What have we learnt from SCORPIO?

State-of-the-art and current issues

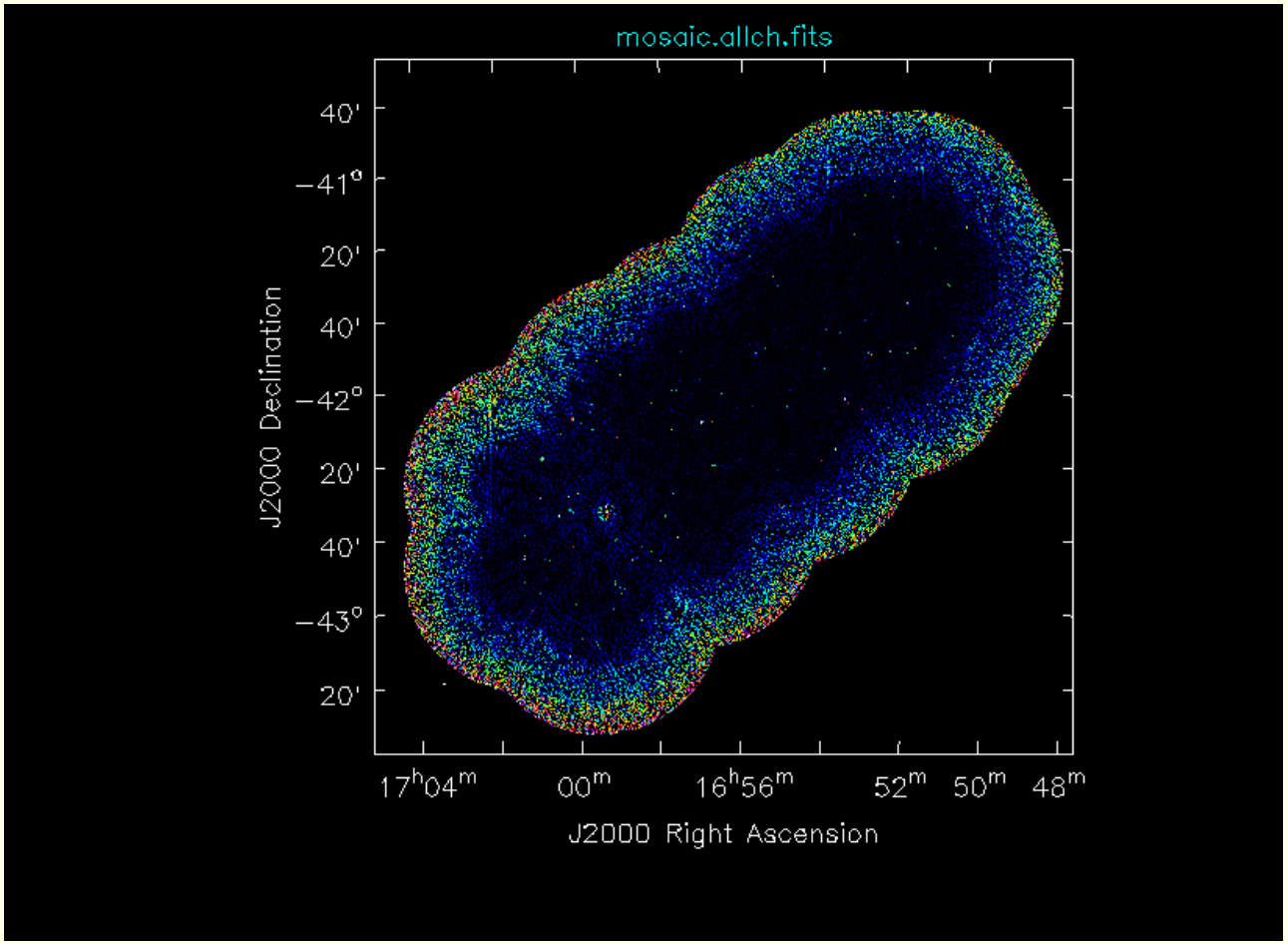
Adriano Ingallinera

INAF - Osservatorio Astrofisico di Catania

What have we done so far?

