

FIONA H. PANTHER

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SUMMARY

- Interdisciplinary scientist with skills and experience in theoretical and observational astronomy, signals processing, Bayesian statistics and information theory
- Experienced scientific programmer, including writing simulation and real-time data analysis software with a large codebase (~50,000 lines)
- Led collaborative projects, including leading or co-leading multiple telescope observing campaigns
- Experience working in large collaborations, including the LIGO-Virgo Collaboration and the Dark Energy Survey
- Self-motivated, problem-solving and collaborative scientist with excellent communication skills

TECHNICAL SKILLS

- **Transient detection:** Optical transient detection, gravitational wave detection (including pre- and post-merger neutron star signals)
- **Astrophysics:** Origin and evolution of high-energy transients, kilonovae and neutron star post-merger remnants
- **Gamma-ray astronomy:** MeV gamma-rays (theory & observation)
- **Particle astrophysics:** cosmic ray propagation & production
- **Statistics:** Bayesian statistics, information theory, machine learning, signals processing
- **Computing:** UNIX/Windows OS, bash scripting, version control (inc. Git), HPC/HTC (slurm, condor), GPU acceleration, networking and system administration, robotics and automation
- **Programming languages and frameworks:** FORTRAN, C/C++, CUDA, Python. GStreamer, TensorFlow, PyTorch, Keras.

EDUCATION

- PhD, Astrophysics, Research School of Astronomy and Astrophysics, Australian National University, conferred 12/12/2019
- BSc(Hons) 1st Class, Physics & Mathematics, The University of Auckland, May 2015

CAREER OVERVIEW

University of Western Australia/OzGrav

Perth, AU

Research Associate

April 2020 to present

- Research focussed on the detection of binary neutron star mergers, and associated electromagnetic emission from kilonovae
- Assistant systems manager at Zadko Observatory, responsible for operation of robotic telescope systems for Australian scientists and international commercial partners
- Reviewer in the LIGO Scientific Collaboration compact binary coalescence working group
- Responsible for the online running of the SPIIR real-time gravitational wave detection pipeline and associated development and LIGO Scientific Collaboration review of codebase (until Oct 2021)
- Preparing the SPIIR pipeline for online and offline operation ahead of LIGO's 4th observing run (until Oct 2021)
- Supervision of students completing projects at the intersection of gravitational wave detection and astrophysics

UNSW Canberra at ADFA

Canberra, AU

Associate Lecturer (pre-PhD conferral until Dec 2019)

February 2019 - February 2020

- Published work investigating a novel method of probing nucleosynthesis in supernovae using gamma-ray line measurements
- Responsible for the delivery of laboratory and tutorial classes for first year physics classes to cadets and civilian students
- Selected to attend the 69th Lindau Nobel Laureate Meeting as an Australian Academy of Science Science Industry and Research Fund (SIEF) fellow
- Organized a public outreach event to promote the space and astronomy and astrophysics programs at UNSW Canberra

Australian National University

Canberra, AU

PhD Student

July 2015 - January 2019

- Developed and led observational program to observe the host galaxies of supernovae, including 14 nights of observing, all data collection and processing of data. Discovered the oldest known supernova progenitors.
- Developed a novel post-processing program to study the microphysical interactions of positrons in plasmas, and used it to determine that antimatter in our galaxy cannot originate from the supermassive black hole at the Galactic center
- Involved in observation and analysis of observations for the Australian Dark Energy Survey (OzDES, making spectroscopic measurements associated with transients found by the Dark energy Survey), and the SkyMapper transient search.

- Research assistant role with Te Punaha Matatini Center for Research Excellence in Complex Systems studying the collaboration networks and the role of the Group of Eight universities in driving collaboration in Australasia
- BSc honours dissertation supervised by Prof. Richard Easther: simulating the orbits of stars around the Galaxy's central super-massive black hole, including the effects of General Relativity in a numerical simulation to investigate star-star gravitational interactions
- Undergraduate reading project in mathematics with Prof. Bernhard Krauskopf on chaos in optically injected semiconductor lasers
- Awarded best student performance in undergraduate laboratory classes
- Founded the Faculty of Science student association, and acted as first secretary, and founded and served as first president of the Physics Students Association.

