Ronaldas Macas

Ronaldas.Macas@port.ac.uk

EDUCATION

Cardiff University, Cardiff, Wales, UK

PhD., Gravitational Physics, 2016-2020

- Thesis title: "Detection, Reconstruction and Interpretation of Gravitational-Wave Bursts"

University of Glasgow, Glasgow, Scotland, UK

MSci., Physics and Astronomy, 2010-2016

- First class degree
- Thesis title: "Investigating an Alternative to Dark Matter: Timescape Cosmology"

PROFESSIONAL EXPERIENCE

University of Portsmouth, Portsmouth, UK

Gravitational-Wave Detector Characterization 2020+

- Estimating the impact of non-Gaussian noise on low latency sky localization
- Automating data quality reports for LIGO-Virgo-KAGRA Observing run 4
- Event validation for LIGO-Virgo Observing run 3
- Data quality shifts for LIGO-Virgo Observing run 3

Cardiff University, Cardiff, UK

Search for Gravitational-Wave Signals Associated with Gamma-ray Bursts 2016-2021

- Lead person for LIGO-Virgo Observing runs 2 and 3a offline gravitational-wave burst search
- Analysed gamma-ray burst triggers during LIGO-Virgo Observing runs 2 and 3
- Member of collaboration paper writing teams for Observing runs 2 (LVC, ApJ, 886 (2019)) and 3a (LVC, ApJ, 915 (2021))

Gravitational-Wave Burst Signal Interpretation 2016-2021

- Developed an algorithm to interpret an unknown gravitational-wave signal using reconstructed waveform
- Tested the method with multiple toy models and astrophysical sources such as GW150914
- Derived theoretical basis for Bayesian parameter estimation with the algorithm

Bayesian Inference Analysis of Unmodelled Gravitational-Wave Transients 2014-2019

- Investigated BayesWave performance in three key areas: sky localization accuracy, signal/noise discrimination, and waveform reconstruction
- Produced a code to perform binary black hole signal injections in LIGO/Virgo data used for the study
- Pannarale, Macas & Sutton, CQG, 36 (2019)

University of Glasgow, Glasgow, UK

Galaxy Catalogue for Multi-Messenger Search with Advanced LIGO and Virgo 2014-2018

- Developed an algorithm to combine multiple galaxy catalogues
- The final GLADE catalogue was used for multiple studies to estimate Hubble constant H_0
- Dalya et al., MNRAS, 479 (2018)

LIGO Hanford Observatory, Hanford, WA, USA
LIGO Fellowship on Live Noise Budget at Hanford Observatory 2018 March-July

- Improved the noise budget software used for detector characterization at Hanford
- Updated and added multiple noise sources (link to aLOG)
- Tse et al., PRL, 123 (2019)

Albert Einstein Institute, Hannover, Germany
Search Parameters for Continuous Gravitational-wave algorithm StackSlide 2015 June - August

- Created a tool to estimate cost-effective search parameters for continous gravitational-waves
- Investigated non-linear relation of SNR loss vs metric mismatch
- Presented at LIGO-Virgo Budapest meeting by Dr. Reinhard Prix (DCC link)

INVITED RESEARCH VISITS

June 2018: Penn State University, University Park, PA, USA

February 2020: University of Glasgow, Glasgow, UK

SCIENTIFIC TALKS AND PRESENTATIONS

July 2021: Amaldi 14 (online)
"Do glitches in gravitational-wave data affect our ability to estimate the correct sky localization?"

July 2021: National Astronomy Meeting (online)
"Do glitches in gravitational-wave data affect our ability to estimate the correct sky localization?"

June 2021: GrEAT Online seminar
"Do glitches in gravitational-wave data affect our ability to estimate the correct sky localization?"

July 2019: Amaldi 13/GR 22, Valencia, Spain
"Search for gravitational waves associated with gamma-ray bursts during the second Advanced LIGO-Virgo observing run"

July 2019: Amaldi 13/GR 22, Valencia, Spain
"Unmodeled source reconstruction with gravitational waves"

July 2019: National Astronomy Meeting, Lancaster, UK
"Search for gravitational waves associated with gamma-ray bursts during the second Advanced LIGO-Virgo observing run"

June 2018: Invited seminar talk at the Institute for Gravitation and the Cosmos, Penn State University, PA, USA
"Gravitational-wave bursts: searching for the Unknown"

May 2018: LIGO Washington Meeting, Hanford, WA, USA
"Live noise budget"

July 2017: National Astronomy Meeting, Hull, UK
"Gravitational-wave search using gamma-ray bursts with Advanced LIGO"

GRANTS AND FUNDING

May 2017: Long Term Attachment Grant for LIGO Fellows Program, STFC. Support for 4-month research visit to LIGO Hanford observatory. £4,851

