



UNIVERSITY of the
WESTERN CAPE



Multi-Wavelength Source Characterization for MeerKAT Extragalactic Continuum Surveys

Mattia Vaccari

www.mattiavaccari.net

Institute for Data Intensive Astronomy

University of the Western Cape

Cape Town, South Africa



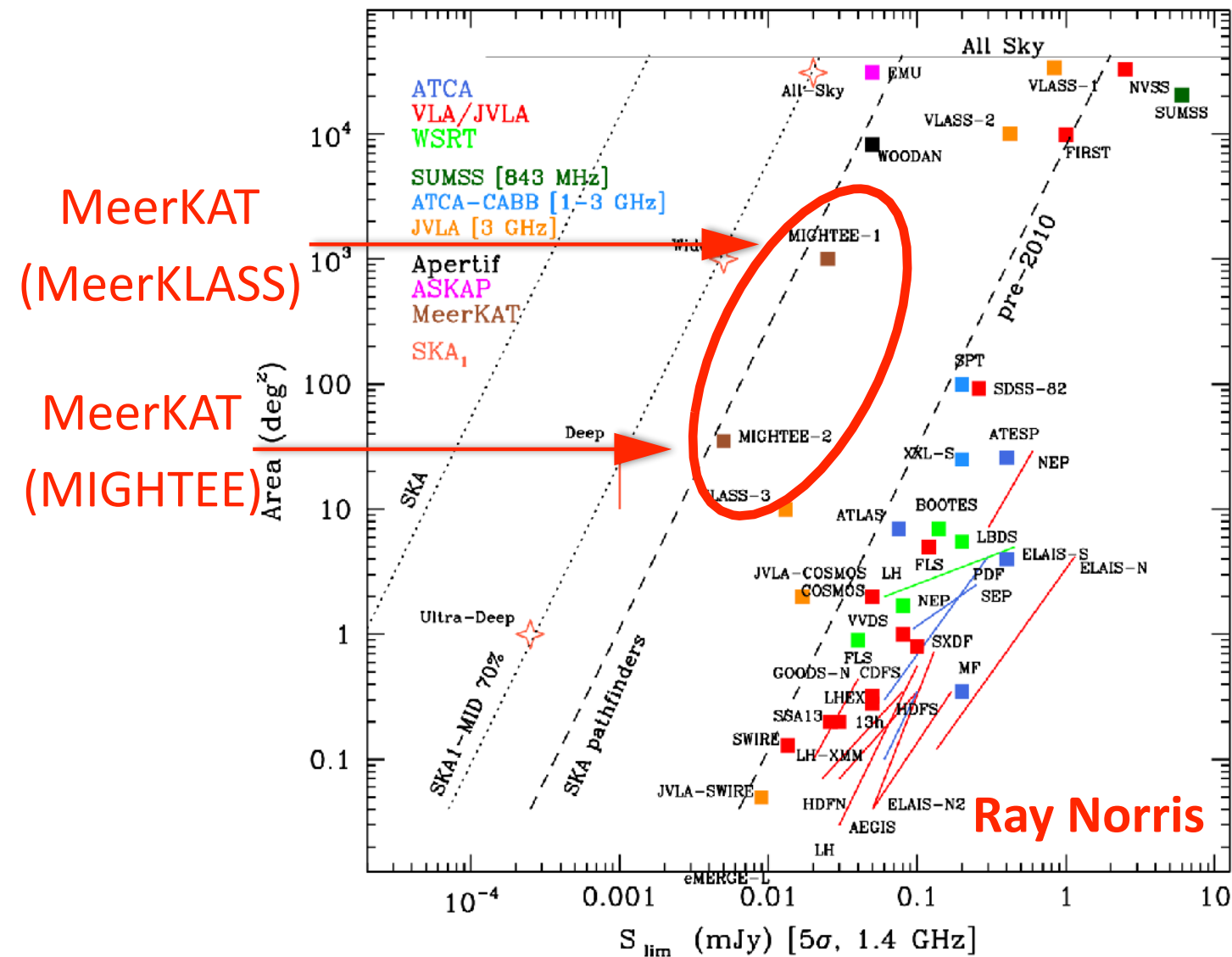
SARAO

South African Radio
Astronomy Observatory

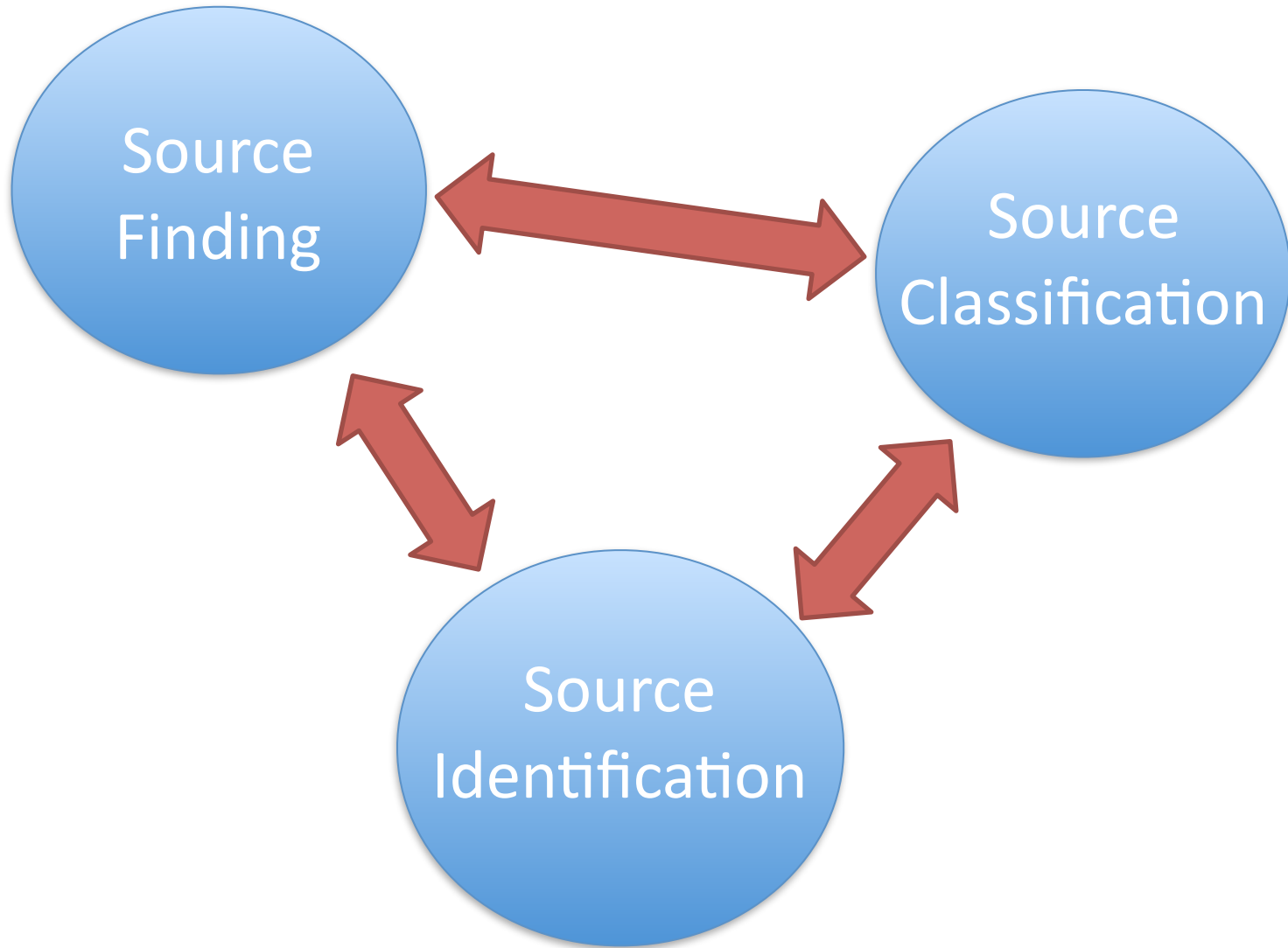
www.idia.ac.za



Upcoming Radio Surveys

