SKA PhD Scholarship Scheme
2017 Projects

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Project List

Below is a list of the projects available in 2017. Project abstracts are available further down.

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- Resolving pulsar magnetospheres with picoarcsecond resolution scintellometry, Curtin University
- Cosmological Evolution of Radio Galaxies and Feedback from Supermassive Black Holes, University of Tasmania
- The HII Region Population in the Milky Way, University of Tasmania
- The Motion of the Magellanic Clouds, University of Tasmania

University of Sydney

Primary contact: Elaine Sadler (elaine.sadler@sydney.edu.au)

Supervisor: Tara Murphy
Project Title: Exploring the transient universe with the MWA and ASKAP

Project Abstract: Some of the most extreme events in the Universe occur when black holes form, or merge with each other, or when stars move too close to a black hole and get sucked in. In each of these cases strong bursts of electromagnetic radiation are released, which we detect on Earth as ’transient’ radio emission. Not only are these events interesting in their own right, they also serve as an astronomical laboratory for exploring physics in extreme conditions. Until now we have had a limited ability to find and study these objects as they appear and disappear on short timescales. Radio astronomy is undergoing a revolution, with new telescopes able to conduct massive all-sky surveys on a regular basis, allowing us to discover ’transient’ radio sources.

In this project you will conduct major surveys with the Murchison Widefield Array (MWA) and the Australian Square Kilometre Array pathfinder (ASKAP) two telescopes located in Western Australia. You will have first prime access to these unique (and completely unexplored) dataset to look for transient and highly variable radio sources, and then draw on multi-wavelength data and observations from other telescopes to identify what these sources are. Your project could focus on developing intelligent algorithms to search for rare objects, or on the scientific interpretation of any objects we find, or a combination of both. There is scope for working on a range of research areas, from exoplanets and flare stars through to gamma-ray bursts and gravitational wave events.

Supervisor: Scott Croom
Project title: Connecting gas content to the location of star formation

Project Abstract: The fundamental fuel for star formation is hydrogen gas that accretes onto galaxies, cools and forms stars. How and where the accretion of gas is modulated, and how this influences star formation is poorly understood. In this project we will aim to combine radio observations that measure the gas content in local galaxies (via 21cm emission line measurements) with spatially resolved maps of star formation from the new SAMI Galaxy Survey (http://sami-survey.org/). This survey, that contains thousands of galaxies across all environments (from voids to dense clusters) gives us the opportunity to understand how a galaxy's environment influences gas accretion onto it, and in turn how that modulates star formation.

Supervisor: Elaine Sadler
Project title: Tracing fuelling and feedback in powerful radio galaxies with 21cm HI absorption

Project abstract: One of the main goals of the SKA is to trace the neutral phase of hydrogen, the most abundant element in the Universe, out to high redshift and connect this to the formation and evolution of galaxies across cosmic time. Observations of the 21cm line of neutral hydrogen (HI), seen in absorption against strong radio continuum sources, provide us with unique information about the flow of gas into and out of galaxies at different stages in their evolution. In particular, recent observations show that radio jets in massive galaxies can drive powerful outflows of neutral gas that rapidly deplete the gas reservoir - meaning that new generations of stars can no longer form.

So far, these studies have mainly been confined to galaxies in the nearby Universe. In this project you will use the Australian SKA Pathfinder (ASKAP) radio telescope to search for redshifted HI absorption lines in distant galaxies and investigate both the infall of neutral gas and the prevalence of jet-driven outflows in radio galaxies over the past 8 billion years of cosmic time. In combination with models and simulations, these ASKAP observations will help us understand the role of galaxy mergers, gas infall and radio jets in shaping the largest and most massive galaxies we see around us today.

More information on Sydney:

www.sydney.edu.au (The University of Sydney)
www.sydney.com.au
www.cityofsydney.nsw.gov.au/learn/about-sydney/tourist-information

Australian National University

Primary contact: Naomi McClure-Griffiths (naomi.mclure-griffiths@anu.edu.au)

Supervisor: Naomi McClure-Griffiths
Project title: Magnetic fields in the Magellanic system

Project abstract: Magnetic fields affect the evolution of the Universe on all scales from the Sun to galaxy clusters. They provide nearly as much energy into the interstellar medium as gas motions or thermal heating, are essential to star formation and contribute enormously to the total pressure of interstellar gas. And yet, we know very little about the origin of magnetic fields within galaxies or indeed the nature of magnetised gas in galaxies. This project will work with new radio interferometric data from the Australia Telescope Compact Array of polarized extragalactic sources to probe the magnetised, ionised medium throughout the nearest galaxies, the Large and Small Magellanic

Clouds. This project will carry on into the Australian SKA Pathfinder Polarization survey of the Universe's Magnetism (POSSUM) and will involve collaboration with Dr Ann Mao at the Max Planck Institute for Radioastronomy in Bonn, Germany and Prof Bryan Gaensler at the University of Toronto, Canada.

