GLEAM: The GaLactic and Extragalactic MWA Survey

MWA
MURCHISON
WIDEFIELD
ARRAY

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Curtin University / International Centre for Radio Astronomy Research

4th November 2013

ICRAR

Curtin University

NATURAM PRIMUM COGNOSCERE RERUM

CfA

CSIRO

POSTERA CRESCAM LAUDE

SWINBURNE UNIVERSITY OF TECHNOLOGY

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SEEK WISDOM

MIT HAYSTACK OBSERVATORY

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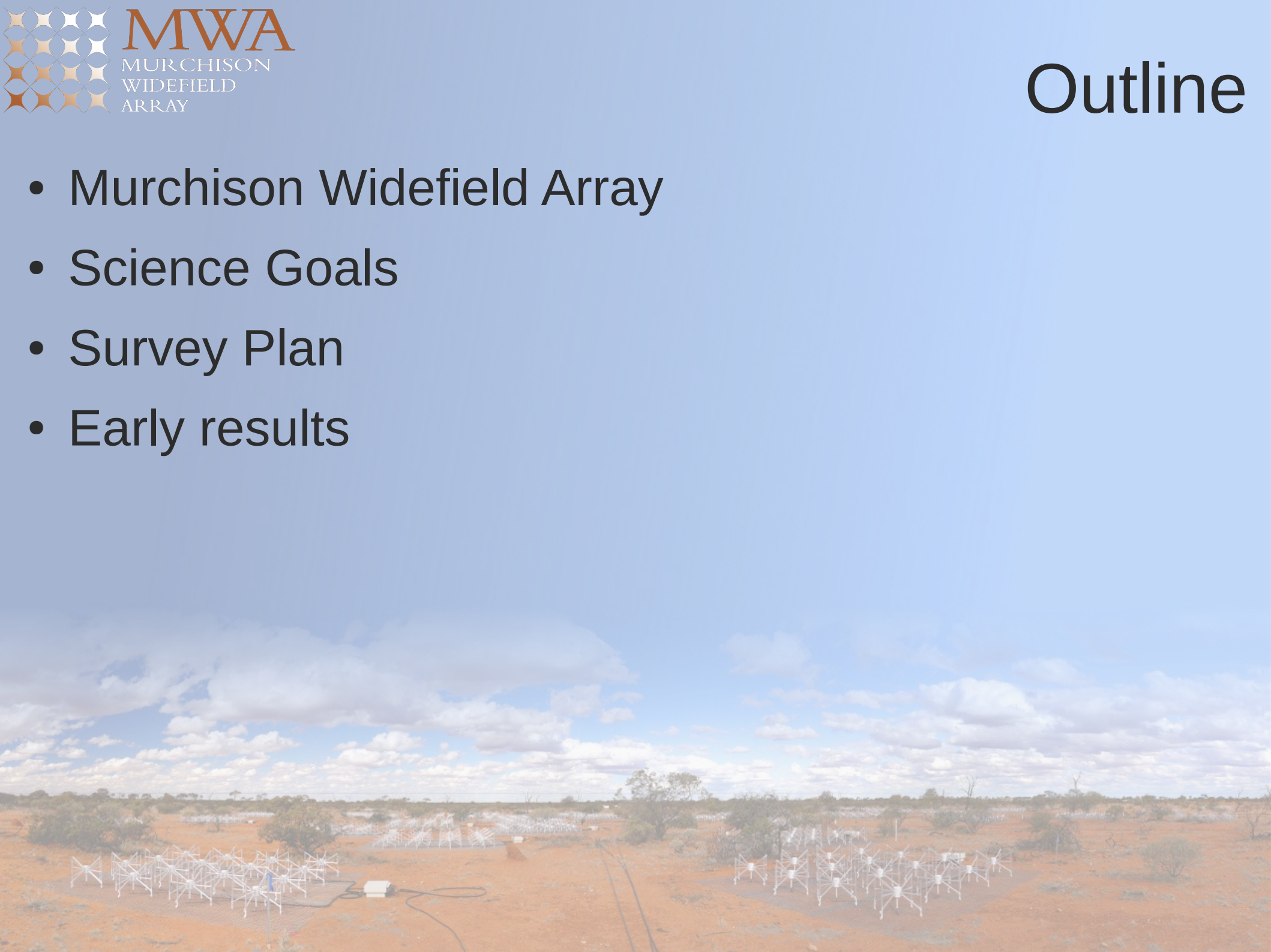
Outline

- Murchison Widefield Array
- Science Goals
- Survey Plan
- Early results



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Murchison Widefield Array

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GLEAM Specifications

	Full Instrument	Expansion plans for 2014
Number of 16-dipole tiles	128	SKA-low prototyping
Number of receivers	16	–
Observing frequencies	75—220 MHz	–
Frequency resolution	40 kHz	10 kHz
Longest baseline	2800m	–
Angular resolution	4'—1.2'	–
Polarisation	I, Q, U, V	–
Primary beam FHWM	25º—10º	–
Confusion limit/mJy	60mJy—5mJy	–

See Tingay 2013 for full system description
2013PASA...30....7T

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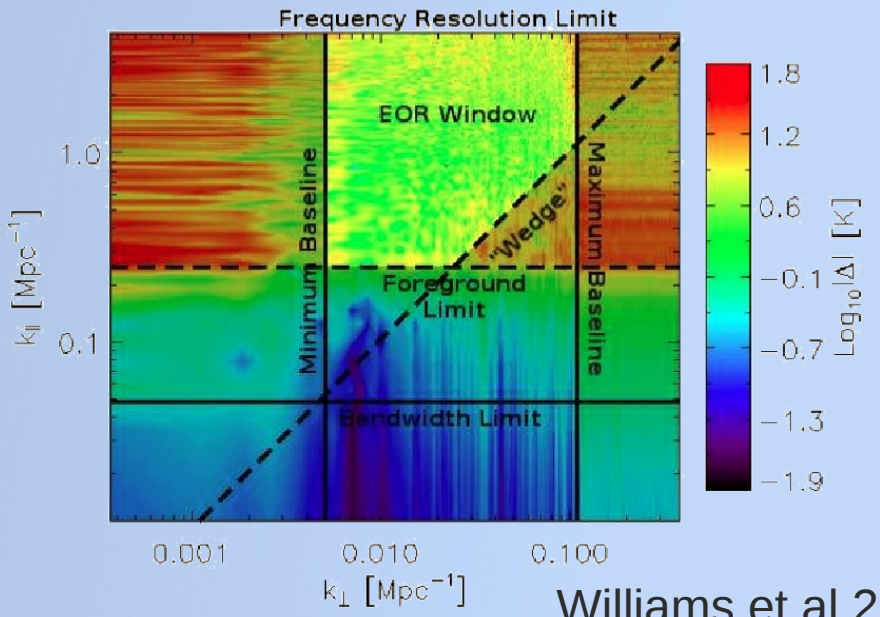
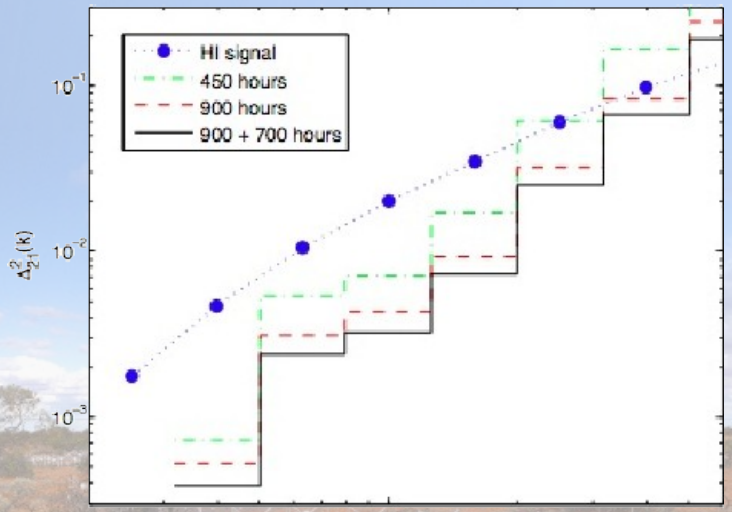
Science Goals

- Statistical detection of the Epoch of Reionisation
- Solar, heliospheric and ionospheric physics
- Detection and characterisation of transient objects



