Newsletter No. 9

April 2018

Editor:
O. Ivy Wong

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Foreword

It is with great pleasure that I welcome you to the April/May 2018 edition of the WALLABY newsletter. If you enjoyed the previous 20-month edition, you're in for a treat as we have another newsletter 'chock-full' (Australian slang for lots) of exciting new updates. This edition brings you commissioning updates from the perspective of four of the PhD students and Early Career Researchers who have been and still are laying much of the groundwork with testing the processing pipeline on early observations from the ASKAP-12 (and ASKAP-16) array. This issue includes special feature articles from Karen Lee-Waddell and Luke Davies. Last but not least, no issue would be complete without the regular features such as the introduction of at least one new student or photos of team members at various events. I hope you enjoy reading this newsletter.

Message from the WALLABY PIs

Welcome to the Wallaby newsletter, and thanks again to Ivy Wong for taking over as editor and help make the delivery of Wallaby updates a more regular activity. As you can see from the updates below, the Wallaby early science team is making solid progress in the reduction (with the ASKAPsoft pipeline) of the early science fields, which will lead to some exciting early publications relating to the gas content of small groups of galaxies later this year. Challenges remain in scaling the pipeline to the full Wallaby data rate anticipated when the 36-antenna (Array Release 4) comes online in January 2019, according to the latest ASKAP schedule. Much of this year will also be taken up with planning for the submission of an updated proposal and survey plan to the Science Survey Project Assessment Panel. The submission deadline is anticipated to be around August, and will lead to an initial allocation of telescope time for successful projects. In the lead up to this, we will be asking for scientific and technical contributions to the refreshed proposal, and for your renewed commitment to the survey.

Announcements

The WALLABY project has a new website at https://wallaby-survey.org and a new Twitter account; @WALLABYsurvey.

Profiles

Chandrashekar Murugesan (PhD student, Swinburne)

I'm Chandrashekar a first year Ph.D student at Swinburne, working on HI studies of galaxies with Prof. Virginia Kilborn and A/Prof. Chris Fluke. My Ph.D thesis is titled "Understanding galaxy evolution using next generation radio telescopes" and thus will involve, in particular, HI studies of galaxies from upcoming surveys such as the WALLABY. As such, my Ph.D will focus on the problem of angular momentum and its connection to the HI content in galaxies as well as studying other processes that might be regulating HI gas. Another major focus of my thesis will be the multiwavelength study of kinematics and morphologies of galaxies, to identify morpho-kinematic parameters that are sensitive to particular environmental processes such as tidal stripping, ram pressure stripping etc. In this direction I'm currently a part of the WALLABY kinematics team to help test 3D fitting codes that are suited for the WALLABY data. My Ph.D project also aims to test new and upcoming data visualisation techniques currently being developed by the ADACS team at Swinburne. The intention is to use these visualisation software to get a quick sense of large data sets, very much like the ones produced through the WALLABY survey.

I have a master's degree in Astrophysics from the University of Bonn, Germany. For my master's thesis I worked at the Max Planck Institute for Radio Astronomy, Bonn, studying the distribution of methanol masers as tracers of potential star forming regions in the Milky Way.

Figure 1: Chandra Murugesan

The ASKAP Commissioning Odyssey

by Karen Lee-Waddell

(reprinted from Feb18 ASKAP News)

The past 17 months of working with ASKAP has been quite the journey, starting with a simple outside-of-working-hours email. On 11 August 2016 at 1905hrs, I received an email from Robin Wark, one of the technical operators of ASKAP, stating that the ASKAP Design Enhancement (ADE) array was ready for testing and that the NGC 7232 group – a nearby system of neighbouring gas-rich galaxies – would be a good pilot field. I was thrilled and quickly replied to verify the observing details that were submitted a few weeks prior on behalf of WALLABY, the Wide-field ASKAP L-Band Legacy All-sky Blind surveY (PIs: Baerbel Koribalski & Lister Staveley-Smith).

Two hours later Aidan Hotan, the current ASKAP Project Scientist, focused 12 ASKAP antennas – all newly equipped with MkII phased array feeds (PAFs) – on the radio emission from a group of galaxies located about 20 Mpc (70 million light years) away. That night the ingest buffers were hovering at 50% full, there were periodic patches of bad performance and a power supply tripped for one of the antennas but eventually, after a lot of finger-crossing and positive thinking, ASKAP completed a 12-hr observation run with 36 beams and a modest 48 MHz of bandwidth (with 18.5 kHz channel resolution).

Commissioning observations – led by the ASKAP Commissioning and Early Science (ACES) team – continued throughout the next few weeks and usable science data was trickling in. The ASKAP spectral line data processing working group (coordinated by Attila Popping and Karen Lee-Waddell) was ramping up efforts and helping to identify issues with both the array and ASKAPsoft, the in-house developed data processing tool specifically designed for ASKAP. Scientists, engineers and software designers worked together to solve problems and with each iteration of improvements, ASKAP was becoming more and more stable.

On 7 October 2016, ASKAP-12 officially started its Early Science program with further observations on the NGC 7232 group. Radio emission data, that would inundate any personal computer with its sheer volume, started to pour in. Using the Pawsey Supercomputing system, astronomers diligently continued their efforts to process and image the data with various 'old tricks' as well as new tools that were made available through ASKAPsoft. Things were going well and by Christmas holidays, ASKAP-12 was able to observe 24-hrs a day with minimal human intervention.

However, as the expansion of the array (in both the number of antennas and overall capability) continued in January 2017, something went astray. With several additional inputs, the spread of data arrival times across the correlator – the part of ASKAP that combines the signals from individual antennas to make the array function as one telescope – started to cause alignment errors. Eventually the problem became so severe that observations were called to a halt. Intensive investigations by the engineering staff revealed a number of issues, deep within the ASKAP system, that needed to be fixed. Consequently, Early Science operations paused for half a year – a lengthy break, but part of the risk associated with early access to such an advanced telescope.

In late August 2017, ASKAP was back online and once again ready to correlate radio signals! The Early Science program resumed and several Survey Science Teams were conducting observations. We now have 16 antennas (which halves the required time on source when compared to ASKAP-12) working together to each receive data from 36 beams over 240 MHz of instantaneous bandwidth. Sitting at my desk on a sunny afternoon in January 2018, I used the ASKAP Observation Management Portal to watch the final telescope scans of the Dorado group – another nearby

