

# Marcus Edward Lower

## Curriculum Vitæ

Centre for Astrophysics & Supercomputing  
Swinburne University of Technology  
Hawthorn, Victoria, 3122, Australia  
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Citizenship: AUS & CAN

### PhD Candidature

**Swinburne University of Technology & CSIRO Astronomy and Space Science.**

Research title: Application of Astrophysical Inference to Next Generation Pulsar Timing Datasets

Supervisors: Prof. Matthew Bailes, Dr. Ryan M. Shannon and Dr. Simon Johnston

### Education

2018–present **PhD candidate, Astrophysics**, *Swinburne University of Technology & CSIRO Astronomy and Space Science.*

Supervised by Prof. Matthew Bailes, Dr. Ryan M. Shannon and Dr. Simon Johnston.

2017–2018 **BSc with Honours (1st class)**, *Monash University.*

Major: Astrophysics

Thesis title: Detecting Eccentricity in the Orbits of Merging Binary Black Holes.

Supervisors: Dr. Eric Thrane, Dr. Paul D. Lasky and Dr. Rory Smith.

2014–2017 **BSc**, *Monash University.*

Major: Applied Mathematics & Astrophysics.

### Research Interests

Black holes, pulsars, magnetars, gravitational waves, tests of general relativity, cosmology.

### Skills

**Languages** **Experienced:** Python, MATLAB, Bash, C shell. **Familiar:** Fortran90, C, C++.

**Code** Contributor to the development of [Bilby](#), a Bayesian inference library for Python.

**Technical**

- Familiar with astronomical image processing and calibration through open source software (e.g. ds9, PyRAF).
- Has experience with using Slurm, Condor/HTCondor and MPI4Py to parallelise large and computationally intensive jobs on computer clusters.
- Trained to observe with the Molonglo radio telescope and the 64 meter dish at Parkes.

**Modelling**

- Created a model for the merger/event rate of primordial black hole binaries as a function of redshift for various dark matter halo mass functions.

**Development**

- Modified and improved a parameter estimation code for recovering the component parameters of eccentric binary compact object inspirals.
- Implemented both Frequentist and Bayesian statistical analysis methods for distinguishing the effect orbital eccentricity has on gravitational-wave signals.

### Work Experience & Volunteering

#### Academic

2018 **Research Internship**, *Centre for Astrophysics & Supercomputing, Swinburne University of Technology.*

- Vetting pulsars for the UTMOST timing program.
- Developing diagnostic tools for tracking telescope observation efficiency.
- Follow up parameter estimation on detected glitches.

## Volunteering

- 2014–2018 **Student Volunteer**, *School of Physics & Astronomy, Monash University*.
- Open Day 2014: conducted first year physics lab demonstration.
  - Guinness World Record for the Most People Stargazing across Multiple Sites (2015 attempt): ran guided telescope tours of bright objects in the night sky and assisted in counting participants.
  - Open Day 2017: assisted in running outreach/public engagement activities.
  - Guinness World Record for the Most People Stargazing across Multiple Sites (2018 attempt): assisted in running the contribution at Monash University Clayton Campus.
- 2015–2016 **Orientation & Open Day Volunteer**, *Monash Residential Services*.
- Organized and ran activities during 2015 and 2016 residential orientation weeks.
  - Open Day 2015: ran guided tours of on campus accommodation.

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## Teaching Experience

- 2017–2018 **Teaching Associate**, *School of Physics & Astronomy, Monash University*.  
Assisted in running workshops for the following subjects:  
Earth to cosmos (ASP1010) and Life in the Universe (ASP1022).

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## Academic Achievements

- 2017 **ASP4100: Astrophysics Honours Research Project**.  
Received a final grade of 87/100 for my honours thesis.
- 2016 **PHS3350: Physics/Astronomy Undergraduate Research Project**.  
Received a final grade of 93/100 for my 3rd-year undergraduate project titled ‘Can GW150914 reveal anything about dark matter?’. Supervised by Dr. Eric Thrane and Dr. Letizia Sammut.

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## Publications

Selection of published works for which I took a leading role or made significant contributions to.

E. Gotthelf, J. P. Halpern, J. A. J. Alford, et. al. *The 2018 X-ray and Radio Outburst of Magnetar XTE J1810–197*, [Astrophys. J. Lett. \*\*874\*\* L25](#) (2019)

S. Dai, **M. E. Lower**, M. Bailes, et. al. *Wideband polarized radio emission from the newly revived radio magnetar XTE J1810–197*, [Astrophys. J. Lett. \*\*874\*\* L14](#) (2019)

G. Ashton, M. Hübner, P. Lasky, et. al. *Bilby: A user-friendly Bayesian inference library for gravitational-wave astronomy*, [Astrophys. J. Supp. \*\*241\*\* 27](#) (2019)

V. Gupta, M. Bailes, A. Jameson, et al., *Detection of FRB190322 at the Molonglo Radio Telescope*, [ATel #12335](#) (2018).

W. Farah, M. Bailes, A. Jameson, et al., *Detection of FRB181228 at the Molonglo Radio Telescope*, [ATel #12335](#) (2018).

**M. E. Lower**, M. Bailes, A. Jameson, et al., *Detection of low-frequency radio emission from the magnetar XTE J1810–197*, [ATel #12288](#) (2018).

**M. E. Lower**, E. Thrane, P. D. Lasky and R. Smith, *Measuring eccentricity in binary black hole inspirals with gravitational waves*, [Phys. Rev. D \*\*98\*\*, 083028](#) (2018).

W. Farah, M. Bailes, A. Jameson, et al., *Two new FRBs discovered by UTMOST*, [ATel #12124](#) (2018).

**M. E. Lower**, C. Flynn, M. Bailes, et al., *Detection of a glitch in the pulsar J1709–4429*, [Res. Notes AAS \*\*2\*\* 139](#) (2018).

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## Talks

- 2019 “Measuring rotational instabilities in pulsars with the Molonglo telescope”, ANITA 2019 workshop, Swinburne University of Technology, Melbourne, VIC, Australia.

2018 “Distinguishing eccentricity in binary black hole mergers with aLIGO”, ANITA 2018 workshop, ICRAR Curtin University, Perth, WA, Australia.

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## Memberships & Affiliations

- 2018–present **MeerTime Project.**  
Swinburne University of Technology
- 2018–present **UTMOST Collaboration.**  
Swinburne University of Technology
- 2018–present **ARC Centre of Excellence for Gravitational-Wave Discovery (OzGrav).**  
Research affiliate, Swinburne University of Technology.
- 2017–present **Australian National Institute for Theoretical Astrophysics (ANITA).**  
Student member.
- 2017–present **Astronomical Society of Australia (ASA).**  
Student member.
- 2016–present **LIGO Scientific Collaboration.**  
Formerly Monash University, currently OzGrav: Swinburne University of Technology