Williams et al 2012



Beardsley et al 2013

See Cath Trott's talk for the latest MWA EoR updates

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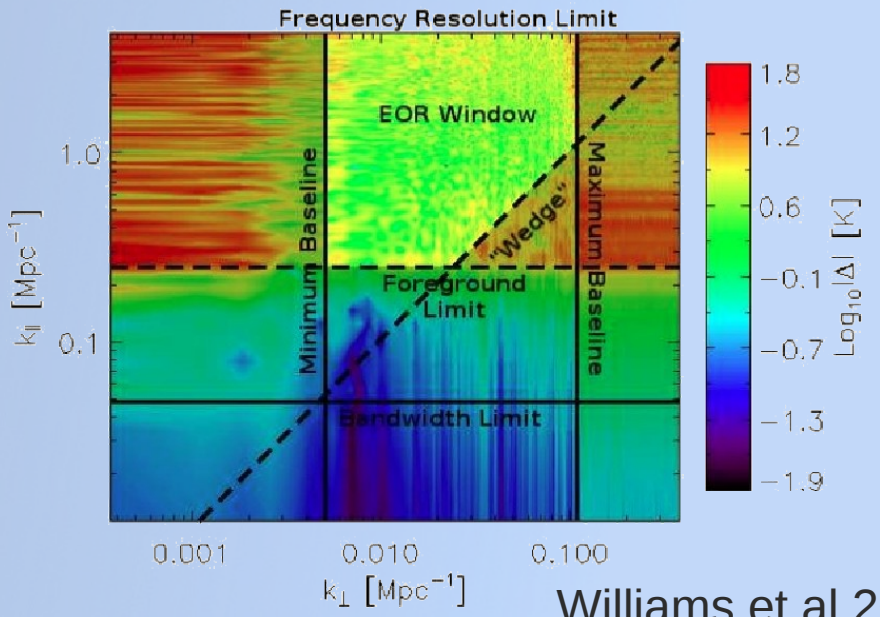
Science Goals

- Statistical detection of the Epoch of Reionisation
- Solar, heliospheric and ionospheric physics
- Detection and characterisation of transient objects
- ...and Galactic and Extragalactic science (everything else...!)



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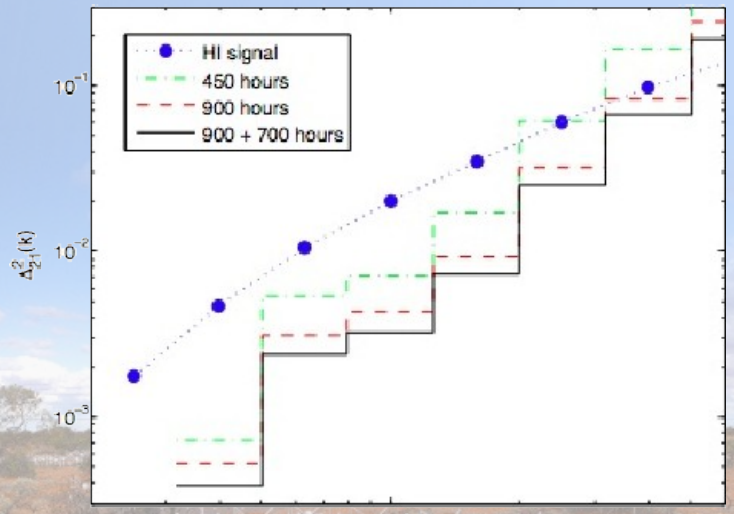

Beardsley et al 2013

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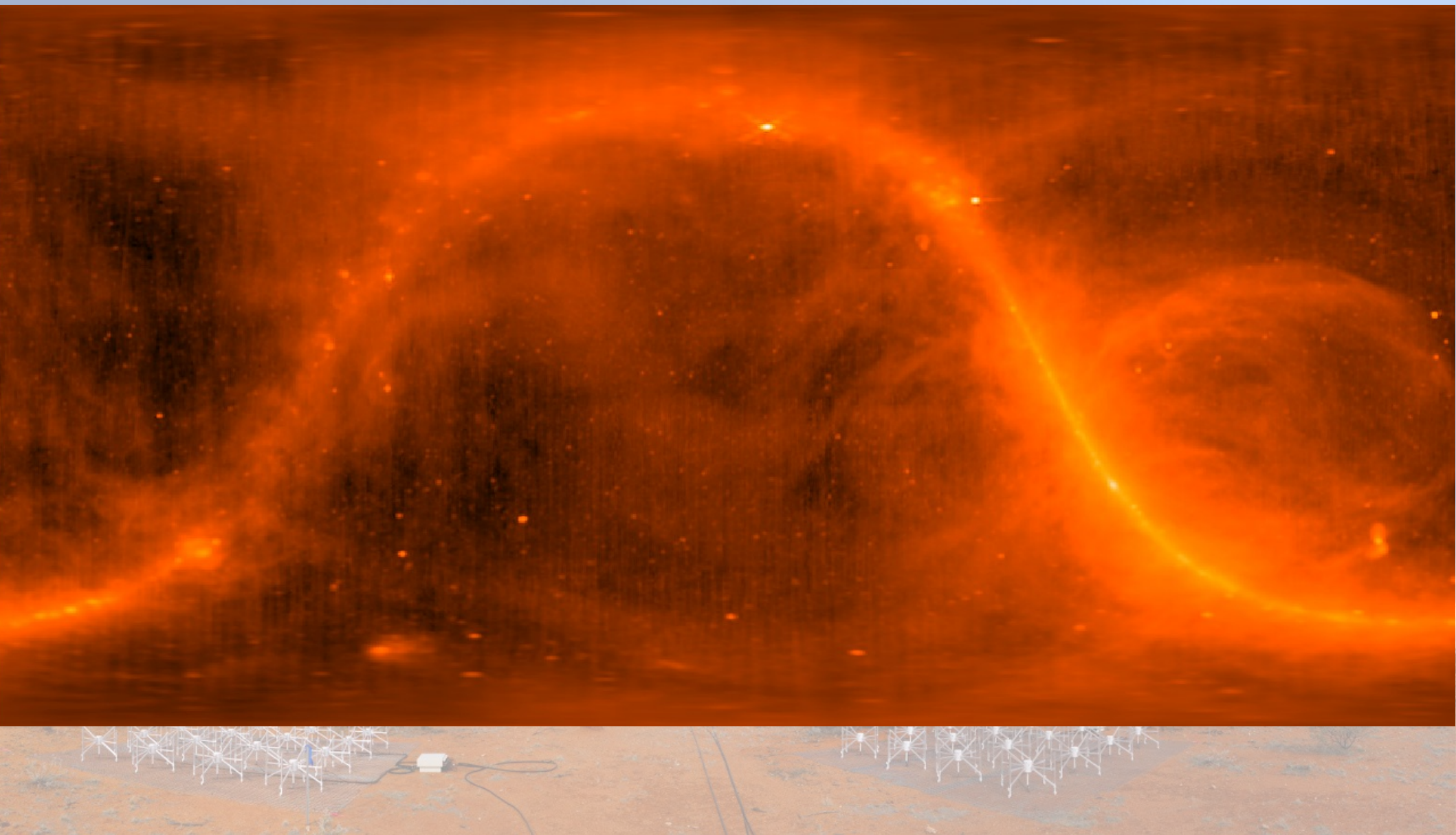
Science Goals



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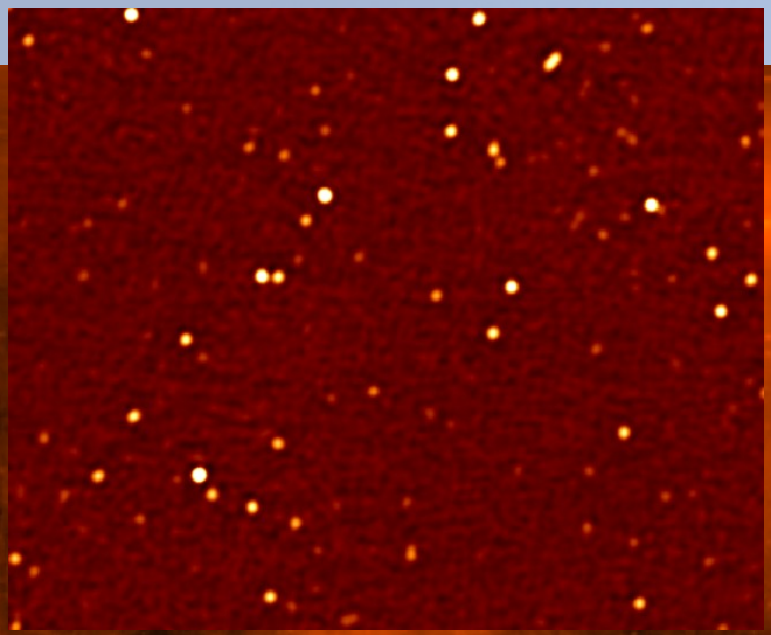
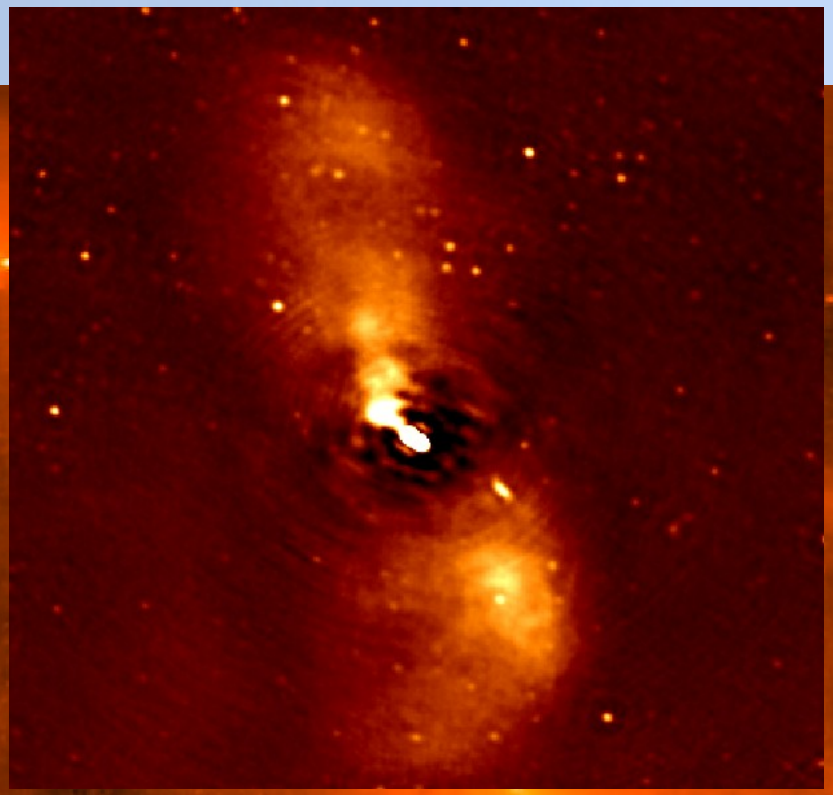
Radio Galaxies