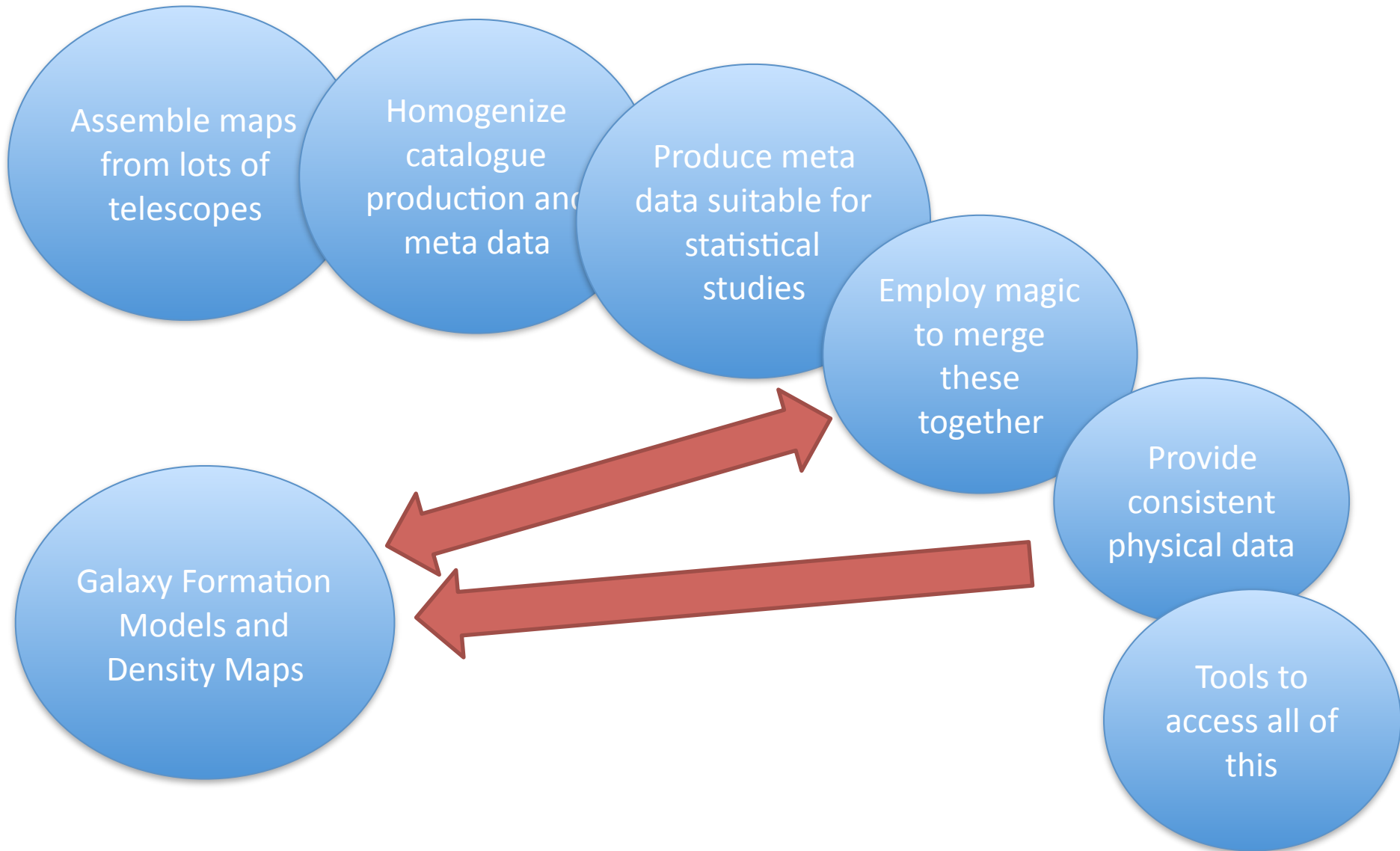


Radio Source Characterisation



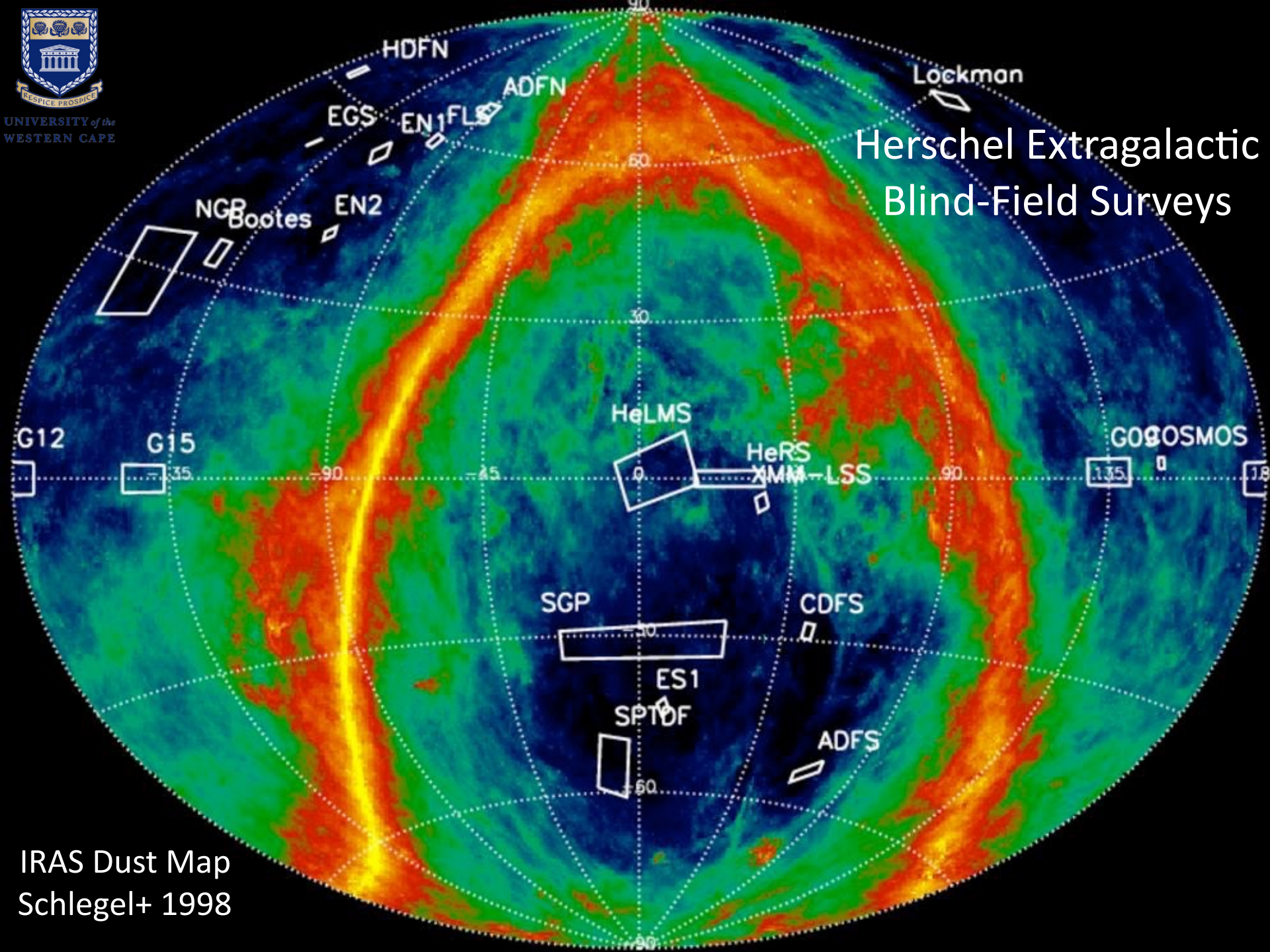
HELP (EC-REA-FP7-SPACE) Concept

Vaccari 2016



Implementation

- Define Optical/Near-Infrared/IRAC **Master List**
- **Match** Master List vs X-ray/GALEX/WISE/Radio
- Estimate **Photometric Redshifts** for Master List
- Measure MIPS/PACS/SPIRE **Forced Photometry**
- Estimate **Physical Parameters** for All Sources



