervisor: Monash
May 2019	Tushar Nagar: Glitches in the Vela Pulsar: A Bayesian approach	Research project supervisor: Monash
May 2018	Chandana Anand: Magnetospheric switching in PSR B1828-11	Research project supervisor: Monash

Teaching

I have 4 years of teaching experience across Monash University and RHUL. Students at Royal Holloway rated their Overall Satisfaction with my teaching as 1.77 (1 being strongly agree and 5 being strongly disagree), while at Monash University, I achieved Student Evaluation of Teaching Units scores averaging 4.6/5.0.

Course Title	Institution	Role	Years taught
Analysing gravitational waves	RHUL	Developed and led module	2022
Advanced Skills	RHUL	Developed new group-project	2022
Physics of the Universe	RHUL	Delivered 4 weeks of content on Special Relativity, organised assessment and marking.	2022,2023
Mathematics 1	RHUL	Module leader: delivered 12 weeks of content and managed all assessment and marking	2020
Mathematics 2	RHUL	Module leader: delivered 12 weeks of content and managed all assessment and marking	2020
Classical Physics and Relativity	Monash	50% module leader: delivered 12 weeks of content in a flipped-classroom approach	2018-2020
Fields and Quantum Matter	Monash	50% module leader: delivered 12 weeks of content in a flipped-classroom approach	2018-2020

Leadership Roles

Tenure	Role
2021 -	Elected Co-chair of the LIGO Compact Binary Coalescence (CBC) group, which studies collisions between black holes and neutron stars. I coordinate ~ 200 international group members, plan the scientific direction, and direct research and development across all aspects of the data analysis.
2020-2021	Appointed Co-chair of the LIGO Parameter Estimation group comprising ~ 50 members responsible for the physical characterisation of every observed gravitational-wave signal. I coordinated the research and development of new data analysis approaches and the production of scientific results.
2020-	Scientific Advisor for GWCloud, a cloud-based platform to access gravitational wave astronomy data with an intuitive fully managed job system.
2019-2020	Co-chair of the LIGO Bilby development group comprising 30 members responsible for the development and deployment of Bilby, the next-generation Bayesian inference library adopted by the LIGO collaboration for the analysis of all CBC signals.
2019-2020	Member of the OzGrav Equity & Diversity Committee. I helped support the committee's efforts across the Centre, for Excellence to foster equity and diversity.
2018-2020	Co-chair of the OzGrav Inference program. This is one of seven research themes in OzGrav, the Australian Research Council's Centre of Excellence for Gravitational Wave Discovery. I coordinated