Synergy with radio facilities

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Current and upcoming facilities

SKA precursors

- Mid-frequency: ASKAP and MeerKAT
- Low-frequency: MWA

Other Interferometers

- VLA / LOFAR / ATCA
- Next generation VLA (ngVLA)

Single-dishes

- SRT (ongoing frequency range upgrade up to 116 GHz)
- Italian radio telescope network (Medicina, Noto dishes)
- GBT / Parkes / …

SKA and its precursors

SKA entered the construction phase in 2022:
SKA1-LOW + SKA1-MID

First observations possibly from 2025/26, key science projects from 2028.

SKA and its precursors

All precursors are fully operational and major surveys are released or ongoing

MeerKAT

Antennas	64 located in South Africa
Frequency	ranging from 600 to 1700 MHz (bands: *UHF* and *L*)
Sensitivity	~10 μJy/beam in 1 hour
Resolution	5 – 20 arcsec

MeerKAT

Observing mode	Large programs, Open time offered with regular calls, …
Galactic Surveys	SARAO MeerKAT GPS: 250° < *l* < 60° @ 1.3 GHz
MK+ update	16 antennas to be added
Frequency update	Band *S*: 1.7 – 3.5 GHz Band 5: up to 15 GHz

VLA

Antennas	27 antennas (25 m diam.)
Frequency	From 1 to 50 GHz
Sensitivity	~5 μJy/beam in 1 hour
Resolution	Up to 0.05 arcsec @ 50 GHz
Surveys	NVSS, VLASS, …

VLA

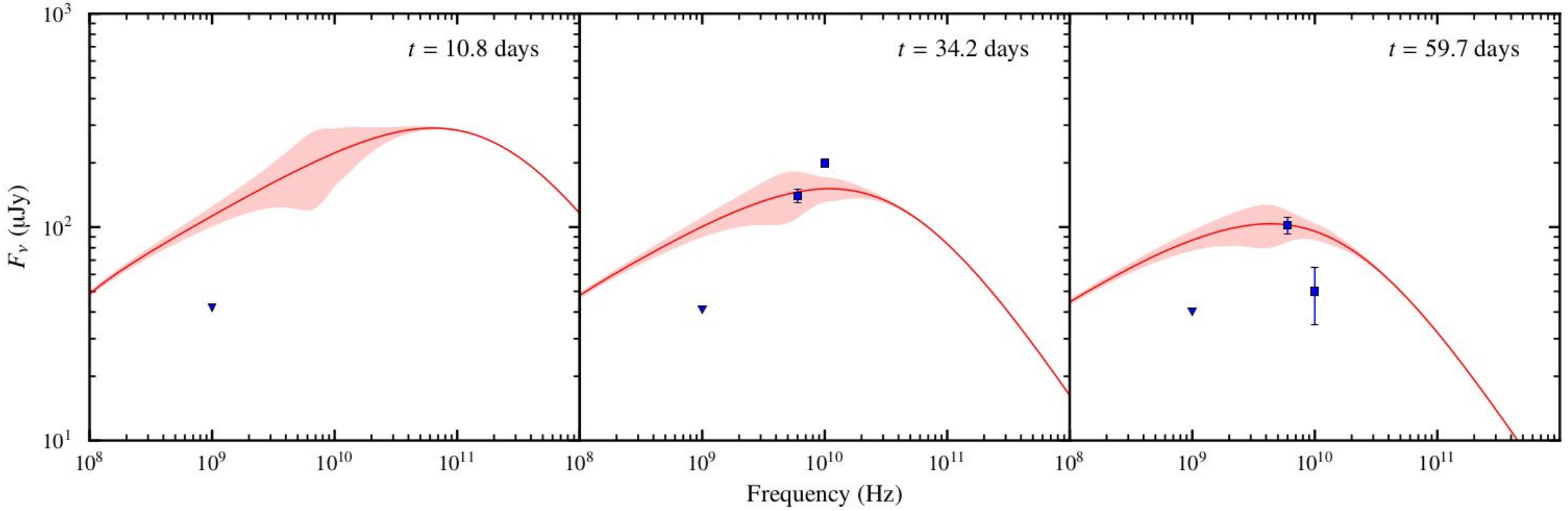
ngVLA	A major upgrade with 244 antennas to be added.
Frequency	From 2 to 116 GHz
Resolution	Up to 1 mas

High-frequency facilities: SRT

Frequency	From 0.3 to 26 GHz
Targets	Especially suitable for extended sources like SNRs.
Observing calls	Ordinary proposals, ToO, NAPA, DDT (within the Italian network)
Upgrade	SRT is being equipped with high-frequency receivers with the possibility of observing at up to 116 GHz.

