

# GRAVITATIONAL WAVE ASTRONOMY @ UWA

Dr Fiona Panther  
on behalf of Professor Linqing Wen & GW Astronomy

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Gravitational Wave Astronomy Group  
Department of Physics, UWA  
ARC Center of Excellence for Gravitational Wave Discovery  
International Space Center

Gravitational Wave Technology and Education Research Cluster  
Machine Learning Application for Physical Sciences Research Cluster

LIGO-Virgo Scientific Collaboration (LSC)



THE UNIVERSITY OF  
**WESTERN  
AUSTRALIA**

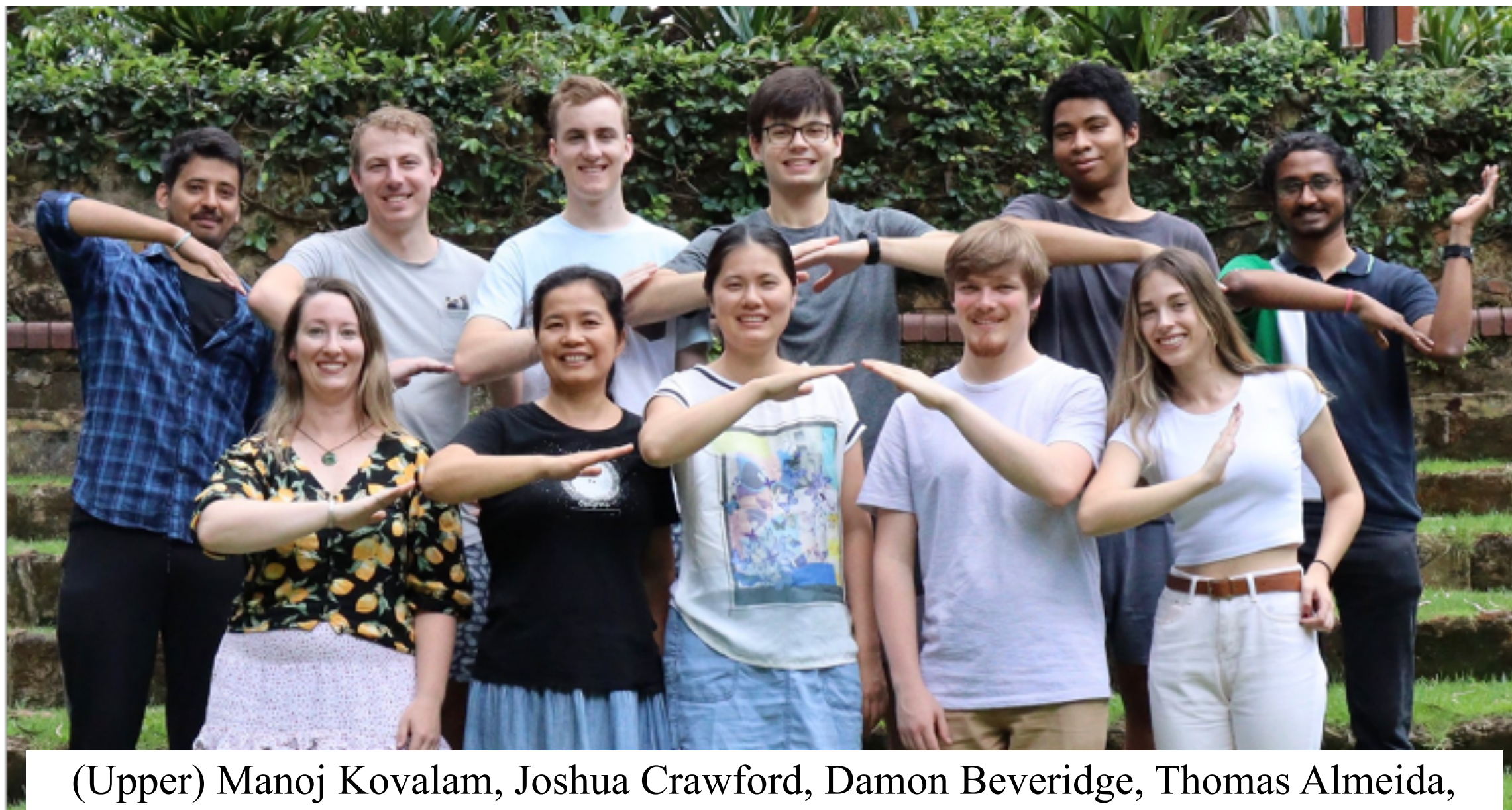


**LIGO**  
Scientific  
Collaboration





# JOIN THE GW ASTRONOMY GROUP AT UWA!



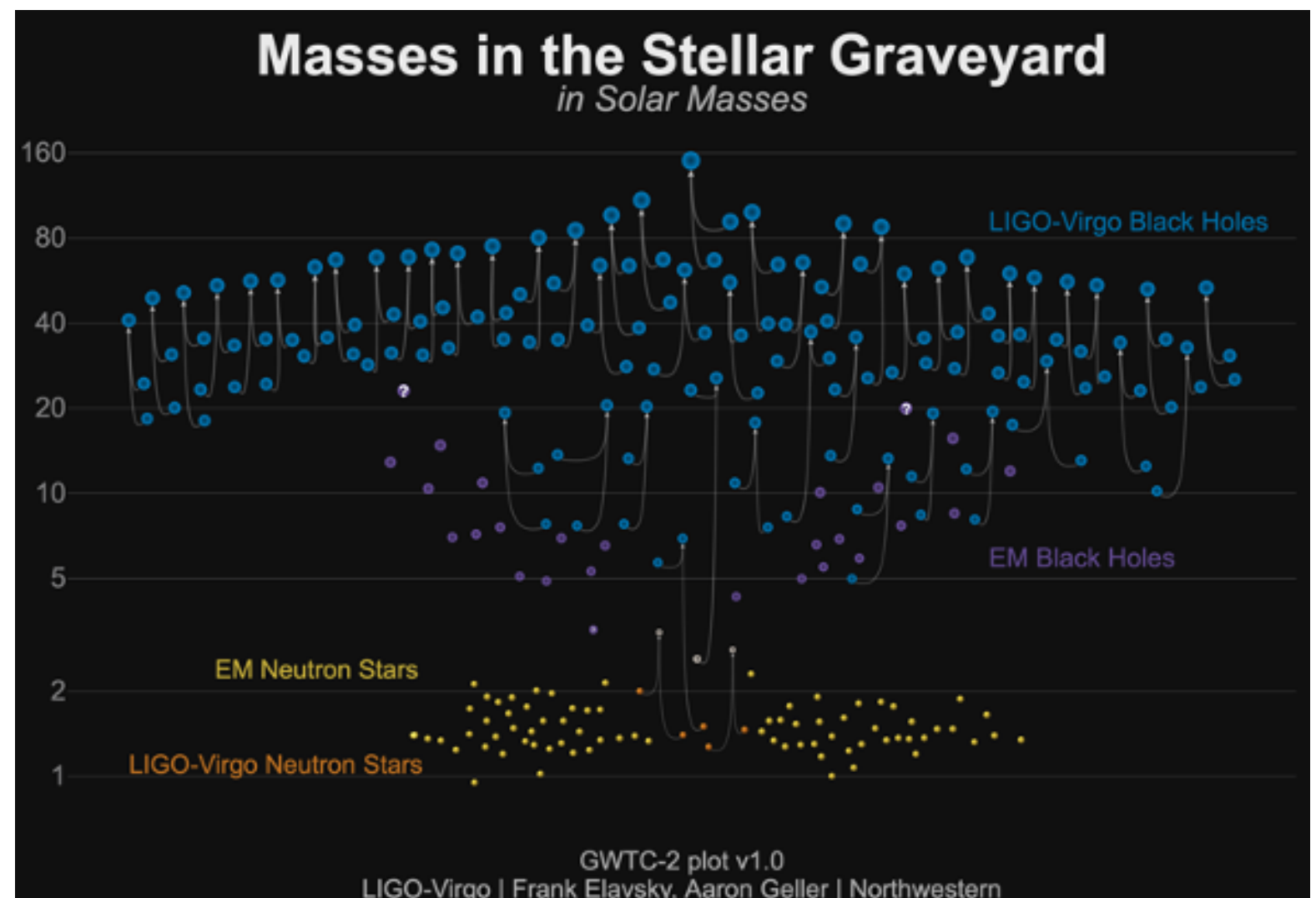
(Upper) Manoj Kovalam, Joshua Crawford, Damon Beveridge, Thomas Almeida,  
Victor Oloworaran, Chayan Chatterjee