March 2018: Support to attend INT-JINA Symposium "First Multi-messenger Observations of a Neutron Star Merger and its Implications for Nuclear Physics", RAS, £700

September 2017: Support to attend LIGO-Virgo meeting in Geneva, Switzerland, IoP, £150

TECHNICAL SKILLS

Computer Programming: Python, Matlab, Bash Shell Scripting, LINUX, git
Computer Applications: LaTeX, vi

TEACHING EXPERIENCE

2021: MSc. student project supervision
2019: PX3143 Computational Physics – demonstrating
2018: PX4128 Data Analysis – marking
2017: PX4128 Data Analysis – demonstrating and marking
2017: PX3241 Particle Physics and Special Relativity – marking
2016: PX4128 Data Analysis – demonstrating and marking

PUBLIC OUTREACH

GW170817-GRB 170817A announcement:

- News article for STEM public outreach website (link, only in Lithuanian)
- Radio interview (link, only in Lithuanian)

VOLUNTEERING

Referee for Classical and Quantum Gravity

Cardiff University Men's Basketball Club President 2018-2019

- Grant application
- Organise weekly basketball sessions
- Arrange table officials and referees for University league games

SELECTED PUBLICATIONS

I have authored or co-authored 60+ papers in total, h-index = 41. As a member of LIGO, I am a co-author on the major discovery papers released since 2017. I highlight here 6 papers to which I have directly contributed.

1. B. P. Abbott et al. Search for Gravitational Waves Associated with Gamma-Ray Bursts Detected by Fermi and Swift during the LIGO–Virgo Run O3a. 2021. *Astrophysics J*, 915(2):87, Jul 2021
   Produced Figures 2 and 4, Tables 1 and 2. Wrote Unmodelled Search Results and part of Discussion.
2. B. P. Abbott et al. Search for Gravitational-wave Signals Associated with Gamma-ray Bursts During the Second Observing Run of Advanced LIGO and Advanced Virgo. 2019. *Astrophysics J*, 886(1):75, Nov 2019
   Produced Figures 4 and 5, Tables 1 and 2. Wrote Unmodelled Search Results, Discussion and a part of Conclusions sections.
3. F. Pannarale, **R. Macas**, and P. J. Sutton. Bayesian Inference Analysis of Unmodelled Gravitational-wave Transients. *Classical and Quantum Gravity*, 36(3):035011, Feb 2019
   Produced a code to perform binary black hole signal injections in LIGO/Virgo data used for the study. Estimated the mismatch between injected and reconstructed waveforms. Wrote the abstract, part of Procedure and Results, and Summary and Conclusions sections.
4. G. Dalya, G. Galgczi, L. Dobos, Z. Frei, I. S. Heng, **R. Macas**, C. Messenger, P. Raffai, and R. S. deSouza. GLADE: A galaxy catalogue for multimessenger searches in the advanced gravitational-wave detector era. *Monthly Notices of the Royal Astronomical Society*, 479(2):2374–2381, Jun 2018.
   Developed an algorithm to combine multiple galaxy catalogues. Wrote a part of Catalogue Compilation and Statistics section.
5. B. P. Abbott et al. Gravitational Waves and Gamma-rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A. *Astrophys. J.*, 848(2):L13, 2017.
   Performed unmodelled gravitational waves search with X-pipeline for GW170817.
6. M. Tse et al. The quantum-enhanced Advanced LIGO detectors in the era of gravitational-wave astronomy. *Physical Review Letters*, 123(23):8, Dec 2019
   Improved noise detection software and included additional noise sources which led to a better understanding of the detector before and throughout the LIGO Observing run 3.

OTHER PUBLICATIONS

[1] B.P. Abbott et al. Search for Gravitational Waves from a Long-lived Remnant of the Binary Neutron Star Merger GW170817. *The Astrophysical Journal*, 875(2):160, Apr 2019.

[2] A. Brooks et al. Point absorbers in Advanced LIGO. *Applied Optics*, 60(13):4047, Apr 2021.

[3] A. Buikema et al. Sensitivity and Performance of the Advanced LIGO Detectors in the Third Observing Run. *Phys. Rev. D*, 102:062003, Sep 2020.

[4] B. P. Abbott et al. Search for Intermediate Mass Black Bole Binaries in the First and Second Observing Runs of the Advanced LIGO and Virgo Network. *Phys. Rev.*, D100(6):064064, 2019.

[5] B. P. Abbott et al. Search for the Isotropic Stochastic Background Using Data from Advanced LIGO's Second Observing Run. *Phys. Rev.*, D100(6):061101, 2019.

[6] Abbott et al. Directional Limits on Persistent Gravitational Waves using Data from Advanced LIGOs First Two Observing Runs. *Phys. Rev. D*, 100:062001, Sep 2019.