Sub-Jy sources
(AGN, star-forming galaxies)



Centaurus A, MWA 150MHz
Credit: Ben McKinley (ANU)

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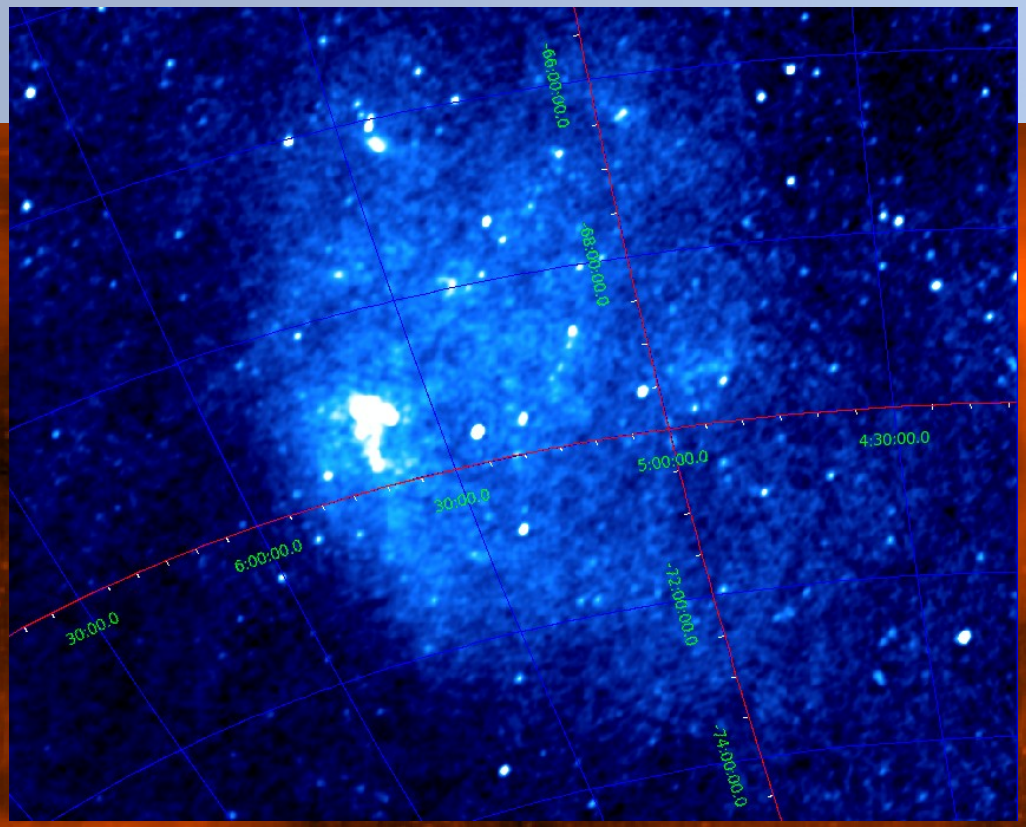
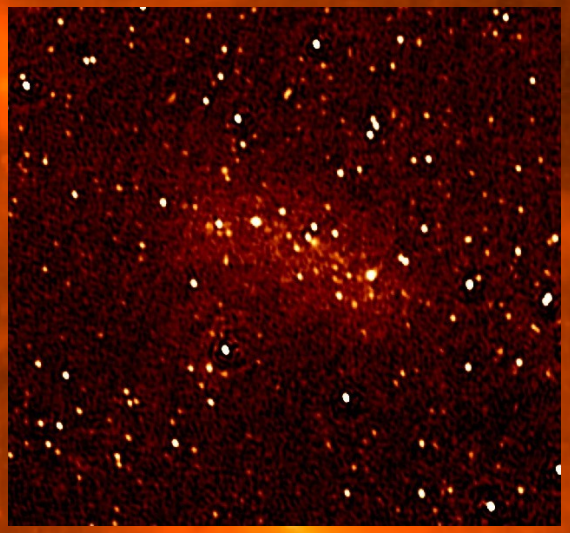
Magellanic Clouds



Large Magellanic Cloud
Credit: Randall Wayth (Curtin)



Small Magellanic Cloud

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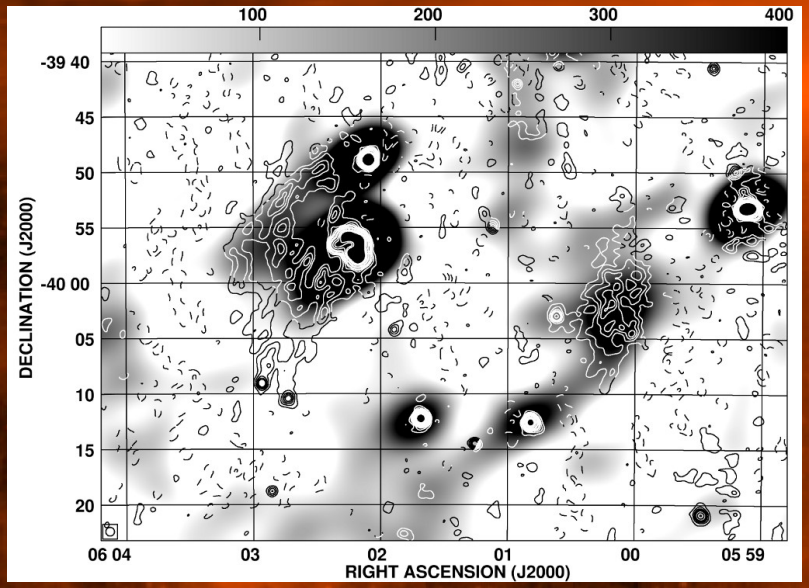
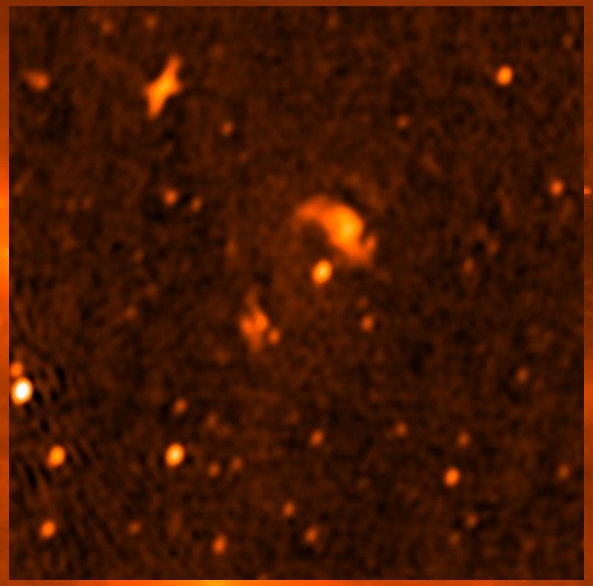
Galaxy Clusters



Abell 3376 MWA & GMRT
150MHz – good agreement
Credit: George & Dwarakanath (RRI)



