ESCAPE WP5 Use Case:
Use case based on VLA data: HI analysis

A representative use case for WP5 developments

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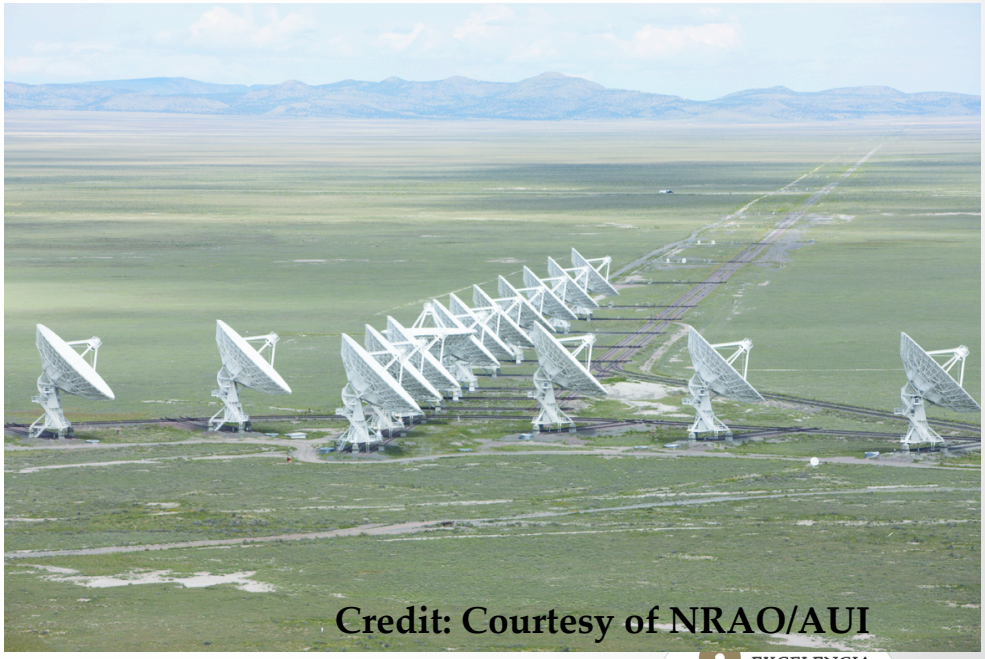
The Facility: Very Large Array

- Radio interferometer located at New Mexico built in the 70s
- Modernized it and extended it by the Expanded VLA project
- Since 2012 is the Karl G. Jansky Very Large Array
- 27 dishes, 25 m diametre each one, arranged in a Y shape
- Frequency coverage: 1 – 50GHz
- 5 different configurations :
  - Distance between antenas
    - Max. Distance: baseline
  - Different sensitivity
  - Different angular resolution

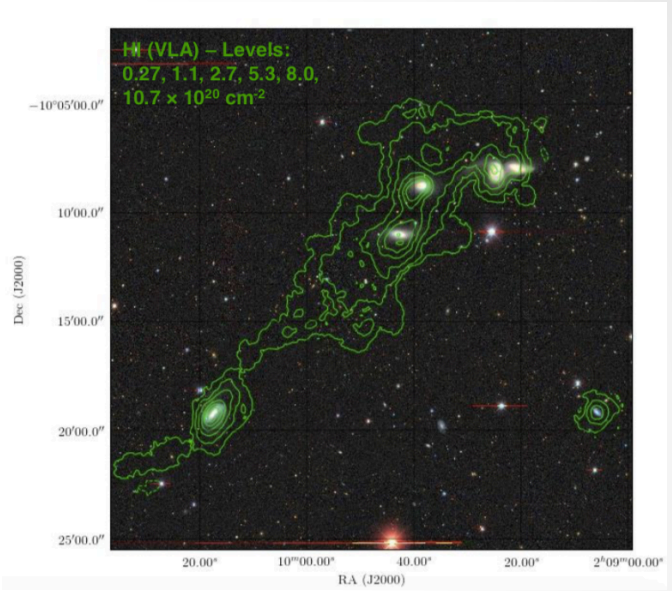


SKA pathfinder

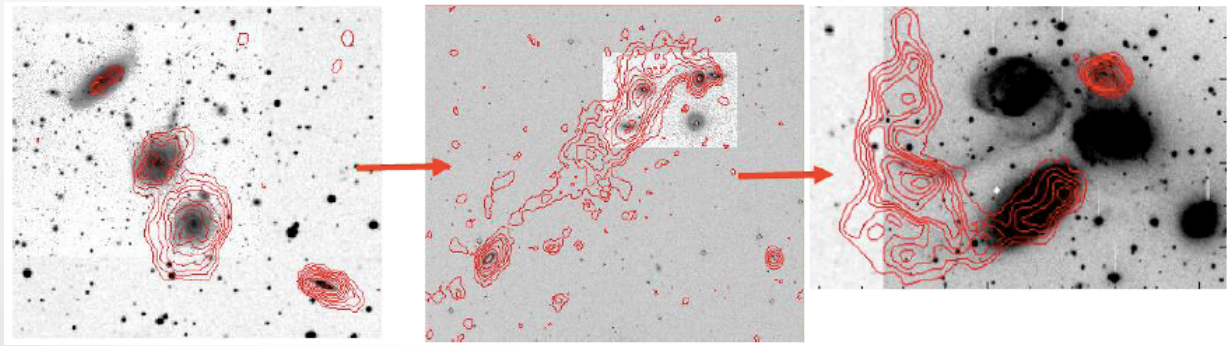
Evolution of the HI content of compact groups: A case study of HCG 16