Herschel Extragalactic Blind-Field Surveys

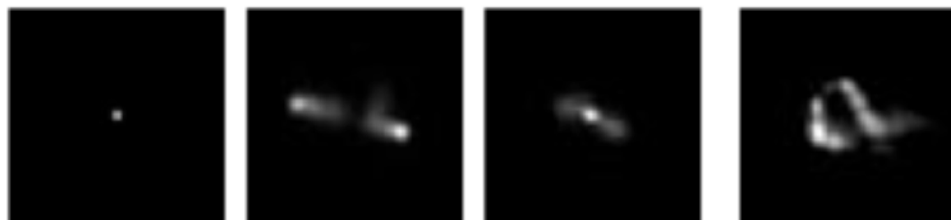
IRAS Dust Map
Schlegel+ 1998

HIPPO : an IDIA Key Project

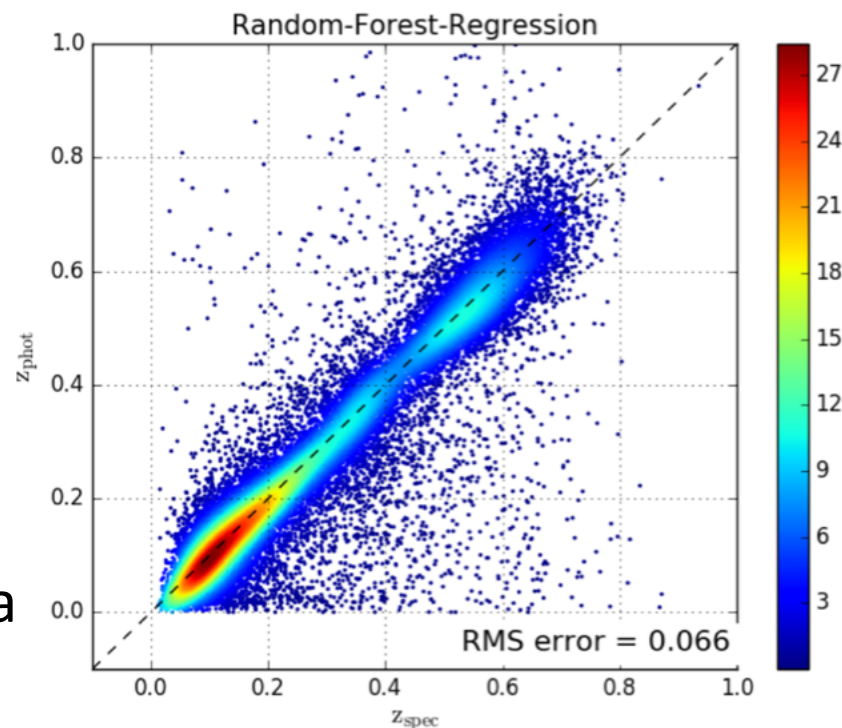
HIPPO : The HELP - IDIA
Panchromatic PrOject
<http://www.mattiavaccari.net/hippo>



A Cloud-Based Environment for the Science Exploitation of Radio Surveys



Working with IDIA programmers to
create a cloud-based environment
where scientists can exploit MeerKAT
in the context of multi-wavelength data



HIPPO's First Steps

- Create a python-centric '**Software Container**' for Source Characterization on the IDIA Cloud.
- Assemble & Homogenize software tools to create **cutouts and contours/overlays** from most surveys
- Simple **Visualization and Annotation Software**
- Source Morphological **Classification** Software
- Source Spectro-Photometric **Classification** Software
- Extend Multi-Wavelength **Ancillary Data (post-HELP)**
- Scientific Exploitation of **Existing Radio Surveys**