Abell 3667 MWA 120MHz
See Luke Hindson's talk

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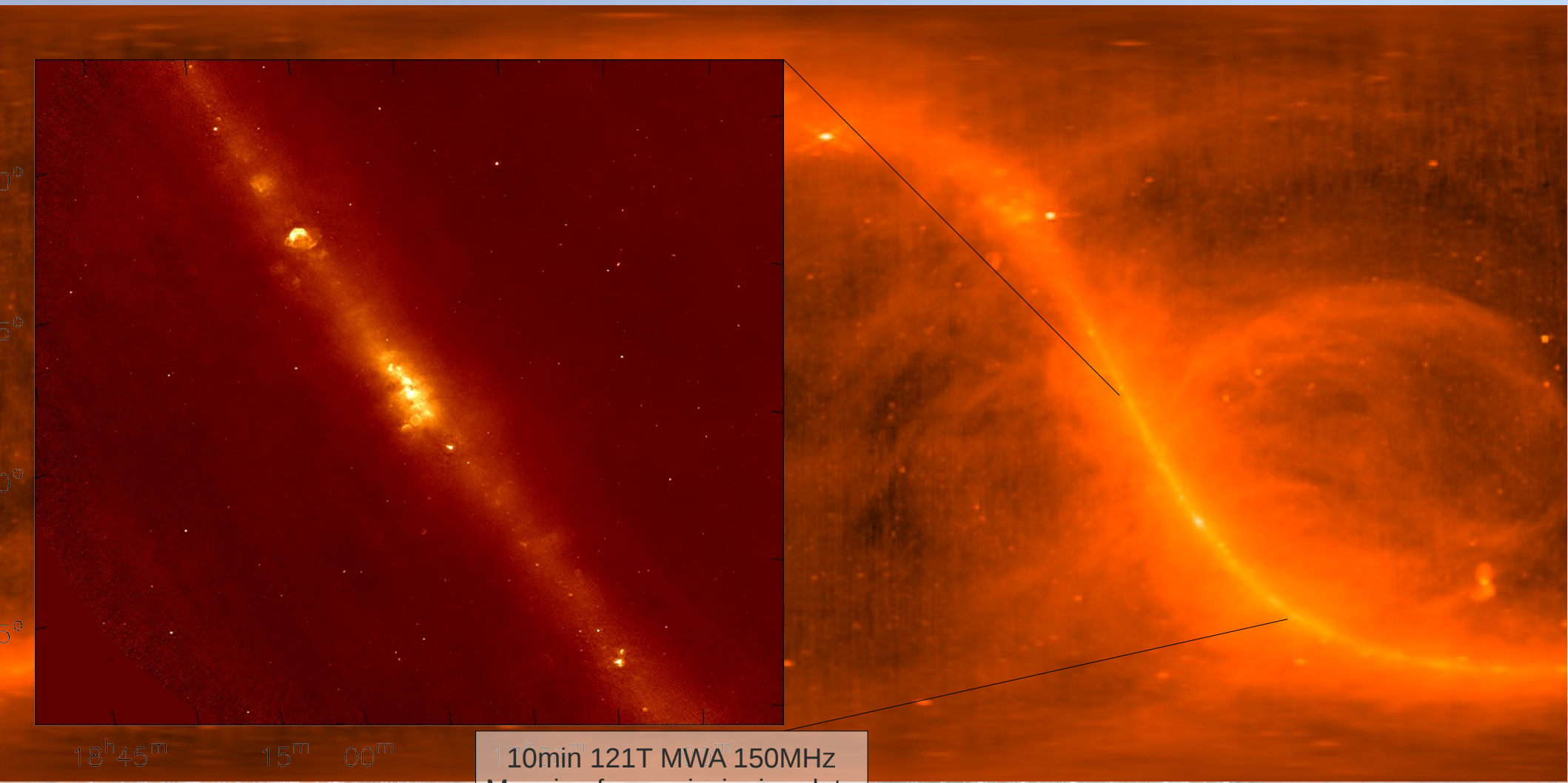
Supernova Remnants, PWNe, HII Regions



10min 121T MWA 150MHz
Mosaic of commissioning data

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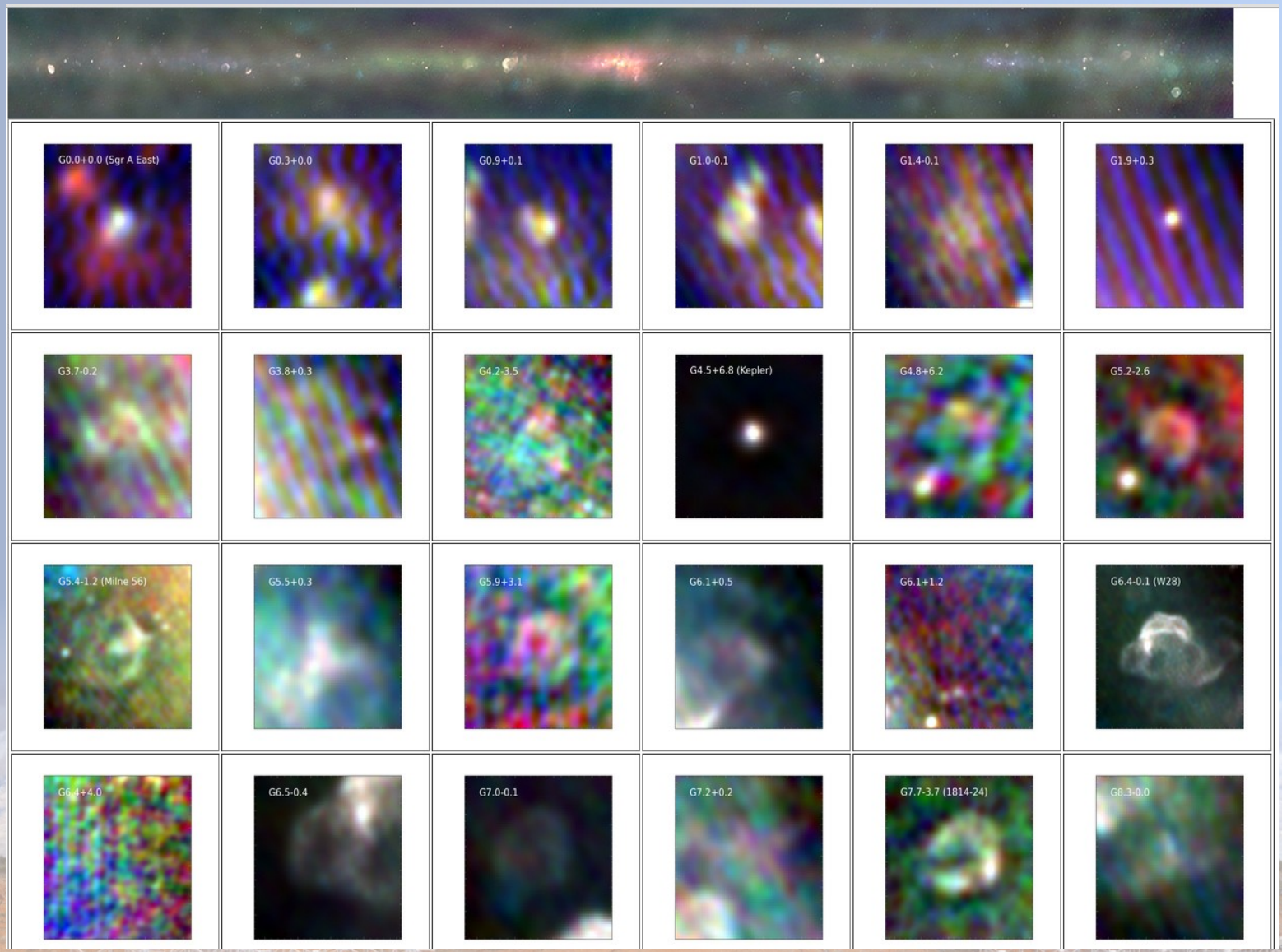
Supernova Remnants, PWNe, HII Regions



Early SNR Gallery
Credit: David Kaplan (UMW)

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Polarisation

Diffuse Galactic ISM at 180 MHz
Credit: Emil Lenc (University of Sydney)

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Survey design

- Meridian drift scans
- 7 declination strips
- 5 x 30MHz frequency bands spanning 75 – 220 MHz
- 4 weeks separated by 3 months → covers entire sky < Dec +25°
- Survey down to the confusion limit (5—60 mJy depending on frequency)

Left: Haslam 408MHz sphere; Right: Multiplied by MWA 200MHz beam
Credit: Randall Wayth (Curtin University)