- Atomic Gas (HI)
  - Tracer of the galaxy formation and evolution
  - HI atoms produce radio emission (1420 MHz)

- Hickson Compact Groups:
  - 4 or more galaxies
  - Very close each other
  - Isolated



M. Jones et al. In prep.



AMIGA

http://amiga.iaa.es

Evolutionary sequence suggested by Verdes-Montenegro et al. 2001

Evolution of the HI content of compact groups: A case study of HCG 16

The HI analysis to study galaxy formation and evolution is of interest for the SKA community

→SKA HI Science Working Group

→HI surveys with SKA precursors/pathfinders:

- MONGOOHSE: MeerKAT HI Observations of Nearby Galactic Objects: Observing Southern Emitters
- LADUMA: Looking At the Distant Universe with the MeerKAT Array (deep HI survey)
- WALLABY: the ASKAP HI All-Sky Survey (ASKAP)
- CHILES The Cosmos HI Large Extragalactic Survey (VLA)
- ...

Evolutionary sequence suggested by Verdes-Montenegro et al. 2001

The Data: Input data

- Raw data (visibilities) from the VLA public archive
  - MeasurementSet format (*):
    - A radioastronomy-specific format.
    - Read/managed by Common Astronomy Software Applications package (and AIPS)
  - Size: 300MB aprox.
- Optical data
  - From the Dark Energy Camera Legacy Survey (DECaLS)
  - FITS format
  - Size: 30 MB aprox.

(*)Before starting the analysis process, the VLA files (*.xp*) should be transformed into MS

The Data: Intermediate & Output data

- Intermediate data:
  - ~ 100 MB
  - We need to identify which data we need to preserve.
    - Workflow provenance
    - Quality Assurance
- Cubes (2D spatial + 1D Frequency)
  - FITS format
  - Few MBs
  - Derived data: Moment maps, cutouts
  - To be published through VO services

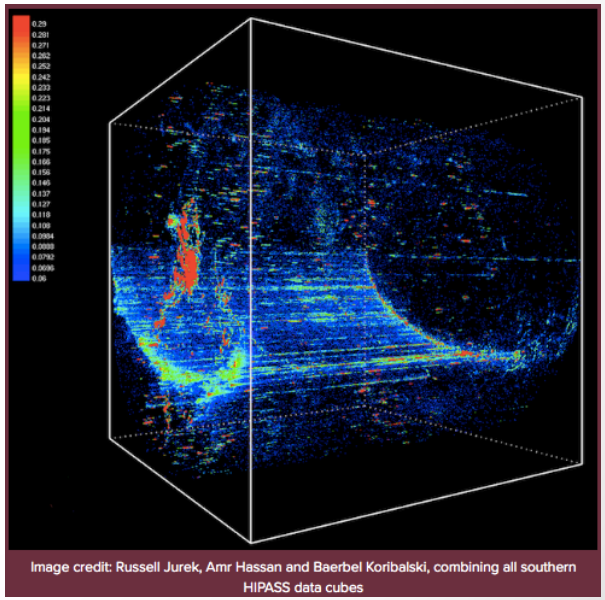
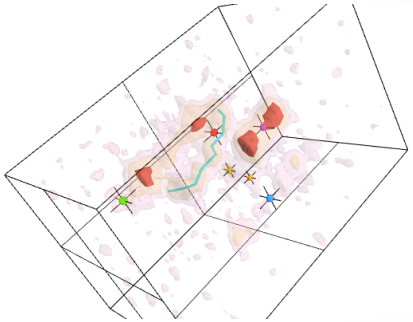


Image credit: Russell Jurek, Amr Hassan and Baerbel Koribalski, combining all southern HIPASS data cubes

Tools involved in the use case

- Flagging, calibration and imaging steps:
  → CASA (python scripts importing casapy libraries)

- Create a source mask and generating a moment maps
  → SoFiA (Source Finding in Astronomy)



- Cube visualisation:
  →X3D pathway

- Identification of Galaxies and Tails:
  →SlicerAstro

- Plot moment maps, create contours, etc
  → Jupyter Notebooks, Astropy

A use case for WP5 developments:

- ✓ Study how to integrate existing IVOA services into ESAP for data discovery (in T5.1)
- ✓ Test how to Integrate ESCAPE-EOSC software and service repository developments through WP3 catalogue into the ESAP (in T5.2)
- ✓ Demonstrate functionality by building, deploying, and ingesting several ESFRI-specific software (in T5.2)
- ✓ Develop representative, ESFRI-specific workflows based on current analysis needs (in T5.3)
- ✓ Evaluate the level of reproducibility and achievement of the FAIR principles supported by the platform (in T5.3)

(*)Not so useful for:

- X Evaluating the performance and responsiveness of prototype Science Platform (in T. 5.3)
- X Evaluating the behaviour and performance of the prototype (in T5.4)

Questions?