Observations

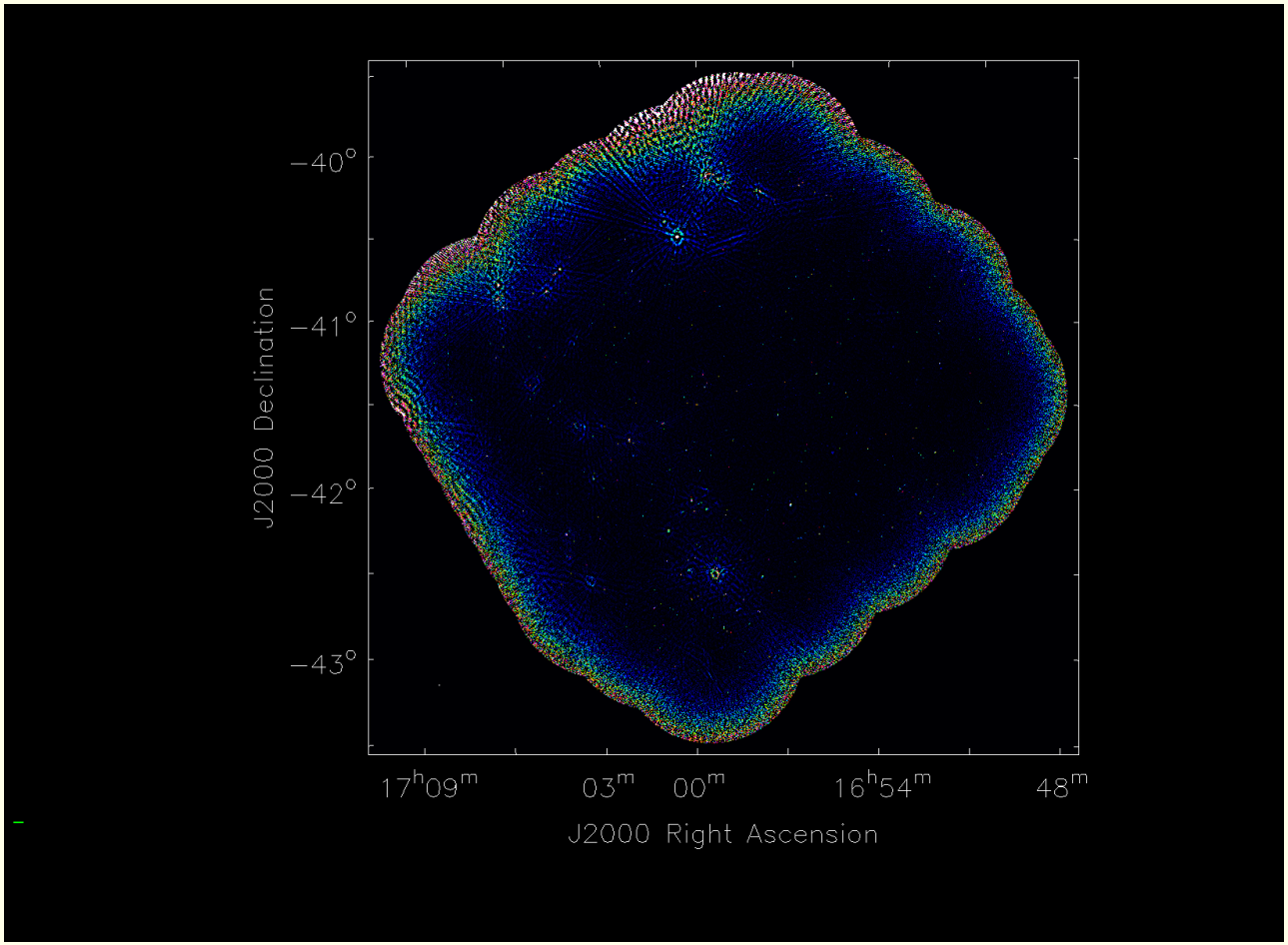
Pilot region with ATCA extended configurations ($6x$)



What have we done so far?

Observations

Entire region with ATCA extended configurations ($6x$)



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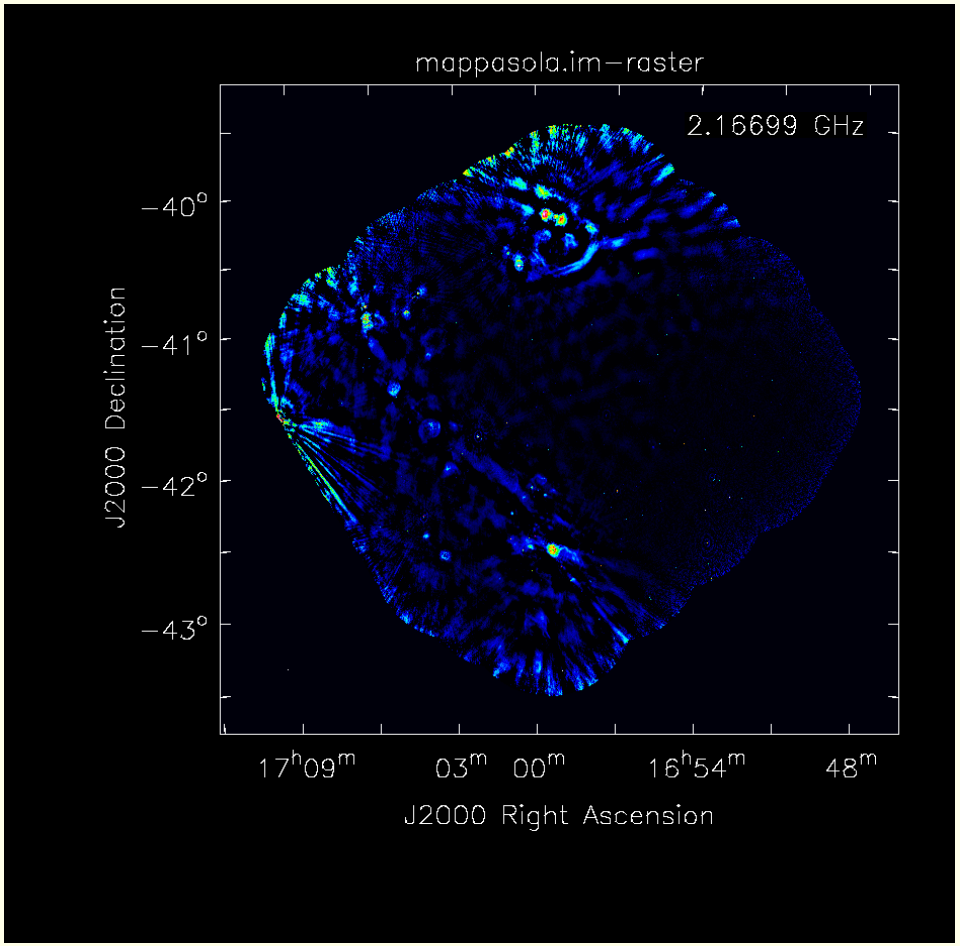
Observations

