



# ATCA Update

ATUC April 2021

Jamie Stevens | 2021-April-13





# Statistics

Project allocations for “normal” projects (who expect to get time in a single semester, excluding NAPA).

	2019OCT	2020APR	2020OCT	2021APR
# of Proposals	26 (1159 hr)	48 (2878 hr)	38 (2411 hr)	33 (2432 hr)
Cutoff Grade	3.2	3.3	3.0	3.3
Projects 90 – 100%	20	21	30	22
Projects 40 – 90%	2	8	5	3
Projects < 40%	0	3	1	1
Projects 0%	4	16	2	7



# ASKAP-related projects

	2019OCT	2020APR	2020OCT	2021APR
# of Proposals regular	26 (1159 hr)	48 (2878 hr)	38 (2411 hr)	33 (2432 hr)
# ASKAP-related regular	3 (60 hr) [5.2%]	7 (473 hr) [16.4%]	10 (565 hr) [23.4%]	6 (428 hr) [17.6%]
# of Proposals NAPA	23 (940 hr)	26 (1367 hr)	30 (1461 hr)	28 (1515 hr)
# ASKAP-related NAPA	1 (60 hr) [6.4%]	2 (173 hr) [12.7%]	3 (280 hr) [19.2%]	3 (272 hr) [18.0%]



# NAPA Allocation

Semester	NAPA/ToO (hours) **	NAPA %	ToO %	ASKAP %
2020OCT	455 (14.7%)	62.1	37.9	9.2
2020APR	348 (11.2%)	60.2	39.8	13.4
2019OCT	633 (20.4%)	48.0	52.0	19.4
2019APR	501 (16.2%)	57.7	42.3	7.8

\*\* Percentages in “hours” column represent the fraction of the usable semester, which is roughly 3100 hours.



# Purchased Time

- Two projects have purchased time on ATCA in 2021APR:
  - C3433, PI Degenaar: 32.5 hours, in coordination with the Integral X-ray telescope
  - SSA, PI Smith: 64 hours, to investigate the use of ATCA for “Space Situational Awareness” purposes



# BIGCAT Science Requirements

- Workshop held on March 11 & 12, well attended
- 12 science case talks, plus one on RFI mitigation
- Discussions on how to use and commission the new correlator
- Overview of BIGCAT at

[https://www.atnf.csiro.au/people/Chris.Phillips/BIGCAT\\_Overview.pdf](https://www.atnf.csiro.au/people/Chris.Phillips/BIGCAT_Overview.pdf)

- Recordings of the meeting available from

<https://www.atnf.csiro.au/content/bigcat-science-requirements-workshop>



# BIGCAT Science Possibilities

## **A deeper AT20G survey**

Global Imprints from  
Nascent Atoms to Now

## **QUOCCA II Polarisation survey**

Automated Rapid Response  
Observing

## **Extreme Scattering Events**

HOPS++

## **Zeeman Splitting of maser emission**

High-z CO survey

## **Satellite Tracking/SSA**

Pulsar binning

## **FRB co-observations**

VLBI

## **VLBI with PAFs**



# BIGCAT Science Requirements

- A document will soon be compiled with help from the community to understand exact mode requirements
  - Continuum/spectral bandwidths and resolutions required
  - Number of simultaneous spectral lines to observe
  - Integration times needed
  - Whether voltage data needs to be stored
  - How the antennas need to move
  - Any special processing
- If you want to tell us your science requirements, email the project scientist Elizabeth Mahony (@csiro.au)





# Legacy Project Status Reports



# Legacy Projects

IMAGINE got its last field in 2020OCT.

CACHMC has four fields remaining.

StarFISH will finish observations soon, but whether it's in summer (2021OCT) or winter (2022APR) is not yet known.

Time allocations for this semester and last (total semester time does not include VLBI and maintenance/reconfig time, or purchased time), and the amount of time remaining for each project.