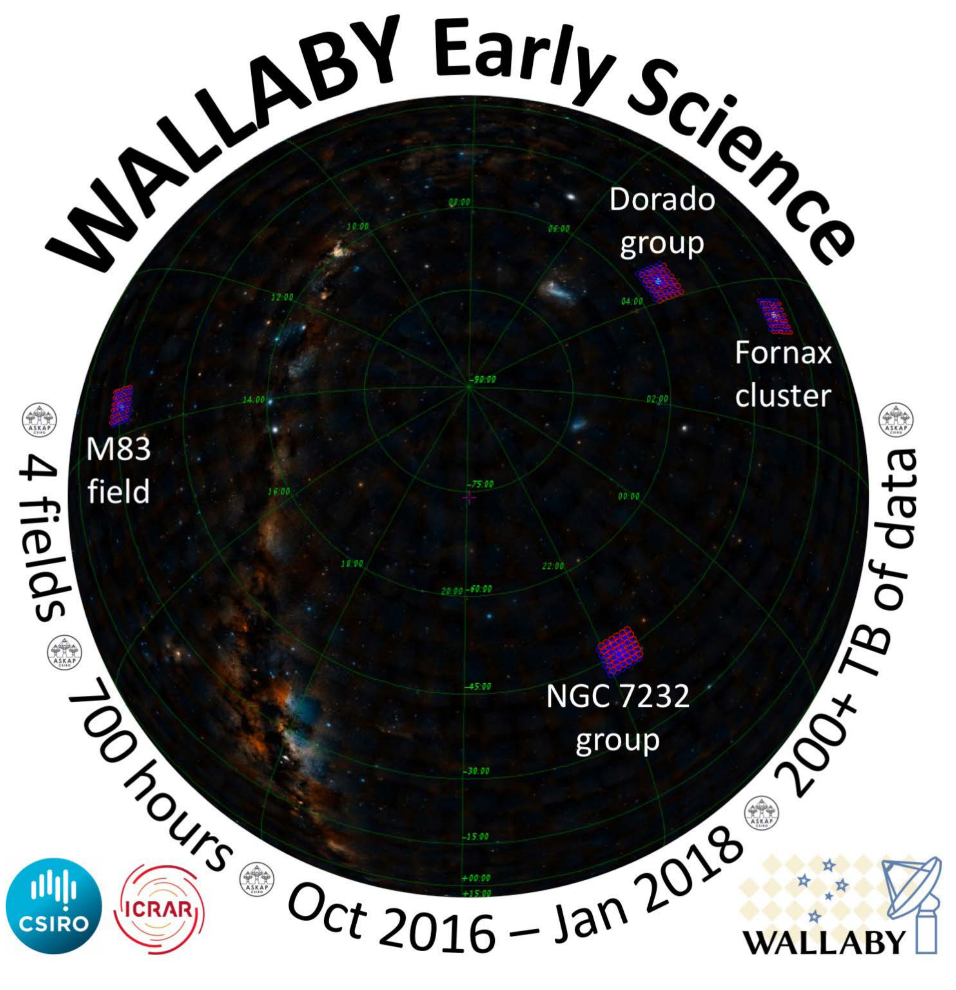


Figure 2: WALLABY early science summary poster by Karen

system of galaxies – which signified the completion of WALLABY Early Science observations.

Overall, WALLABY has collected just over 700 hrs of commissioning and Early Science observations on four different science fields: the NGC 7232 and Dorado groups, Fornax cluster, and field around the M83 spiral galaxy. The 220 TB of raw data will produce high resolution neutral hydrogen image cubes with full WALLABY sensitivity (i.e. have an RMS noise of 1.6 mJy/beam per 4 km/s channel) of the four fields. These cubes will provide detailed maps of the hydrogen gas content of the nearby systems and enable the discovery of new galaxies.

The next step for us will be verifying the ASKAP data products and analysing them for scientific purposes. The next step for ASKAP will be incorporating all 36 PAFs (the last one was installed on 17 November 2017) and other newly implemented features to transform itself into a high-speed, high resolution survey instrument that will truly help us discover and understand the universe.

ASKAP Early Science Commissioning Update

(Foreword by A. Popping)

With the ASKAP early science and processing activities increasing during the last year, the ASKAP spectral line processing group has made very significant progress in processing data and improving the processing pipeline. Apart from the weekly telecons we started organising three-monthly face-to-face busy weeks. Since the previous update we have held two of such busy weeks, the first in Sydney in October 2017 and the second in Perth in January 2018. Both busy weeks were attended by approximately 15 people from CASS and ICRAR-UWA including students, postdocs and more senior staff. The first busy week concentrated on improving the processing pipelines where we split up in sub-groups to work on different components. A number of problems and improvements were found, especially in the flagging, calibration and continuum subtraction. In the second busy week we concentrated on data visualisation, imaging and data combination. Our next busy week is planned for the end of May in Sydney and we very much encourage everybody interested to join.

Groundwork snippet reports for each commissioning field:

1) NGC 7232

by Tristan Reynolds

Data processing of the NGC 7232 field is progressing well. There are three papers in prep led by Karen on the NGC 7232 triplet, Dane on IC 5201 and Tristan on the NGC 7162 group. Dane and Tristan have successfully combined observations from 2016 with new observations in 2017. The RMS for combined images are 2.8mJy/beam (67hr, Karen), 1.5-1.9mJy/beam (180hr, Dane), 2.3mJy/beam (175 hr; Fig 3, Tristan). Cleaning has not yet been completely successful as there are still sidelobes remaining in the final image cubes around the brightest sources. These sidelobes are picked up in source finding with SoFiA. For example, apparent extended emission around the NGC 7162 and NGC 7162A is due to sidelobes.

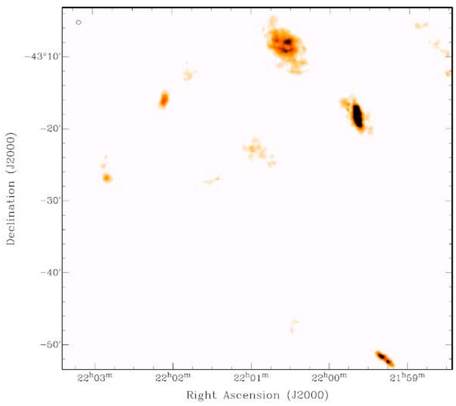


Figure 3: Moment-zero map of the NGC 7162 group (16-nights)

2) Dorado

by Ahmed Elagali

In the Dorado field, I have reduced and combined 7 beams around NGC 1566 (4 in footprint B and 3 in footprint A). I made several cubes with different robust and tapering parameter values. The rms noise of these cubes are ranges between 1.5 to 1.7 mJy/beam/channel and the beam sizes are between 31 to 38 arcsec. So far, I am happy with the reduction process and the output of the pipeline (see Fig 4).

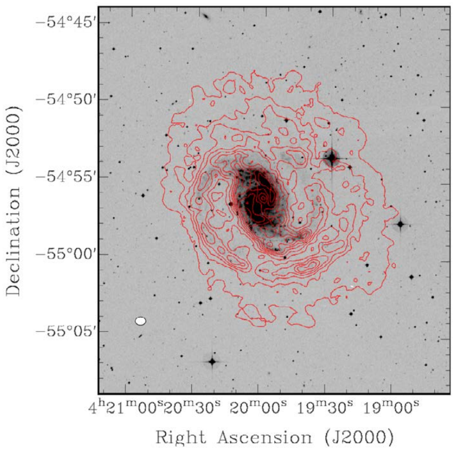


*Figure 4: HI moment-zero column density contours overlaid on the R-band image of NGC 1566. The first contour is at 10^{20} atom cm^{-2} and the rest are in steps of 7 *10^{20} atom cm^{-2} of that value. The N(HI) 3-sigma minimum value of our observations is 2.2 * 10^{19} atom cm^{-2}.*

Currently, I am studying the central galaxy of the Dorado field, NGC 1566. This will form my first paper for this field. I am investigating the HI gas morphology and the kinematics and mass model of this galaxy. The HI gas morphology & kinematics of NGC 1566 provides hints that this galaxy is undergoing ram pressure stripping (see the HI moment zero map and the HI column density radial profile). In the paper, I aim to investigate the influence of ram pressure on this system. I will also explore other properties of this galaxy by analysing the SFR maps I produced from the H-alpha, FUV and 24 microns images. Finally, I will look at the dust temperature of this system using a 24/70 micron map.

