

Searching and characterizing extended Galactic sources in SCORPIO

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Introduction

SCORPIO, a deep survey on the Galactic plane:

- Instruments: **ATCA**, Parkes, ASKAP
- Pathfinder for the Galactic part of EMU
- **Science goals:**
 - studying radio stars
 - **stellar evolution**
 - Galactic object populations
- **Technical goals:**
 - testing and tuning data reduction
 - data analysis and source characterization

Bridging to next-generation surveys

Potentiality

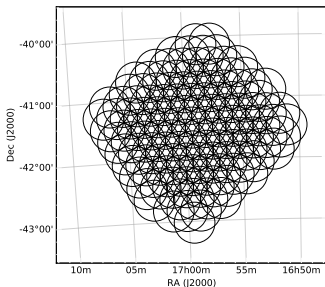
- Galactic source characterization
- Population studies
- Discovering missing objects

Challenges

- Testing calibration and imaging algorithm
- Source extraction and classification
- Dealing with missing short baselines

ATCA observations

- Frequency range: 1.4 - 3.1 GHz
- Configurations: 6A, 6B, EW352, EW367
- LAS: $\sim 4'$ at 3.1 GHz
- Studying extended sources (Ingallinera et al. *in prep.*)



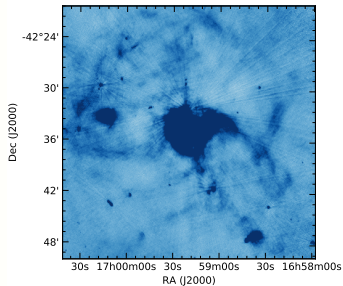
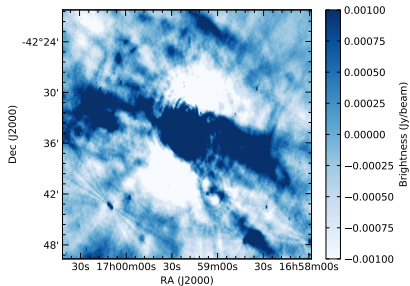
133 pointings
320 hours

Data reduction

'linmos'

vs.

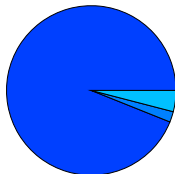
'mosmem'



Source extraction

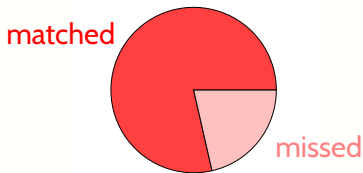
By visual inspection

- Manual search by two observers
- 93 sources by both + 6 only by one



Automated extraction with CAESAR (Riggi et al. 2016)

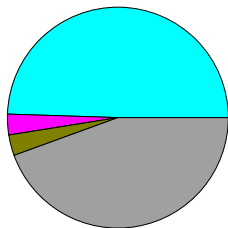
- Limited by artifacts
- False positive issues



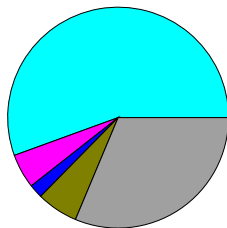
(also Riggi et al. in prep.)

Source classification and catalogue

Source type	From the literature	After this work
H II regions or candidates	49	55
PNe or candidates	3	5
LBV/WR stars or candidates	0	2
SNRs or candidates	3	6

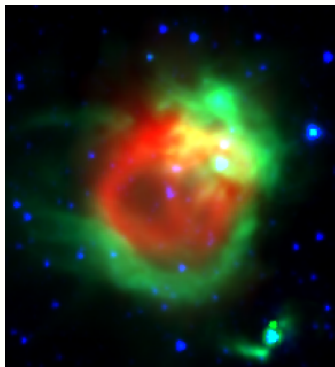


H II regions
PNe
LBV/WR stars
SNRs
undetected /
unclassified



H II regions

Most abundant extended Galactic sources at this frequency.



Comparison with IR

- Checking candidates
- Proposing 6 new

Radio quiet H II regions

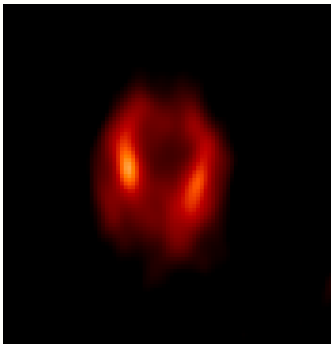
- Detected 30%
- Only a sensitivity limit?

Completeness

- $\sim 100\%$ for UC, compact and classic

Planetary nebulae

Many known PNe are still point-like



New detections

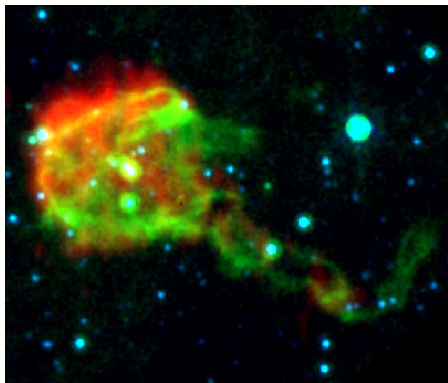
- 2 new proposed PNe
- Low-brightness objects
- Need for high-resolution

Completeness

- ~50% for EMU???
- Can we recognize them?

Massive evolved stars

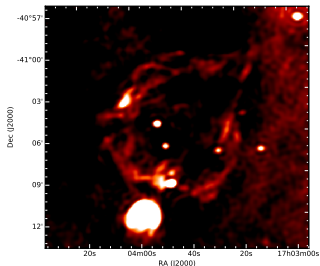
Studying last phases of massive stars evolution



Rare objects

- Proposing 2 new candidates
- Maybe LBV stars?
- Poorly understood evolution phases

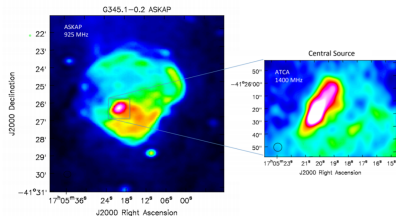
Supernova remnants



- 1 known
- 2 candidates from literature
- 3 proposed by us as new SNRs
- Joint Italian program SKA-CTA

Possible PWN

- *Chandra* proposal
- Synergy with X-ray and gamma community



Impact on ASKAP

Scientific forecasts

- Potentiality and difficulties on source characterization
- Estimates on completeness

Technical challenges

- Imaging extended and diffuse emission
- Sensitivity not limited by thermal noise but artifacts
- Inputs on ASKAP pipeline parameters

Conclusions

Source extraction and classification

- Manual and automated extraction
- Effectiveness on classification, also with high-resolution radio and infrared images (in future **SKA** and **JWST**)
- New discoveries and missing objects

Open issues

- Compromise between imaging algorithms
- Automation in source extraction and classification

And... **let's start to work!**