Studying relativistic jets in Active Galaxies at multiple scales and wavelengths

LOFAR Family Meeting 2022

Etienne Bonnassieux, JMU Würzburg

on behalf of LOFAR-VLBI Working Group, and many more beside

Scientific Context: Continuum Emission of AGN

Our work focuses on a very specific band: continuum radio emission, at low frequencies (~150 MHz).

Particularity of radio measurements: no extinction of emission!

Emission present at various scales: need to deal with diffuse & compact emission simultaneously

Want: sensitivity, diffuse emission, compact emission, & low frequency.

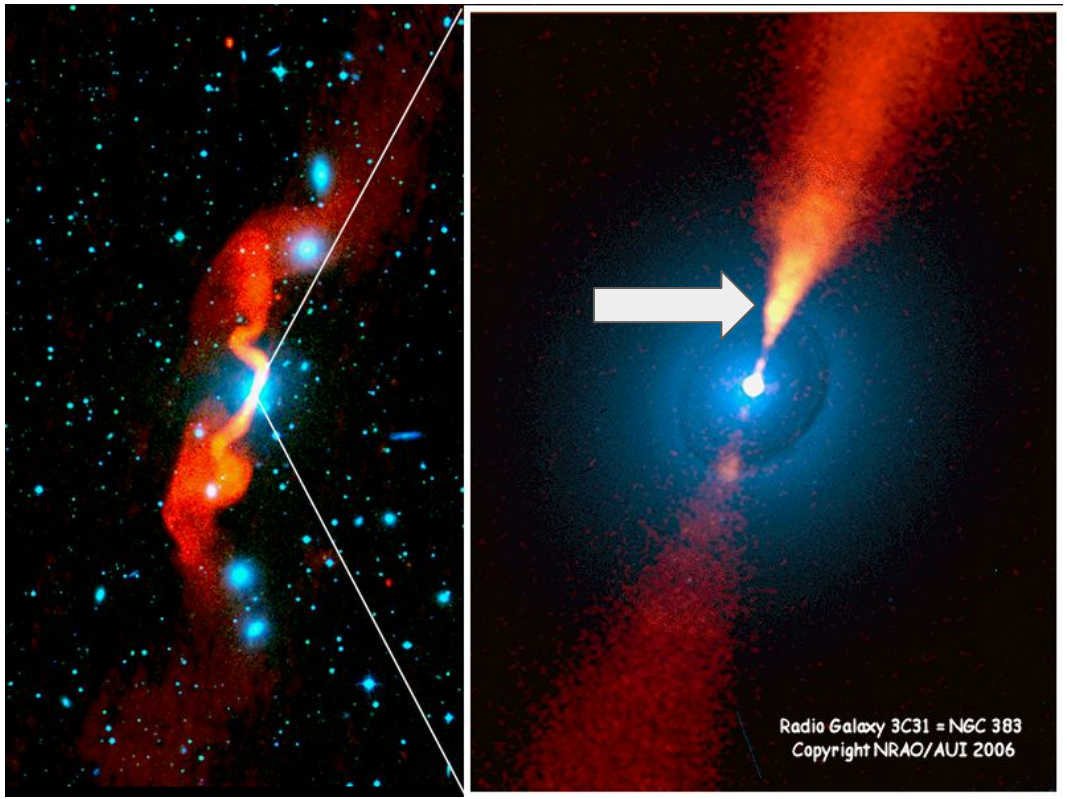


Image source: https://upload.wikimedia.org/wikipedia/commons/c/cb/Faraday-effect.svg

Scientific Context: SKA and its Pathfinders

Slide credit: Cyril Tasse

Collecting area: 1 sq. km

Resolution: ~10 mas a 1 GHz
(a 1 euro coin at 400 kilometers)

Sensitivity: ~50 nJy/Beam
[8 hours, 500Mhz bandwidth]