Supervisor: Christian Wolf
Project title: Radio star formation rates in transition galaxies

Project abstract: Indicators of star formation rate are well cross-calibrated for continuously star-forming galaxies, but disagree for galaxies in the process of undergoing quenching. Radio SFRs have been considered a good new way of mapping galaxy transformation and its relation to environment across huge volumes of the Universe surveyed in the next decade. Here, we use new data from the optical and radio to improve SFR measurements in transition galaxies, to lay the groundwork for interpreting future radio data, and to find new trends among transition galaxies.

Supervisor: Geoff Bicknell
Project title: Determination of radio spectrum, Stokes parameters and rotation measure from magnetohydrodynamic simulations of high redshift radio galaxies

Project abstract: The interaction of relativistic jets with the interstellar medium of evolving galaxies is a form of black hole feedback, which is believed to have an important influence on the evolution of galaxies. The spectrum and polarization of radio emission is an important diagnostic of the interaction informing us about the turbulence and density of the interaction region and the role of magnetic fields in both dynamics and emission. In this project the student will use magnetohydrodynamic simulations incorporating the evolution of the relativistic electron distribution to produce synthetic images of total intensity, polarization and rotation measure relating to jet-ISM interactions at high redshifts.

More information on Canberra:

www.anu.edu.au (Australian National University)
http://visitcanberra.com.au
www.canberratourism.com.au

University of Western Australia

Primary contact: Lister Staveley-Smith (lister.staveley-smith@uwa.edu.au)

Supervisor: Richard Dodson
Project title: Delivering the goods - Data-intensive SKA-scale astronomy

Project abstract: Science is becoming increasingly data-intensive and this requires a new data focused approach. The prime example is the Square Kilometre Array (SKA) project, one of the world's latest large- scale global scientific endeavours, which will be co-hosted in Australia and is set to produce orders of magnitude more data than all of mankind's past accomplishments. Just one of the SKA phase-1 science projects (e.g. the HI survey) will produce derived data in the order of several terabytes per second, and the second phase of the SKA project will be at least an order of magnitude greater. This project will work on some of the most extreme datasets observed in Radio Astronomy to date, and provide a perfect test bed for the data-driven paradigm. The data will will come from the Australian SKA Pathfinder, and from a Deep HI pathfinder project called CHILES. The student will investigate the ideas and methods, demonstrating new approaches on frontier data products. We are interested to hear from potential candidates from any STEM background, as the range of skill sets required (and to be developed) can not be limited to one traditional field of study. The candidate would join an active multi-disciplinary group with many scientific and commercial cross fertilisation possibilities. Similar PhD projects in this field and related science can be found at http://www.icrar.org/study-with-icrar/postgraduate-opportunities/postgraduate-research-projects/ .

Supervisor: Barbara Catinella
Project title: Exploiting the next-generation radio surveys with spectral stacking

Project abstract: Atomic hydrogen gas is the raw material out of which stars are formed, and thus it is clearly of key importance for galaxy formation and evolution. Due to limitations of existing radio telescopes, our current knowledge of this crucial galaxy component is still limited to the local Universe, but this is about to change. The next-generation radio surveys planned for the Square Kilometre Array and its precursor facilities, such as the Australian Square Kilometre Array Pathfinder (ASKAP) in Western Australia, will usher in a new era for extragalactic studies, allowing us to measure the gas content of galaxies at cosmological distances. Although a large number of galaxies will be individually detected, the most stringent constraints on gas content of galaxies across cosmic time will come from spectral stacking of undetected sources. Briefly, this technique requires to co-add (i.e. “stack”) the radio spectra of faint, undetected sources, for which accurate positions and redshifts are known from optical surveys, and yields an estimate of the average gas content of the ensemble. The student will build a flexible, modular, user-friendly software package to be used by the next-generation extragalactic radio surveys. The software will be tested on both available and upcoming data sets, as well as on mock catalogs generated by numerical simulations of galaxy formation and evolution. The emphasis of the first part of this project is on the computational aspect; hence a strong background in programming (especially parallel computing) is required. The second part will focus on the scientific applications, such as the determination of gas scaling relations as a function of redshift. Similar PhD projects in this field and related science can be found at http://www.icrar.org/study-with-icrar/postgraduate-opportunities/postgraduate-research-projects/ .