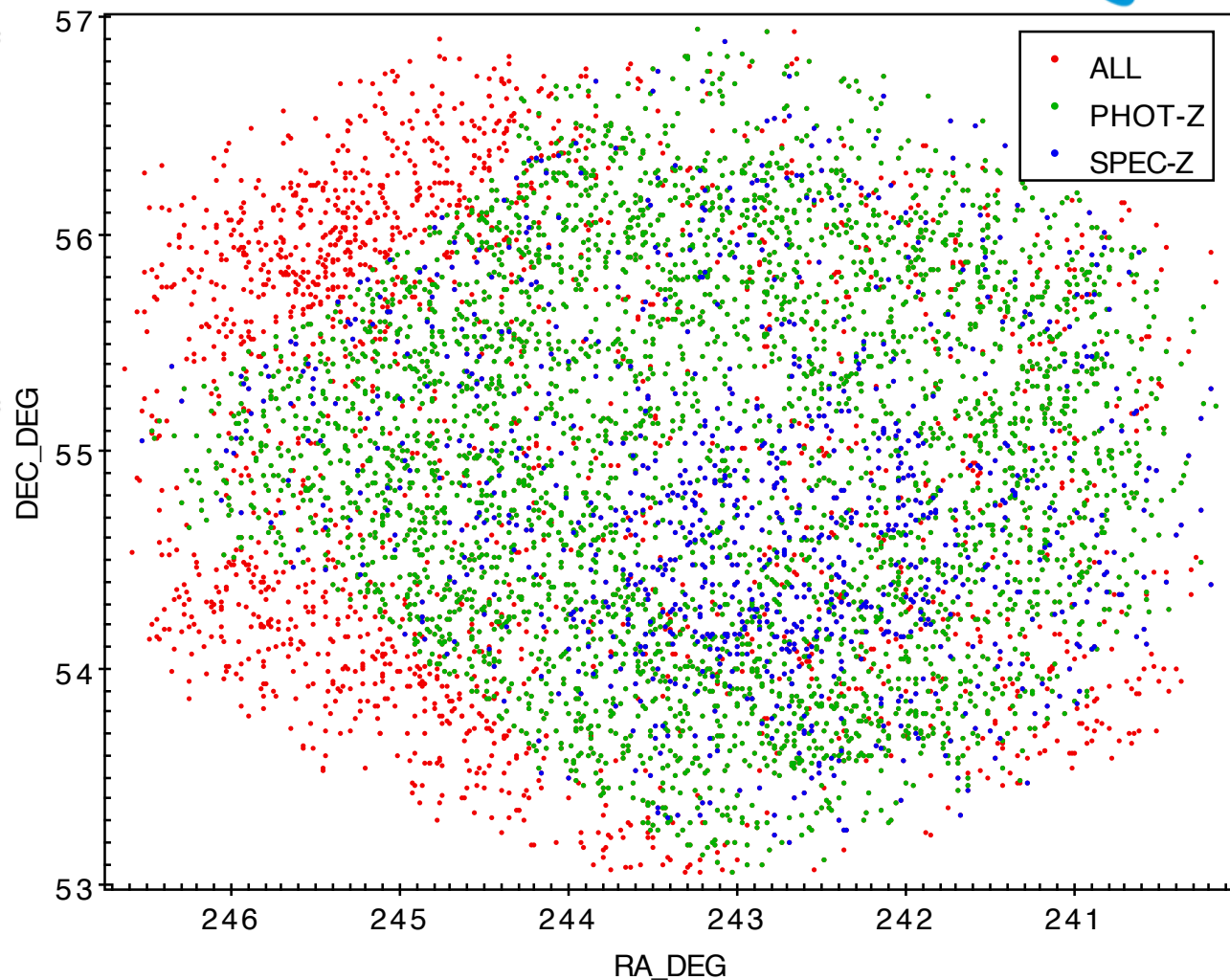


UNIVERSITY of the
WESTERN CAPE

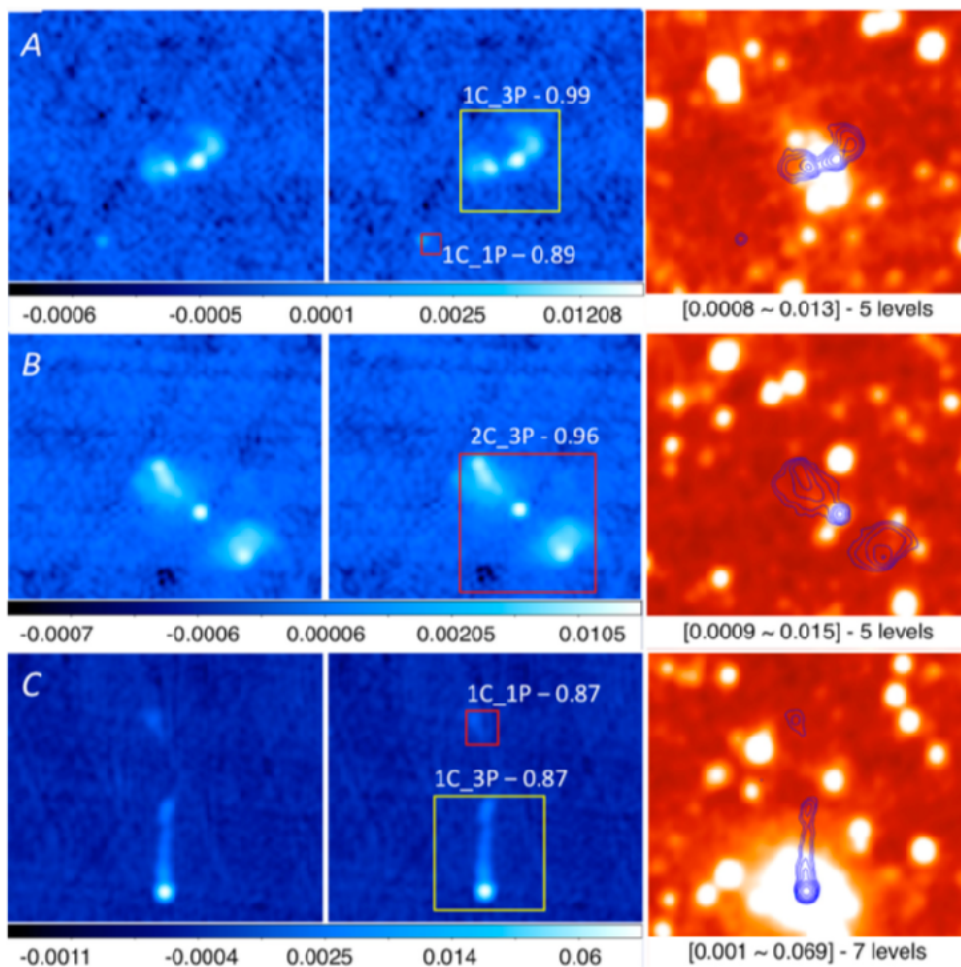


ELAIS N1 GMRT Wide Survey

Catalogue	Size	Fraction
GMRT	6400	100%
MATCHED	5078	79.3%
SWIRE	4945	77.3%
UKIDSS	4029	63.0%
SWIRE IRAC1234	2827	44.2%
SWIRE MIPS24	3408	53.3%
X-RAY	59	0.9%
SPECZ	970	15.2%
REDSHIFTS (ANY)	4661	72.8%

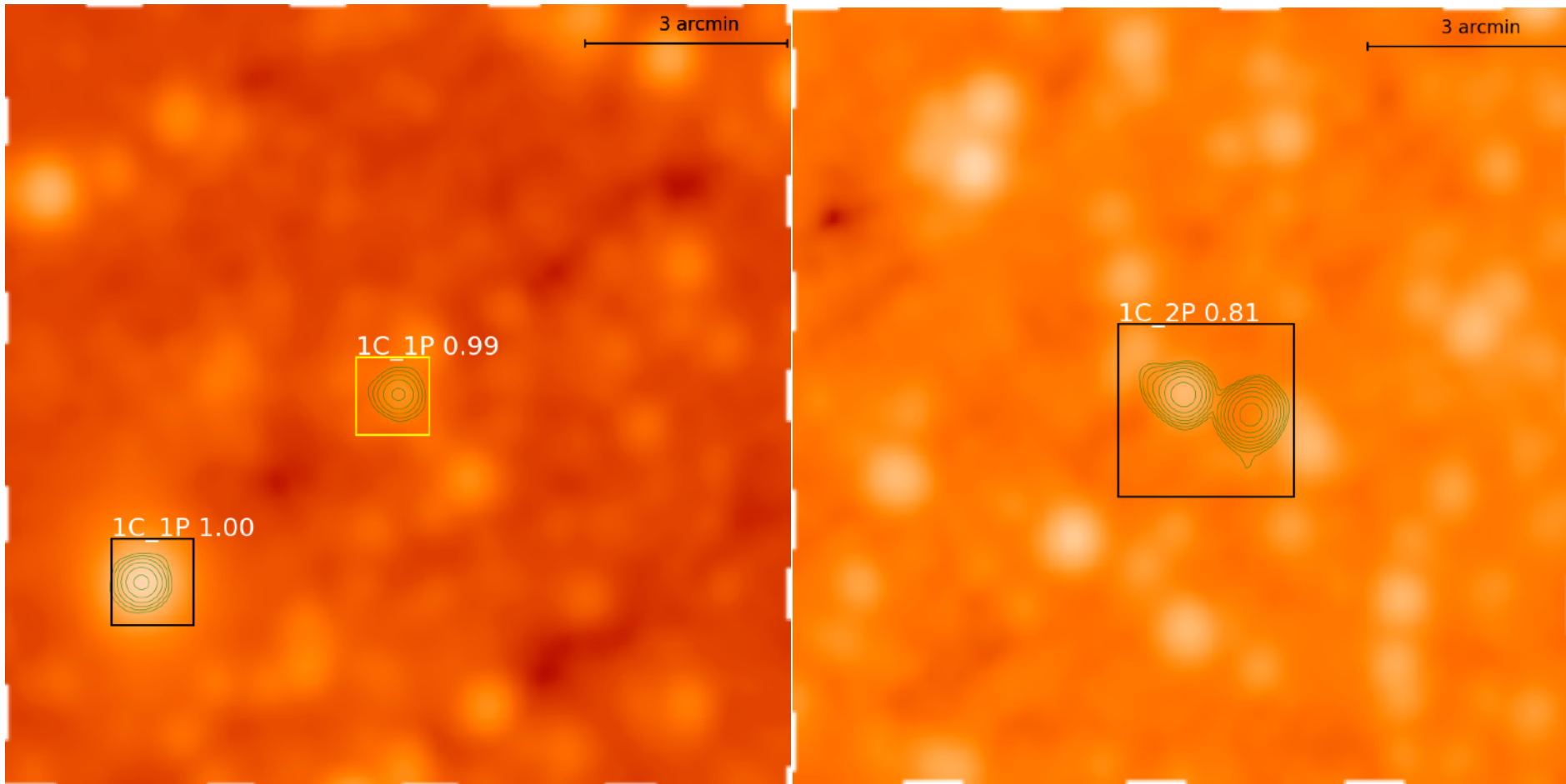


- GMRT 13 deg² ELAIS N1 Image (Ishwara-Chandra+ in prep)
- 40 μ Jy/bm rms @ 610 MHz - 20 μ Jy/bm rms @ 1.4 GHz



