THE LOFAR VIEW OF THE EDFN

M. Bondi (INAF-IRA, Bologna)

Collaborators: F. Sweijen, J. De Jong, J. Petley, L. Bisigello, M. Giulietti, M. Magliocchetti, L. Morabito, I. Prandoni, H. Rottgering, R. Scaramella + et al.

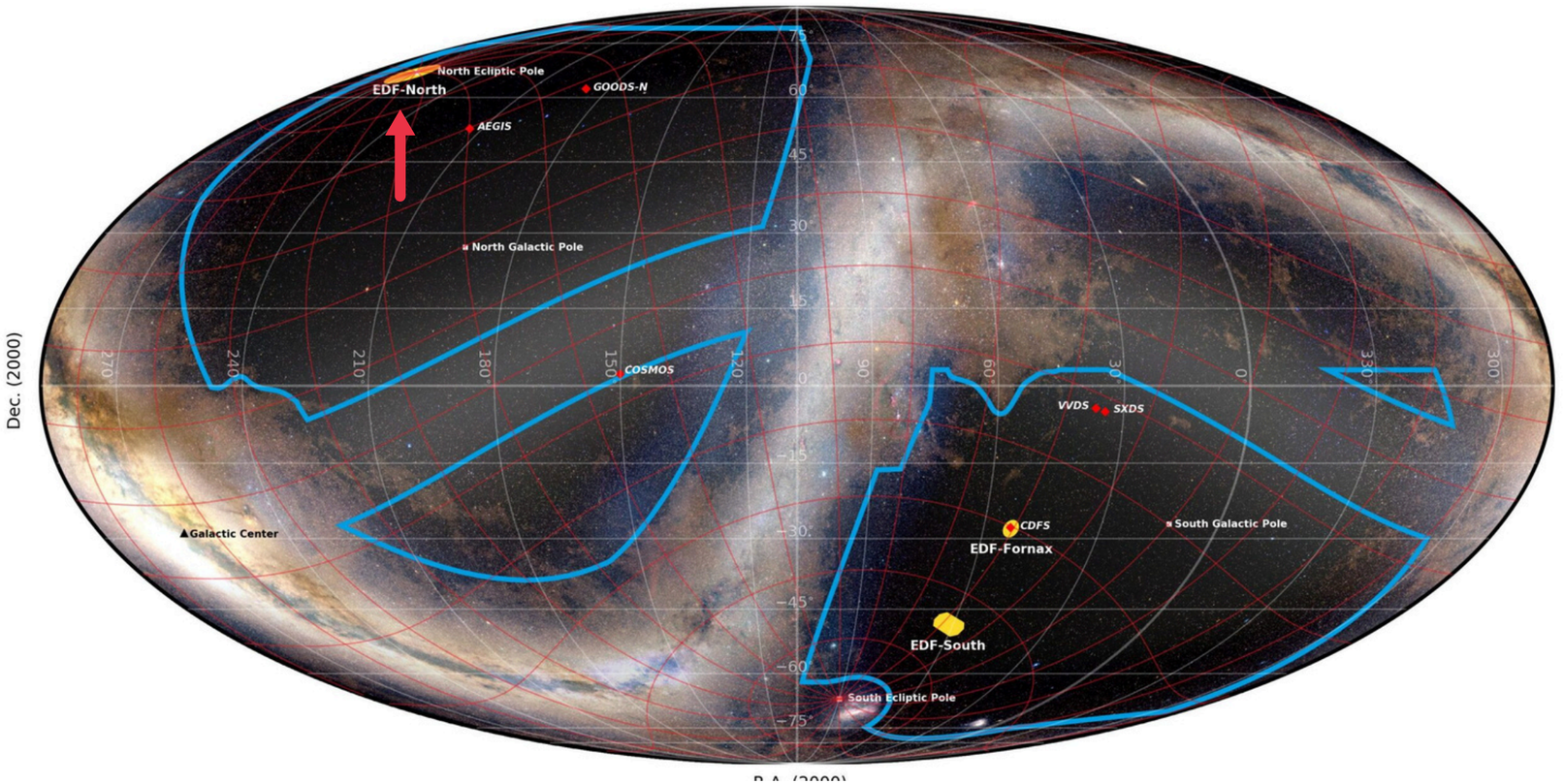
OUTLINE

- The Euclid mission in 20 seconds
- LOFAR obs the EDFN: status & some results
- Widefield LOFAR-VLBI of the EDFN:
  - images and catalogs released
  - power of multi-resolution, examples
- Next steps