3) M83

by Bi-Qing For

I am focusing on 4 beams, which include known galaxies, M83, IC4316, NGC5264 and UGCA365. The firmware updates deployed on the supercomputers, Magnus and Galaxy, had a major impact on the work. Constant re-processing has been required due to various issues. RFI flagging needs improvement but we seem to have a handle on the selfcal parameters. Cleaning M83 has proved to be very challenging with the current pipeline. Attempts at combining and cleaning data that include IC4316 are promising. Preliminary result shows the data in IC4316 region has reached the WALLABY expected rms of 2.7 mJy per 4 km/s channel.

4) Fornax

by Chandra Murugesan & Ivy Wong

The neutral atomic hydrogen (HI) content of spiral galaxies has been observed to vary with environment, with more HI-poor or HI-deficient spirals being observed in high density environments. This has been attributed to influences such as ram pressure stripping and tidal interactions, which remove HI from the galaxies. However, some isolated spirals have also been observed to have relatively low HI mass fractions. The low densities of the Intra Group Medium in isolated environments make ram pressure stripping and tidal interactions unlikely candidates for gas removal. What then could be making some isolated spirals HI poor? Recently, Obreschkow et al. introduced the f_{HI} - q relation (f_{HI} is the HI mass fraction of a galaxy and q is the global stability parameter), where they find a tight positive correlation between the two parameters among isolated disk galaxies. The q parameter is directly linked to the specific angular momentum of the galaxy. The theoretical prediction is that this should be applicable to both HI excess and HI deficient disk galaxies. If this were to be true, then the HI deficiency in galaxies that reside in loose groups and fields can be explained not necessarily due to any stripping mechanisms but due to their low specific angular momentum. This result brings to light the importance of angular momentum in understanding the formation history of galaxies. As a next logical step, one can test if spiral/disk type galaxies in cluster like environments also follow this relation, or if they deviate systematically. To what extent does angular momentum play a role in regulating gas in denser environments? To study this, we seek to use the unprecedented quality of the WALLABY data from the Fornax field to identify HI deficient galaxies, particularly in the infall regions and estimate their angular momentum and HI mass fractions. We will test if these galaxies systematically deviate from the relation and why. As a start, we are currently identifying and selecting HI deficient galaxies as potential targets for the study.

In terms of the early science observations, we've been verifying the Fornax observations and optimising pipeline inputs for the automated processing using ASKAPsoft. The focus has mainly been on the continuum so far. Fig 5 shows a continuum moment-zero map of the Fornax field.

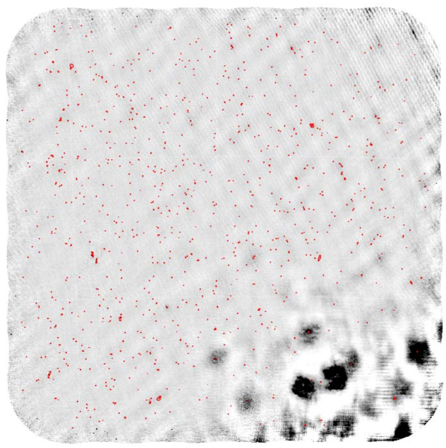


Figure 5: Working progress of a 1.2 GHz continuum map (12 MHz bandwidth; 11 hours integration) centred on the Fornax Cluster using ASKAPsoft. The red contours mark the location of the sources found by Selavy (finder within ASKAPsoft). Fornax A and its associated sidelobes are located in the South-western corner of the map.

TWG 4 – Source Finding and Cataloguing

T. Westmeier on behalf of TWG 4

Release of SoFiA 1.1

The source finding team is proud to announce the release of a new version 1.1 of SoFiA, the 3D source finding and parameterisation pipeline. The new stable release was published in October 2017 and introduces several new features, including the calculation of statistical uncertainties of several source parameters, the ability to only merge pixels with positive flux into sources, and several improvements to the graphical user interface, most notably a new built-in image viewer that allows output images from SoFiA to be inspected without the need to launch an external FITS viewer. In addition, numerous bugs have been fixed in SoFiA 1.1, making it the most reliable and stable version released so far. As usual, the latest SoFiA can be obtained from GitHub at https://github.com/SoFiA-Admin/SoFiA/.

The team is currently in the process of further improving the speed of SoFiA by optimising some of the most time-critical algorithms. Improvements in the way SoFiA measures the noise across data cubes have already led to a substantial speed-up of the pipeline, and further improvements in speed are expected over the next few months, as more algorithms will be optimised. Once these changes and improvements have been finalised and tested, they will be included in the next stable release of SoFiA expected to appear later this year.

Although it is difficult to keep track of the number of SoFiA users, several indicators suggest that SoFiA is becoming increasingly popular, not just within the HI community. During the fortnight of March 8–21, 2018, the SoFiA GitHub site recorded 51 unique visitors. The SoFiA paper has attracted 23 citations in ADS so far, most of which have used the pipeline on either HI or CO data cubes. Another popular use of SoFiA beyond its original purpose is for the automated generation of cleaning masks for the deconvolution of interferometric data.

Testing SoFiA on ASKAP early science data

With the start of the ASKAP early science programme we are finally able to test the performance of SoFiA on real data from ASKAP–12. For this purpose, a subcube of 800×800 pixels and 800 channels without any noticeable real HI emission in it was extracted from an observation of the G23 field taken as part of the DINGO early science programme. About 600 artificial galaxies covering a large range of different fluxes, sizes, rotation velocities and spatial orientations were then convolved with the clean beam of the ASKAP observation and inserted into the ASKAP data cube. The resulting cube was then fed into SoFiA to test the completeness and reliability of the pipeline using the S+C finder with a 3σ detection threshold in combination with SoFiA's dedicated reliability filter.

Overall, SoFiA detects more than 60,000 sources above the 3σ threshold. However, only about 270 of these sources remain after reliability filtering, demonstrating that SoFiA's sophisticated reliability module is capable of removing the overwhelming majority of false detections caused by noise peaks. Only three of the remaining sources turned out to be false detections, implying a near-100% reliability of the source catalogue produced by SoFiA. This spectacular success also suggests that the ASKAP data are largely free of artefacts such as RFI or residual continuum emission (after additional image-based continuum subtraction).