	2020OCT	2021APR	Remaining
Time (hrs)	3331	3225	
GLASS (Huynh)			0
IMAGINE (Popping)	12 hrs 0.4 %		0
StarFISH (Breen)	288 hrs 10.6 %	516 hrs 19.4 %	254 hrs 9.4 %
CACHMC (Jackson)			432 hrs 28.8 %
Total	300 hrs 9.0 %	516 hrs 16.0 %	



# GLASS Progress

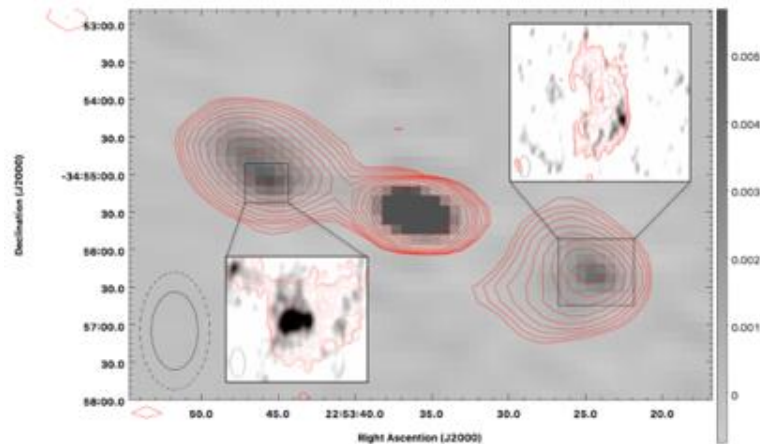
- Observations completed in OCT2019
  - Finished last region
  - Patch pointings with low integration times
  - More obs at 1.5km to check resolution bias
- Imaging
  - Preliminary images at 5.5 GHz of full field, all data
  - Preliminary 9.5 GHz images soon



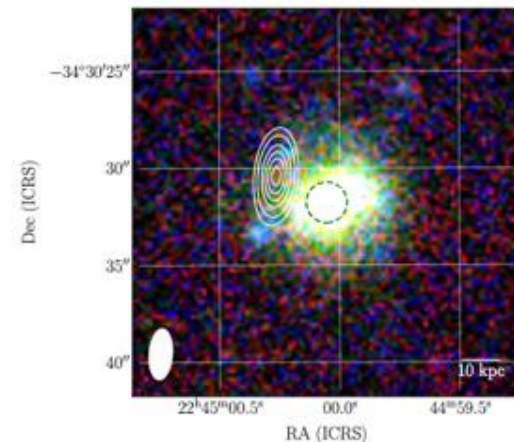
# GLASS Papers

- GLASS data used in:
  - Seymour et al. 2020, PASA, 37, 13
  - Allison et al. 2020, MNRAS, 497, 2730
  - Quici et al. 2021, PASA, 38, 8
- Initial data release paper in progress:
  - Semester one data, images and catalogues and source counts
  - Resolution and clean bias analysis ongoing to understand systematics

Seymour et al. 2020



Allison et al. 2020





# GLASS Data Release Plans

- Initial data release with paper 1
  - Semester one data, Region D
  - 5.5 and 9.5 GHz images and catalogues
  - Expected: Dec 2021
  
- Second data release
  - All six regions, inc. OCT2019 patch data
  - 5.5 and 9.5GHz images and catalogues
  - Expected: Dec 2022