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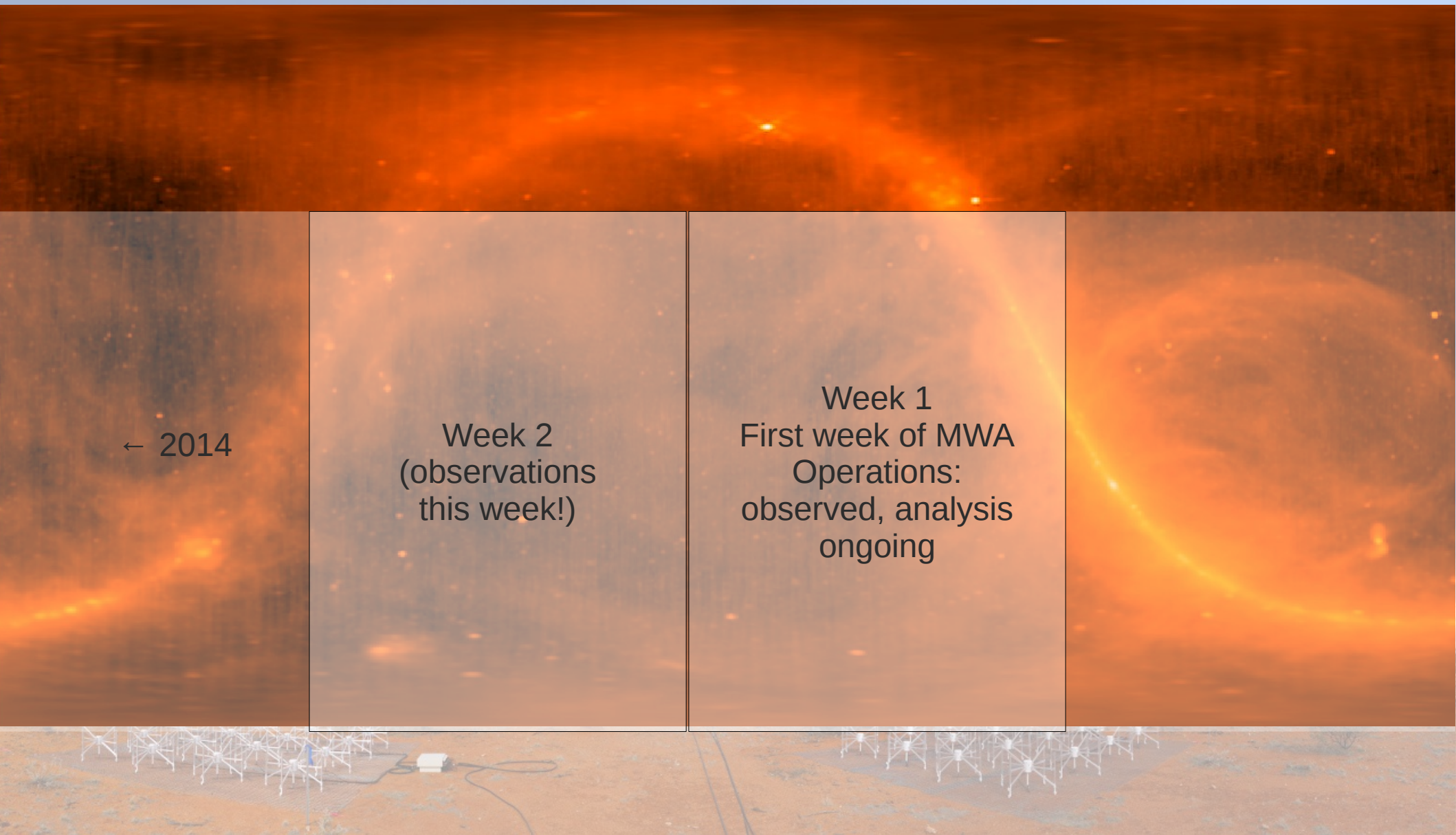
Survey design



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Data Reduction

- Data amenable to *standard software* e.g. CASA, miriad
- W-snapshots under development (see André Offringa's talk)
- Snapshot rms ~100mJy
- Mosaic rms ~ 15mJy

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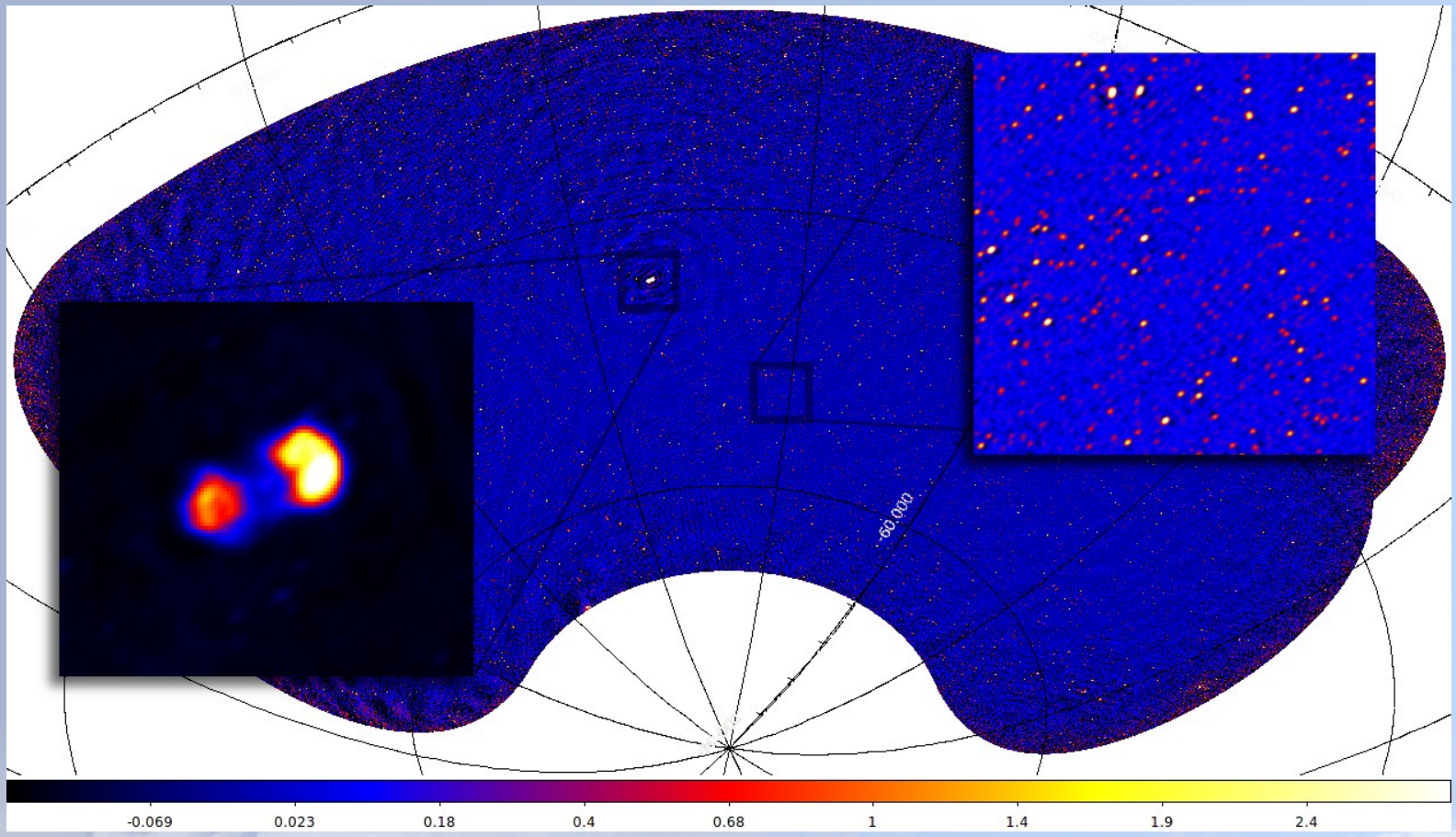
Early Results: MWACS



MWA Commissioning Sky Survey
Credit: NHW, John Morgan,
Randall Wayth (Curtin University)