GRB case: GRB 210731A

Long-duration GRB (22.5 s) discovered by *Swift*



de Wet et al. *submitted*

GRB case: GRB 221009A

Radio emission detected with the Medicina radio telescope.

TITLE: GCN CIRCULAR
NUMBER: 32791
SUBJECT: GRB 221009A: Medicina Radio Telescope observations
DATE: 22/10/18 14:16:50 GMT
FROM: Marco Marongiu at Ferrara U <marco.marongiu@unife.it>

M. Marongiu, E. Egron, A. Pellizzoni (INAF/OAC), S. Righini (INAF/IRA), C. Guidorzi (UniFe), and S. Mulas (UniCa), report:

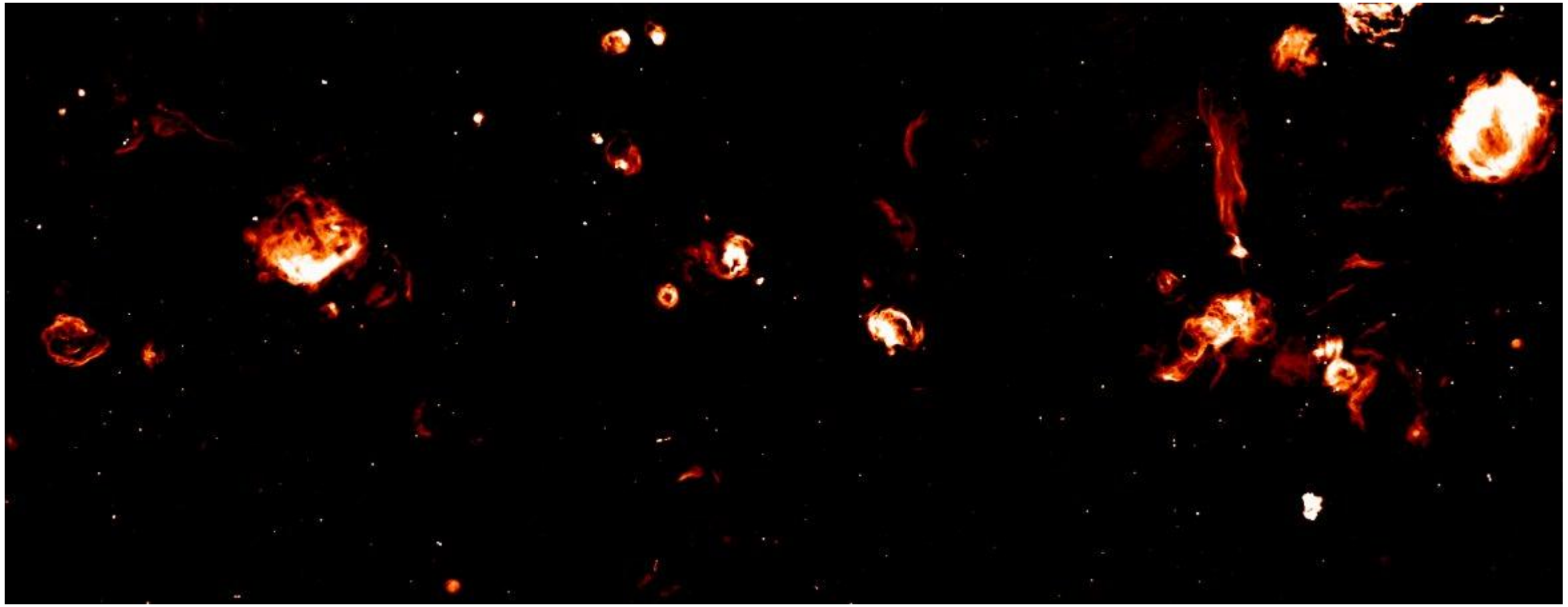
We observed GRB 221009A (Dichiara et al. GCN 32632) with the Medicina Radio Telescope (www.radiotelescopes.inaf.it) through single-dish imaging in X-band (central frequency 8.2 GHz, bandwidth 0.3 GHz) in two time intervals: (1) 13:30-19:30 UTC on October 14, 2022 (4.97-5.22 days after the burst), and (2) 11:30-19:30 UTC on October 17, 2022 (7.89-8.22 days after the burst).

