CAASTRO Newsletter Edition 21, December 2017

INTRODUCTION FROM CAASTRO DIRECTOR

It was great to see so many members of CAASTRO at our final Annual Retreat, held in South Australia's Barossa Valley in November. We enjoyed a wonderful program of science talks and meetings, as well as a chance to celebrate the full breadth of CAASTRO's achievements over the past seven years. It has been particularly rewarding to see a new generation of researchers move into leadership positions as CAASTRO has evolved.

Only two members of the original 2011 CAASTRO Executive remain in place in 2017 – Deputy Director Lister Staveley-Smith and COO Kate Gunn. Lister and Kate have been the custodians of CAASTRO's corporate knowledge, and have ensured that the Centre continued to flourish in times of change. I am enormously grateful to them. Warmest thanks also to Kylie Williams, Kate Gunn and the CAASTRO A-team for organizing this seventh and last Retreat, and for making it such a memorable occasion.

As CAASTRO moves towards its official end date of 31 March 2018, we are starting to say goodbye to some familiar faces. Kate Gunn will become the new Chief Operating Officer at the Garvan Institute of Medical Research on 1 March 2018. Kate's contributions to CAASTRO over the past seven years have been immense, and I wish her well in this exciting new role. As already mentioned in the October Newsletter, Kylie Williams is now working with the University of Sydney's Faculty of Dentistry. Several of our CAASTRO professional staff are moving on to roles with the new ARC Centres ASTRO 3D and OzGrav, and our researchers are starting to

take up new positions around Australia or overseas. CAASTRO's Education and Outreach manager Wiebke Ebeling begins a new position in February 2018 as Centre Manager of the new Wave Energy Research Centre at UWA's Albany Campus. Very best wishes to all of you who are moving on to new positions – we will miss you!

CAASTRO's science program continues at full speed, and in this Newsletter you can read about our involvement in the follow-up to LIGO's first detection of gravitational waves from the merger of a pair of neutron stars. We continue to hold international workshops and conferences, the most recent of these being the Dark Energy Survey (DES) collaboration meeting in Brisbane and 'Science at Low Frequencies IV' in Sydney. Our first Galaxy Convention in November brought high school girls from all over Australia to Sydney for two days of meetings and workshops on STEM and female entrepreneurship. Thanks go to Janette Ellis and the organizing committee for putting together an excellent program of inspiring speakers.

Finally, I'd like to wish you and your families a safe and relaxing Christmas break and a Happy New Year for 2018.

Elaine Sadler
Director

RESEARCH UPDATE

First electromagnetic counterpart of a gravitational-wave event

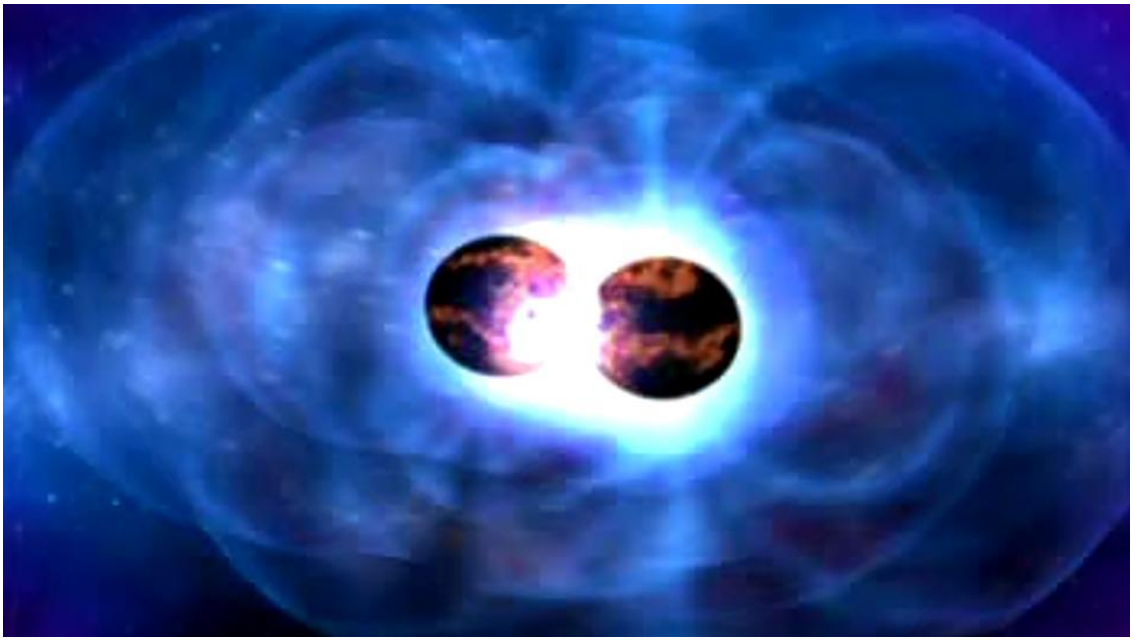
In August 25 CAASTRO astronomers from eight institutions took part in the successful follow-up and modelling of a neutron-star merger first detected by the LIGO and Virgo gravitational-wave observatories. The event, involving ~3,000 researchers, brought gravitational-wave and electromagnetic astronomy together for the first time.