# IMAGINE



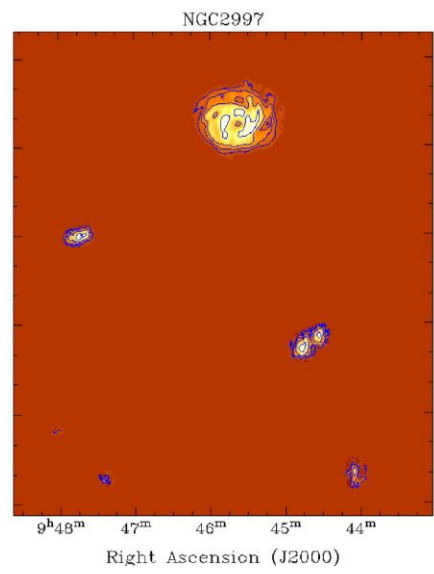
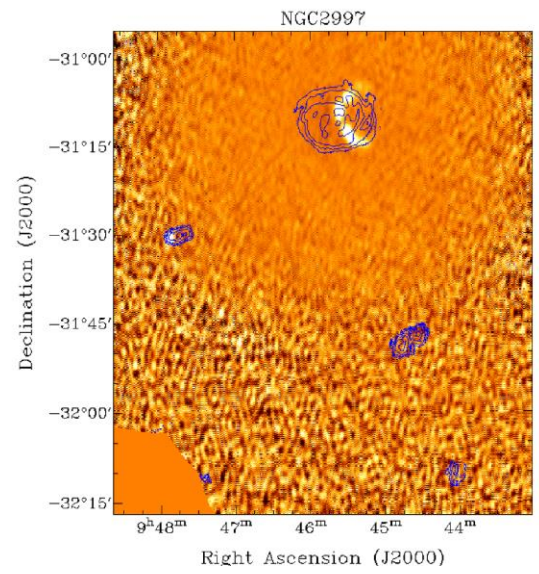
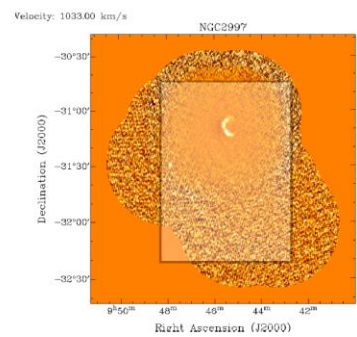
- Last observation: Feb 2021 (observing completed)
- Most IMAGINE observations reduced
- IMAGINE pipeline re-reduces ATCA archival data using similar settings for uniformity
- Main challenge/delay in incorporating archival data (e.g. different file names, calibrator not always known, unknown issues)
- Cubes with H168 and 750m configuration for all galaxies
- “Finished cubes” with all data for 5 galaxies
- Consulting with the ATNF computing group to deliver an internal data release to the IMAGINE team
- Internal data release consists of:
  - imagine pipeline
  - reduced visibilities (IMAGINE)
  - reduced visibilities (archival ATCA)
  - reduced data cubes and data products (cubelets, moment maps etc.)
- Same products released to public together with overview paper after assessment period (intent is sooner than later, exact date TBD with team)



# IMAGINE



**Example cube: NGC 2997 IMAGINE data plus available archival ATCA data**  
**Data reduced with IMAGINE pipeline (no human intervention)**