THE EUCLID MISSION

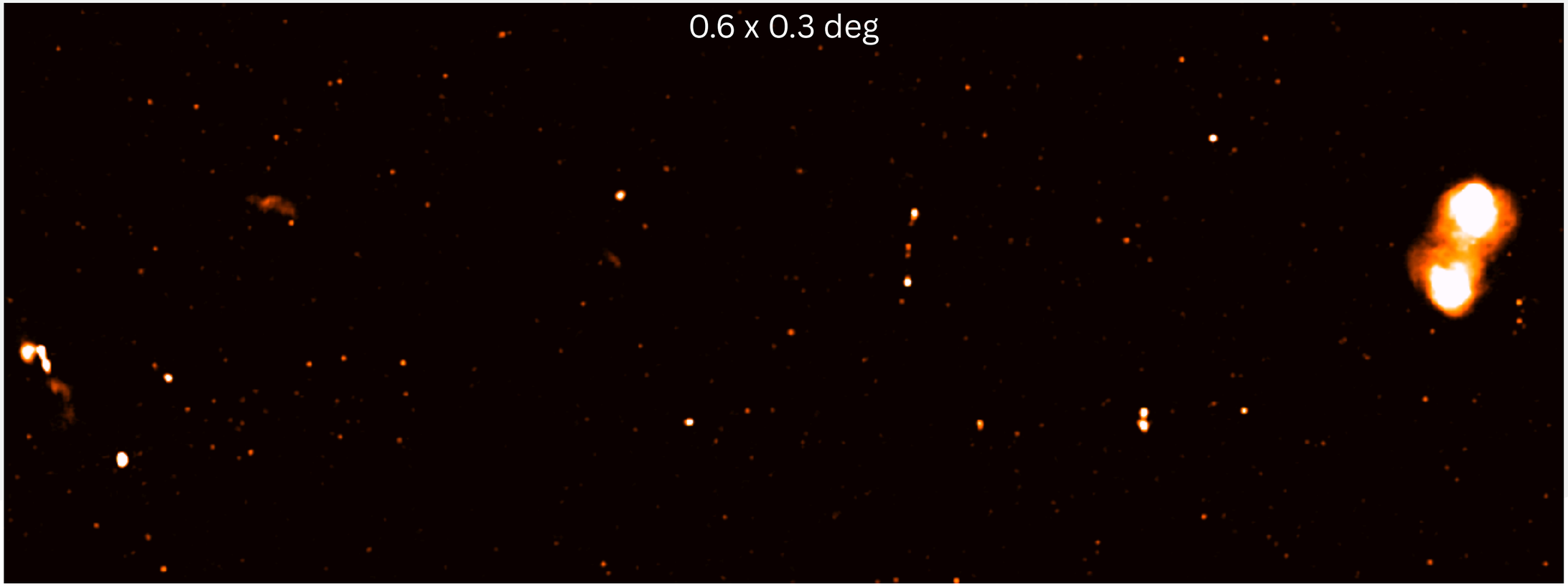
- ESA spacecraft, launched July 2023
  - NISP: near-IR (Y, J, H) photometry & spectroscopy
  - VIS: I-band photometry

- Surveys:
  - Wide:
    ~15,000 sq.deg. H~24
  - Deep:
    3 fields, ~50 sq.deg. H~26



EDFN & LOFAR

- EDFN is one of the four LoTSS Deep Fields (Best+23)
- Observed for 72 hrs in 2019 inner 10 sq. deg.
  - **6" resolution image (r.m.s. 32 microJy/bm) and catalog of radio sources (Bondi+24)**



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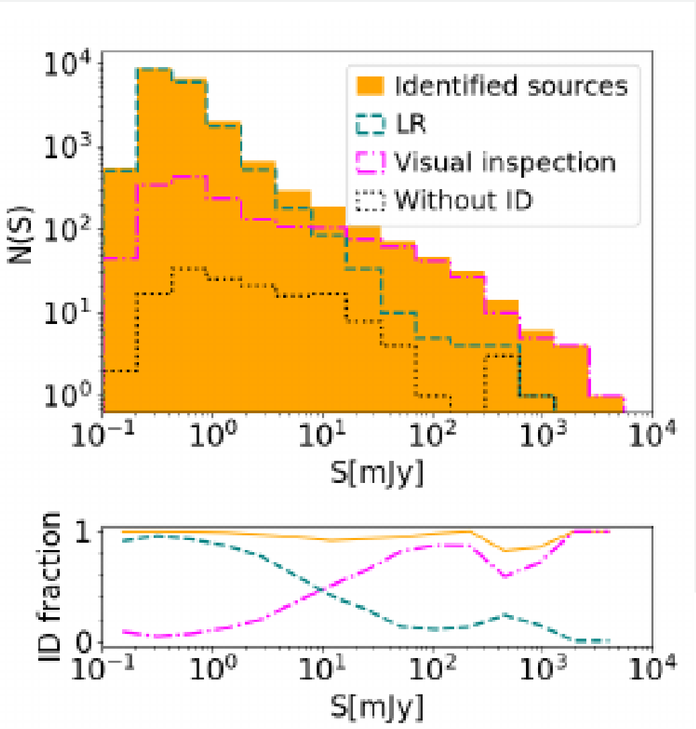
SUMMARY OF THE NUMBER OF SOURCES IN THE LOFAR CATALOGUE WITH AND WITHOUT COUNTERPARTS.