In our analysis, at 5.1 days (after the burst) we detected a faint radio emission at 8.2 GHz with a flux density of 26 +- 5 mJy at a position consistent with the optical position (Dichiara et al., GCN 32632) and the radio position (Laskar et al., GCN 32740, Laskar et al., GCN 32757).

We did not detect any significant signal with a 2-sigma upper limit of 20 mJy at 8.1 days.

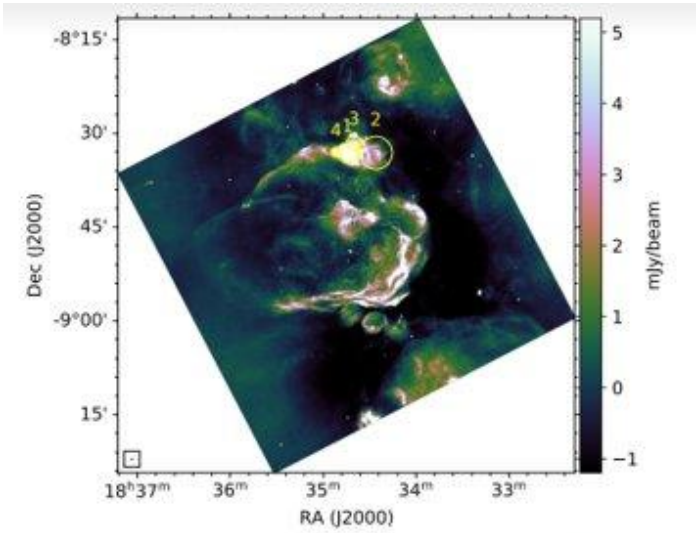
We acknowledge the scheduler and the staff of the Medicina Radio Telescope for approving and executing these observations.

Supernova remnants: the SKA precursors view



MeerKAT at 1.3 GHz (Goeadhart et al. *in prep.*)

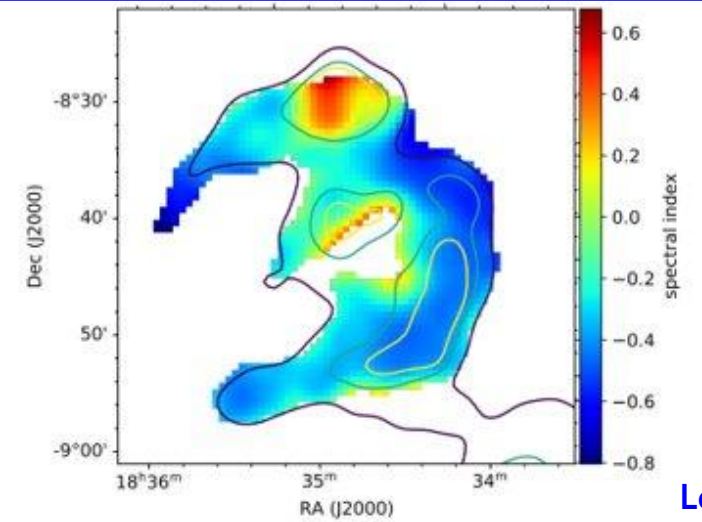
Supernova remnants: the SKA precursors view