Supervisor: Lister Staveley-Smith
Project title: Galaxy formation and evolution

Project abstract: The new Australian Square Kilometre Array Pathfinder (ASKAP) in Western Australia will be the most powerful survey instrument in the world for the study of the gaseous properties of galaxies at moderate angular resolution. It will transform our understanding of the relationship of the cool gas in galaxies with other components such as stars, ionised gas and molecular gas. It will also explore the distribution of dark matter in galaxies and in the nearby Universe. This project will use the early science phase of ASKAP (ASKAP-12) to undertake a study of the environmental properties of galaxies. In particular, we know that there are gravitational and hydrodynamic forces that will remove gas from galaxies located in massive galaxy clusters. But these forces also seem to operate in an efficient manner in smaller groups of galaxies, giving rise to a strong density dependence in the gaseous properties of galaxies that is not understood. Part of the problem is the lack of understanding of the location of the diffuse ionised ‘cosmic web’ where about 50% of the normal ‘baryonic’ material in the Universe is supposed to reside. Part is due to lack of understanding of the early radiation conditions in dense environments. Observations with ASKAP-12 will help answer these problems by detecting and measuring the detailed properties of thousands of galaxies in a range of environments, thereby gathering sufficient information and statistical accuracy to unequivocally separate out the various physical processes and work, and helping build a fuller picture of galaxy formation and evolution. The project involves gathering 21cm ASKAP data in several early science fields, reducing and analysing the data, extracting kinematic information from the data cubes and examining systematic trends of the data with overall galaxy density as determined from optical red- shift surveys. Similar PhD projects in this field and related science can be found at http://www.icrar.org/study-with-icrar/postgraduate-opportunities/postgraduate-research-projects/ .

More information on Perth:

www.uwa.edu.au (University of Western Australia)
http://www.westernaustralia.com/en/Destinations/Experience_Perth/Pages/Experience_Perth.aspx
http://www.experienceperth.com

University of Melbourne

Primary contact: Rachel Webster (r.webster@unimelb.edu.au)

Supervisor: Rachel Webster
Project title: Epoch of Re-ionisation: Foreground removal

Project abstract: The signal from the first stars responsible for the Epoch of Re-ionisation in the early universe is dwarfed by radio emission from our galaxy and other radio sources along the line-of-sight. This project will develop techniques to improve the foreground signals to reveal the underlying signal from the EoR. This project will use the massive datasets obtained from the upgraded Murchison Widefield Array, which is located on the site in Western Australia that will house the new SKA-low telescope.

More information on Melbourne:

www.unimelb.edu.au (University of Melbourne)
www.visitmelbourne.com

Swinburne University

Primary contact: Chris Blake (cblake@swin.edu.au)

Supervisor: Virginia Kilborn
Project title: Understanding galaxy evolution with next generation radio telescopes

Project abstract: Understanding the neutral hydrogen (HI) content of galaxies is important to understand the evolution of galaxies - hydrogen is the main ingredient in star formation, and the distribution of HI within galaxies helps to understand the processes affecting the galaxy. However, detailed, resolved, HI images exist for less than one thousand galaxies. Galaxies have been mapped in HI for a number of reasons - for example, spiral galaxies in the Virgo cluster have been mapped for HI to understand environmental effects in dense regions (e.g. Chung et al. 2009, AJ, 138, 1741). A small number of surveys have targeted galaxies of varying mass and environment (e.g. LVHIS, Koribalski et al. in prep; WHISP, van der Hulst et al. 2002; THINGS Walter 2008, AJ, 136, 2563), and individual galaxies have been mapped for various reasons (usually due to interest in particular galaxy or region), providing maps for several hundred galaxies in total. However, the advent of the next generation radio telescopes, in particular the SKA pathfinders ASKAP and Apertif will change this paradigm, with resolved images expected for more than 10,000 galaxies with ASKAP alone as part of the WALLABY all-sky HI survey. This PhD project will use archive data as detailed above, along with dedicated new observations to investigate the relationship between the HI properties of galaxies and their optical properties. In particular the student will investigate the HI extent, profile, and HI surface density of galaxies of differing optical properties (such as morphology and colour) as a function of stellar mass. The student will work closely with the latest visualisation techniques as a novel method for analysing large visual datasets. The student will have the opportunity to be co-supervised at the Australia Telescope National Facility, and will be expected to spend time working on the ASKAP early science data - both making observations, and reducing and analyzing early science results. This project will help us to prepare for the upcoming large SKA HI surveys, and provides an outstanding opportunity to be involved in cutting-edge radio astronomy research.