# CACHMC Legacy Survey

Progress and Status Report

April 2021

Blue 3.6  $\mu\text{m}$ ; Green 8  $\mu\text{m}$ ; Red 24  $\mu\text{m}$

With CACHMC  $\text{NH}_3$  1,1 integrated intensity maps overlaid





# Data reduction

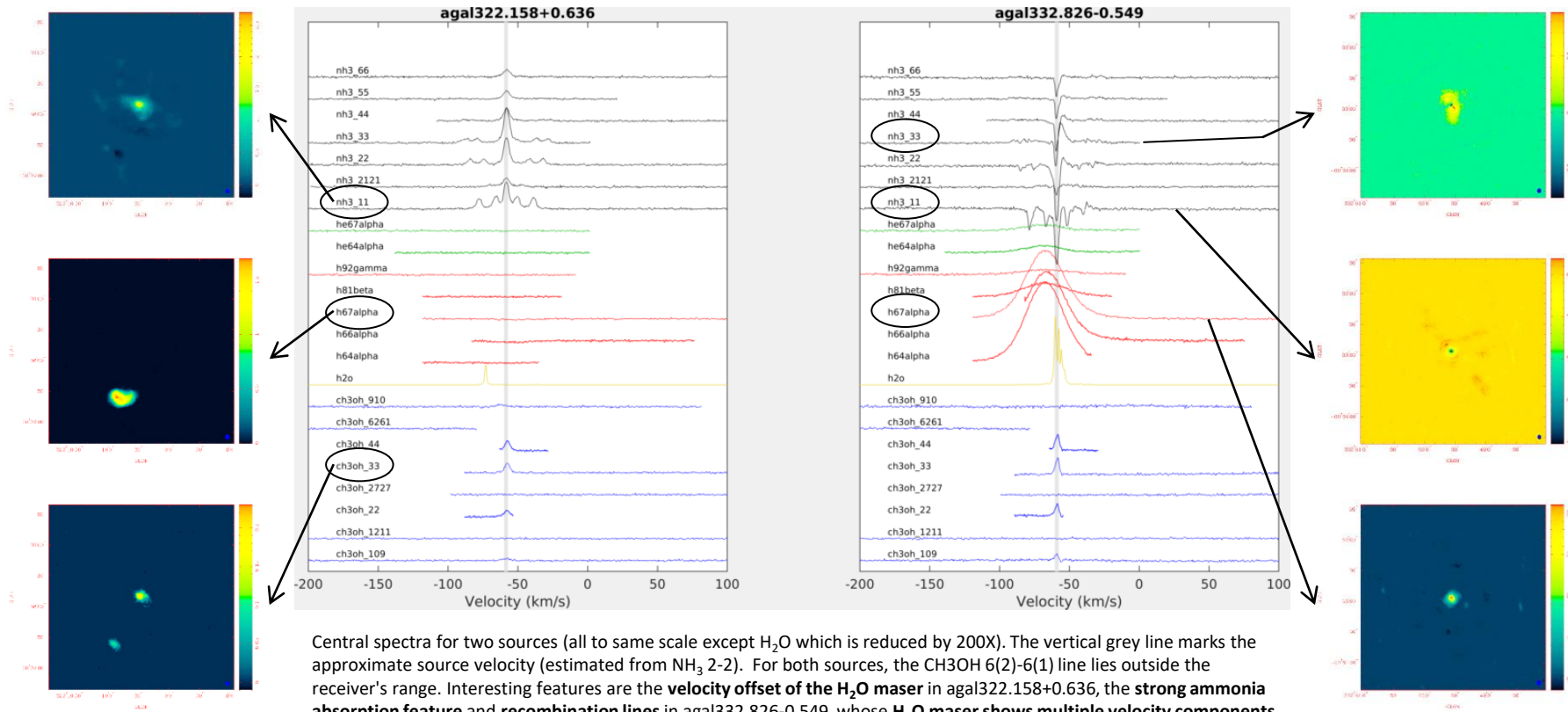
- Pipeline completed, tested, and verified
- Data reduction approximately 95% complete
- 25 spectral lines identified (plus continuum)
- Data products generated from pipeline:
  - data cubes for 25 spectral lines [FITS]
  - 3'x3' moment 0 and 1 maps for 25 spectral lines [FITS]
  - Spectra of 25 lines at central position [ASCII and PNG]
  - Continuum maps [FITS]
  - NH<sub>3</sub> temperature maps [FITS]
  - NH<sub>3</sub> Hyperfine Intensity Anomaly maps [FITS]
- Data paper is in progress and planned for submission mid-2021
- Accompanied by data release via Harvard Dataverse (also CSIRO?)
  - Chosen for its model of data access, citation tools, and DOI status



# Planned publications

- Data release (FITS cubes and moment maps) plus basic analysis (e.g., temperature and column density maps) *August 2021*
- Nessie A structure *May 2021*
- NH<sub>3</sub> hyperfine intensity anomaly paper discussing the ubiquity of the observed anomaly; CACHMC makes this possible as it has produced some of the highest SNR ammonia data ever collected. Software developed and hyperfine anomalies mapped with significant variations. *September 2021*
- NH<sub>3</sub> (3,3) masers, ~30 new masers identified, more than doubling the known number *July 2021*
- Discovery of the H<sub>2</sub>O 6(1,6)-5(2,3) line, the usual “water maser” line, thermally excited and in absorption *November 2021*
- The fragmentation of high-mass clumps (in particular, this requires the 1500-metre baseline data collected in 2020) *January 2022*

# CACHMC sample sources:



Central spectra for two sources (all to same scale except H<sub>2</sub>O which is reduced by 200X). The vertical grey line marks the approximate source velocity (estimated from NH<sub>3</sub> 2-2). For both sources, the CH<sub>3</sub>OH 6(2)-6(1) line lies outside the receiver's range. Interesting features are the **velocity offset of the H<sub>2</sub>O maser** in agal322.158+0.636, the **strong ammonia absorption feature and recombination lines** in agal332.826-0.549, whose **H<sub>2</sub>O maser shows multiple velocity components**.



# Thank you

## **Astronomy and Space Science**

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