The completeness of the resulting source catalogue as a function of peak and integrated signal-to-noise ratio is shown in Fig. 6. SoFiA starts picking up sources at a peak SNR of about 1 and an integrated SNR of about 3. Much to our surprise, SoFiA reaches 100% completeness at a peak SNR of about 2.5 and an integrated SNR of about 5. This is far better than anticipated and can largely be

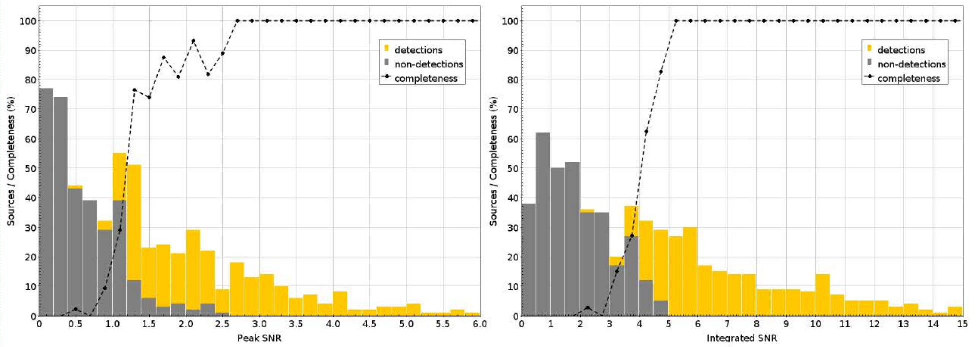


Figure 6: Source count (histograms) and resulting completeness (dashed line) as a function of peak SNR (left) and integrated SNR (right) after running SoFiA on a real ASKAP data cube with about 600 artificial galaxies in it. Non-detections are shown in grey and detections in orange.

attributed to the well-behaved noise in the ASKAP data in combination with the successful removal of false detections by SoFiA's reliability filter.

Lastly, we can use this source finding test to study the accuracy with which SoFiA is able to recover the observational parameters of the artificial galaxies. While SoFiA's measurements of parameters such as the line centroid, line width and integrated flux are generally accurate within their statistical uncertainties for the vast majority of sources, there are large errors in these parameters in a few individual galaxies. Further investigation reveals that these errors are the result of the source being only partially detected or broken up into multiple detections. Faint, edge-on galaxies characterised by a broad double-horn profile largely buried in the noise are particularly prone to this error, resulting in a systematic bias in the measured observational parameters for a small number of sources with an integrated signal-to-noise ratio below about 6. Further tests are needed to characterise the impact of this bias on the measurement of galaxy parameters in large surveys such as WALLABY.

VISTA-view: NIR data access and bespoke photometry for southern hemisphere surveys

by Luke Davies

As part of the multi-wavelength surveys group at ICRAR we have recently downloaded and unpacked the Visible and Infrared Survey Telescope for Astronomy (VISTA) survey data from VHS (VISTA Hemisphere survey) and VIKING (VISTA Kilo-Degree Infrared Galaxy Survey). Combined these datasets cover the whole of the southern hemisphere in J- and Ks-band (VHS+VIKING) and ~1500deg^2 in Z, Y, H (VIKING). The VHS regions reach a 5sig AB limiting depth of J=21.2 and Ks=20.0, while VIKING reaches 23.1, 22.3, 22.1, 21.5 and 21.2 in Z, Y, J, H and Ks respectively. This dataset will provide an essential resource for all upcoming Australian large area surveys which will cover a significant fraction of the southern hemisphere, i.e. WALLABY, EMU, Taipan, WAVES, etc.

However, easily accessing and moving this data is problematic. The total unpacked VHS+VIKING dataset is comprised of 3.7 million individual overlapping FITS files, forming ~65Tb of data. Ultimately this data will be processed, combined and photometry automatically extracted for all sources using ProFound (Robotham et al 2018, 2018MNRAS.tmp..432R), and will then be served via AAO Data Central. However, this processing is computationally expensive and will not occur on a short timescale.

In the interim, the early ASKAP science programs are taking data that would dramatically benefit from access to the complementary VISTA imaging. In addition, the photometric measurements that will be made automatically over the full southern hemisphere are likely to be tuned to produce robust photometry for the majority of sources. However, this is likely to fail for the small minority of large nearby galaxies which, due to their visibly diffuse nature and complex structure, will require bespoke ProFound settings to robustly extract their photometry. These are the very sources being targeted for early science with WALLABY.

In light of this, we have developed the VISTA-view tool (see Fig 7). This tool allows users to access cutouts from the available VISTA data at ICRAR and determine bespoke ProFound parameters to accurately extract target photometry. Given an input source name or RA and DEC, and size, the tool identifies all overlapping VISTA frames, combines with SWARP (Bertin et al. 2002) for a user-defined set of parameters, and allows uses to download the resultant images in FITS or PDF format. ProFound can then be run dynamically on this cutout region to extract target photometry. The extracted sources are displayed as a 'segmentation' map, and properties of the extracted photometry are given in a table. This table can then be downloaded, as well as the full output of the ProFound code (this is useful for further analysis such as structural decomposition fitting with ProFit - Robotham et al 2017, 2017MNRAS.466.1513R). Fig 7 displays the VISTA-view output for source NGC7162, a WALLABY early science target. The ProFound parameters (left) are tuned to provide a good segmentation map for the source (red segment). A summary of key source properties is given in the top row of the table. For example, NGC7162 has an extracted J-band