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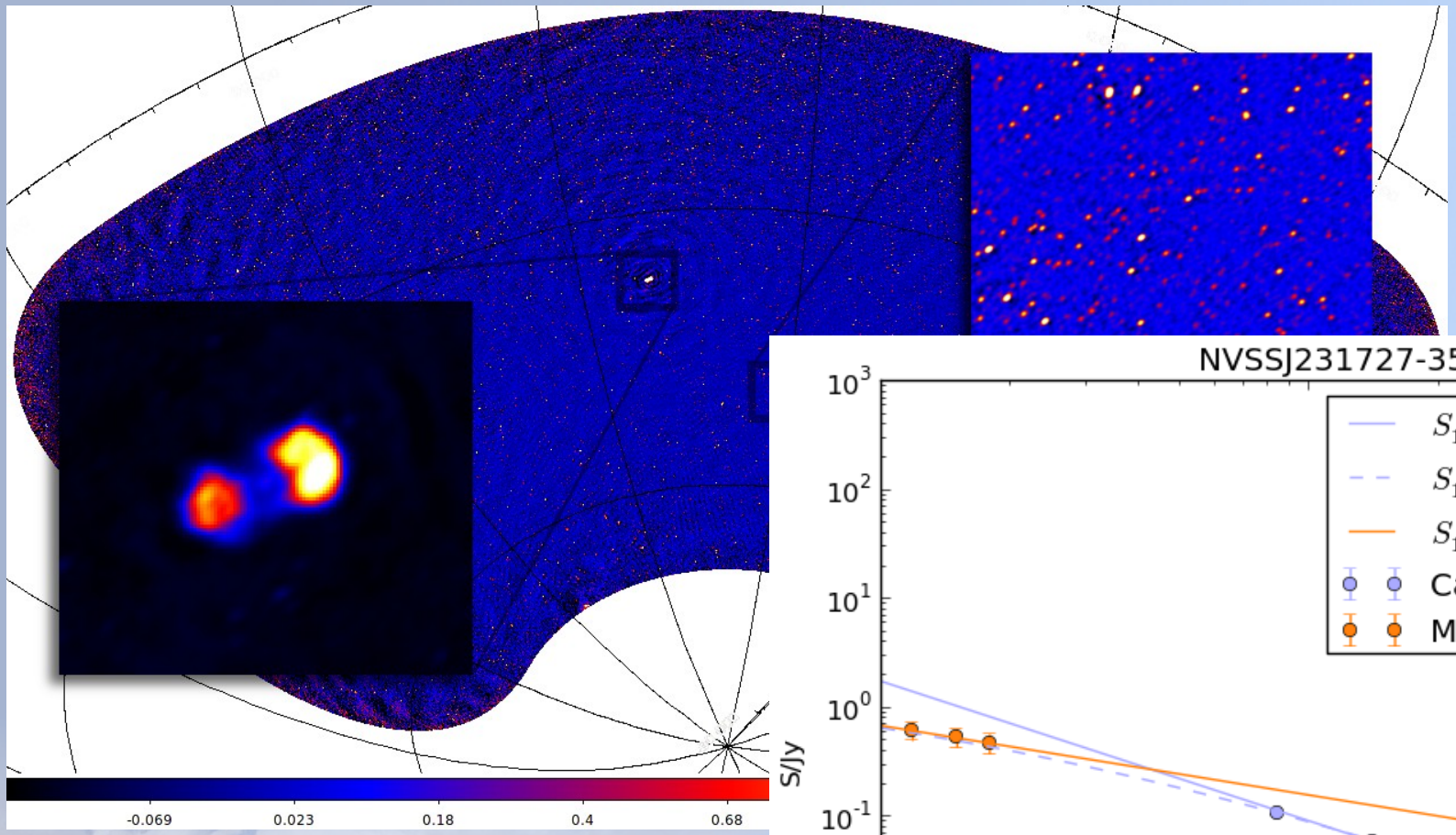

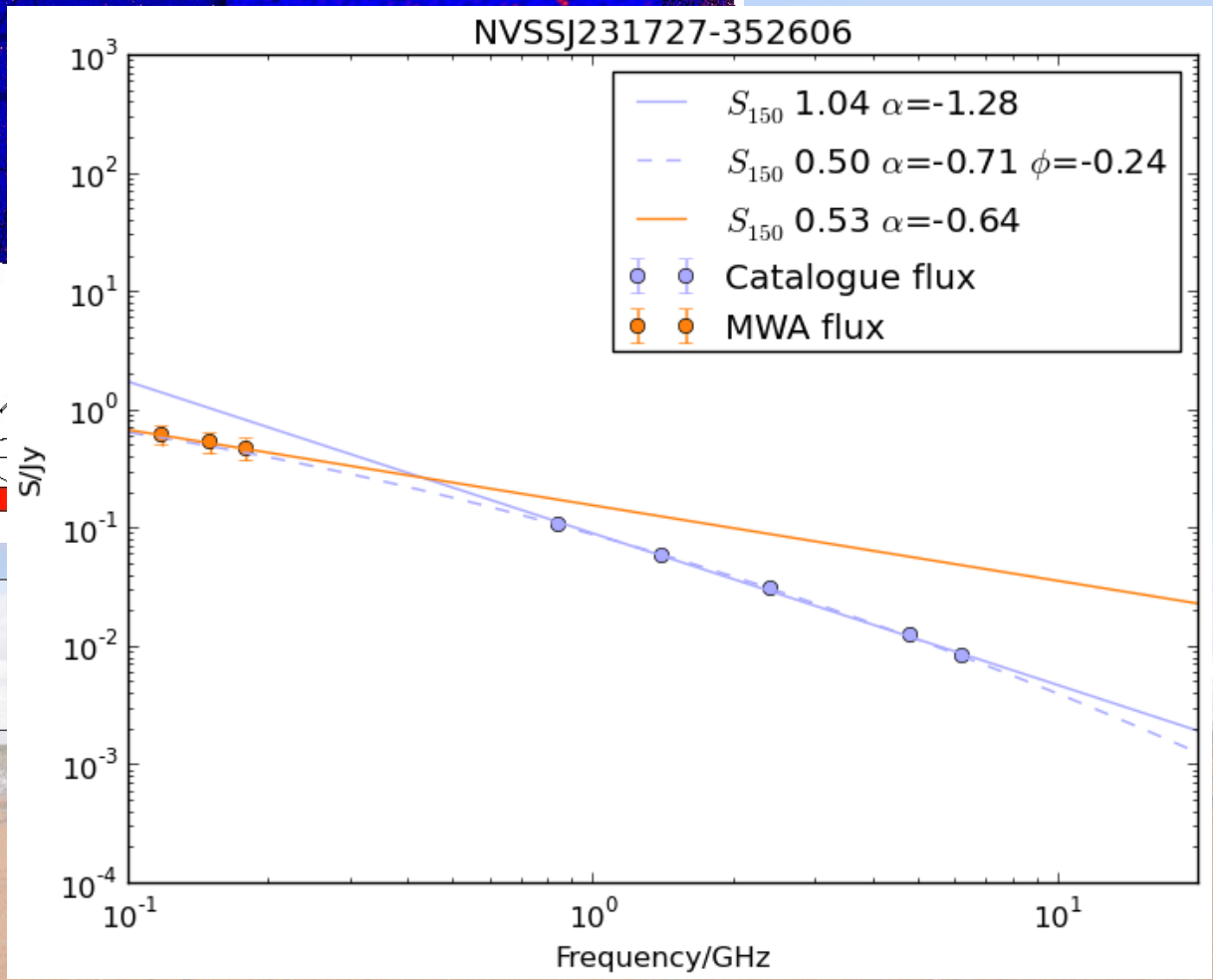

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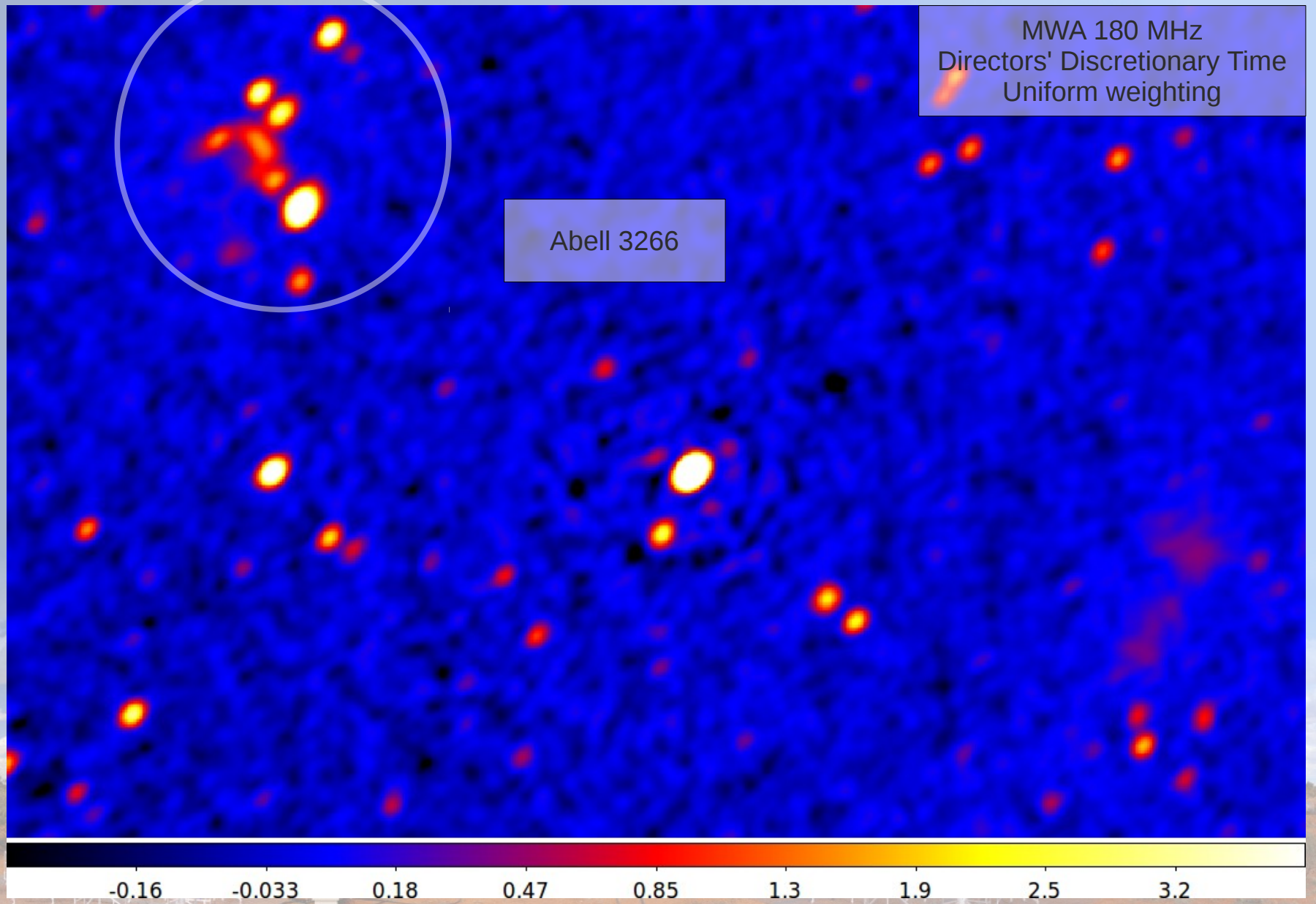
Serendipitous discovery