Supervisor: Chris Fluke
Project title: Astronomical knowledge discovery beyond the petascale

Project abstract: As astronomy moves ever closer to the Square Kilometre Array's exascale data era, an increasing number of existing desktop-based workflows will fail. Instead, astronomers will turn to automated processing using dedicated high-performance computing resources coupled with advanced data archives. Yet the ability to look at the most important data is crucial. In this project, you will research, design, implement and evaluate new visualisation-based knowledge discovery approaches. The goal is to support interactive, multi-dimensional analysis of data from observations, simulations, model fits and empirical relationships. The resulting framework is expected to merge visualisation-directed model-fitting with emerging machine learning techniques - such as Deep Learning - to enhance and accelerate the path to discovery. All stages of the project will utilise Graphics Processing Units (GPUs) as computational accelerators. Two main applications motivate this work: (1) Morphological (i.e. shape-based) studies of the neutral hydrogen content of galaxies, using radio-telescope data from existing and next generation surveys. A key focus will be preparing for the WALLABY survey with the Australian Square Kilometre Array Pathfinder (ASKAP); (2) Light-curve analysis and gravitational lensing modelling using the extensive online datasets generated by the GPU-Enabled, cosmological MicroLensing parameter survey (GERLUMPH). This project will suit a student with existing strong programming skills, and interests in GPU-computing and/or data-intensive discovery.

Supervisor: Karl Glazebrook
Project title: The fundamental physics behind galaxy formation

Project abstract: One of the oldest and most fundamental observations about galaxies is they spin. Rotation drives the majestic spiral structures but also the properties of elliptical galaxies. Spiral galaxies appear to retain the angular momentum of their original dark matter halos as they form and evolve, in contrast ellipticals seem to lose a lot, giving a direct physical picture of the origin of galaxy morphology. However angular momentum is a difficult measurement requiring deep observations of the dim outskirts of galaxies. In this project we will provide new measurements of angular momentum in galaxies in the nearby Universe using data from the Australian SAMI survey (to measure galaxy starlight in the optical) and from the Australian Square Kilometre Array Pathfinder (to measure neutral gas emission). We will then measure the evolution of angular momentum with redshift using the 10m Keck telescope in Hawaii and the ALMA sub-mm array. This will provide some of the most fundamental constraints on galaxy formation and evolution with redshift. Thus project is part of an extremely active collaboration between Swinburne and the University of Western Australia, funded by the Australian Research Council. It will require hands on observational skills with some of the world's most advanced telescopes.

More information on Melbourne:

www.swinburne.edu.au (University of Melbourne)
www.visitmelbourne.com

Curtin University

Primary contact: Carole Jackson (carole.jackson@curtin.edu.au)

Supervisor: Natasha Hurley-Walker
Project title: Advanced calibration and imaging with the MWA

Project abstract: The Murchison Widefield Array (MWA) is a low frequency (80 — 300 MHz) radio telescope operating in Western Australia and the only SKA_Low precursor telescope. Its design has many small antennas rather than fewer larger antennas as is typical for radio telescopes working at higher frequencies.

Forming high-fidelity images with the MWA can be challenging. The issues include: the very wide field of view of the MWA, the large data volume due to having many antennas, the corrupting effect of the ionosphere, the unusual reception pattern of the antennas (they are fixed on the ground), among others. Processing MWA data can often violate assumptions inherent in conventional radio astronomy data processing software. More accurate techniques are available but often come at a huge computational cost. Because of this, supercomputers are required to process large quantities of MWA data.

This project aims to investigate and develop novel techniques in radio astronomy data processing to improve the performance and/or fidelity of calibration and imaging algorithms, with a focus on MWA and future SKA_Low data. The application of these techniques has the potential to impact the Epoch of Reionisation (EoR) and GLEAM survey science programs of the MWA, which have each collected several PB of raw data.

This project is suited to a student with a strong interest in the fundamentals of radio astronomy and a solid background in computer science, maths and/or physics.