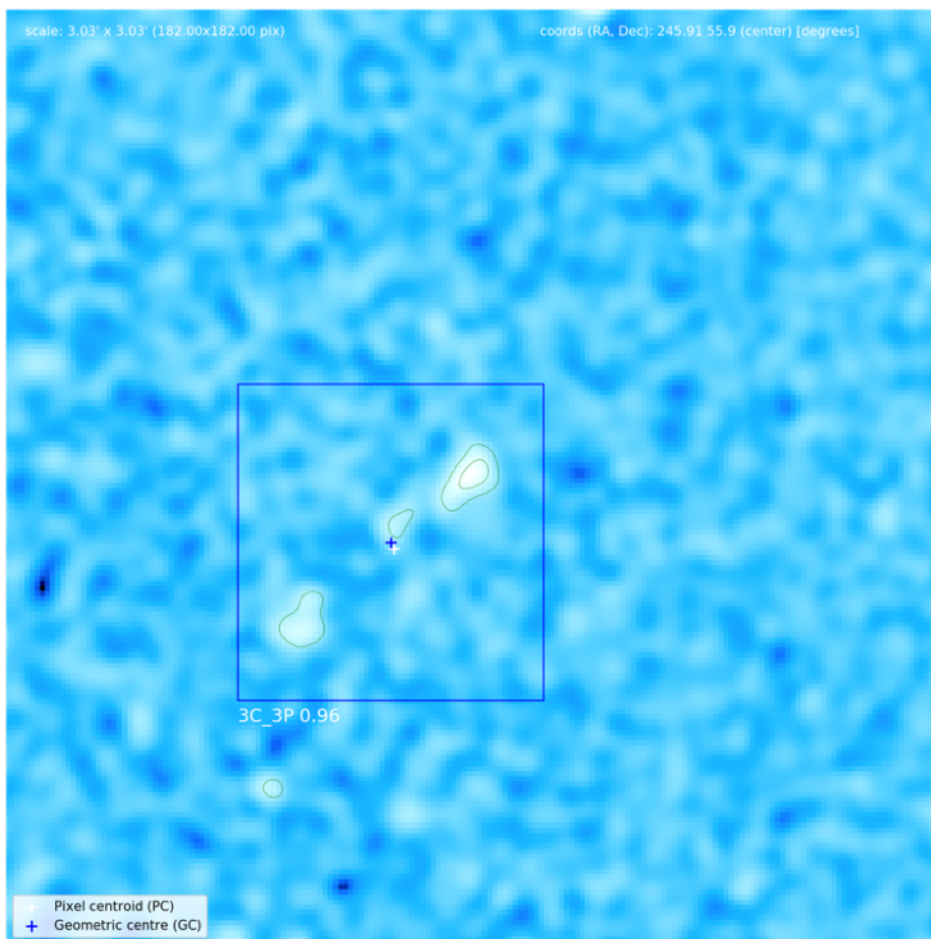
Wu et al. 2019 - https://github.com/chenwuperth/rgz_rcnn/
 Chaka Mofokeng (MSc) - Applied to GMRT(/MeerKAT) Data

GMRT ELAIS N1 Wide Survey

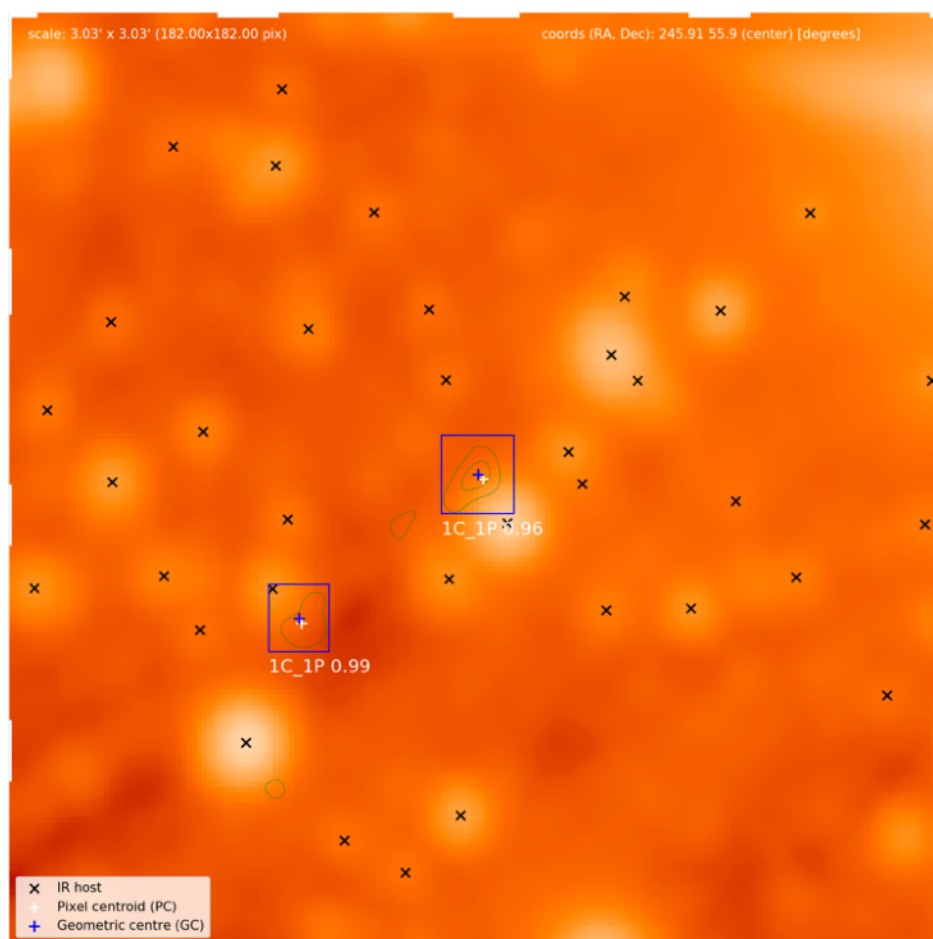


- Source Detection & Component / Peak Classification
- GMRT Contours (FIRST-Like Resolution) on WISE BG Image