Career interruption

My PhD was conferred on 12/12/2019. From the end of my contract at UNSW Canberra (14/02/2020) to 06/04/2020 I experienced a career interruption due to serious illness.

OBSERVING TIME AWARDED

2022C	<i>Same Same or Different: Host galaxies of the brightest and faintest SNe Ia (PI Panther)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 4 full classical nights
2020, 2021	<i>Exploring the Solar System with INTEGRAL (PI Siegert)</i> International Gamma Ray Astrophysical Laboratory Spectrometer on-board INTEGRAL – 1.123Ms awarded
2020, 2021	<i>Positron Annihilation in Globular Clusters (PI Siegert)</i> International Gamma Ray Astrophysical Laboratory Spectrometer on-board INTEGRAL – 1Ms awarded
2019	<i>2.2 MeV emission from a highly magnetized white dwarf (PI Pleintinger)</i> International Gamma Ray Astrophysical Laboratory Spectrometer on-board INTEGRAL – 1.5Ms awarded
2019 - 2021	<i>R-process elements from neutron star mergers (PI Siegert) (reawarded in 2019 and 2020)</i> International Gamma Ray Astrophysical Laboratory Spectrometer on-board INTEGRAL – ToO program
2018	<i>TIMELESS: The INTEGRAL Medium-Latitude Extended Sky Survey (PI Bodaghee)</i> International Gamma Ray Astrophysical Laboratory Spectrometer on-board INTEGRAL – extended legacy program
2017A	<i>Mass loss in close binaries: Unveiling the dynamics of the common envelope phase (PI Ruiter)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 5 full classical nights
2017A	<i>Host Galaxies of SN1991bg-like supernovae: Hunting down a source of Galactic antimatter (PI Panther)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 2 full classical nights
2016D	<i>Host Galaxies of SN1991bg-like supernovae: Hunting down a source of Galactic antimatter (PI Panther)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 2 full classical nights
2016C	<i>Host Galaxies of SN1991bg-like supernovae: Hunting down a source of Galactic antimatter (PI Panther)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 4 full classical nights
2016C	<i>Determining the dust masses in two young core-collapse supernova remnants (PI Seitzzahl)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 4 full classical nights
2016B	<i>Host Galaxies of SN1991bg-like supernovae: Hunting down a source of Galactic antimatter (PI Panther)</i> – ANU 2.3m Advanced Technology Telescope WiFeS – 6 full classical nights
2016A	<i>Dark Matter, Positrons, and the Galactic Bulge Binary Fraction (PI Crocker)</i> – AAO Anglo-Australian 4m Telescope AAOmega/2dF (fiber-fed multi-object spectrograph) – 6 full classical nights

SELECTED INVITED TALKS AND SEMINARS

July 2021 – Australian National University Research School of Astronomy and Astrophysics colloquium, virtual/Canberra, Australia
 March 2021 – Monash University Astrophysics colloquium, virtual/Melbourne, Australia
 September 2019 – Auckland University physics colloquium, Auckland, New Zealand
 July 2019 – POSMOL 2019: Low energy positron physics, Belgrade, Serbia
 April 2019 – CTA-Oz consortium meeting (fully funded), Sydney, Australia
 February 2019 – 12th INTEGRAL Conference, 2019 (fully funded), Geneva, Switzerland
 September 2018 – Macquarie University astronomy colloquium, Macquarie University, Sydney, Australia
 July 2018 – GRAPPA weekly colloquium, GRAPPA, University of Amsterdam, The Netherlands
 July 2018 – Universe Excellence Cluster 'Special Universe' Colloquium (as Excellence Cluster visiting research fellow), Max Planck Institute for Extraterrestrial Physics (MPE), Garching, Germany
 June 2018 – RSAA Colloquium, Australian National University, Canberra, Australia
 February 2018 – Colloquium at ICRAR-University of Western Australia, Perth, Australia
 October 2017 – Three Elephants in the Gamma Ray Sky: Loop I, The Fermi Bubbles and the Galactic Center Excess, Garmisch-Partenkirchen, Germany (fully-funded)
 July 2017 – Colloquium at Heidelberg Institute for Theoretical Studies (HITS), Heidelberg, Germany
 June 2017 – Colloquium at GRAPPA, University of Amsterdam, The Netherlands
 September 2016 – Colloquium at Max Planck Institute for Nuclear Physics (MPIK), Heidelberg, Germany
 September 2016 – Colloquium at Max Planck Institute for Extraterrestrial Physics (MPE), Garching, Germany
 August 2016 – Colloquium, ANU Research School of Physics and Engineering Plasma Physics seminar series
 Note this list does not include contributed talks. A full list, including selected talk slides can be found at antimatter.space/talks