Supervisor: Nick Seymour (nick.seymour@curtin.edu.au)
Project title: Finding the most massive clusters with the Murchison Widefield Array

Project abstract: Clusters of galaxies are the most massive bound structures in the Universe lying at the crossroads of the large scale structure. In the nearby Universe they dominated by giant elliptical galaxies with very low star formation rates, but in past they must have been forming stars at a prodigious rate. However, finding young proto-clusters in the distant Universe is difficult as typical search methods (e.g. X-ray emission from hot gas, Sunyaev–Zel'dovich, SZ, effect) become much less sensitive. High redshift radio galaxies are known to lie in over-dense, proto-cluster environments and be beacons to pockets of extreme star formation. This is because the radio galaxy is powered by a massive and rapidly growing black hole and scaling relations suggest that this will be in the most massive host galaxy and dark matter halo. This project will take advantage of a new all sky low frequency radio survey with the Murchison Widefield Array (MWA) and combine it with NASA's mid-infrared WISE mission to find and characterise new distance proto-clusters in particular looking for the most massive ones.

This project will comprise three parts:

(i) Calibrating how well the WISE survey traces known clusters found in X-ray, millimetre (via the SZ effect) and radio surveys as a function of mass and redshift. Then the WISE data can be used to investigate the build-up of the red sequence statistically. For the radio-loud sample the potential dependence on radio jet orientation and size of the over-density of proto-cluster members can be investigated

(ii) Using this technique to search for new high redshift clusters around MWA sources. Once the best candidates are chosen, they can be followed-up with deep optical and near-infrared imaging and spectroscopy in order to confirm their redshift and nature.

(iii) Using the Australian Telescope Compact Array to observe high redshift (above redshift=1) proto-clusters at high frequencies to measure their mass distribution via the SZ effect. This technique has only been applied to lower redshift clusters to date, but can provide unique insights in the dark matter content of clusters.
The Spiderweb Galaxy. Deep Hubble image of the core of the MRC 1138-262 protocluster at z = 2.2 obtained with the Advanced Camera for Surveys.(Miley et al., 2006). Superimposed on the HST image are contours of Lyα (blue) obtained with ESO's very Large Telescope (VLT), delineating the gaseous nebula and radio 8GHz contours (red) obtained with NRAO's VLA, delineating the non-thermal radio emission.

Supervisor: Jean-Pierre Macquart
Project title: Resolving pulsar magnetospheres with picoarcsecond resolution scintellometry

Project abstract: The radio emission of pulsars remains, more than 40 years since their discovery, a poorly understood phenomenon. The single most important unconstrained component of pulsar emission theories is the site of the emission in relation to the surface of the neutron star, with the three major classes of models predicting particle acceleration at wildly different locations: the polar gap, the slot gap or the outer gap in the pulsar magnetosphere. The predicted emission height is tiny, ranging from ~10km (for inner gap models; 13 pico-arcseconds at a distance of 500pc) to ~5000km (for outer gap models; the size of the light cylinder for a 0.1s period pulsar). The angular resolution necessary to resolve such structure remains well beyond the capabilities of modern instrumentation.

Fortunately, the scattering of pulsar radiation by the interstellar medium (ISM) presents a means to directly measure the emission height. Pulsar radiation is subject to strong interference effects as it propagates through the turbulent ISM; interstellar scattering causes the point-like image of the pulsar to break up into thousands of sub-images or speckles that all interfere with each other. The ISM effectively operates as a giant interferometer — albeit with imperfect optics — whose diameter is comparable to the ~10AU transverse distance of speckles across the scattering region.

The technique of pulsar scintellometry uses the scintillation as an interferometer to detect a relative astrometric shift in the location of the emission region as the pulsar beam rotates through our line of sight. At its most basic, the principle behind the astrometric measurement is shown in the Figure below (see Pen et al. 2014 & Brisken et al. 2010 for full details). An angular displacement in the emission site causes a lateral displacement in the scintillation pattern at Earth. An angular difference in the emission site between different regions of the pulse would therefore cause a time lag between the scintillation patterns associated with different parts of the pulse profile. This technique (see Pen et al. 2014) improves on this principle by applying holographic phase-retrieval techniques to partially descatter the pulsar radiation in order to boost the pulsar S/N by a factor of several thousand over the raw scattered signal, and thus attain an additional ~103 increase in astrometric precision. This enables us to achieve pico-arcsecond relative astrometry on the location of the pulsar emission between time channels spread across the pulse profile.