Sample	Number of sources
Original (Bondi et al. 2024)	23 333
Updated[a]	23 309
After masking	19 550
With identifications	19 401
Optical+NIR identifications	18 032
Optical-only	6
IRAC-only	1363
Not identified	149



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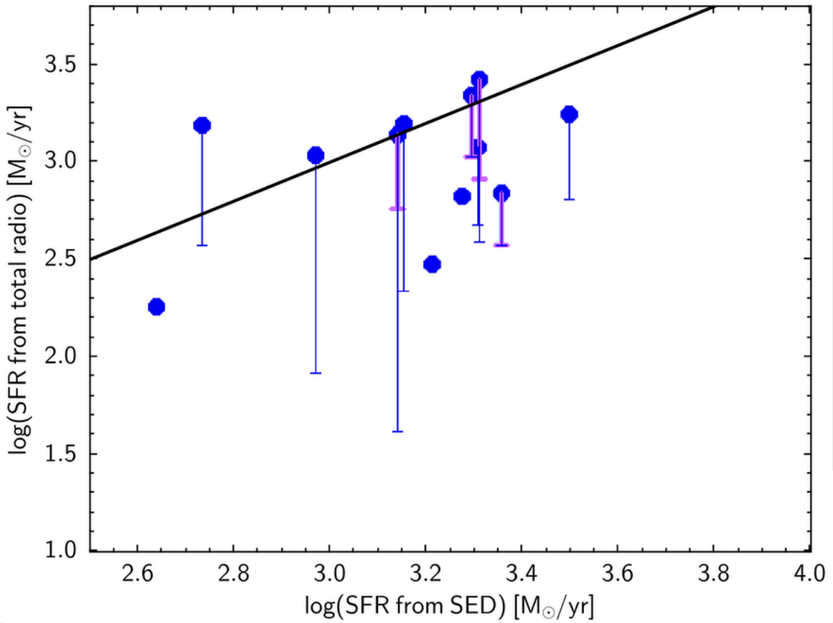

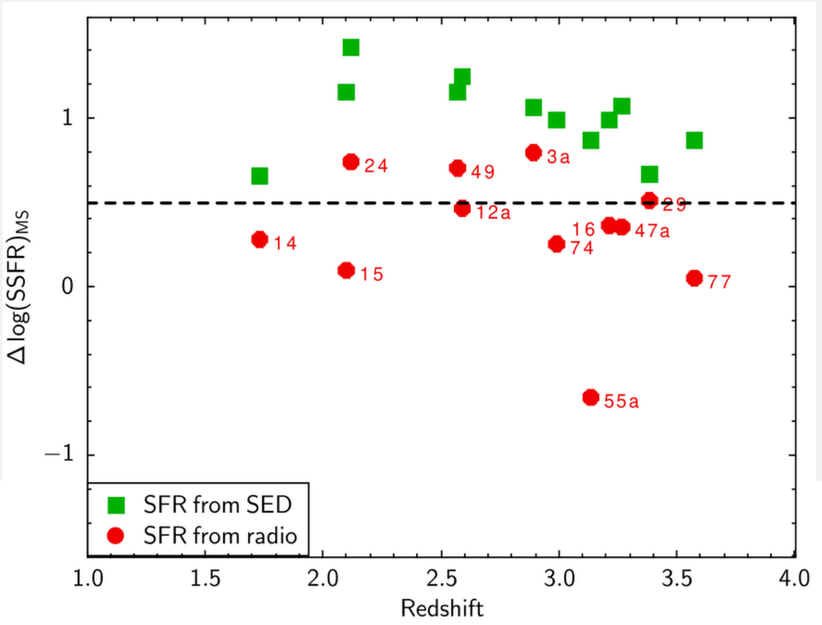

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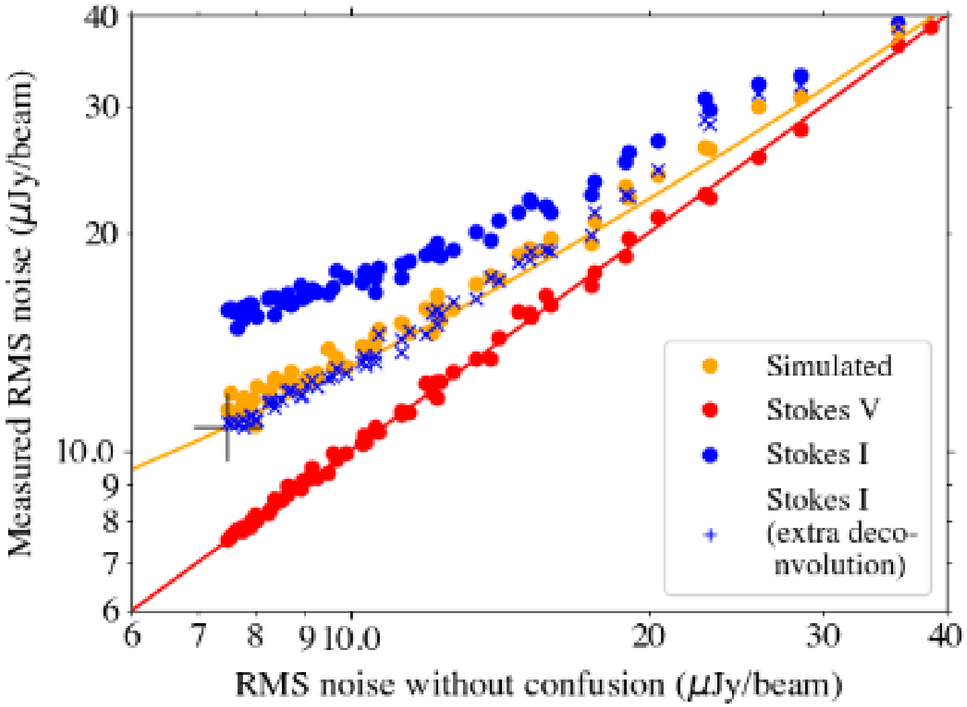
  - **H. Edler talk**: LBA observations
  - **J. Petley poster**: dusty + outflowing AGN
  - ....