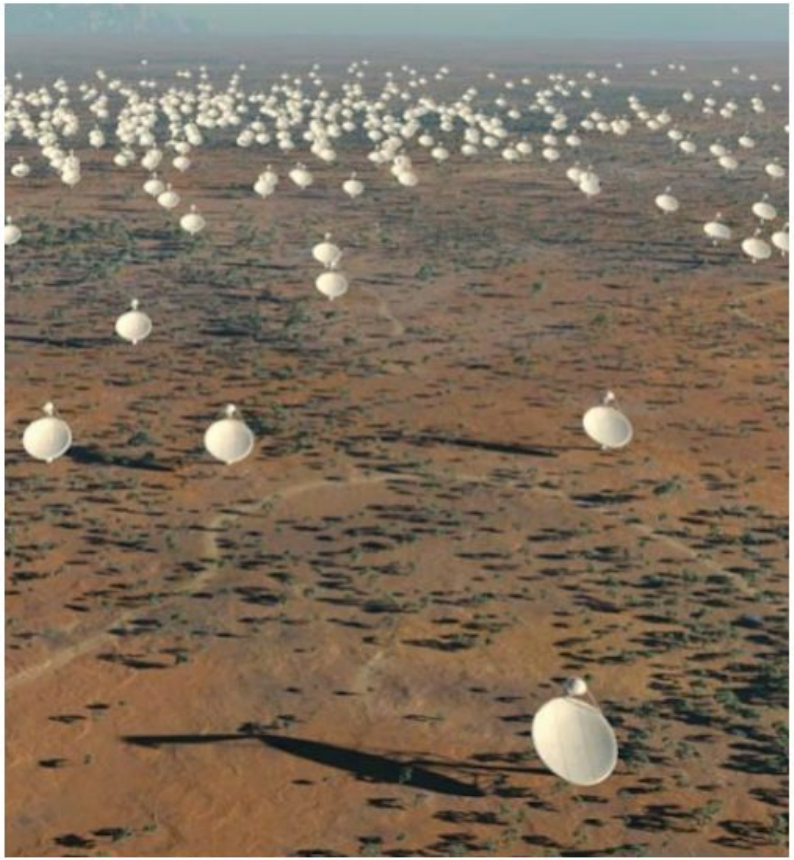
Field of view: ~ 1 degré carré

360.000x360.000 pixels images

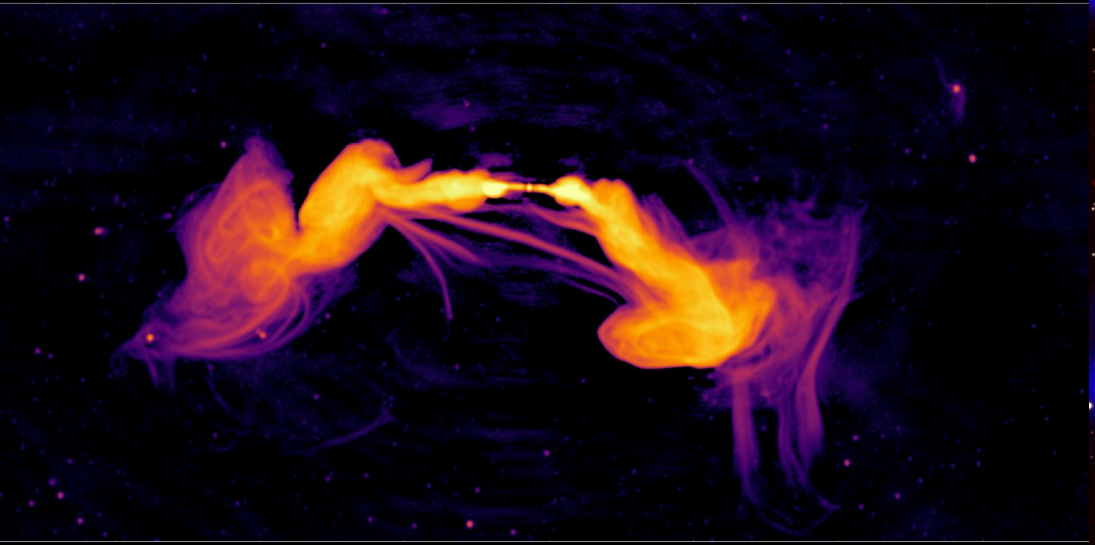
Survey speed: x10.000

A few huge radiotelescopes prototypes of the SKA:

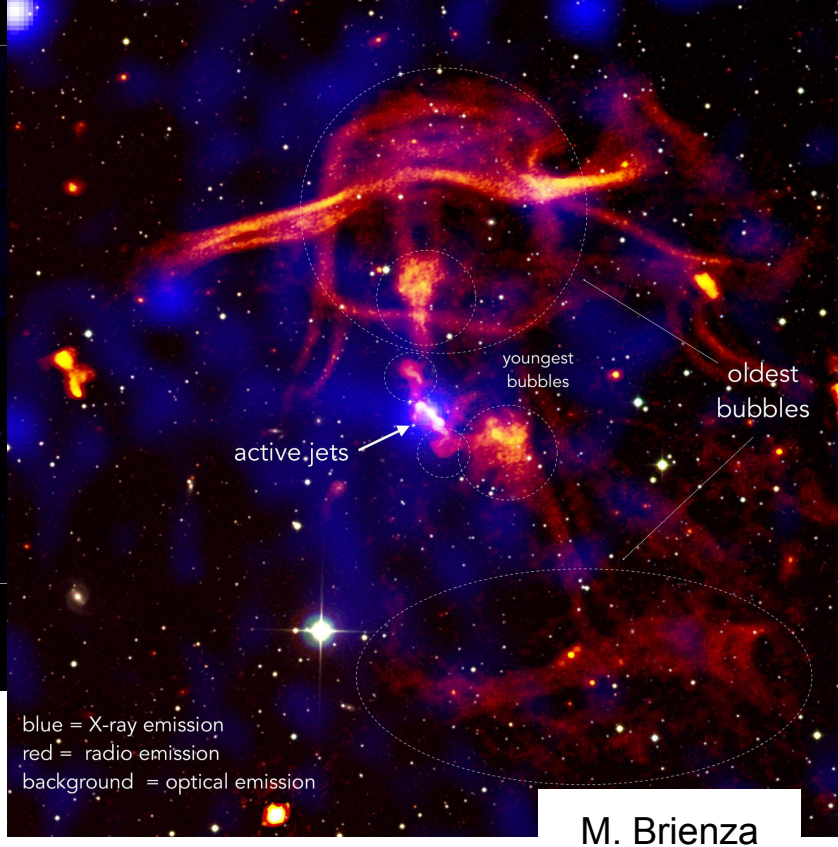
- **MeerKAT (under construction)**
- **LOFAR (operational)**
- ASKAP
- …..



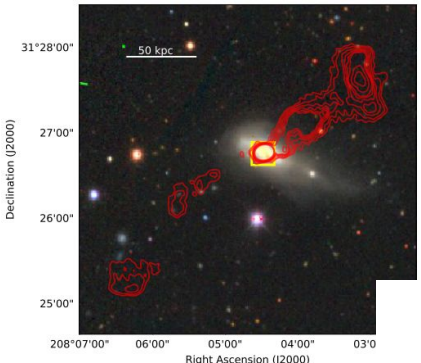
ESO 137-006

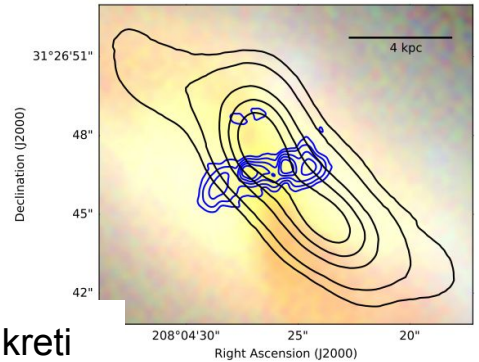


"Collimated synchrotron threads linking the radio lobes of ESO 137-006", M. Ramatsoku et al. 2020, A&A
MeerKAT Radio Telescope image at 1000 MHz
Image credits: Rhodes University / INAF / SARAO