(Lower) Fiona Panther, Linqing Wen (Me), Qi Chu, Alistair Mcleod, Alex  
Moroianu

(Not present) Andrew Gozzard, Scott Hardie, Ben Burridge, James Arcus, Sean  
Stephenson, Bruce Uduste, Daniel Tang, Micheal Hou + 4 SDURI undergraduate  
interns (remote)

# AN EXCITING TIME FOR GW DISCOVERY

- GWs are **ripples in space-time** predicted by Einstein over 100 years ago, and detected for the first time in 2015!
  - Since then, the LIGO/Virgo collaboration have announced the detection of **almost 100 GW events**, including black hole mergers, binary neutron star mergers, and neutron star-black hole binary mergers!
  - UWA is home to the **SPIIR pipeline**, one of only 5 real-time GW detection pipelines in the world. We detect GWs within seconds of their arrival at the GW detectors
  - SPIIR contributed directly to 60% of all detections and public alerts during the third observing run!
- 
- As a student in the GW astronomy group at UWA, you will work at the **cutting edge of GW discovery**
  - **Be the first to see data from the LIGO, Virgo and KAGRA detectors** within seconds, and make discoveries with the SPIIR pipeline
  - Projects in **GW detection, theory, joint GW and EM searches and machine learning!**





# AN EXCITING TIME FOR GW DISCOVERY

- The 4th LIGO-Virgo-KAGRA observing run begins in 2022, with the prospect of more exciting discoveries!
- SPIIR will provide ‘early warning’ of binary neutron star mergers, with alerts sent up to 30s before merger, opening up new possibilities for real-time searches for electromagnetic counterparts
- Event rate of several/week - be a part of the discovery
- Opportunities to test new technologies, including machine learning for localization, parameter estimation and detection



More detections - more science! Use GW events to probe our universe!  
Opportunities for collaboration: be part of LIGO, UWA International Space Center and OzGrav!



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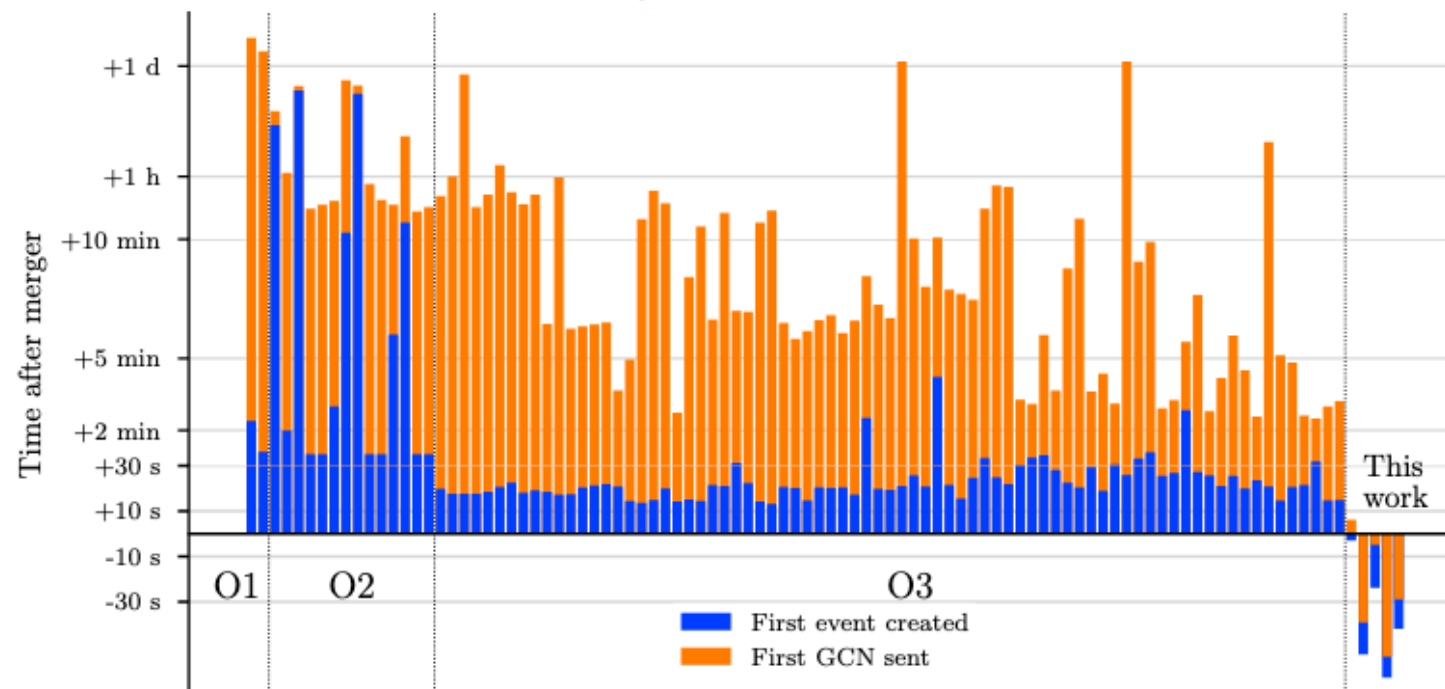