STUDENT SUPERVISION

Masters/HDR Students

- 2021 Alistair McLeod (MSc, Co-supervised with Prof. Linqing Wen)
Deep learning for rapid parameter estimation and detection of gravitational wave signals
- 2021 Manoj Kovalam (PhD, Co-supervised with Prof. Linqing Wen)
Early warning detections of binary neutron star mergers
- 2020 - 2021 Alexandra Moroianu (MSc, Co-supervised with Prof. Linqing Wen)
A coincidence search for gravitational waves and fast radio bursts
- 2020 - 2021 Ben Burridge (MSc, Co-supervised with Prof. Linqing Wen)
Localizing and detecting gravitational waves (now in full-time role with KPMG)

Undergraduate Research/Honours Students

- 2021 Jamie McGregor (OzGrav summer research programme)
Simulations of positron annihilation in astrophysical environments (now completing Hons degree in Math at UWA)
- 2021 Jordan Moncrieff (OzGrav summer research programme)
Positron annihilation in kilonovae (Now completing BSc in physics at UWA)
- 2020 Jamie Miller (Honours, co-supervised with Prof. Linqing Wen)
Measuring the Directional Distribution of Gravitational Wave Sources: A Bayesian Method (Graduated with High Distinction, employed in data scientist role in industry)
- 2016 Ella Xi Wang (Undergraduate Research, co-supervised with Assoc. Prof. Roland Crocker, now completing PhD at ANU)
Escape of positrons from SiC dust grains

Selected Mentoring

- 2022 UWA ASTR2002/3002 project mentor
Mentor for student Thomas Italiano completing a project on nucleosynthesis in binary neutron star mergers
- 2020- OzGrav mentoring program
Mentor for PhD students and peer mentor for postdocs through the OzGrav mentoring program
- 2020 ATHENA by WiSTEM Camp Talaria
A remote mentored research program run by ATHENA throughout the month of July.
Arizona-based high-school student Lauren Aoyama completed a research project measuring distances to Cepheid variables observed by AS-ASN
- 2019 UNSW Canberra School of Science Women in STEM mentor
Mentor for PhD students in UNSW Canberra's School of Science
- 2018-2019 ACT Science Scholars mentor
Mentor for high school students undertaking an observational astronomy project using the MSATT outreach telescope

I have mentored several Masters and PhD students in an unofficial capacity, and have given a number of presentations on pursuing a career in STEM to both school and university students. I am particularly interested in supporting those in underrepresented minorities or who are not following a traditional path through university to access opportunities and careers in STEM.

