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Exploration of Radio Sources with Diverse Flux Range Detected in MeerKAT Galaxy

Proto-Cluster Field

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Results

Introduction

- Radio astronomy enables the study of the universe through radio-frequency emission
- The MeerKAT telescope, located in the Karoo region of South Africa, consists of 64 dishes and operates in the L-band (856–1712 MHz), providing high-resolution radio images.
- We explore the data that was awarded time to study candidates of 3 proto-clusters (Ding, Clements, Leeuw et al. 2024)
 - To study the morphology and special and rare characteristic they have and how the sources differs with flux range.

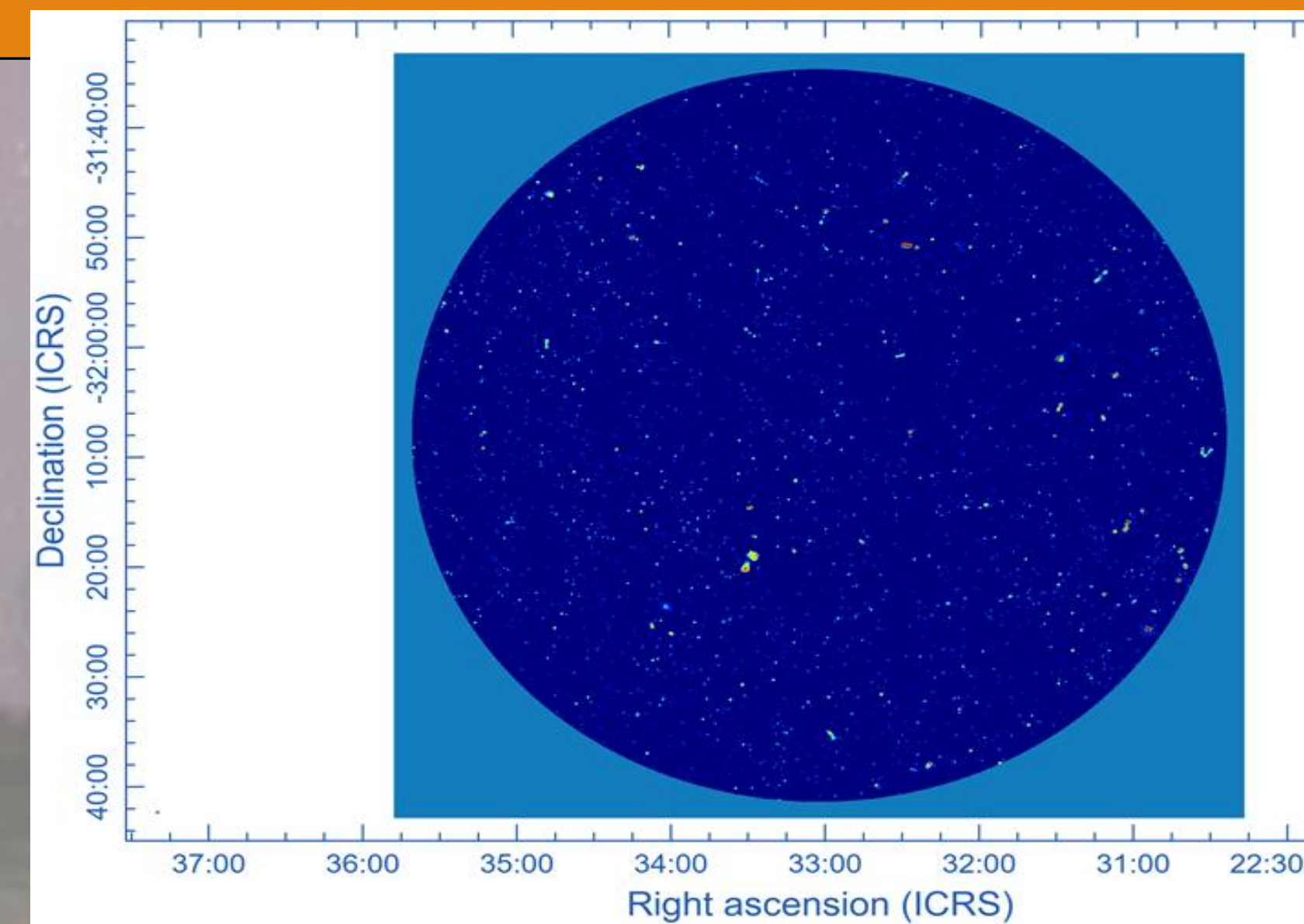


Figure 1: The image taken by meerkat telescope of the field named G014 (Ding, Clements, Leeuw et al. 2024)

Methodology

- Source extraction
 - PyBDSF
 - Designed for radio data
 - Detects emission above 3σ (islands) and 5σ (peaks)
 - Fits Gaussian components
 - Handles extended sources effectively
 - Source selection
 - Sources span across range of fluxes
 - Sources are selected across the field with diverse flux range
 - 15 sources were chosen to be studied.