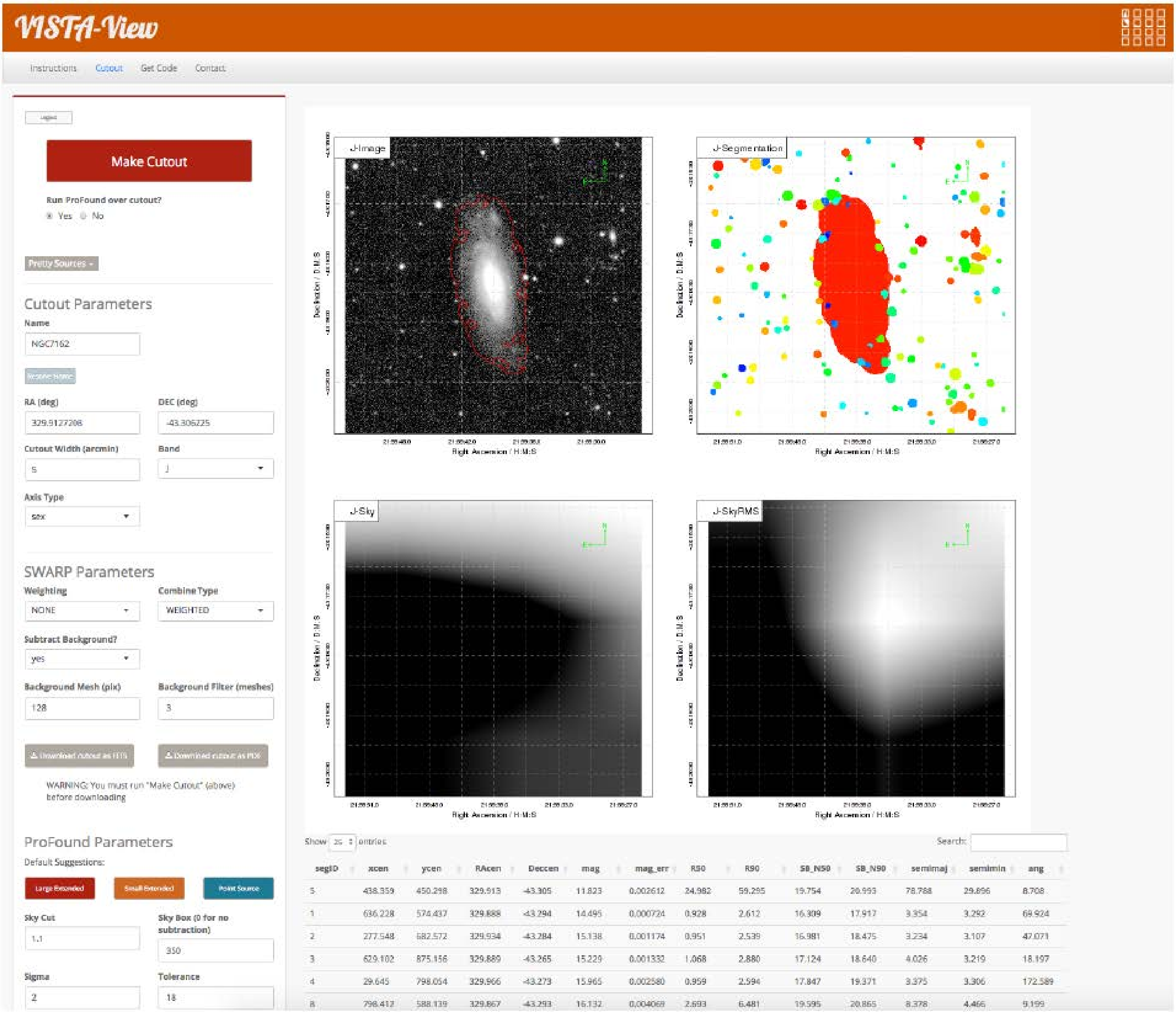


Figure 7: The VISTA-view tool for NGC7162. Input parameters for source position (name resolver or RA,DEC), cutout size, band, and key SWARP and ProFound parameters. The ProFound parameters have been tuned to provide a good extraction of NGC7162 photometry. The resultant images on the right show: cutout region (top left), ProFound segments (top right), ProFound sky estimation (bottom left) and ProFound skyRMS (bottom right). The table below the figures shows the extracted source properties.

magnitude of 11.823.

To highlight the benefit of the bespoke tuning offered by VISTA-view, Fig 8 displays the same source but run with the default ProFound parameters (tuned for the majority of sources in the VISTA imaging). Clearly this provides a poor segmentation for NGC7162, splitting it into two segments, and not extending to its low surface brightness wings. This would result in incorrectly measured photometry (this segmentation measures a J-band magnitude of 12.642, nearly 1 mag fainter than the previous segmentation). This is not a problem with the ProFound code, but simply highlights that generic photometric extraction parameters are not adequate for the bulk of the WALLABY early science targets.

VISTA-view is currently only available internally to ICRAR, but will be made available to survey teams in the near future following user testing.

ASKAPSoft News

by Steve Ord & Daniel Mitchell

The last 8 months has seen some great progress with ASKAPSoft processing of spectral line data. Specifically, the ability to write out parallel FITS images and the addition of features that permit integration of observations over multiple nights and multiple pointings.

The new parallel linear mosaicking tool is now run as standard, and the spectral line imaging now routinely produces either sub-cubes or writes to an output cube in parallel greatly improving the efficiency of cube generation. The image weighting has been adapted to deal with cases where input mosaicks have different weights, allowing to combination of observations with differing lengths of integration. These features have allowed the team to generate images that reach WALLABY depths with early science data using both ASKAPSoft and MIRIAD.

We are now working on improving the performance of the spectral line imaging in order to provide the capacity within the future real time pipeline to permit multiple clean cycles in pseudo real-time operation. We have also identified areas where appreciable improvements can be made over the current scheme and over the next six to eight months the software team hope to greatly improve the efficiency of the spectral line imaging; introduce accurate primary beam corrections into the mosaicking and improve the performance and fidelity of the multiscale deconvolution.

Pawsey GPU Hackathon

by George Bekiaris

After a very successful run at multiple locations around the world in 2017, the world-wide series of GPU Hackathons finally came to Fremantle, Western Australia, in April 16-20, 2018. The Pawsey Supercomputing Centre, in collaboration with the Oak Ridge National Laboratory, organised a 5-day GPU programming workshop that brought together scientists, engineers, and GPU mentors to work on a wide range of software applications.

The goal of a GPU hackathon is for current or prospective user groups of large hybrid CPU-GPU systems to send teams of at least 3 developers along with either a scalable application that could benefit from GPU accelerators, or an application running on accelerators that needs optimisation. Besides the obvious outcome of bringing back home a GPU-accelerated software, the hackathon is a unique opportunity to learn how to program GPU accelerators by working closely with GPU experts and mentors from companies like Cray, IBM, PGI, NVIDIA, just to name a few.

After a very successful attendance at the EuroHack 2017 in Lugano, Switzerland, CASS sent not one but two teams to participate in the first Southern Hemisphere GPU Hackathon. The ASKAPsoft team, represented by Daniel Mitchell, Steve Ord, and George Bekiaris worked

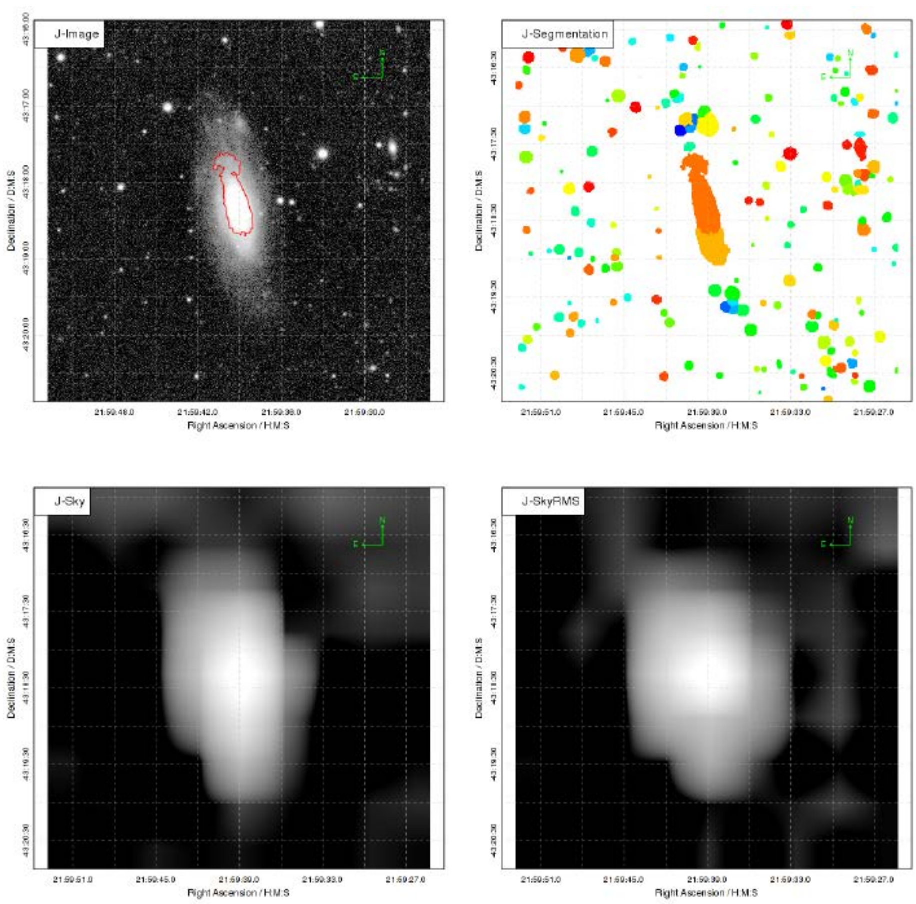


Figure 8: ProFound segmentation for NGC7162 using generic input parameters designed for the 'typical' source. This highlights the benefit of being able to tune source extraction parameters for resolved nearby sources. The sky is not correctly fit, and only the central part of the galaxy is extracted.

on speeding-up several parts of the ASKAP software suit, but also improved parts of its existing GPU code. The gCorr team, represented by Chris Phillips, Jamie Stevens, and their collaborators, Adam Deller and Cherie Day (Swinburne) and Mark Kettenis (JIVE), ported their radio astronomy cross-correlation software to the GPU for the first time. The team is aiming to develop a generic high-performance cross-correlation implementation that can be used with a wide variety of instruments (specifically focussing on VLBI and ATCA applications).