Selected Teaching

- May 2021: *PHYS4020: Astronomical Instrumentation, University of Western Australia*
– Guest lecture on x-ray and gamma-ray astronomical instrumentation, and gamma-ray astronomy for Masters students
- March 2021: *SCIE1121: Our Universe, University of Western Australia*
– Delivering 4x lectures on light, telescopes and the evolution of stars for introductory astronomy course.
– design of associated exam questions
– supervision of 2x observatory field trips to Gravity Discovery Center, Gingin
- Feb– Nov 2019: *ZPEM1501: Physics IA/IB, UNSW Canberra at ADFA*
– Delivering 2x2hr labs and delivery and development of 2x1hr tutorials per week as part of introductory physics for first-year undergraduates (Officer Cadets and civilians) at ADFA
- Feb – June 2018: *ASTR1001: Introductory Astronomy, Australian National University*
– Responding daily to student questions and comments in online forums of the course both as a MOOC available worldwide, and for students enrolled at the Australian National University
- Aug – Nov 2016 - 2018: *ASTR3002/6002: Black Holes and Cosmology, Australian National University* (undergraduate and masters combined)
– Organization, planning and delivery of 1x weekly lecture-tutorial on to facilitate student understanding of mathematics of General Relativity
– Design of four assignments together with course lecturer Dr. Roland Crocker, and marking of assignments for up to 40 students
- Mar – Jul 2016: *PHYS1001: Introduction to Physics 1, Australian National University*
– Organization, planning and delivery of weekly tutorials to complement course material on introductory undergraduate physics
– Marking of two assignments for 60 students.
- Mar – Jul 2015: *PHYSICS211: Mathematics and Computation for Physics, The University of Auckland*
– Organization, planning and delivery of weekly Python-based tutorials to complement course material on introductory undergraduate physics
– Marking of 6 computer laboratory experiments for 30 students
- Aug – Nov 2014: *PHYSICS150: Introduction to Physics 2, The University of Auckland*
– Organization, planning and delivery of weekly laboratory sessions to complement course material on introductory undergraduate physics
- Mar – Jul 2014/2015: *PHYSICS390/PHYSICS391: Experimental Physics 1 & 2, The University of Auckland*
– Supervision of senior undergraduate students undertaking independent laboratory work with specialization in nuclear physics, laser physics and atomic physics.

During my undergraduate degree I worked as a tutor and lab demonstrator for a large number of physics courses at the University of Auckland, and also as a tutor in the Tuakana program, which provided academic and pastoral support to Maori and Pasifika students undertaking degrees at the University of Auckland.

PROFESSIONAL MEMBERSHIP AND SERVICE

- 2021 – current - Member of the Zadko Observatory team
- 2021 – current - reviewer, Compact Binary Coalescences working group, LIGO Scientific Collaboration
- 2021 - SPIIR pipeline lead
- 2021 - Low Latency/All-Sky gravitational wave detection working group liason, LIGO Scientific Collaboration
- 2021 – current - OzGrav Data Analysis program chair
- 2021 - SOC chair OzGrav Rapid Transients and EM followup workshop
- 2021 – current - Australian National Institute for Theoretical Astronomy (ANITA) steering committee member (2022 secretary)
- 2021 – current - OzGrav Media Advisory Group ECR representative
- 2021 – current - Observing time allocation committee Member, *INTEGRAL* panel #3 (Nucleosynthesis) for AO 19 and AO 20
- 2020 – current - ODC liason, Gravitational Wave Data Center Science Advisory Committee
- 2020 – current - GWDC liason, Australian Optical Data Center Science Advisory Committee
- 2020 – current - member of the ARC Center of Excellence for Gravitational Wave Discovery (OzGrav)
- 2019 - SOC member, 2020 ANITA theory workshop
- 2019 - Mentor, UNSW Canberra Women in STEM mentoring program
- 2019 - Member, CTA-Oz consortium
- 2018 – 2019 - Mentor, MSATT/Science Scholars ACT high school science research program
- 2018 – 2019 - Group meeting co-ordinator, RSAA high-energy astrophysics group
- 2017 – 2018 - Student representative, RSAA 2.3m Telescope Time Allocation Committee
- 2017 – 2018 - Student representative, RSAA Computing Committee
- 2018 - RSAA journal club (AstroCoffee) organizer
- 2017 – 2018 - RSAA Colloquium Committee member
- 2017 - SOC Chair, ASA Harley Wood Winter School 2017
- 2016 - Joint LOC/SOC member, 2016 Mt Stromlo Student Seminars
- 2016 - LOC member, IAU Symposium 322: The Multi-Messenger Astrophysics of the Galactic Center
- 2016 – 2018 - Member of the SkyMapper Telescope team