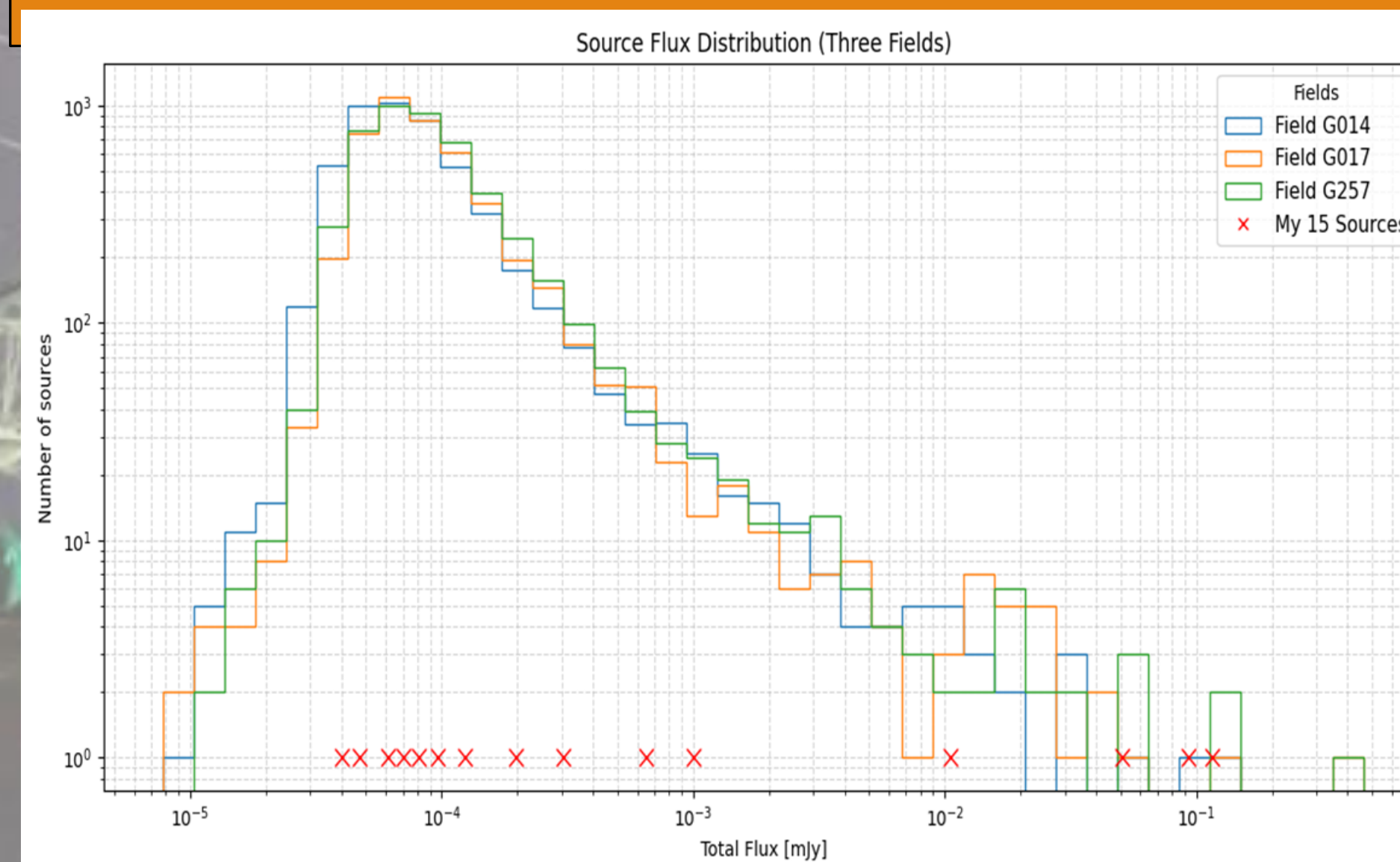


Figure 2: Flux distribution of the three fields and with the 15 selected sources marked as x.

Characteristics:

- Shape
 - The sources are both extended and non-extended sources
- Resolution
 - Extended sources are resolved where else non-extended are unresolved
- Contour line
 - Extended sources: They have a complex shape showing extended contour, with the brightness decreasing from centre and have multiple peaks.
 - Non-extended sources: they are round in shape with few contour lines and no multiple peaks.
- As shown in Table 1, flux is not correlated with source extent.