Report from recent meetings

WALLABY busy-week at CASS, Marsfield (3 – 6 October 2017)

by Ivy Wong

This busyweek began with a cupcake challenge whereby the team member with the "best" 36-beam early-science cube wins a tray of cupcakes made by Dr Karen Lee-Waddell (see bottom panel of figure 9 for an example). However, this was not to be as we soon faced and identified many remaining challenges at every stage of the processing. This led to the new goal of documenting these challenges and providing the processing software team with our recommendations. To celebrate a week of teamwork, no one won the entire tray of cupcakes but we all earned a single cupcake each.

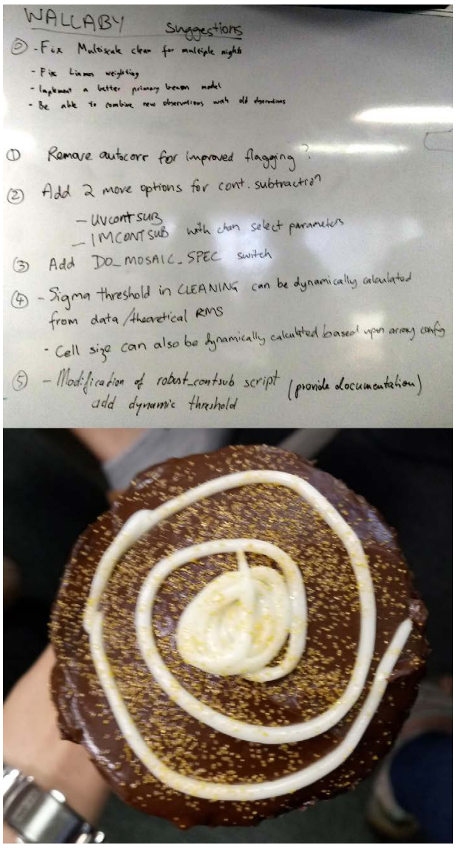


Figure 9: Top: processing recommendations (for ASKAPsoft). Bottom: Example cupcake at the October 2017 busy-week

WALLABY busy-week at ICRAR/ UWA, Crawley (29 Jan – 2 Feb 2018)

by Karen Lee-Waddell & Baerbel Koribalski (this report also appeared in the CASS February 2018 newsletter)

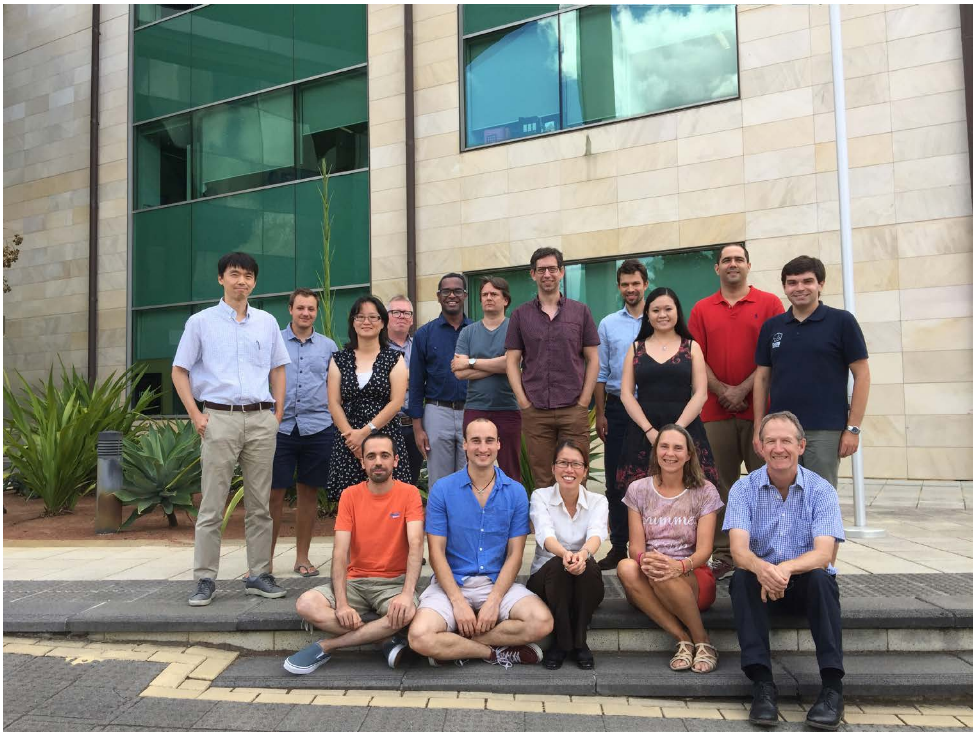


Figure 10: Team photo at the Jan-Feb busyweek. Photo credits: Claudia Lagos & Lister Staveley-Smith (photographers) & Ivy Wong (post-processing)

The quarterly ASKAP spectral line busy week took place 29 Jan – 2 Feb 2018 in Perth, WA. Sixteen members of the ASKAP spectral line data processing work group, which is coordinated by A. Popping and K. Lee-Waddell, as well as a few guests gathered at the International Centre for Radio Astronomy Research (ICRAR) at UWA for a very productive week of working with data from the WALLABY Early Science program.

Highlights include a session on data visualization with Ugo Varetto (Acting Executive Director of Pawsey) who introduced FastX, a web-based remote desktop tool that enables users to access and interact with data products on the Pawsey Supercomputing system. Since ASKAP spectral line data and cubes are quite large (the raw data for a single night of observations is a few TBs), a quick and user-friendly interface allows us to look at and analyse the quality of the data products, which is crucial for improving ASKAPsoft – the in-house developed processing pipeline – and identifying possible issues with the array during the commissioning and early science phase. There were also in-depth discussions about the nuances of the deconvolution algorithm (i.e. cleaning) in ASKAPsoft that is used to make images of the radio emission from galaxies.

In order to reach full WALLABY sensitivity, ~20 nights of early science observations for one field need to be calibrated and combined. To make the task achievable, WALLABY members concentrate on a few of the 36 beams and a limited velocity range to focus on specific science goals, such as a compact galaxy group or interacting pair of galaxies. Several postdocs and students work on high priority targets in all four WALLABY Early Science fields (each 30 sq degrees), which were observed between Oct 2016 and Jan 2018 (700+ hours, 200+

TB of data). Results presented at the end of our busy week included hydrogen (HI) intensity maps and velocity fields of several nearby galaxies, the discovery of new dwarf galaxies and tidal tails between galaxies as well as comparison of imaging performance with different ASKAPsoft parameters. Figures 10 and 11 are a collection of photos taken during this busyweek.