[7] B. P. Abbott et al. . GW170817: Implications for the Stochastic Gravitational-Wave Background from Compact Binary Coalescences. *Phys. Rev. Lett.*, 120:091101, Feb 2018.

[8] B. P. Abbott et al. Estimating the Contribution of Dynamical Ejecta in the Kilonova Associated with GW170817. *The Astrophysical Journal*, 850(2):L39, Dec 2017.

[9] B. P. Abbott et al. First Narrow-band Search for Continuous Gravitational Waves from Known Pulsars in Advanced Detector Data. *Phys. Rev. D*, 96:122006, Dec 2017.

[10] B. P. Abbott et al. GW170608: Observation of a 19 Solar-mass Binary Black Hole Coalescence. *The Astrophysical Journal*, 851(2):L35, Dec 2017.

[11] B. P. Abbott et al. GW170814: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence. *Phys. Rev. Lett.*, 119:141101, Oct 2017.

[12] B. P. Abbott et al. GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral. *Phys. Rev. Lett.*, 119:161101, Oct 2017.

[13] B. P. Abbott et al. Multi-messenger Observations of a Binary Neutron Star Merger. *The Astrophysical Journal*, 848(2):L12, Oct 2017.

[14] B. P. Abbott et al. On the Progenitor of Binary Neutron Star Merger GW170817. *The Astrophysical Journal*, 850(2):L40, Dec 2017.

[15] B. P. Abbott et al. Search for High-energy Neutrinos from Binary Neutron Star Merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory. *The Astrophysical Journal*, 850(2):L35, Nov 2017.

[16] B. P. Abbott et al. Search for Post-merger Gravitational Waves from the Remnant of the Binary Neutron Star Merger GW170817. *The Astrophysical Journal*, 851(1):L16, Dec 2017.

[17] B. P. Abbott et al. Search for Subsolar-Mass Ultracompact Binaries in Advanced LIGO's First Observing Run. *Phys. Rev. Lett.*, 121:231103, Dec 2018.

[18] B. P. Abbott et al. Search for Tensor, Vector, and Scalar Polarizations in the Stochastic Gravitational-Wave Background. *Phys. Rev. Lett.*, 120:201102, May 2018.

[19] B. P. Abbott et al. A Fermi Gamma-Ray Burst Monitor Search for Electromagnetic Signals Coincident with Gravitational-wave Candidates in Advanced LIGO's First Observing Run. *The Astrophysical Journal*, 871(1):90, Jan 2019.

[20] B. P. Abbott et al. All-sky Search for Continuous Gravitational Waves from Isolated Neutron Stars using Advanced LIGO O2 Data. *Phys. Rev. D*, 100:024004, Jul 2019.

[21] B. P. Abbott et al. All-sky Search for Long-duration Gravitational-wave Transients in the Second Advanced LIGO Observing Run. *Phys. Rev. D*, 99:104033, May 2019.

[22] B. P. Abbott et al. Binary Black Hole Population Properties Inferred from the First and Second Observing Runs of Advanced LIGO and Advanced Virgo. *The Astrophysical Journal*, 882(2):L24, Sep 2019.

[23] B. P. Abbott et al. Constraining the p-Mode–g-Mode Tidal Instability with GW170817. *Phys. Rev. Lett.*, 122:061104, Feb 2019.

[24] B. P. Abbott et al. Low-latency Gravitational-wave Alerts for Multimessenger Astronomy during the Second Advanced LIGO and Virgo Observing Run. *The Astrophysical Journal*, 875(2):161, Apr 2019.

[25] B. P. Abbott et al. Narrow-band Search for Gravitational Waves from Known Pulsars using the Second LIGO Observing Run. *Phys. Rev. D*, 99:122002, Jun 2019.

[26] B. P. Abbott et al. Properties of the Binary Neutron Star Merger GW170817. *Phys. Rev. X*, 9:011001, Jan 2019.

[27] B. P. Abbott et al. Search for Multimessenger Sources of Gravitational Waves and High-energy Neutrinos with Advanced LIGO during Its First Observing Run, ANTARES, and IceCube. *The Astrophysical Journal*, 870(2):134, Jan 2019.

[28] B. P. Abbott et al. Search for Transient Gravitational-wave Signals Associated with Magnetar Bursts during Advanced LIGO's Second Observing Run. *The Astrophysical Journal*, 874(2):163, Apr 2019.

[29] B. P. Abbott et al. Searches for Continuous Gravitational Waves from 15 Supernova Remnants and Fomalhaut b with Advanced LIGO. *The Astrophysical Journal*, 875(2):122, Apr 2019.

[30] B. P. Abbott et al. Searches for Gravitational Waves from Known Pulsars at Two Harmonics in 2015–2017 LIGO Data. *The Astrophysical Journal*, 879(1):10, Jun 2019.