M. Brienza



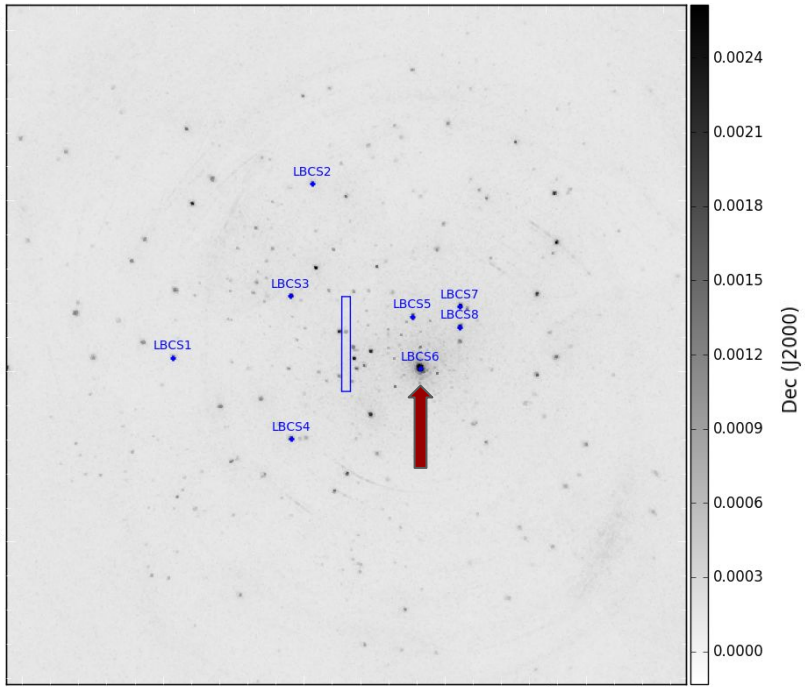


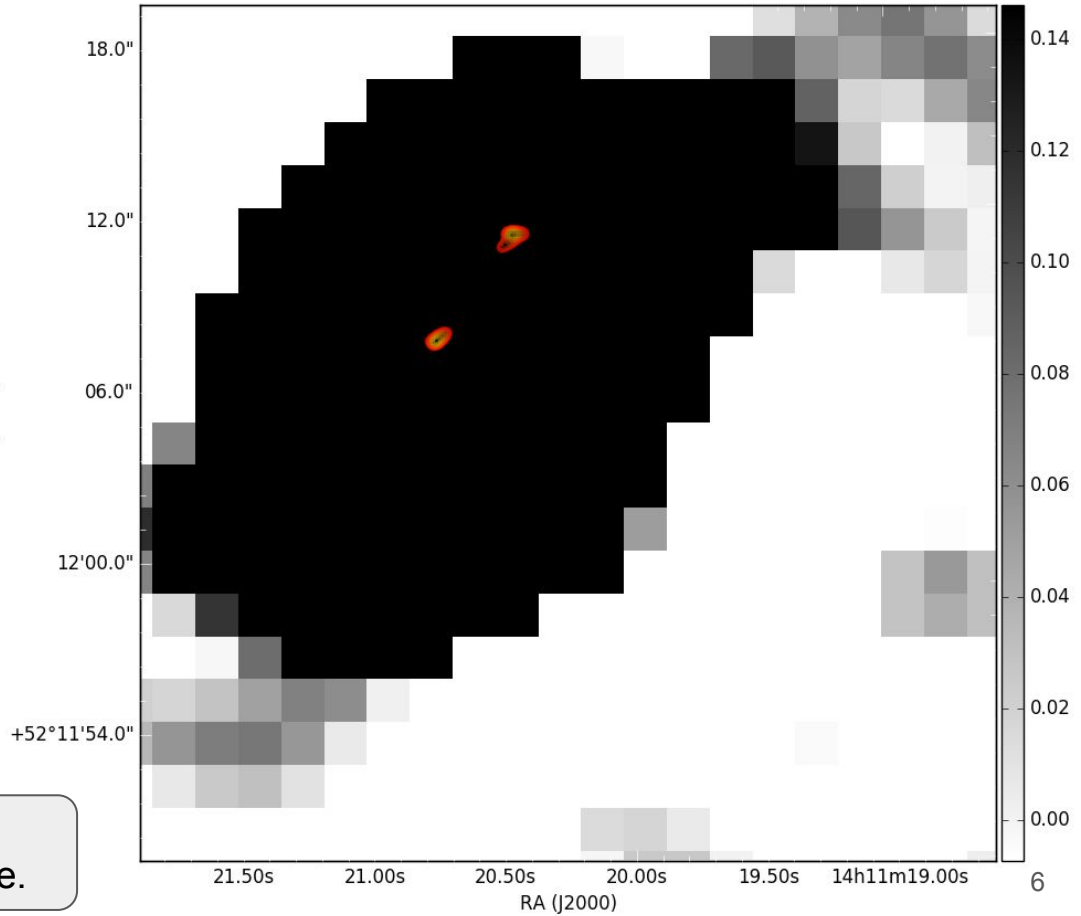
P. Kukreti

SKA precursor results for AGN observations


Onsala
Irbene
Birr
Dutch stations
Chilbolton
Norderstedt
Bałdy
Potsdam
Borówiec
Jülich
Effelsberg
Tautenburg
Łazy
Nançay
Unterweilenbach
Medicina

Images of LBCS sources in the field - 3C295





Right: overlay of LOFAR-VLBI image on widefield direction-dependent image above.