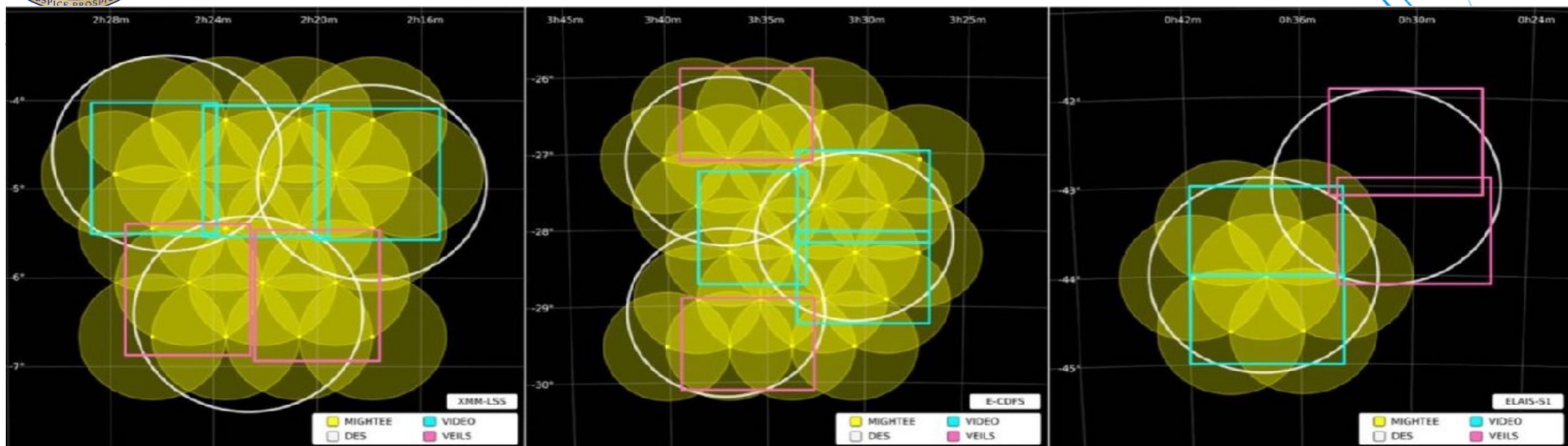
GMRT ELAIS N1 Wide Survey



Radio Image



Radio/WISE Image



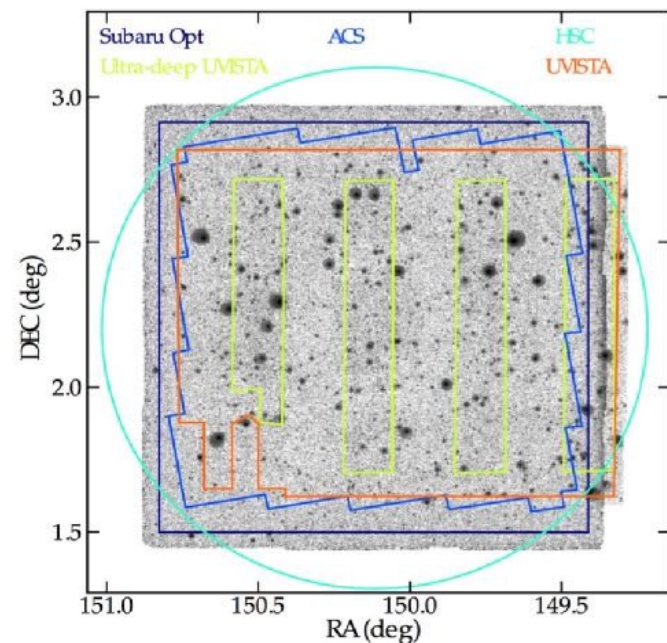
XMM-LSS

ECDFS

ES1

- XMM-LSS – 02 18 -05 00 - 7.5 deg²
- ECDFS – 03 30 -28 00 - 7.5 deg²
- ES1 – 00 40 00 -44 00 00 - 3 deg²
- COSMOS – 10 00 +02 00 - 1.5 deg²

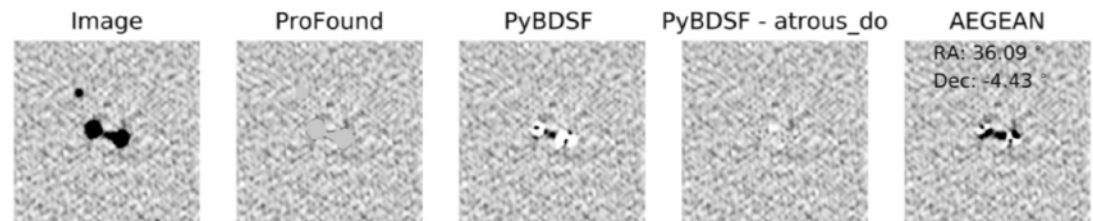
COSMOS



A few lines of work

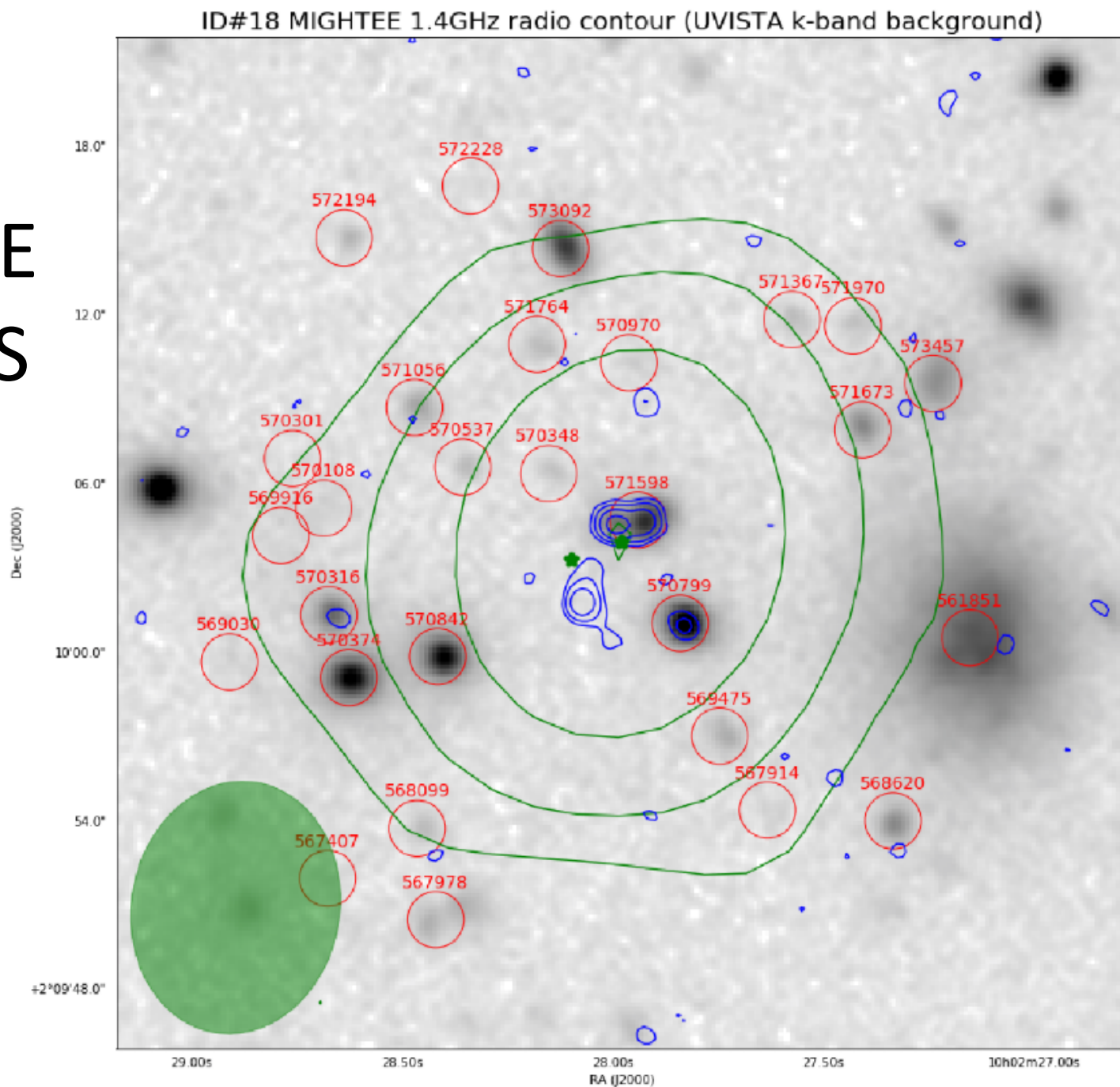
- Improve Source Extraction
- Pre-Select “Complex” Sources
- Visual Inspection of “Complex” Sources
- Consensus Classification & Matching
- Statistical Matching of Compact Sources

Improved Source Extraction



Hale et al. 2019

MIGHTEE COSMOS





UNIVERSITY of the
WESTERN CAPE

MIGHTEE COSMOS Early Work



MATCH ID

Write IDs here!