On 17 August the LIGO-Virgo collaboration sent out an alert, triggering telescopes worldwide into action. The Swope telescope in Chile was the first to detect an optical counterpart, in the galaxy NGC 4993.

CAASTRO ANU node leader Christian Wolf led photometry of the source with the SkyMapper telescope while Associate Investigator Chris Lidman (AAO) took spectra with the Anglo-Australian Telescope.

CAASTRO Dynamic Theme Leader, Associate Professor Tara Murphy (The University of Sydney) led a team that detected a radio counterpart with CSIRO's Australia Telescope Compact Array. Long-term monitoring of the radio source will distinguish between various models for the merger.

Read more



Caption

Neutron stars merging – artist's impression. Credit: NASA/Goddard Space Flight Center

Publication Details

Abbott, B.P., et al., "Multi-messenger observations of a binary neutron star merger," ApJL (2017) (in press)

Andreoni I., et al., "Follow up of GW170817 and its electromagnetic counterpart by Australian-led observing programs", Publications of the Astronomical Society of Australia (2017) (submitted - preprint on arXiv).

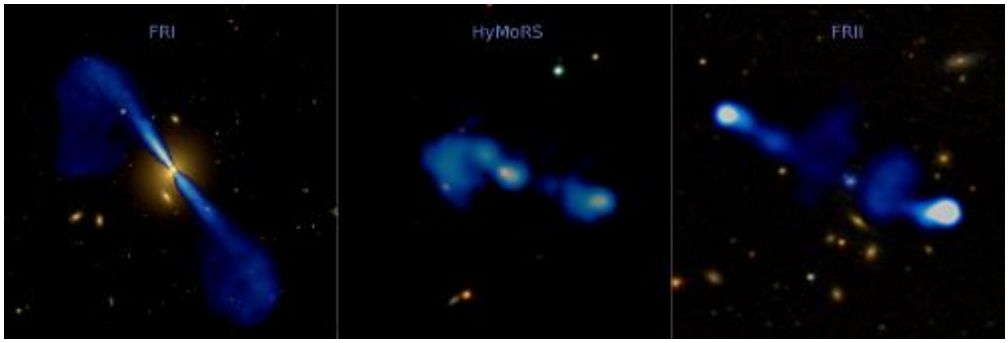
Hallinan, G., et al., "A radio counterpart to a neutron star merger", Science (2017)

Smartt, S.J., et al., "A kilonova as the electromagnetic counterpart to a gravitational-wave source", Nature (2017)

Citizen scientists find more rare HyMoRS galaxies

A team of professional and citizen scientists from the international Radio Galaxy Zoo (RGZ) project has doubled the known number of a rare type of galaxy, the Hybrid Morphology Radio Sources or HyMoRS. These combine the characteristics of two classes of radio galaxy (FR I and FR II) that were first thought to be distinct. FR I galaxies have jets that fade away as they extend outwards, while FR II galaxies have jets that end in a bright, strongly-emitting region (a 'hotspot').

The FR I and FR II classes were distinguished in 1974; the first HyMoRS was found in 2002. Fewer than 30 HyMoRS had been found until the advent of Radio Galaxy Zoo, which has now uncovered another 25. The RGZ HyMoRS researchers, led by Anna Kapínska (ICRAR–UWA), canvass a number of explanations for HyMoRS in their discovery paper. Read more



Caption

L-R: An FR I galaxy (radio jets in blue, overlaid on an infrared image), a HyMoRS galaxy and an FR II galaxy. The HyMoRS galaxy shows both FR I and FR II characteristics. Image: A. Kapínska et al.

Publication Details

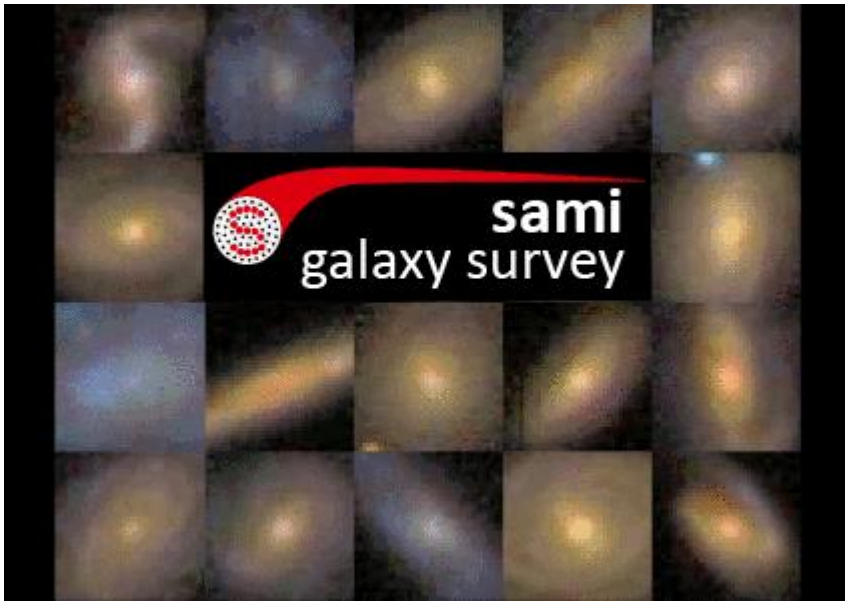
A.D. Kapínska *et al.*, "Radio Galaxy Zoo: A search for hybrid morphology radio galaxies", 2017, Astronomical Journal, 154, 253 [URL is https://doi.org/10.3847/1538-3881/aa90b7]