# UWA GRAVITATIONAL WAVE ASTRONOMY GROUP

Group Leader: Prof. Linqing Wen



## Real-time and pre-merger online detection and follow-up of gravitational waves



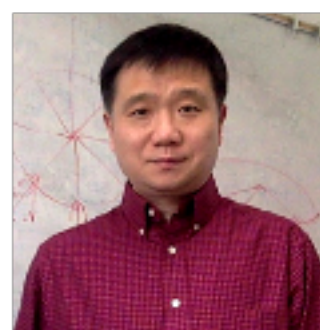
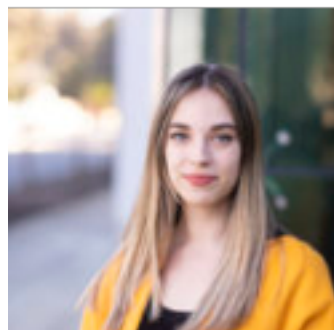
Detect GW events in real time and send out public alerts - be the first to analyse LIGO-Virgo-KAGRA data!



L-R: Manoj Kovalam (PhD), FP

## Electromagnetic followup and coincidence search for gravitational wave discoveries, GRBs and FRBs

Search for EM emission associated with GW events in real time using Australian radio telescopes



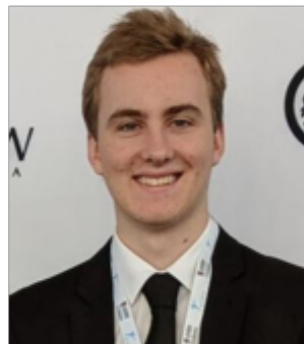
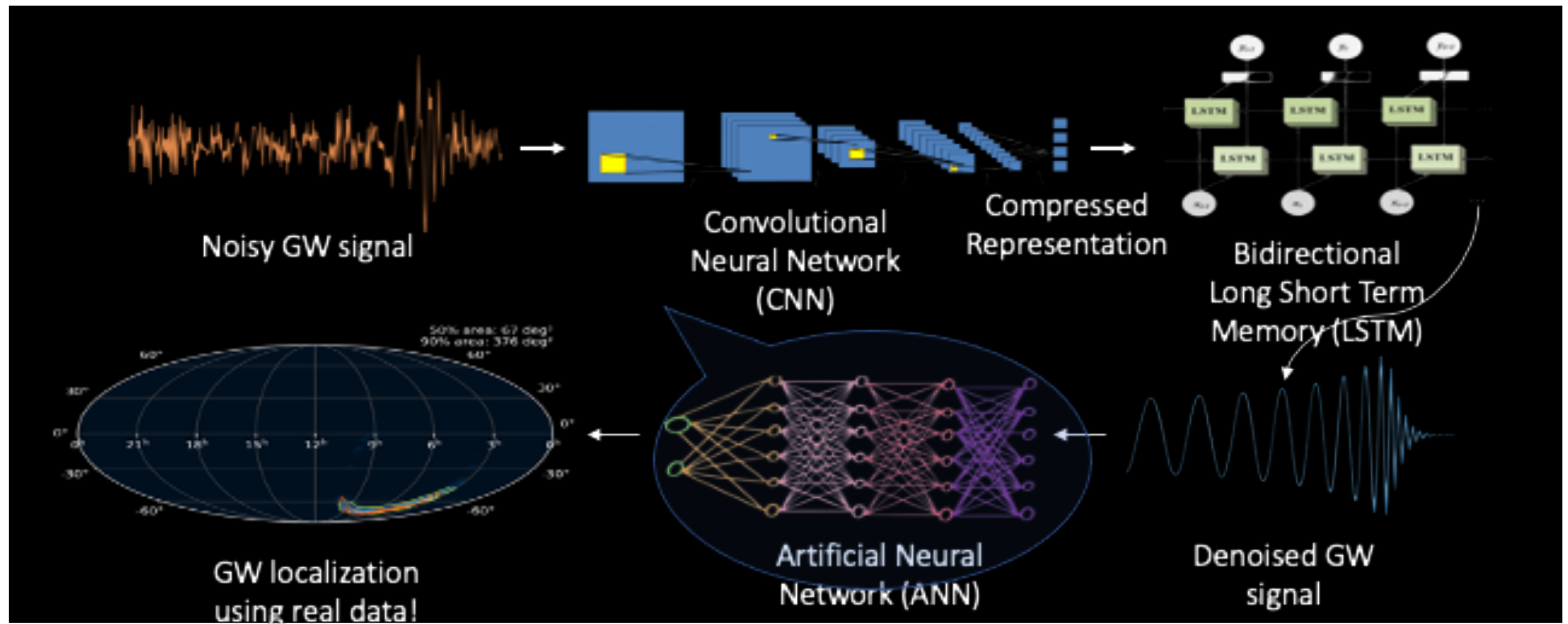
L-R: Alexandra Moroianu, FP, Clancy James (Curtin), Bing Zhang (UNLV)