GO

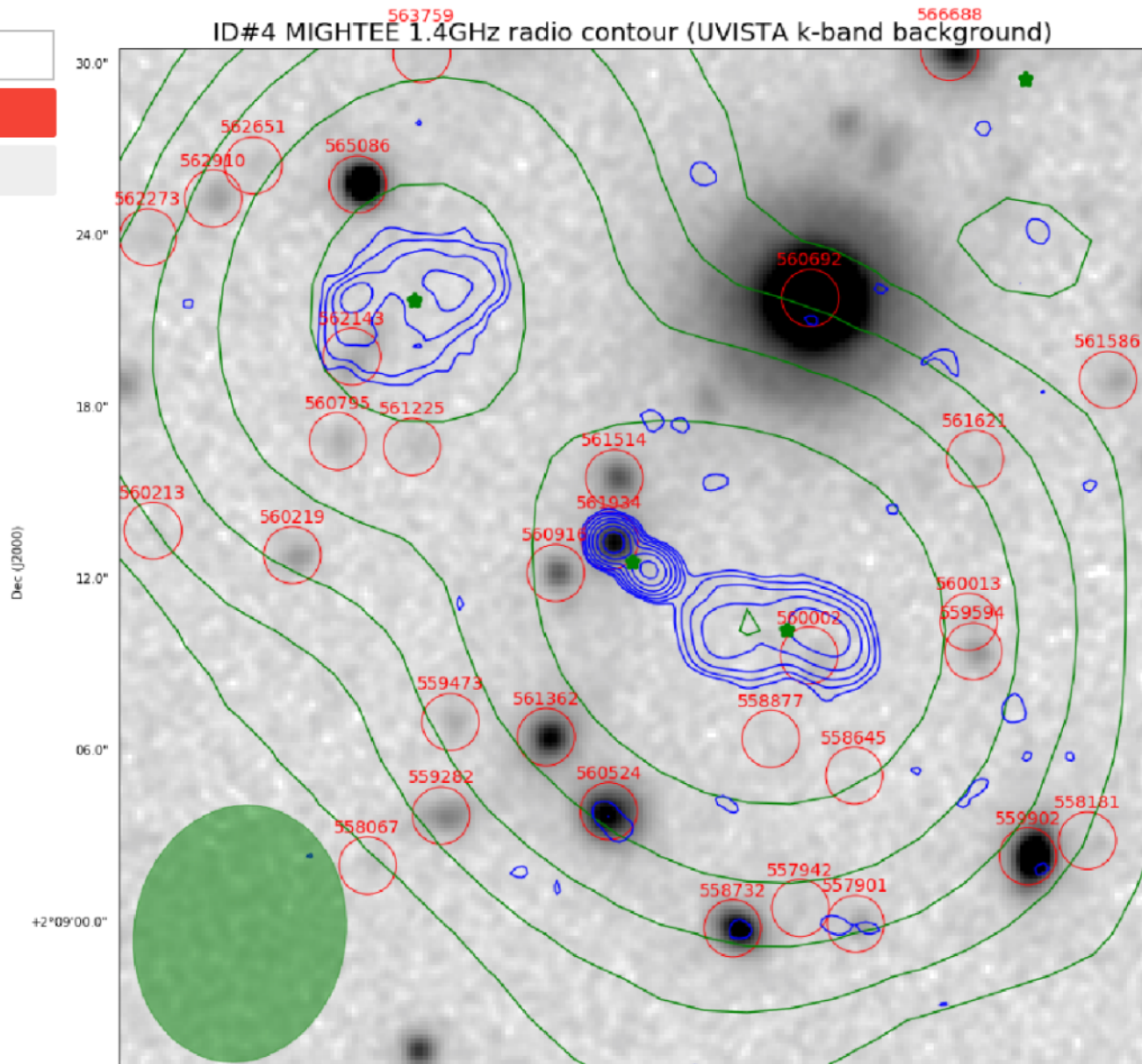
BACK

ZOOM OUT

ZOOM BACK

RANDOMISER!

ID#4 MIGHTEE 1.4GHz radio contour (UVISTA k-band background)





UNIVERSITY of the
WESTERN CAPE



MIGHTEE COSMOS Early Work

MATCH ID

Write IDs here!