SAMI links galaxy shapes with rotation speed

A team using the CAASTRO-supported SAMI instrument has made the first reliable measurements that show how a galaxy's 3D shape depends on its rotation speed.

Low-spin systems are more commonly triaxial than high-spin ones, while the latter are more intrinsically flattened and axisymmetric, the researchers found.

The intrinsic shape of galaxies is linked to their formation and merger histories. Galaxies with high-spin values have intrinsic shapes consistent with dissipational minor mergers, while the intrinsic shape of low-spin systems is consistent with dissipationless multimerger assembly histories. Read more



Publication Details

C. Foster and 19 coauthors, "The SAMI Galaxy Survey: the intrinsic shape of kinematically selected galaxies". *Monthly Notices of the Royal Astronomical Society* (2017) [URL is https://doi.org/10.1093/mnras/stx1869]

CAASTRO EDUCATION AND OUTREACH

On the 4th to 5th of December CAASTRO hosted the inaugural Galaxy Convention at Sydney Nanoscience Hub. Designed to inspire the next generation of female STEM entrepreneurs, the event was supported by the Australian Government through a Women in STEM and Entrepreneurship (WISE) grant. Female school students in years 10-12 from all over Australia listened to talks by inspiring speakers such as Daniel Shaddock (ANU and Liquid Instruments), Tara Murphy (USYD and Grok Learning), Liz Kaelin (SBE and Caitr'd), Solange Cunin (Cuberider) and Sally-Ann Williams (Google). They learned about the essential characteristics of successful entrepreneurs, most importantly resilience, and also participated in marketing and strategy workshops with teachers, undergrads, postgrads and industry professionals. The feedback from participating students was positive, such as this comment from a year 12 Western Australian delegate: "It has opened my eyes to so many possibilities and has made me excited for the future."

CAASTRO MEMBER PROFILE

Anais Moller, Research Staff, ANU

Anais is a postdoctoral fellow working on cosmology with type Ia supernovae (SNe Ia) at ANU. She is currently leading the SkyMapper Transient Survey that discovers and studies SNe Ia and other transients at low-redshift. At the high-redshift end, she is working on assesing biases in the SN Ia cosmological analysis for the Dark Energy Survey and obtaining SN and host-galaxy spectra with the OzDES survey at the AAT. Alongside this work, she is developing machine learning applications for supernova classification and analysis.

CAASTRO LEGACY ITEMS

At the end of its funding period (2017-2018) CAASTRO is keen to leave behind a legacy of useful items for future researchers, outreach and professional staff members working within astrophysics.

A CAASTRO Legacy website will replace our current website in March 2018. Please let us know if you have anything you want to include on the legacy website into the future. Email: coo@caastro.org

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PAST EVENTS

Dark Energy Survey Collaboration Meeting
6-10 November 2017, Brisbane

The Dark Energy Survey (DES) recently held its biannual collaboration meeting at the Department of Physics of the University of Queensland. Over a period of a week, 110 scientists from all over the world discussed all aspects of the survey, which is now entering its 5th year.

The 3-year cosmological analysis is now in full swing. Excellent progress towards getting all the tools in place for the analysis was made at the meeting. We look forward to seeing the results of this work over the course of the next year.

In addition to the cosmology, there were talks on the stellar streams and satellite galaxies orbiting the Milky Way, and the kilonovae that resulted from the merging of two neutron stars, which also resulted in the emission of gravitational waves that

were detected here on Earth.

One of the highlights of the meeting was the public lecture given by three DES scientists. Hosted by Nobel Laureate Brian Schmidt, the event was attended by 450 people. Another 2,000 viewed the lecture online, and on Facebook, it reached 34,000 people.

The meeting would not have been as successful as it was without the support of CAASTRO, and theefficient and dedicated work of the staff, post-doctoral fellows, and students at the University of Queensland.

And finally, the US team won the football match. The Europeans have some work to do.

A photo of collaboration members in front of the Forgan Smith Building at the University of Queensland.
(Photo Credit: Josh Calcino)

Science at Low Frequencies IV

was held on 12-15 December 2017, SNH Building, University of Sydney. It was a very successful event with over 150 people attending.

SALF Delegates, Dec 2017

FINAL CAASTRO EVENTS

- Four Pillars of Radio Astronomy, Book Launch, 9 February 2018, Holme Building University of Sydney, Sydney, Australia
- FRB2018: Finding and Understand Fast Radio Bursts, 14-16 February 2018, Swinburne University of Technology, Melbourne, Australia