THE NEED FOR WIDEFIELD LOFAR-VLBI

- **~200 hr still to be reduced and analyzed. Confusion limited.**

Shimwell+ 2025



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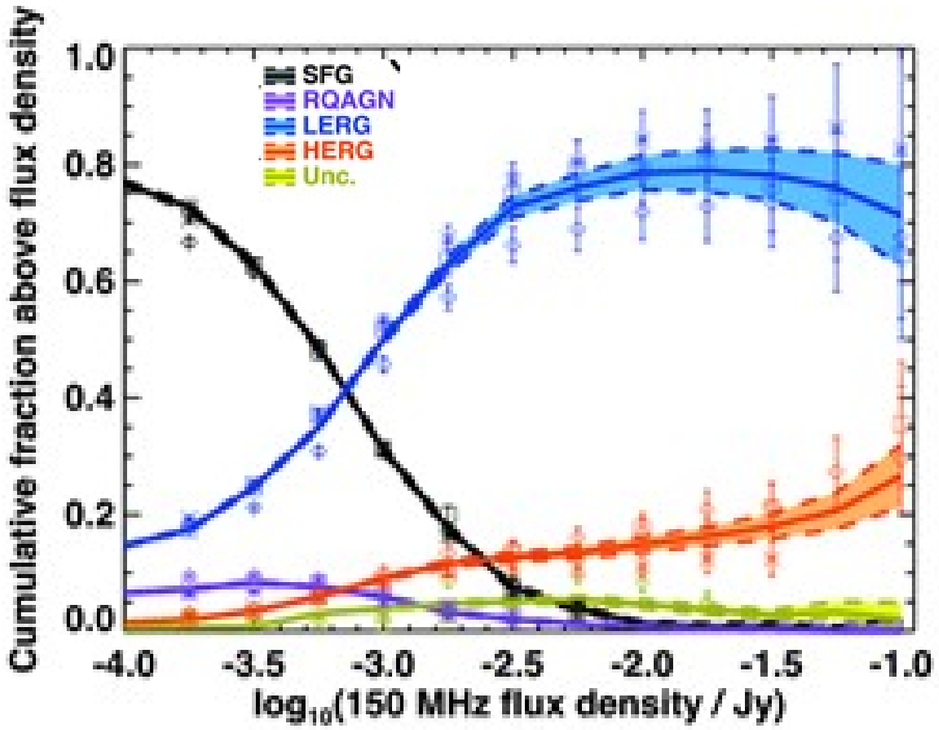
  - **more reliable physical parms**
  - **“resolution filter” to separate AGN from SFG radio emission (e.g. Morabito+ 2022, 2025)**