# UWA GRAVITATIONAL WAVE ASTRONOMY GROUP

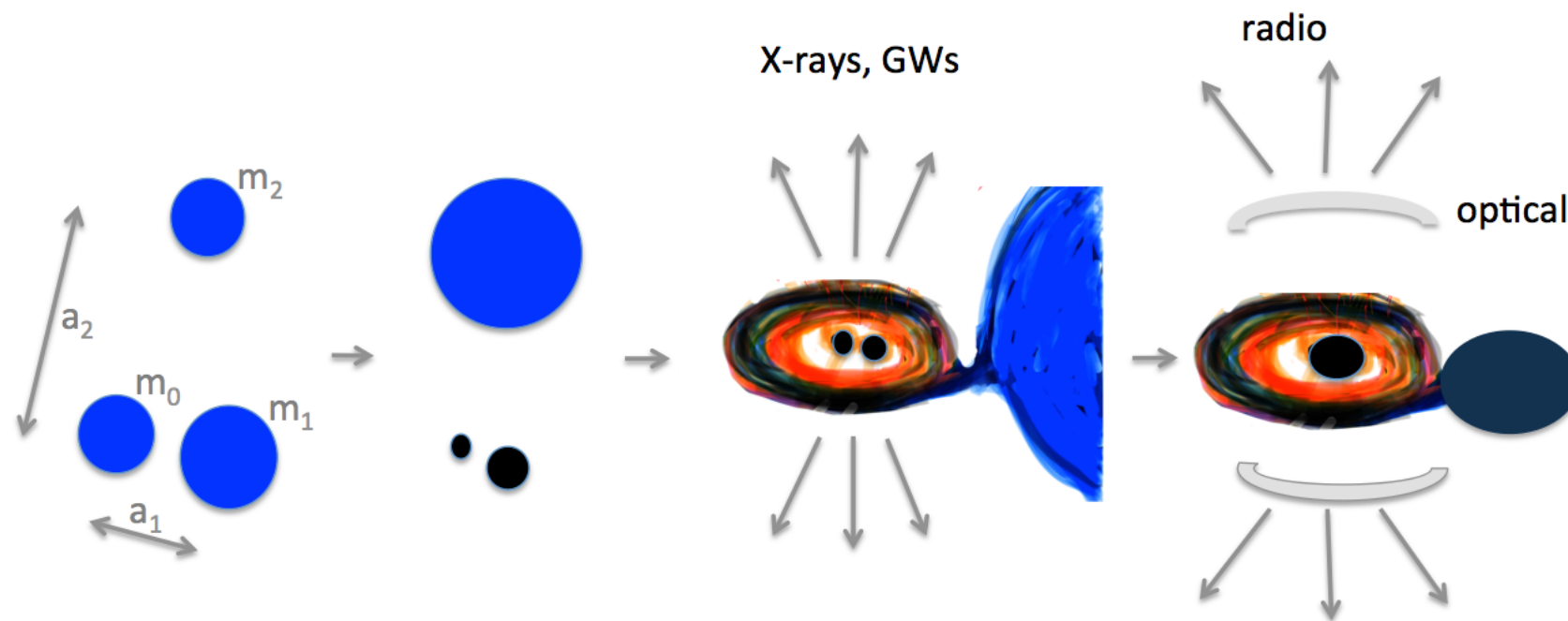
## Machine Learning for GW discovery, parameter estimation and localisation



## JOIN THE TEAM!

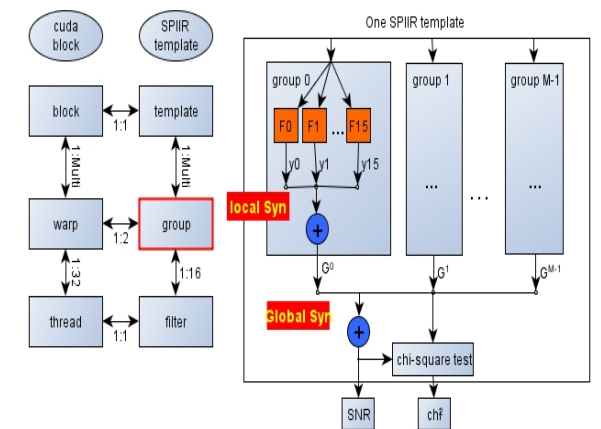
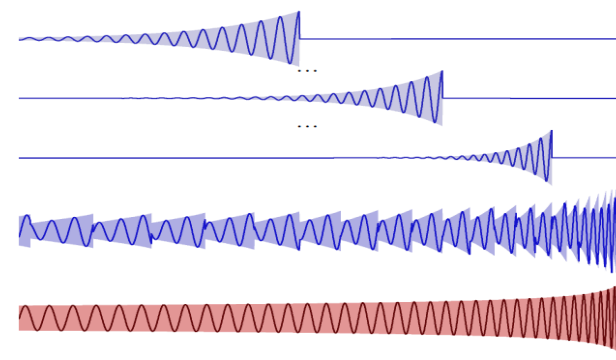
L-R: Chayan Chatterjee (PhD), Damon Beveridge (PhD), Alistair McLeod (Masters)  
Collaborators: Foivos Diakogiannis, Kevin Vinsen, Andreas Wicenec, ICRAR DIA & UWA  
Computer science

# UWA GRAVITATIONAL WAVE ASTRONOMY GROUP



**Modelling the evolution of stars interacting with black holes and the emission of GWs from these systems!**

**High-performance computing, algorithm design, mathematical optimisation and GPU acceleration!**



**Discuss your study options with our group and meet the team!**  
**Contact [linqing.wen@uwa.edu.au](mailto:linqing.wen@uwa.edu.au) and [fiona.panther@uwa.edu.au](mailto:fiona.panther@uwa.edu.au)**