The next WALLABY "busy week" is planned for May 2018 and will be held at the CASS Headquarters in Sydney. Prior to that, we aim to hold a writing retreat to concentrate on science publications that are currently being drafted.

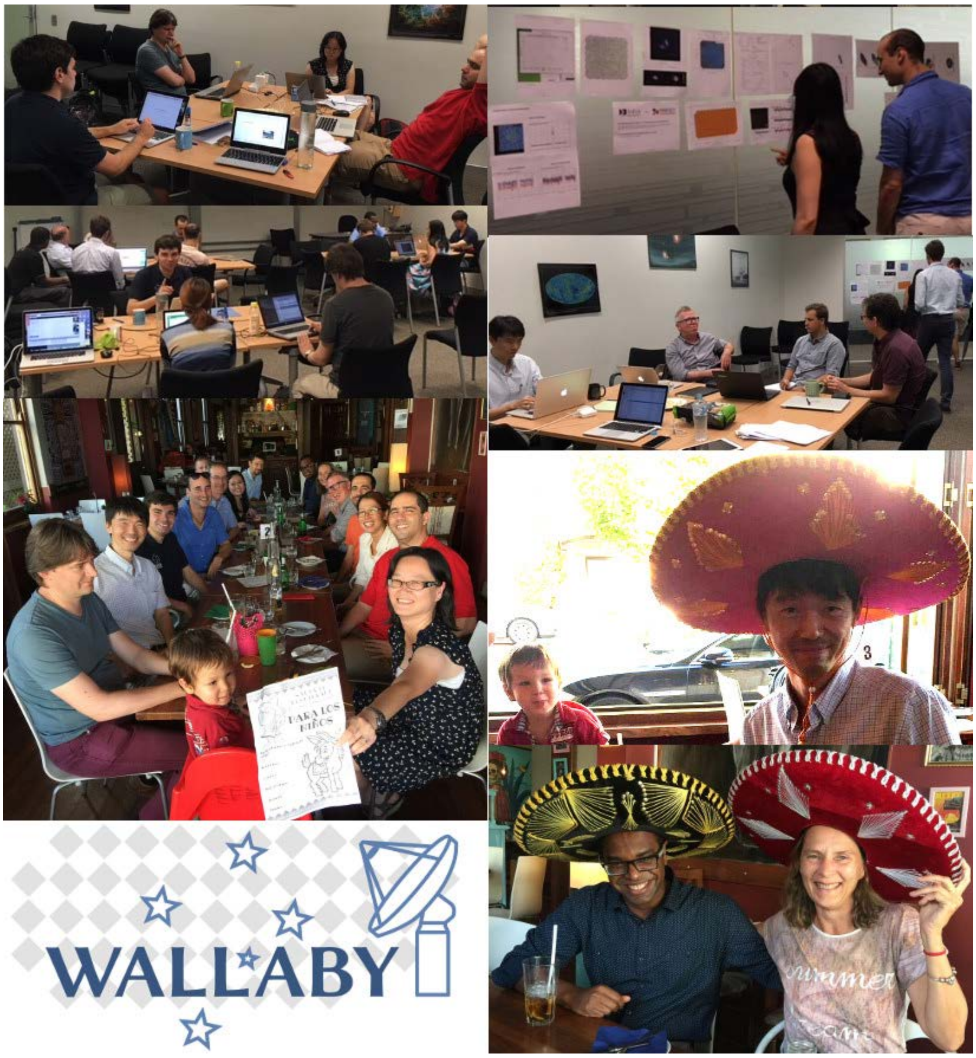


Figure 11: Jan-Feb 2018 busyweek activities. Photo credits: Bi-Qing For & Lister Staveley-Smith

Upcoming Meetings

Q2 WALLABY busy-week

Marsfield, AU

21 - 25 May 2018

ACAMAR 4

Sichuan China

6 - 8 June 2018

PHISCC

Pingtang International Radio Telescope Astronomical Park, Pingtang, China

11 - 13 June 2018

PHISCC breakouts

RFI, data reduction, etc

14 - 15 June 2018

RSA-CN-AU-NL Pathfinders Synergies meeting

Pingtang, Guizhou, China

13 - 15 June 2018

KIAA meeting on Gas in Galaxies

Beijing (lead chair: Jing Wang)

18 - 22 June 2018

IAU General Assembly 2018

Vienna, Austria

20 - 31 August 2018

ICRAR/CASS Joint Radio School

Geraldton, AU

1 - 5 October 2018

WALLABY Publications

2018 articles which mention WALLABY (according to ADS Beta):

Oh, S.-H., Staveley-Smith, L., Spekkens, K., Kamphuis, P. & Koribalski, B.S. 2018 2D Bayesian automated tilted-ring fitting of disc galaxies in large H I galaxy surveys: 2DBAT Monthly Notices of the Royal Astronomical Society, 473, 3256

Stark, D.V., Bundy, K.A., Orr, M.E., Hopkins, P.F., Westfall, K., Bershady, M., Li, C., Bizyaev, D. et al 2018 SDSS-IV MaNGA: constraints on the conditions for star formation in galaxy discs Monthly Notices of the Royal Astronomical Society, 474, 2323

Jones, M.G., Haynes, M.P., Giovanelli, R. & Moorman, C. 2018 The ALFALFA HI mass function: A dichotomy in the low-mass slope and a locally suppressed `knee' mass in press Monthly Notices of the Royal Astronomical Society

Schneider, A. & Truijillo-Gomez, S., 2018 Constraining cosmology with the velocity function of low-mass galaxies Monthly Notices of the Royal Astronomical Society, 475, 4809

Elahi, P.J., Welker, C., Power, C., Lagos, C.D.P., Robotham, A.S.G., Cañas, R. & Poultoun,R. 2018 SURFS: Riding the waves with Synthetic UniveRses For Surveys Monthly Notices of the Royal Astronomical Society, 475, 5338

2017 articles which mention WALLABY (according to ADS Beta):

Bosma, A. 2017 "HI in the Outskirts of Nearby Galaxies" Outskirts of Galaxies, Astrophysics and Space Science Library, Volume 434. ISBN 978-3-319-56569-9. Springer International Publishing AG, 2017, p. 209

Hess, K.M., Cluver, M. E., Yahya, S., Leisman, L., Serra, P., Lucero, D. M., Passmoor, S. S., Carignan, C., 2017, "H I in Group Interactions: HCG 44", Monthly Notices of the Royal Astronomical Society, 464, 957

Howlett, C., Staveley-Smith, L. & Blake, C. 2017 "Cosmological forecasts for combined and next-generation peculiar velocity surveys", Monthly Notices of the Royal Astronomical Society, 464, 2517

Jarrett, T. H., Cluver, M.E., Magoulas, C. Bilicki, M., Alpaslan, M., Bland-Hawthorn, J., Brough, S., Brown, M.J.I., et al. 2017 "Galaxy and Mass Assembly (GAMA): Exploring the WISE Web in G12" Astrophysical Journal , 836, 182

Crain, R.A., Bahe, Y.M., Lagos, C. d. P., Rahmati, A., Schaye, J., McCarthy, I. G., Marasco, A., Bower, R. G., Schaller, M., Theuns, T., van der Hulst, T., 2017 "The EAGLE simulations: atomic hydrogen associated with galaxies", Monthly Notices of the Royal Astronomical Society, 464, 4204