Best+ 2023



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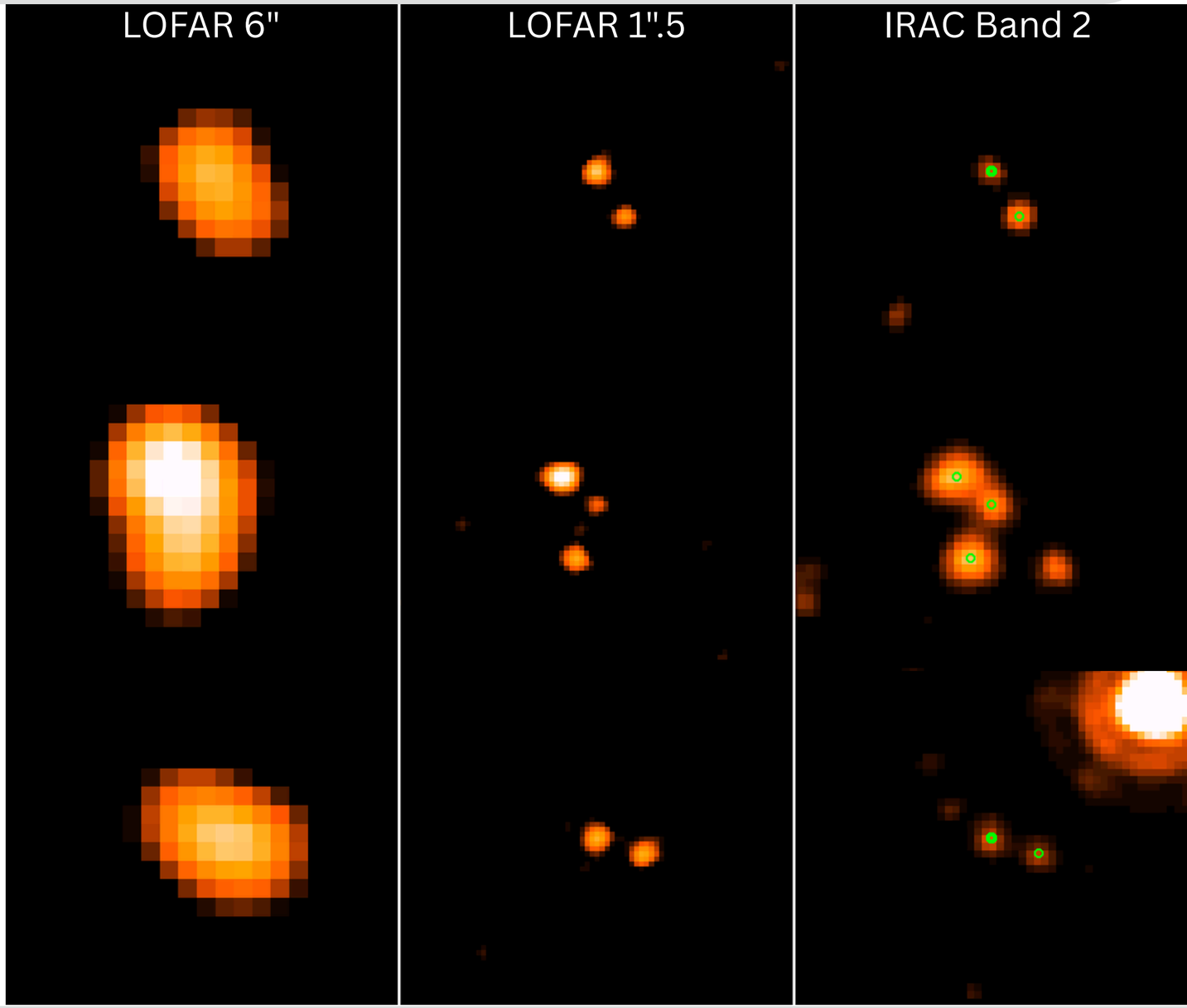
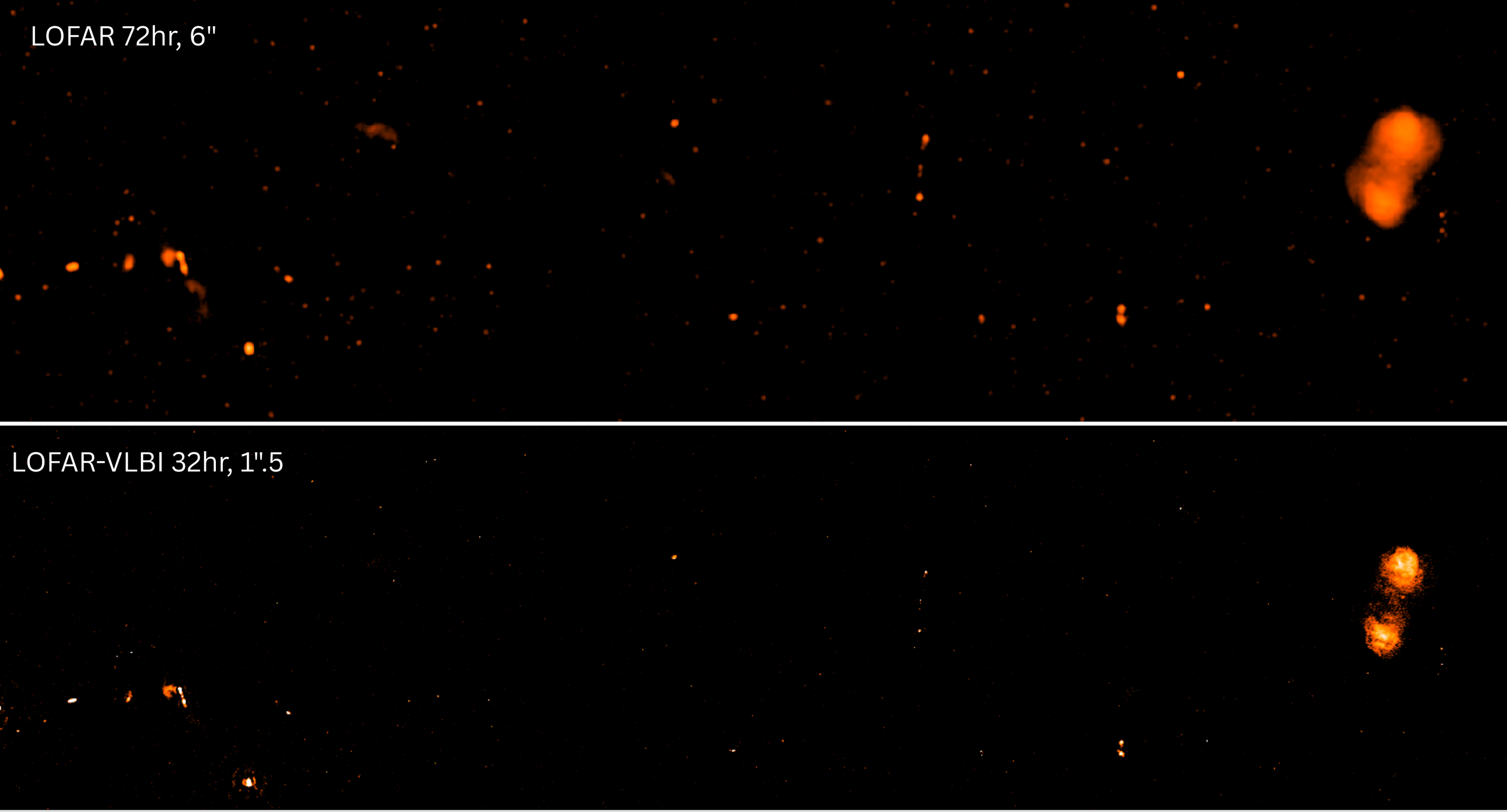