Studying morphology in great detail

Looking for SNR environment

Disentangling foreground/background objects



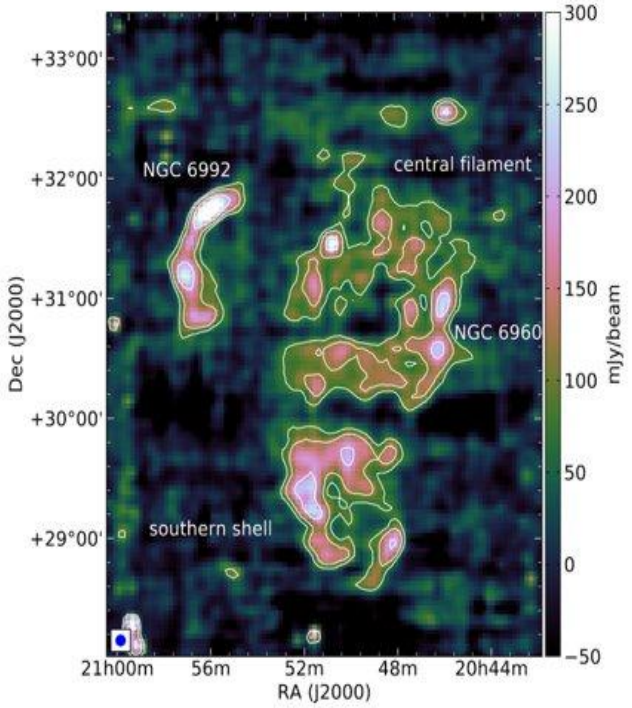
Spectral index maps

Highlighting PWNe and mol. cloud interactions

Challenging the “one spectral index” paradigm

Loru et al. *in prep.*

Supernova remnants: the radio-gamma link



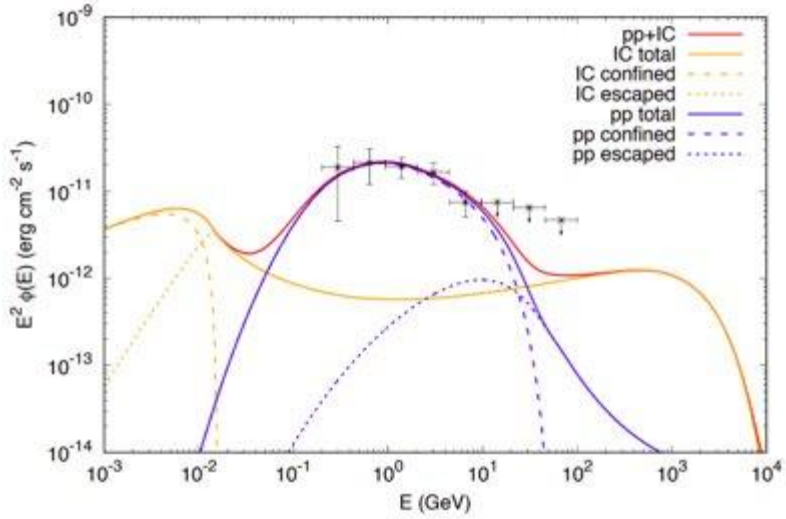
Loru et al. 2021

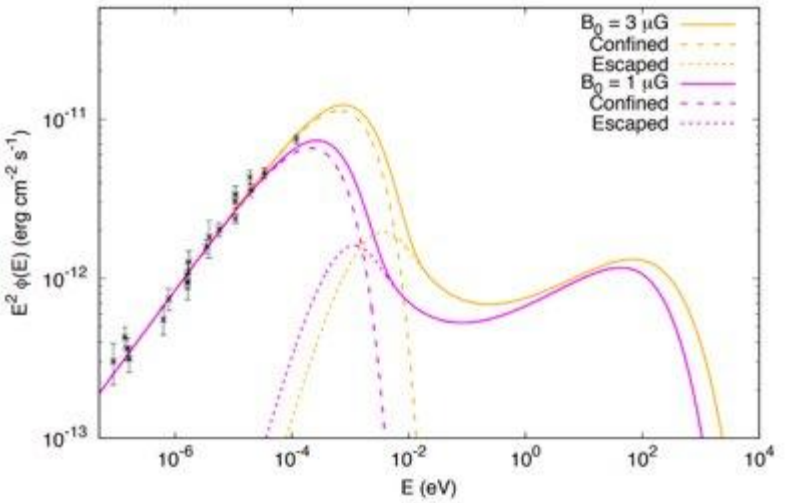
SNR Cygnus Loop

Radio observations with SRT and Medicina

Gamma data from Fermi-LAT

Non-thermal emission model





Conclusions

New and existing radio facilities opening new opportunities to detect high-energy counterparts.

The VLA and the SKA precursors are the top-level current observatories at GHz frequencies.

Single-dish telescopes offer good compromise at frequencies up to over 100 GHz.

Science on hot topics, like GRBs and SNRs, fully enabled by multiwavelength studies.