Taylor, R. 2017 "Visualizing Three-dimensional Volumetric Data with an Arbitrary Coordinate System" Publications of the Astronomical Society of Pacific, Volume 129, Issue 972, pp. 028002

Davies, L.J.M., Huynh, M.T., Hopkins, A.M., Seymour, N., Driver, S.P., Robotham, A.G.R., Baldry, I.L., Bland-Hawthorn, J., et al 2017 "Galaxy And Mass Assembly: the 1.4 GHz SFR indicator, SFR-M relation and predictions for ASKAP-GAMA", Monthly Notices of the Royal Astronomical Society, 466, 2312*

Kleiner, D., Pimbblet, K.A., Jones, D.H., Koribalski, B.S. & Serra, P. 2017 " Evidence for H I replenishment in massive galaxies through gas accretion from the cosmic web" Monthly Notices of the Royal Astronomical Society, 466, 4692

Papastergis, E. & Ponomareva, A.A. 2017 "Testing core creation in hydrodynamical simulations using the HI kinematics of field dwarfs" Astronomy & Astrophysics, 601, 1

Huterer, D., Shafer, D.L., Scolnic, D.M. & Schmidt, F. 2017 "Testing ΛCDM at the lowest redshifts with SN Ia and galaxy velocities" Journal of Cosmology and Astroparticle Physics, Issue 05, article id. 015

Maccagni, F.M., Morganti, R., Oosterloo, T.A., Geréb, K. & Maddox, N. 2017 Kinematics and physical conditions of H I in nearby radio sources. The last survey of the old Westerbork Synthesis Radio Telescope Astronomy & Astrophysics 604, 43

Weigel, A.K., Schawinski, K., Caplar, N., Wong, O.I., Treister, E. & Trakhtenbrot, B. 2017 AGNs and Their Host Galaxies in the Local Universe: Two Mass-independent Eddington Ratio Distribution Functions Characterize Black Hole Growth Astrophysical Journal, 845, 134

Guo, H., Li, C., Zheng, Z., Mo, H.J, Jing, Y.P., Zu, Y., Lim, S.H., Xu, H. 2017 Constraining the H I-Halo Mass Relation from Galaxy Clustering Astrophysical Journal, 846, 61

Bolatto, A.D., Wong, T., Utomo, D, Blitz, L., Vogel, S., Sánchez, S., Barrera-Ballesteros, J., Cao, Y. et al. 2017 The EDGE-CALIFA Survey: Interferometric Observations of 126 Galaxies with CARMA Astrophysical Journal, 846, 159

Schneider, A., Trujillo-Gomez, S., Papastergis, E., Reed, D.S., Lake, G, Hints against the cold and collisionless nature of dark matter from the galaxy velocity function Monthly Notices of the Royal Astronomical Society, 470, 1542

Howlett, C. Robotham, A.S.G., Lagos, C.D.P. & Kim, A.G. 2017 "Measuring the growth rate of structure with Type IA Supernovae from LSST" Astrophysical Journal, 847, 128

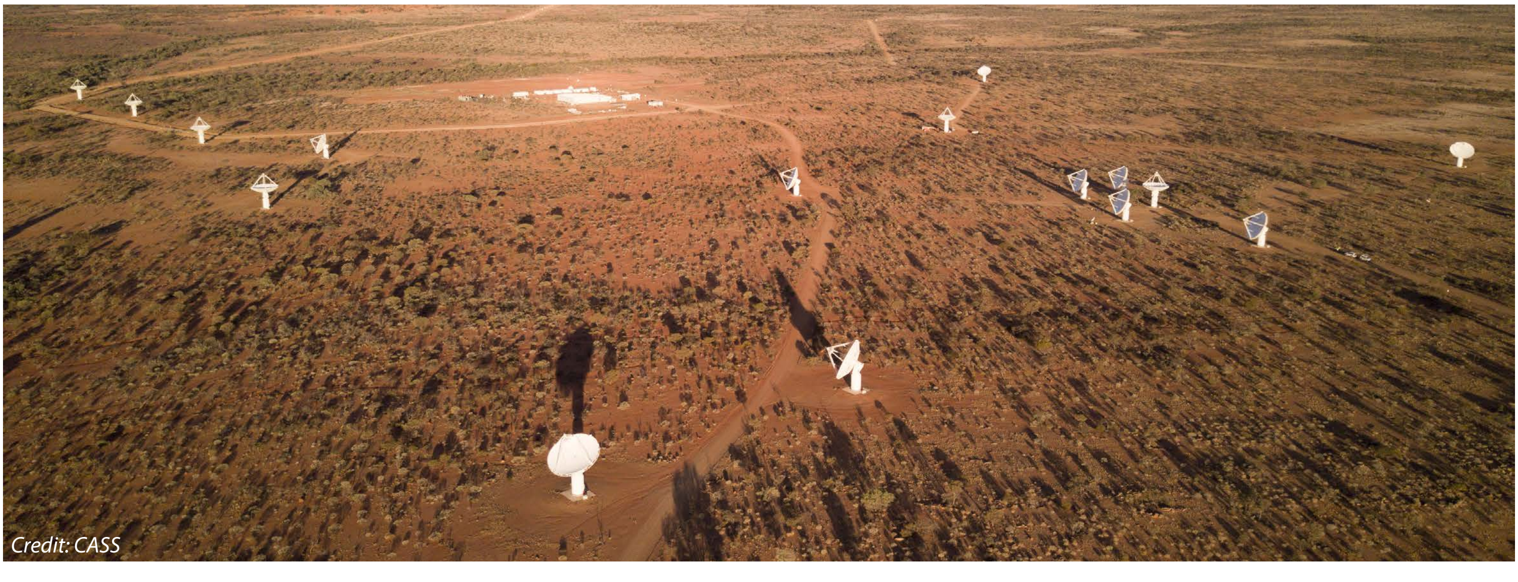
Stevens, A.R.H. & Brown, T. 2017 Physical drivers of galaxies' cold-gas content: exploring environmental and evolutionary effects with Dark Sage Monthly Notices of the Royal Astronomical Society, 471, 447

Adams, C. & Blake, C., 2017 Improving constraints on the growth rate of structure by modelling the density-velocity cross-correlation in the 6dF Galaxy Survey Monthly Notices of the Royal Astronomical Society, 471, 839

da Cunha, E., Hopkins, A.M., Colless, M., Taylor, E.N., Blake, C., Howlett, C., Magoulas, C., Lucey, J.R., et al 2017 The Taipan Galaxy Survey: Scientific Goals and Observing Strategy Publications of the Astronomical Society of Australia, 34, 47

Howlett, C., Staveley-Smith, L., Elahi, P.J., Hong, T., Jarrett, T.H., Jones, D.H., Koribalski, B.S., Macri, L.M. et al 2017 2MTF - VI. Measuring the velocity power spectrum Monthly Notices of the Royal Astronomical Society, 471, 3135

Wang, J., Koribalski, B.S., Jarrett, T.H., Kamphuis, P., Li, Z.-Y., Ho, L.C., Westmeier, T., Shao, L. et al 2017 The Local Volume H I Survey: star formation properties Monthly Notices of the Royal Astronomical Society, 472, 3029



Credit: CASS