[31] B. P. Abbott et al. Tests of General Relativity with GW170817. *Phys. Rev. Lett.*, 123:011102, Jul 2019.

[32] B. P. Abbott et al. A Gravitational-wave Measurement of the Hubble Constant Following the Second Observing Run of Advanced LIGO and Virgo. 909(2):218, mar 2021.

[33] B. P. Abbott et all. First Measurement of the Hubble Constant from a Dark Standard Siren using the Dark Energy Survey Galaxies and the LIGO/Virgo Binary–black-hole merger GW170814. *The Astrophysical Journal*, 876(1):L7, Apr 2019.

[34] B.P. Abbott et al. A Gravitational-wave Standard Siren Measurement of the Hubble Constant. *Nature*, 551(7678):85–88, Nov 2017.

[35] B.P. Abbott et al. Full Band All-sky Search for Periodic Gravitational Waves in the o1 LIGO Data. *Phys. Rev. D*, 97:102003, May 2018.

[36] B.P. Abbott et al. GW170817: Measurements of Neutron Star Radii and Equation of State. *Phys. Rev. Lett.*, 121:161101, Oct 2018.

[37] B.P. Abbott et al. A Standard Siren Measurement of the Hubble Constant from GW170817 without the Electromagnetic Counterpart. *The Astrophysical Journal*, 871(1):L13, Jan 2019.

[38] B.P. Abbott et al. All-sky Search for Short Gravitational-wave Bursts in the Second Advanced LIGO and Advanced Virgo Run. *Phys. Rev. D*, 100:024017, Jul 2019.

[39] B.P. Abbott et al. GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs. *Phys. Rev. X*, 9:031040, Sep 2019.

[40] C. Whittle et al. Approaching the Motional Ground State of a 10-kg Object. *Science*, 372(6548):1333–1336, 2021.

[41] Derek Davis et al. LIGO Detector Characterization in the Second and Third Observing Runs. apr 2021.

[42] E. Schwartzi et al. Improving the Robustness of the Advanced LIGO Detectors to Earthquakes. 37(23):235007, Nov 2020.

[43] L. McCuller et al. LIGO's Quantum Response to Squeezed States. *Phys. Rev. D*, 104:062006, Sep 2021.

[44] P. Nguyen et al. Environmental Noise in Advanced LIGO Detectors. 38(14):145001, jun 2021.

[45] R. Abbott et al. Gravitational-wave Constraints on the Equatorial Ellipticity of Millisecond Pulsars. 902(1):L21, Oct 2020.

[46] R. Abbott et al. GW190521: A Binary Black Hole Merger with a Total Mass of 150 Solar Mass. *Phys. Rev. Lett.*, 125:101102, Sep 2020.

[47] R. Abbott et al. Properties and Astrophysical Implications of the 150 Solar Mass Binary Black Hole Merger GW190521. 900(1):L13, Sep 2020.

[48] R. Abbott et al. All-Sky Search in Early O3 LIGO Data for Continuous Gravitational-Wave Signals from Unknown Neutron Stars in Binary Systems. *Phys. Rev. D*, 103:064017, Mar 2021.

[49] R. Abbott et al. Constraints on Cosmic Strings Using Data from the Third Advanced LIGO–Virgo Observing Run. *Phys. Rev. Lett.*, 126:241102, Jun 2021.

[50] R. Abbott et al. Diving below the Spin-down Limit: Constraints on Gravitational Waves from the Energetic Young Pulsar PSR J0537-6910. 913(2):L27, may 2021.

[51] R. Abbott et al. GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo during the First Half of the Third Observing Run. *Phys. Rev. X*, 11:021053, Jun 2021.

[52] R. Abbott et al. Observation of Gravitational Waves from Two Neutron Star–Black Hole Coalescences. 915(1):L5, jun 2021.

[53] R. Abbott et al. Open Data from the First and Second Observing Runs of Advanced LIGO and Advanced Virgo. *SoftwareX*, 13:100658, 2021.

[54] R. Abbott et al. Population Properties of Compact Objects from the Second LIGO–Virgo Gravitational-Wave Transient Catalog. 913(1):L7, may 2021.

[55] R. Abbott et al. Search for Anisotropic Gravitational-Wave Backgrounds Using Data from Advanced LIGO and Advanced Virgo's First Three Observing Runs. *Phys. Rev. D*, 104:022005, Jul 2021.

[56] R. Abbott et al. Upper Limits on the Isotropic Gravitational-Wave Background from Advanced LIGO and Advanced Virgo's Third Observing Run. *Phys. Rev. D*, 104:022004, Jul 2021.

[57] S. Soni et al. Reducing Scattered Light in LIGO's Third Observing Run. 38(2):025016, Jan 2021.