In this project you would undertake low-frequency VLBI observations with FAST and the MWA to make speckle images of scintillating pulsars and apply the techniques of scintellometry to resolve the structure of pulsar emission regions.

A displacement in the emission site results in a lateral displacement of the scintillation pattern. Measurement of this shift enables high precision relative astrometry. This will be a project involving research across the Curtin University's Institute of Radio Astronomy and the Institute for Computation: it will develop cutting-edge computational techniques with access to expertise and supercomputing resources.

More information on Perth:
www.curtin.edu.au (Curtin University)
http://www.westernaustralia.com/en/Destinations/Experience_Perth/Pages/Experience_Perth.aspx
http://www.experienceperth.com

University of Tasmania

Primary contact: John Dickey (john.dickey@utas.edu.au)

Supervisor: Stanislav Shabala
Project title: Cosmological Evolution of Radio Galaxies and Feedback from Supermassive Black Holes

Project abstract: Accretion onto supermassive black holes at the centres of galaxies powers relativistic jets of radio-emitting plasma, which in turn significantly affect the fate of galactic gas - the raw material from which stars are made. In this way, these objects (known as Active Galactic Nuclei; AGN) regulate the growth of galaxies through the process of AGN feedback.
AGN feedback is a major science goal for both the recently constructed Australian Square Kilometre Array Pathfinder (ASKAP) and the future SKA. However, the physics of how AGN jet energy couples to the surrounding gas is still poorly understood. This PhD project will combine analytical models and numerical simulations to quantify the efficiency of AGN feedback for a wide range of jet and galaxy parameters, and how the feedback mechanisms have evolved over cosmic time. A unique feature of this project is in the ability to model the AGN and galaxy populations together for the first time. This is made possible by a self-consistent treatment of gaseous environments through which AGN jets propagate. The successful candidate will use the UTAS-developed RAiSE analytical model for AGN jet propagation, complemented by simulations with the PLUTO numerical hydrodynamics code run on a distributed grid.

Supervisor: John Dickey
Project title: The HII Region Population in the Milky Way

Project abstract: The Southern HII Region Discovery Survey (SHRDS) is a radio frequency survey of the Milky Way Galactic plane, using the Australia Telescope Compact Array telescope. Coupled with a similar survey in the Northern Hemisphere, the SHRDS has detected radio recombination line emission from some 200 new HII regions in the inner Galaxy. The challenge now is to determine the distances, chemical compositions, masses and temperatures of these regions. Using the existing data, plus new observations from telescopes at UTAS and CSIRO, the Ph.D. student will map the structure and motions of our Galaxy. In particular, HII regions trace spiral arms, and the SHRDS will allow a more complete picture of the spiral structure of the Milky Way to be drawn. The project combines technical expertise working with telescopes and radio astronomy data calibration, with numerical modelling and radiative transfer astrophysics to interpret the data in the context of the interstellar medium.

Supervisor: Simon Ellingsen
Project title: The Motion of the Magellanic Clouds

Project abstract: Interactions between galaxies are known to play a key role in their evolution throughout cosmic history. Studies of past and current interactions between Local Group galaxies provide us with a unique opportunity to investigate the key factors and effects of such interactions at high resolution and sensitivity. The Large and Small Magellanic Clouds (LMC & SMC), at distances of ~50 kpc and ~62 kpc respectively, are two of the closest galaxies to the MW. Because of their proximity, they are a benchmark for studies of a variety of topics, including stellar populations, the interstellar medium, and the cosmological distance scale. Observations of the MCs can be compared with cosmological simulations to determine how interactions may have led to the triggering of star formation and how infall into the MW's halo may have led to quenching of star formation in the MCs due to gas stripping.
Our understanding of the interaction of the LMC & SMC with each other and with the Milky Way (MW) have changed dramatically in the last decade due to new measurements of the proper motions of the LMC and SMC. This project will utilise the three orders of magnitude improvement in resolution of very long baseline interferometry (VLBI) over optical observations and avoid the substantial systematic effects inherent in proper motion determination from the stellar population. LBA observations with a time baseline of 18-24 months have been undertaken and will be able to provide an independent estimate of the proper motions of both Magellanic Clouds accurate to ~50 μas/yr (corresponding to an uncertainty in velocity of ~13 kms-1 and thus giving stronger constraints on their past orbits than any previous measurements.

More information on Hobart:
www.utas.edu.au (University of Tasmania)
www.discovertasmania.com.au