IRAC image from Moneti+ 2022

EDFN: WIDEFIELD LOFAR-VLBI

1".5 resolution

- 32 hr combined
- 2".5 x 2".5 field
- DD facet calibrated
- r.m.s. = 38 microJy/bm
- flux scale & astrometry corrected


LOFAR 72hr, 6"
LOFAR-VLBI 32hr, 1".5

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1".5 resolution

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~0".7 resolution

- 8 hr
- 2".5 x 2".5 field
- DD facet calibrated and facet imaging
- r.m.s. = 53 microJy/bm
- flux scale & astrometry corrected

WIDEFIELD LOFAR-VLBI

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- 2".5 x 2".5 field
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~0".7 resolution

- 8 hr
- 2".5 x 2".5 field
- DD facet calibrated and facet imaging
- r.m.s. = 53 microJy/bm
- flux scale & astrometry corrected

~0".5 resolution

- 8 hr
- 2".5 x 2".5 field
- DD facet calibrated and facet imaging
- r.m.s. = 41 microJy/bm
- flux scale & astrometry corrected

Images & raw catalogs internally released June 2025

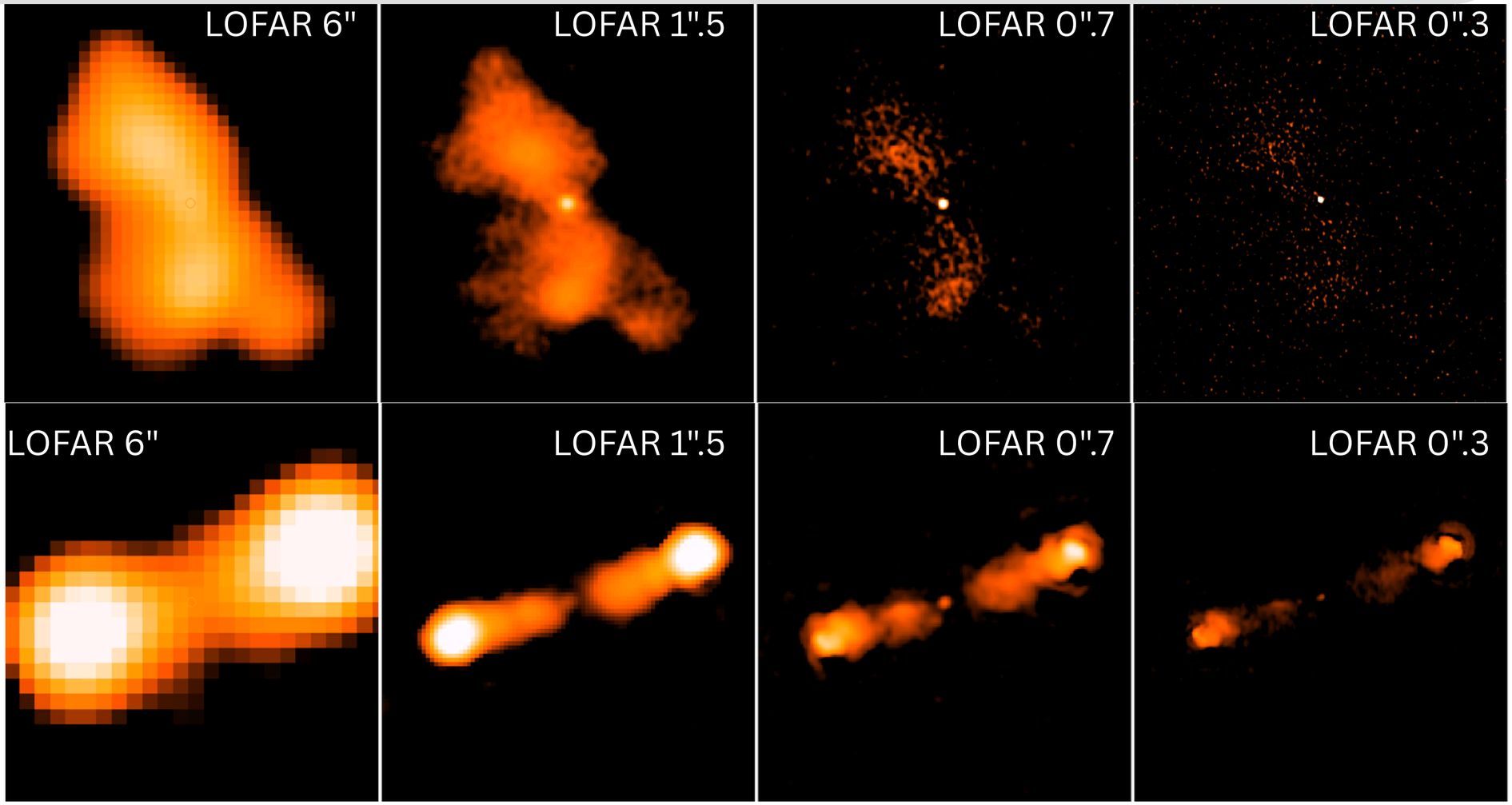
WIDEFIELD LOFAR-VLBI

New!

1".5 resolution	~0".7 resolution	0".3 resolution
• 32 hr combined • 2".5 x 2".5 field • DD facet calibrated • r.m.s. = 38 microJy/bm • flux scale & astrometry corrected	• 8 hr • 2".5 x 2".5 field • DD facet calibrated and facet imaging • r.m.s. = 53 microJy/bm • flux scale & astrometry corrected	• 8 hr • 2".5 x 2".5 field • DD facet calibrated and facet imaging • r.m.s. = 37 microJy/bm