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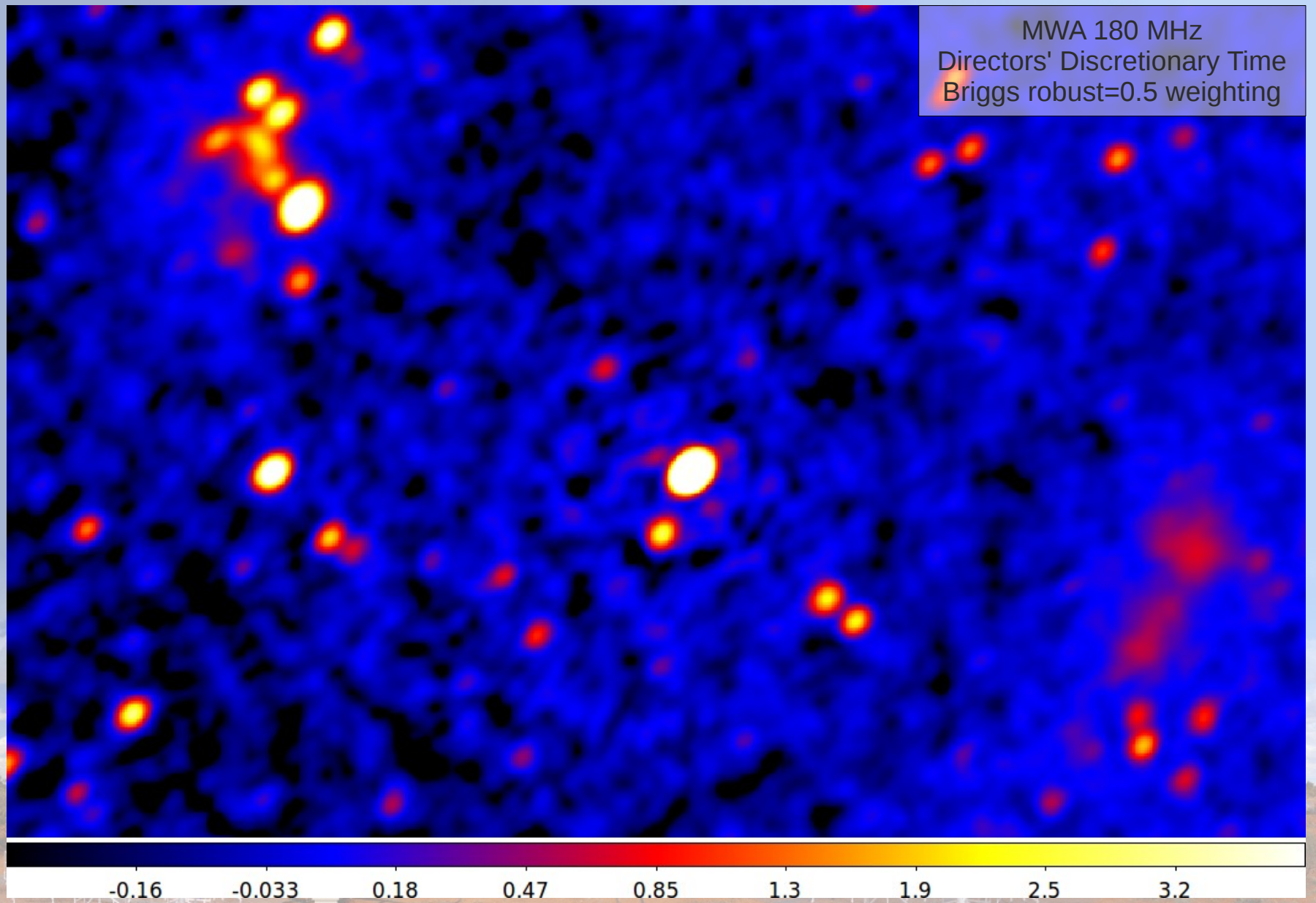

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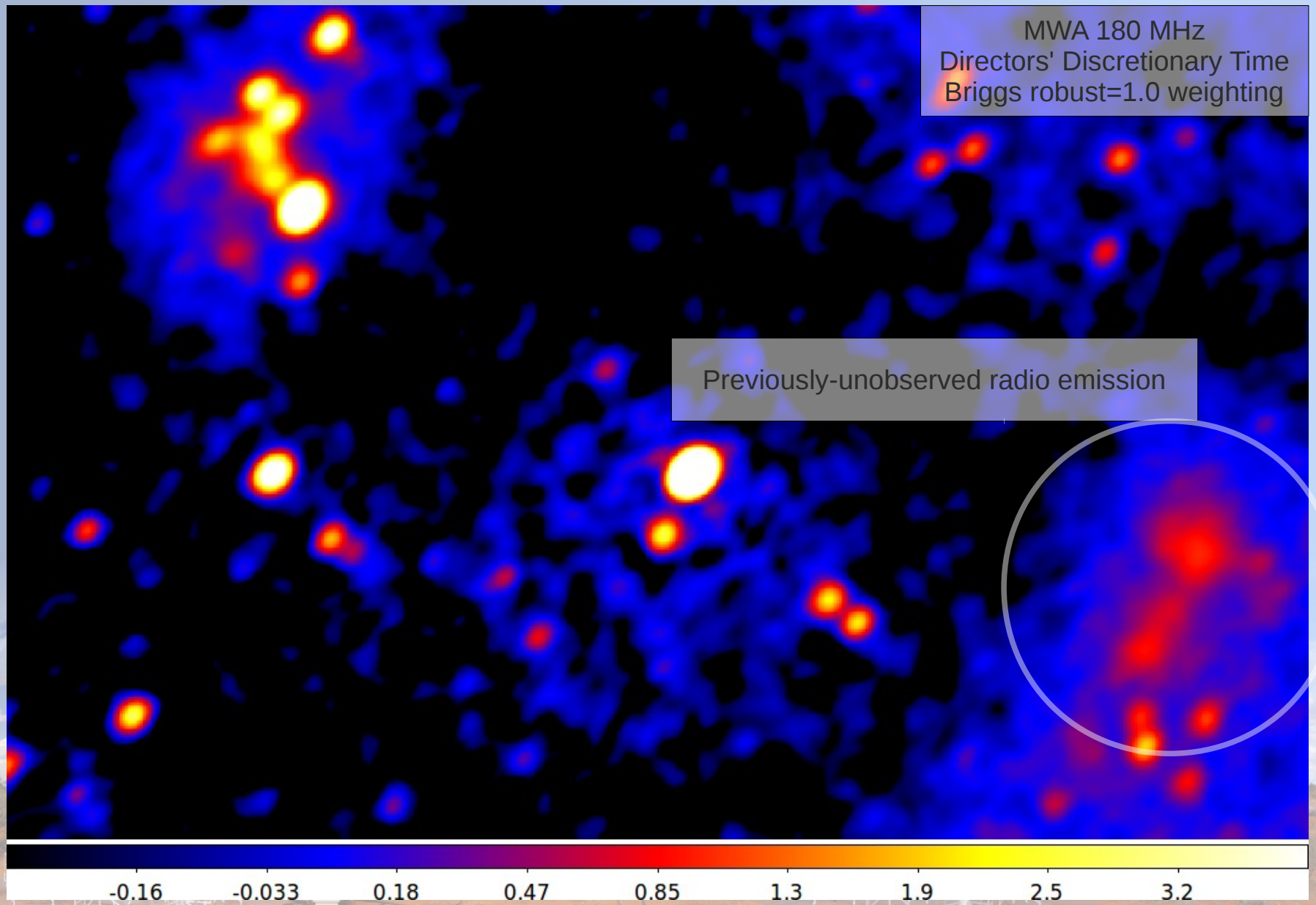