New era, new challenges

Key challenges for new era of radio interferometry. Importantly:

➔ SKA data volume…

- 100 times global internet traffic!!!!
- Need on-the-fly calibration + imaging
- Can only realistically store final science products (images)

➔ Need fast, efficient algorithms to improve final images.

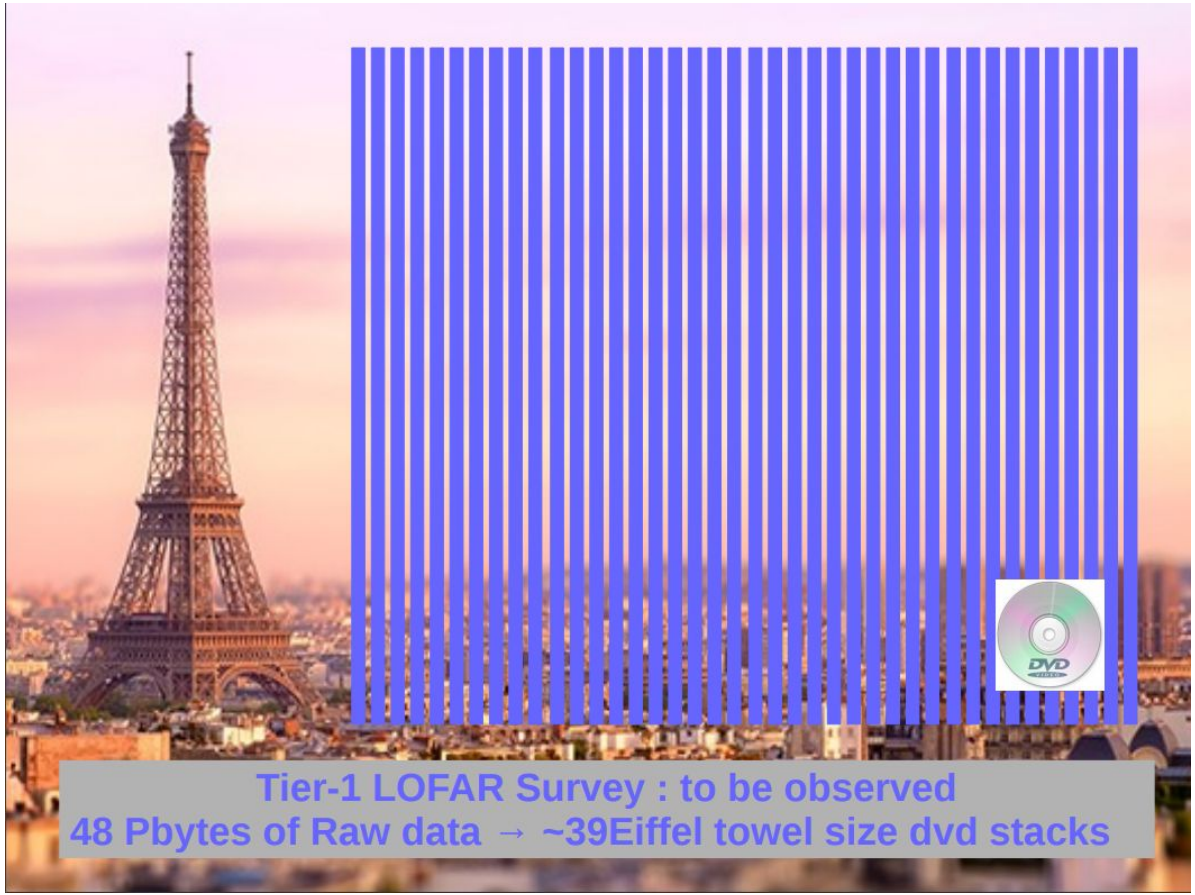


Image credit: Cyril Tasse

Much work remains!

Questions?