GO

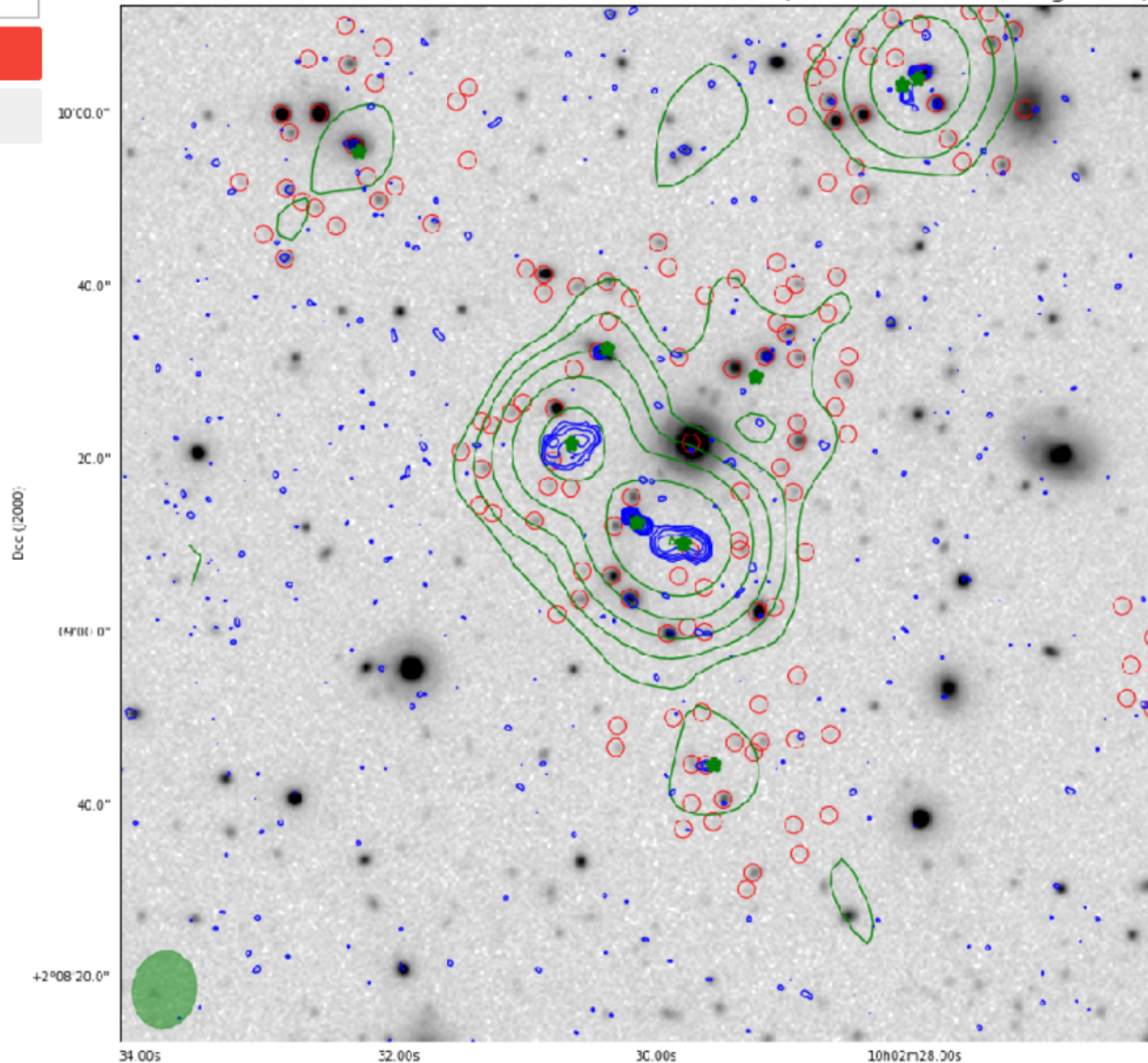
BACK

ZOOM OUT

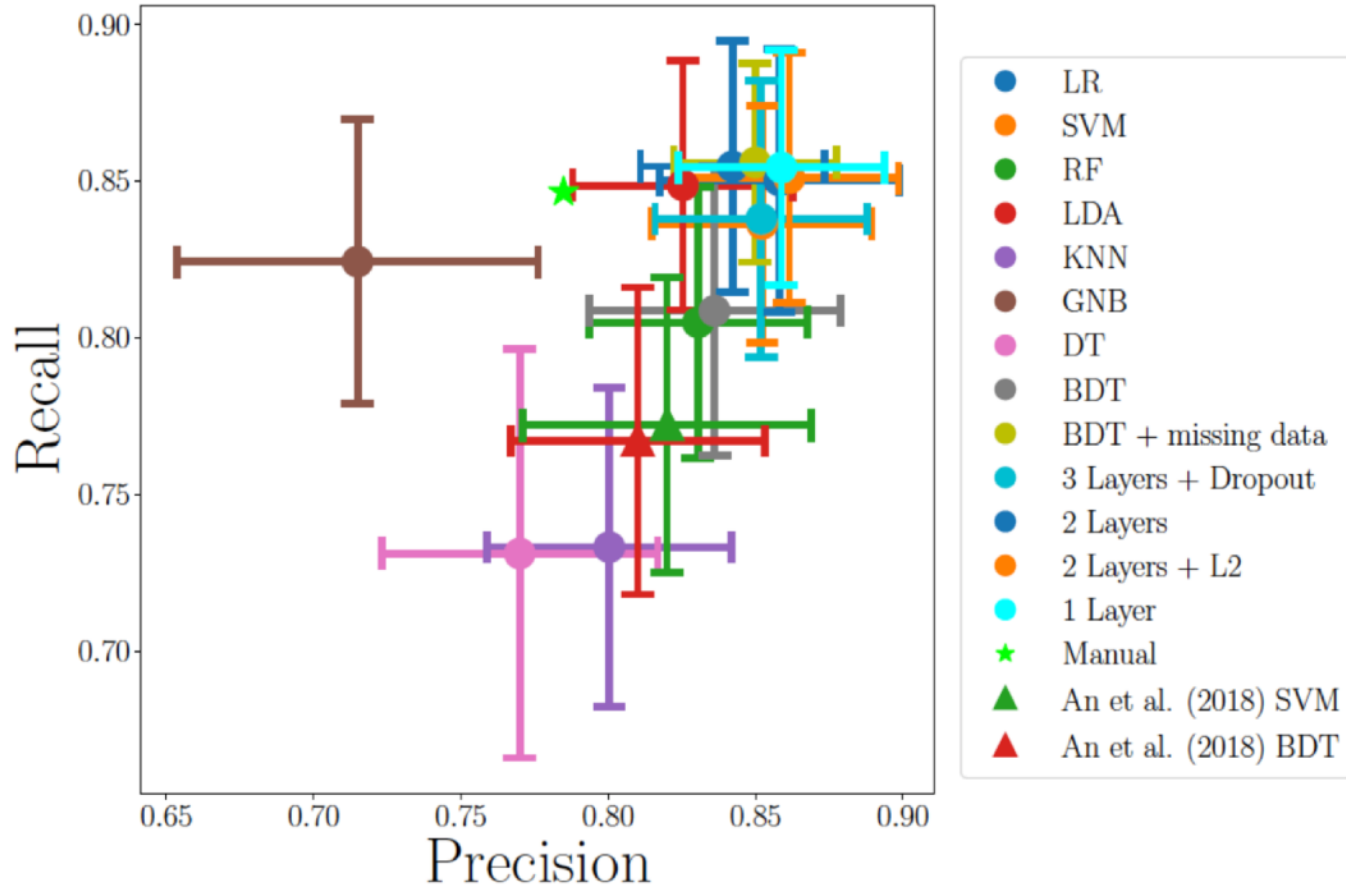
ZOOM BACK

RANDOMISER!

Non-ZOOMED ID#4 MIGHTEE 1.4GHz radio contour (UVISTA k-band background)



Matching of Compact Sources

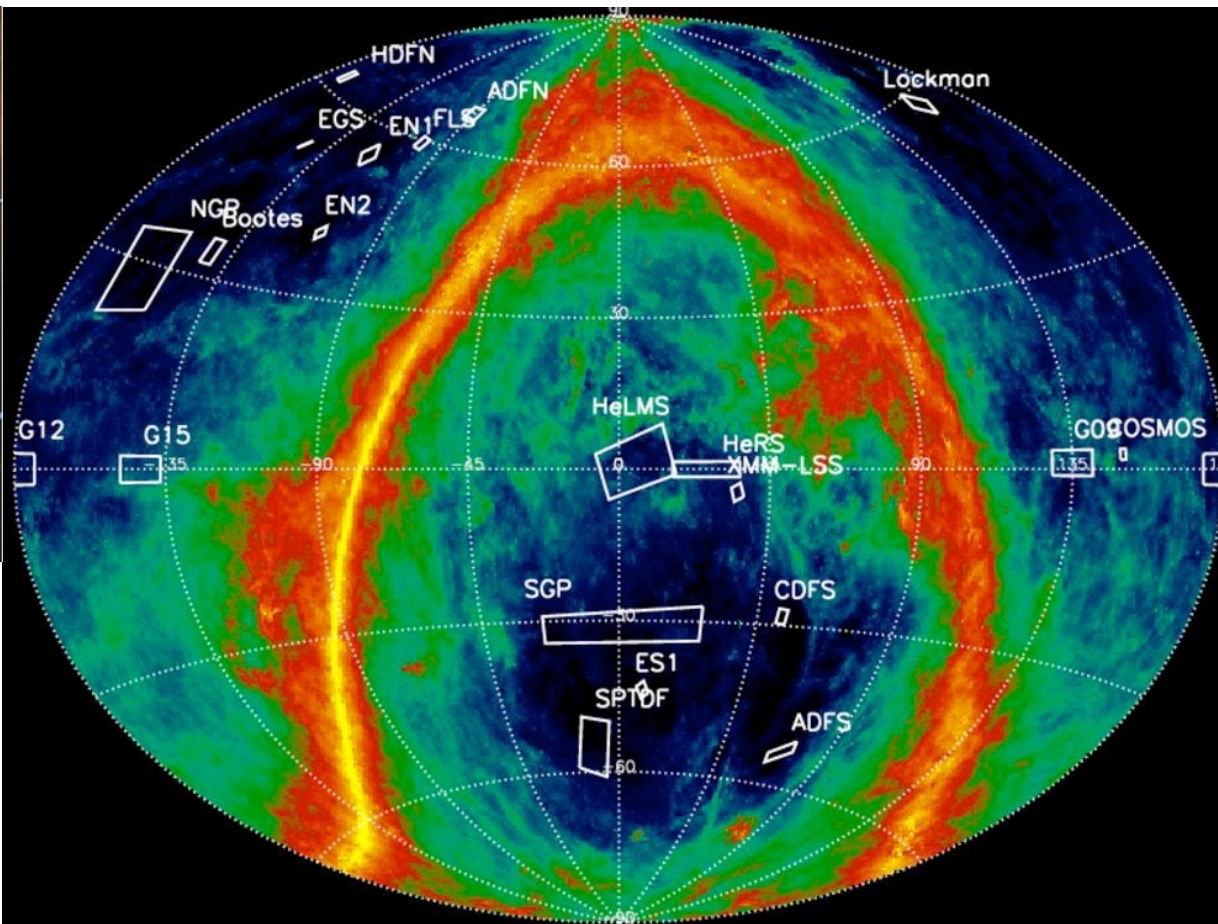
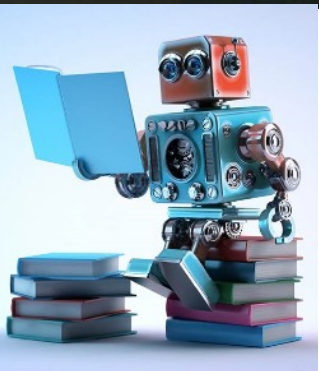


An et al. 2018, Liu et al. 2019



UNIVERSITY of the
WESTERN CAPE

To Be Continued...



<http://www.idia.ac.za>

<http://www.mattiavaccari.net>