THE POWER OF MULTI-RESOLUTION IMAGES

- **Core id & morphology**



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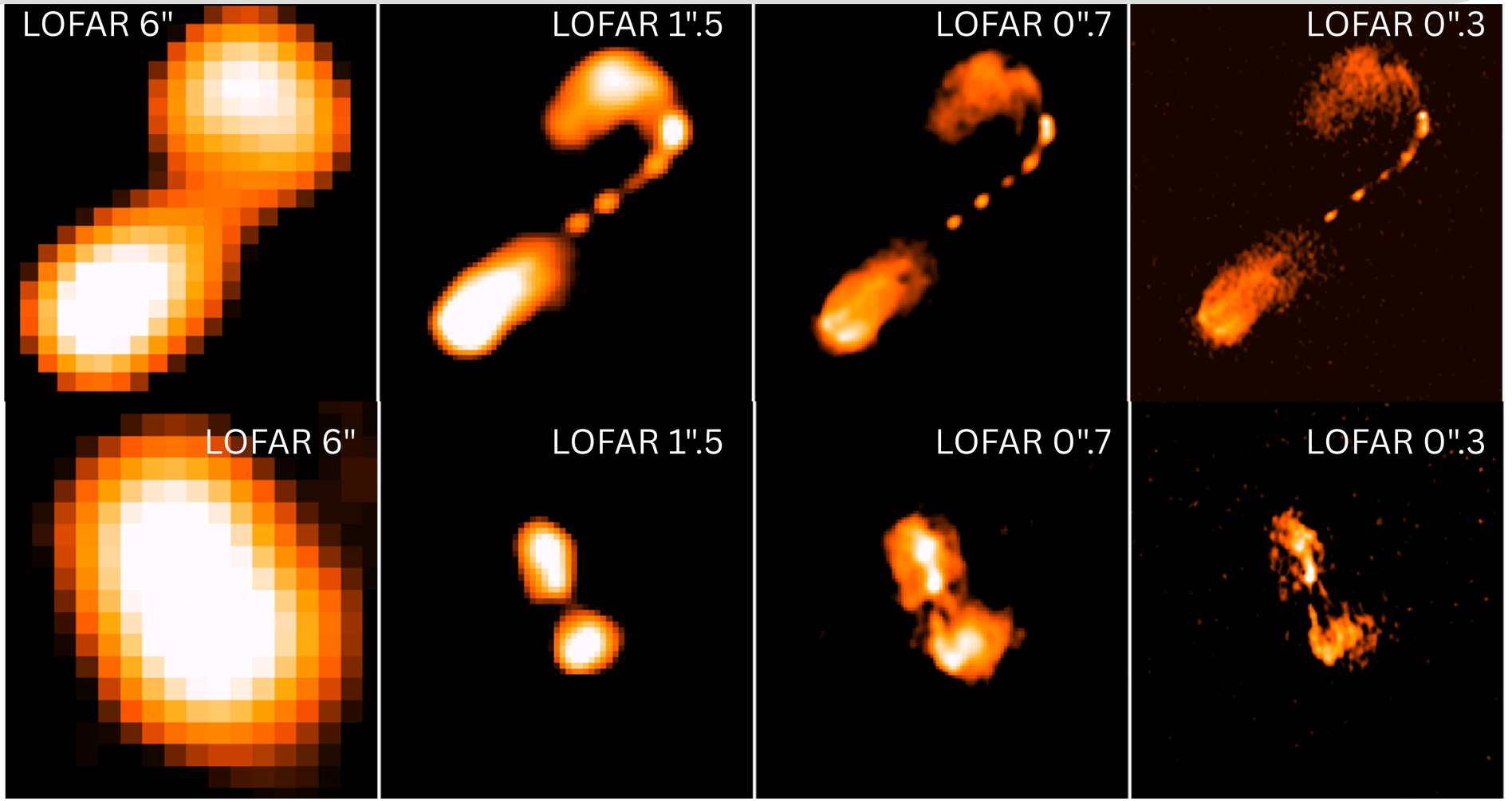
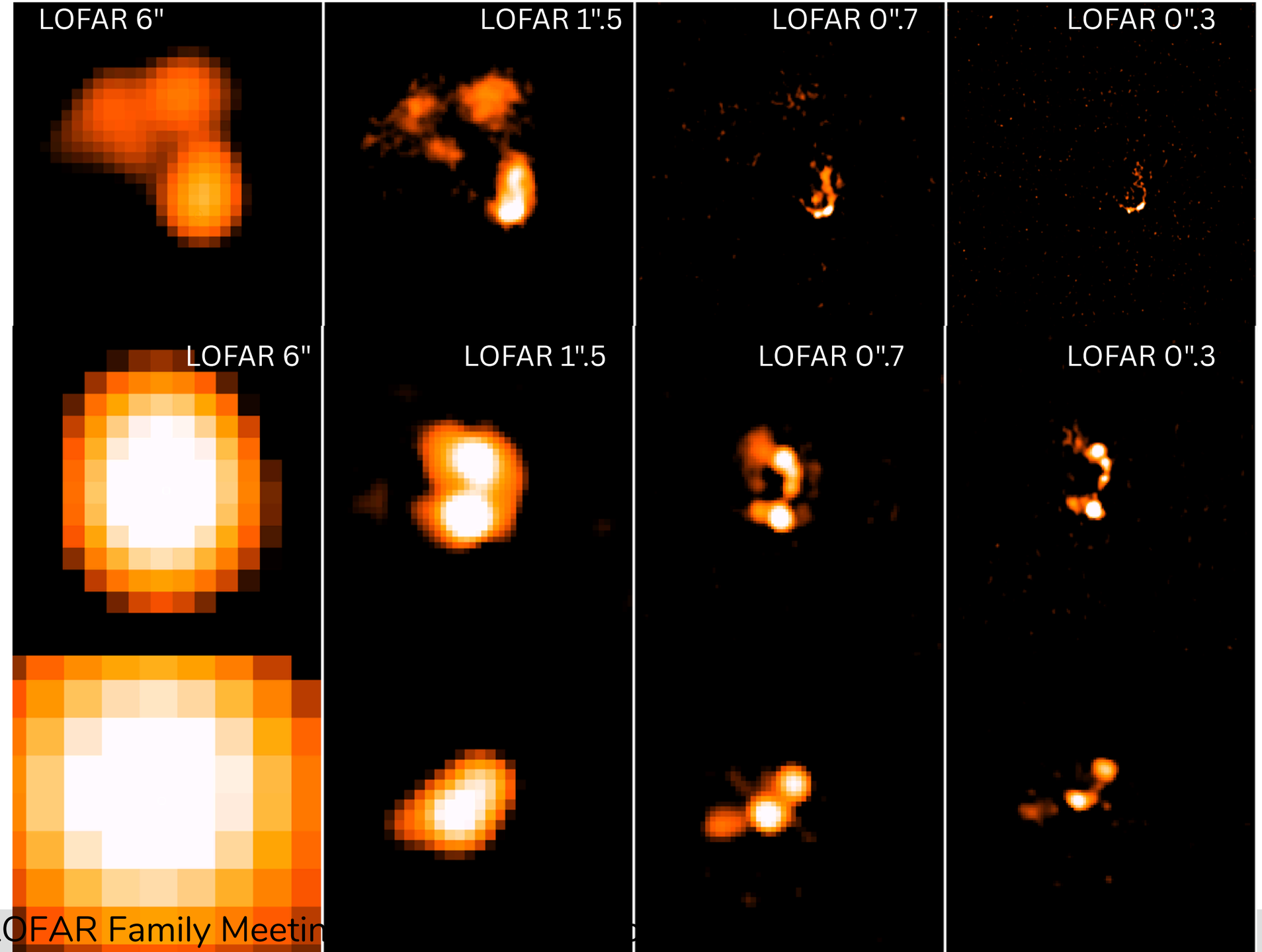


- **High redshift clusters**

z_sp=0.702

z_sp=1,625

z_ph~4



WHAT NEXT

- **Short timescale:**
  - **Correct flux scale & astrometry of 0".3 image & release the image and raw catalog**
  - **Use the 1"5 LOFAR-VLBI image and deep IRAC image to improve the 6" radio catalog: better positions, more accurate deblending, more sources**

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  - **LOFAR-VLBI images at 0".3 resolution combining 32 hr (J. Petley)**
  - **LOFAR 6" combining all the EDFN observations (200-250 hr): deeper & wider**
  - **Increase FOV of LOFAR-VLBI combining different pointings ?**

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- **Long Timescale:**
  - **Sidereal stacking (De Jong+25) on ~100 hr of widefield LOFAR-VLBI ?**
  - **LOFAR2 Ultra-Deep Observations (LUDO, P. Best & L. Morabito)**


THANK YOU