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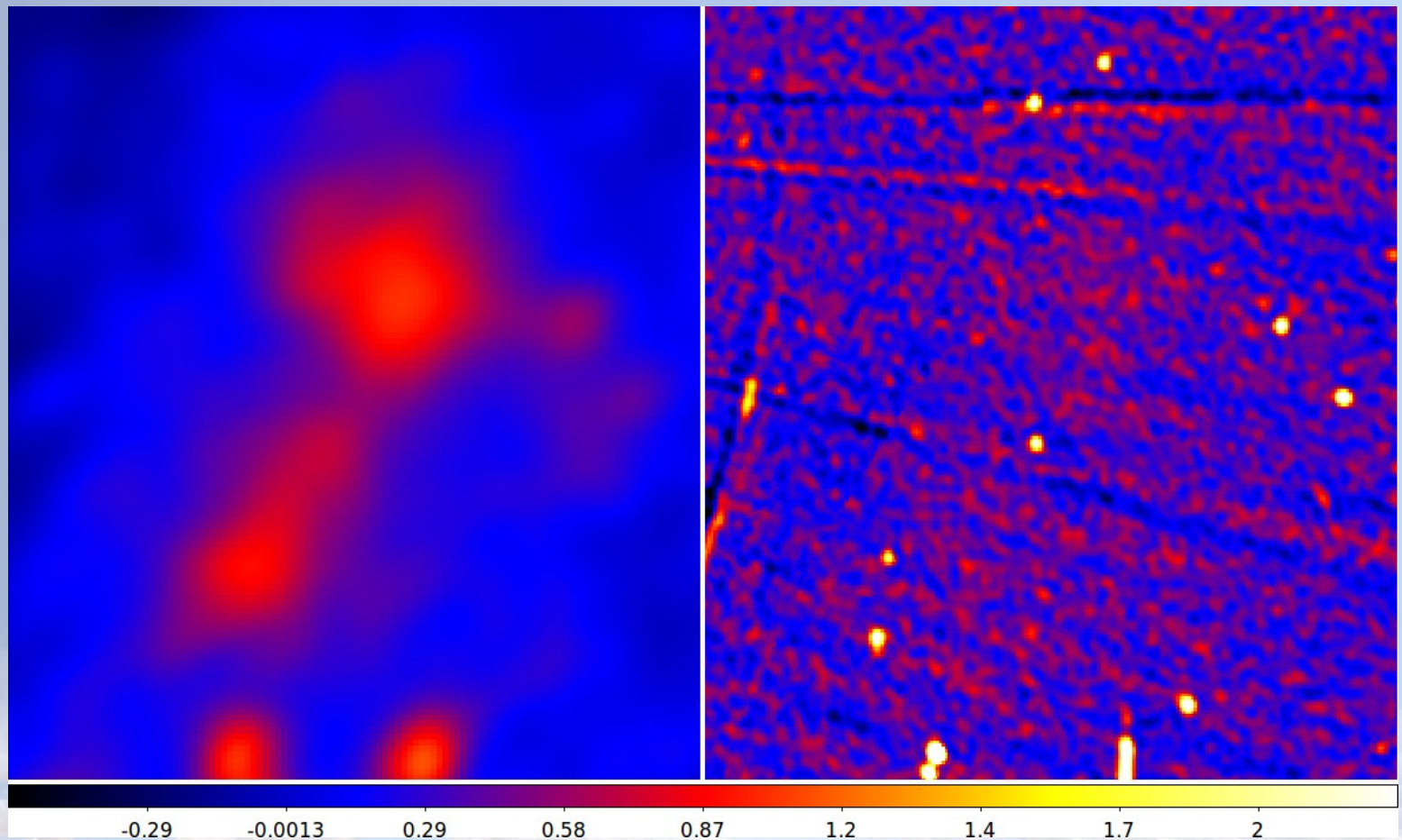

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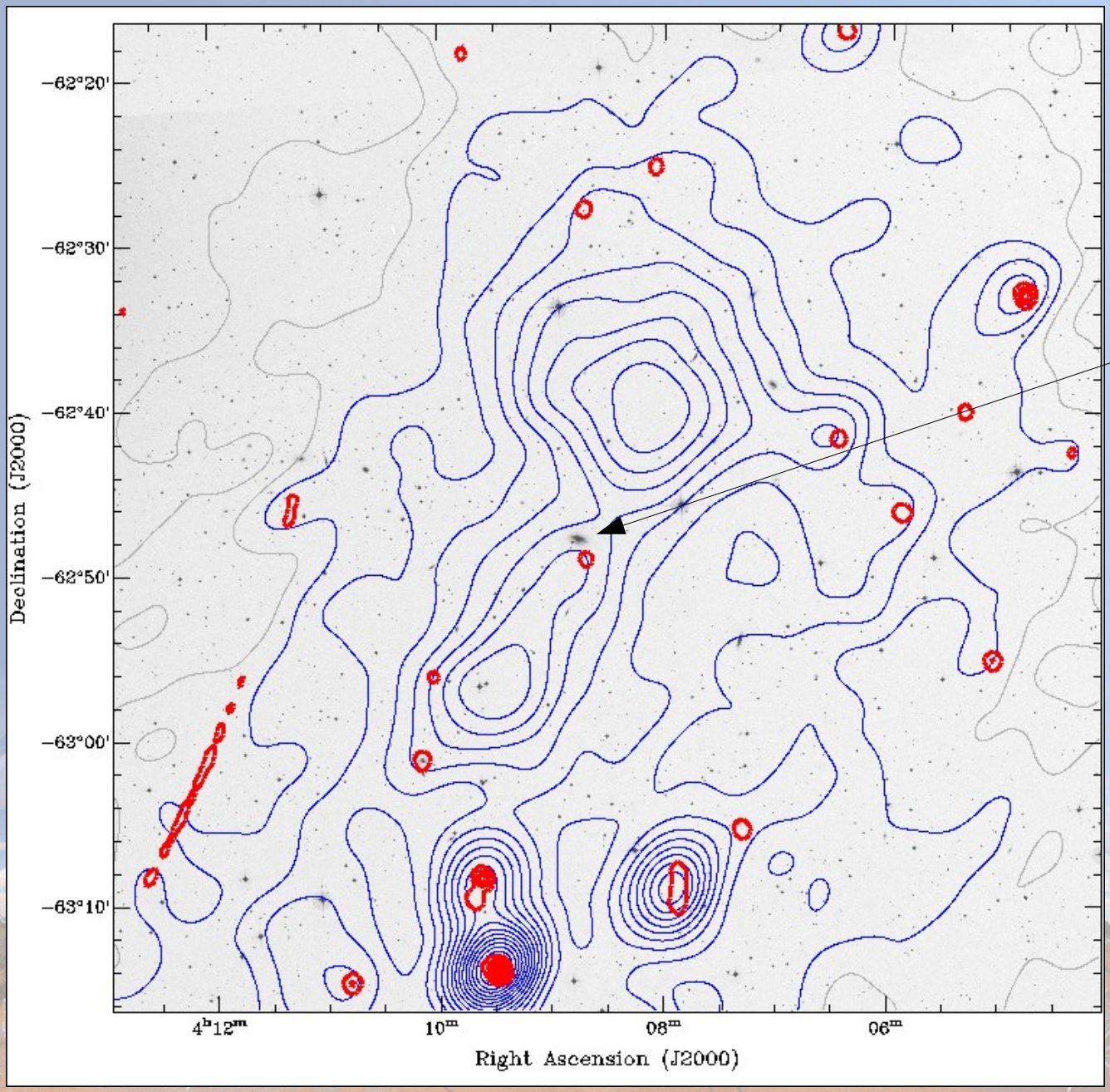

z=0.01 galaxy

850kpc extent?
c/f CenA = 350kpc

Blue: MWA 180 MHz
Red: SUMMS 843 MHz
Greyscale: DSS

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Conclusions

- GLEAM underway, progressing well
- Will explore a huge range of science topics in the low-frequency, low surface-brightness domain
- Southern hemisphere location advantageous for minimal RFI, Galactic and Magellanic observations
- Observations conclude in June 2014
- Follow us on Facebook: https://www.facebook.com/Murchison.Widefield.Array