2017 - ANU representative on the CAASTRO student committee
2015 – 2018 - Member of CAASTRO (ARC Center for Excellence in All Sky Astrophysics)
2015 – 2019 - Member of The Dark Energy Survey
2015 – 2019 - Member of OzDES
2015 – 2019 - Member of the Mt Stromlo Observatory Outreach team
2015 - Member of Te Punaha Matatini Center for Research Excellence in Complex Systems

POPULAR SCIENCE WRITING

Ongoing: Blog at auntiematter.space
– Blog posts and opinion on astronomy and academia
October 2020: Article series on academic job hunting at SpaceAustralia.com
– Series of articles providing advice for PhD students searching for academic jobs
August 2018: Popular science article in ANU's Woroni student newspaper
– Short invited publication on antimatter on Earth and in the Milky Way - 'What your fruit bowl and the Galaxy have in common' - for general audiences

SELECTED PUBLIC OUTREACH

May 2022: Pint of Science Perth
– volunteer and speaker for Perth Pint of Science AU event at The Brisbane Hotel
March - April 2022: Mature Adults Learning Association Perth Lectures
– 5 invited guest lectures on 'How we know: making discoveries in modern physics'
July 2022: ABC Breakfast and ABC Radio National
Interviewed on ABC Breakfast and ABC Radio National about the discovery of the first binary black hole - neutron star mergers discovered by LIGO
April 2021: Astrophiz Podcast
– Podcast episode on my work in gravitational wave detection with popular Australian astronomy podcast Astrophiz
April 2021: Mug of Science & Pint of Science Perth
– Filmed 'Mug of Science' episode with Dr. Tom Carruthers. Presenter for Perth Pint of Science.
September 2020: New Scientist Live: The Biggest Questions in Physics
– 'Expert Guide' for the online course The Biggest Questions in Physics.
September 2019: New Scientist Live: The Biggest Questions in Physics
– Invited speaker at New Scientist Live: Sydney on the topic 'cosmic antimatter'.
May 2019: Pint of Science Canberra
– Presented public talk on radioactivity and the production of the elements in space
April 2019: FameLab Australia NSW Finals
– One of 10 finalists invited to a science communication workshop day at the PowerHouse Museum, Sydney, and presentation of a 3-minute talk on 'What your fruit bowl and the Galaxy have in common'
September 2017: Cassini End of Mission, Canberra Deep Space Network
– Selected to join Deep Space Network, NASA staff, and 29 other Australian and NZ science social media influencers to report on the end of Cassini's mission from an Australian perspective
March 2017: BBC Stargazing Live
– Member of the SkyMapper science team involved in the television production BBC Stargazing Live.
– Backend software developer for the Zooniverse project planetninesearch.org
February 2017: Curator of the @astrotweeps Twitter account
– One week as curator of popular astronomy outreach Twitter account @astrotweeps
Aug 2016 - Jan 2019: Regular speaker at ACT Physics in the Pub
– Presentation of short public talks about my own research and more general physics at a number of events organized around Canberra by Dr. Phil Dooley.
April 2016: CAASTRO Astronomer in Residence, Uluru
– Two weeks as CAASTRO's Astronomer in Residence at Voyages Ayers Rock Resort
– Ran daily astronomy information sessions for the general public in the resort Town Square, sharing CAASTRO resources and information resources and games I developed myself.
– Supported the resort's resident astronomers in nightly Star Tours, answering questions and pointing out objects of interest in the night sky
2015 – 2019: Public outreach volunteer at the Research School of Astronomy and Astrophysics
– Several times per month, two-hour sessions explaining astrophysics concepts to students and teachers
– Stargazing with students and staff
– Guiding visitors around the Observatory facilities
– Assisting during university and observatory open days and public astronomy nights

An exhaustive list of outreach activities is available on my website, auntiematter.space