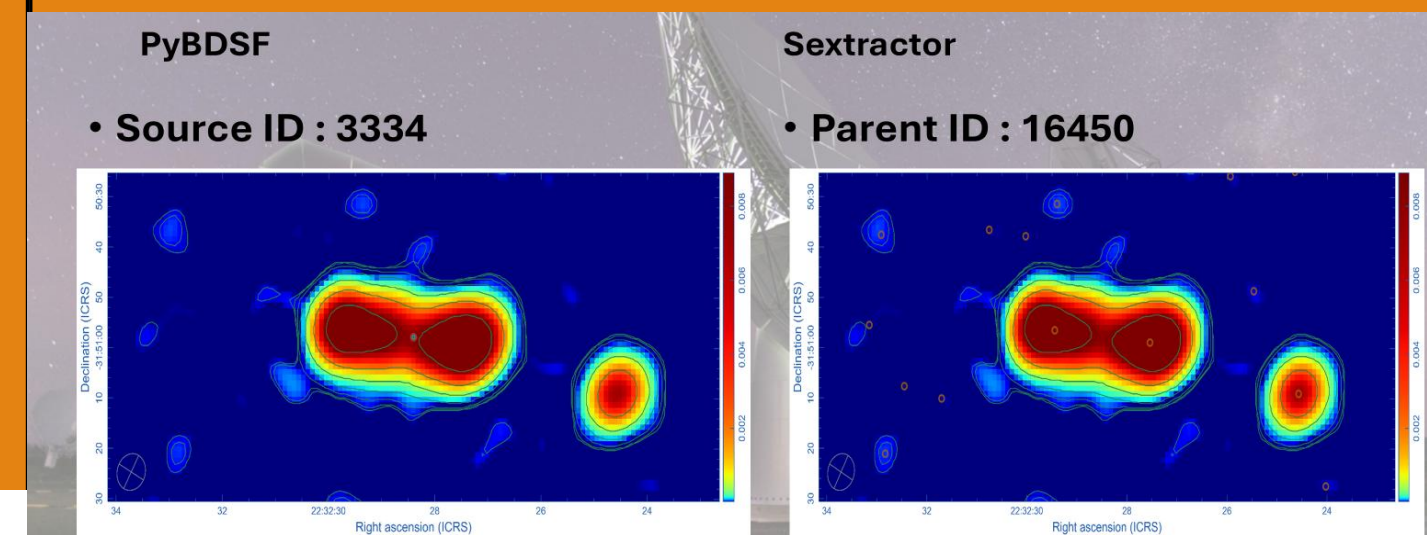


Figure 3: the source from pdysf and SExtractor

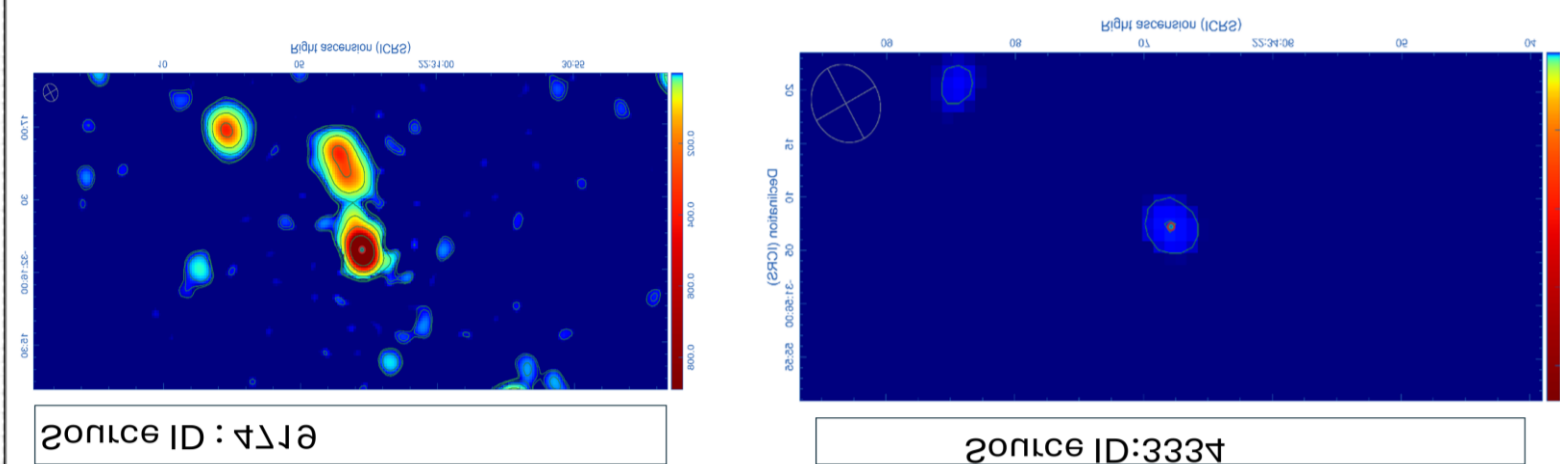


Figure 4: the sources from the field resolved and unresolved

| Source ID(from high flux to lowest) | Extended or non extended |
|--------------------------------------|--------------------------|
| 3334 | Extended |
| 4809 | Non-extended |
| 4719 | extended |
| 4404 | extended |
| 1267 | Non-extended |
| 812 | Non-extended |
| 1545 | Non-extended |
| 1372 | Non-extended |
| 2972 | extended |
| 3658 | Non-extended |
| 126 | Non-extended |
| 98 | Non-extended |
| 3404 | Non-extended |
| 4819 | Non-extended |
| 1266 | Non-extended |

Table 1: showing the 15 sources and whether they are resolved or not.

Future work

More studies will be done to identify the type of radio galaxies they are, how far they are and any other special and rare characteristic they might have (cf. Tole et. al and Petersen et al. *in prep*)