Entire region with ATCA compact configurations (EW3*xx*)



What have we done so far?

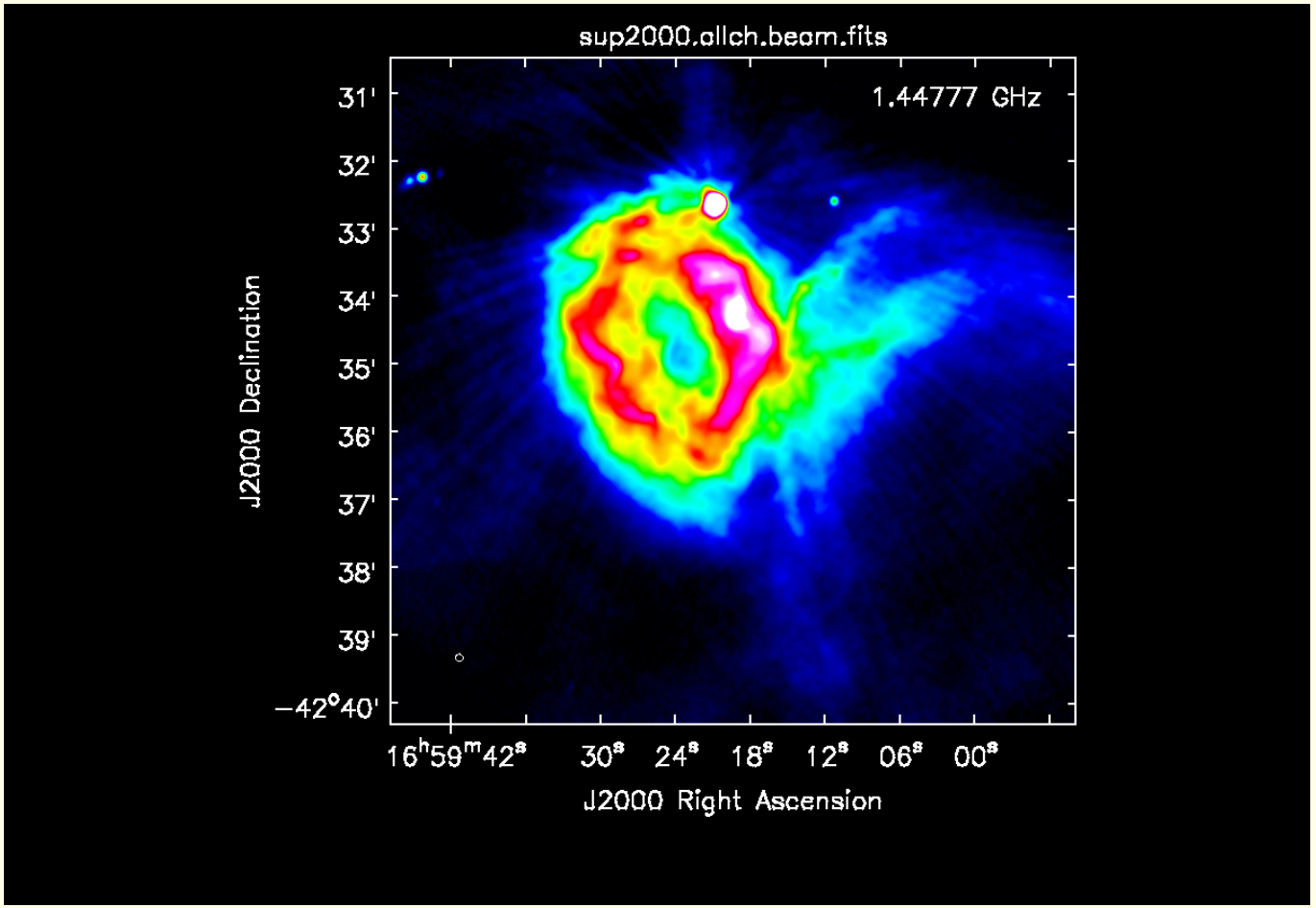
Observations

Entire region with Parkes (Apr 2016, 1.2 - 1.8 GHz)

What have we done so far?

Data reduction

Stokes-*IQUV* maps divided in 7 sub-bands from ATCA data



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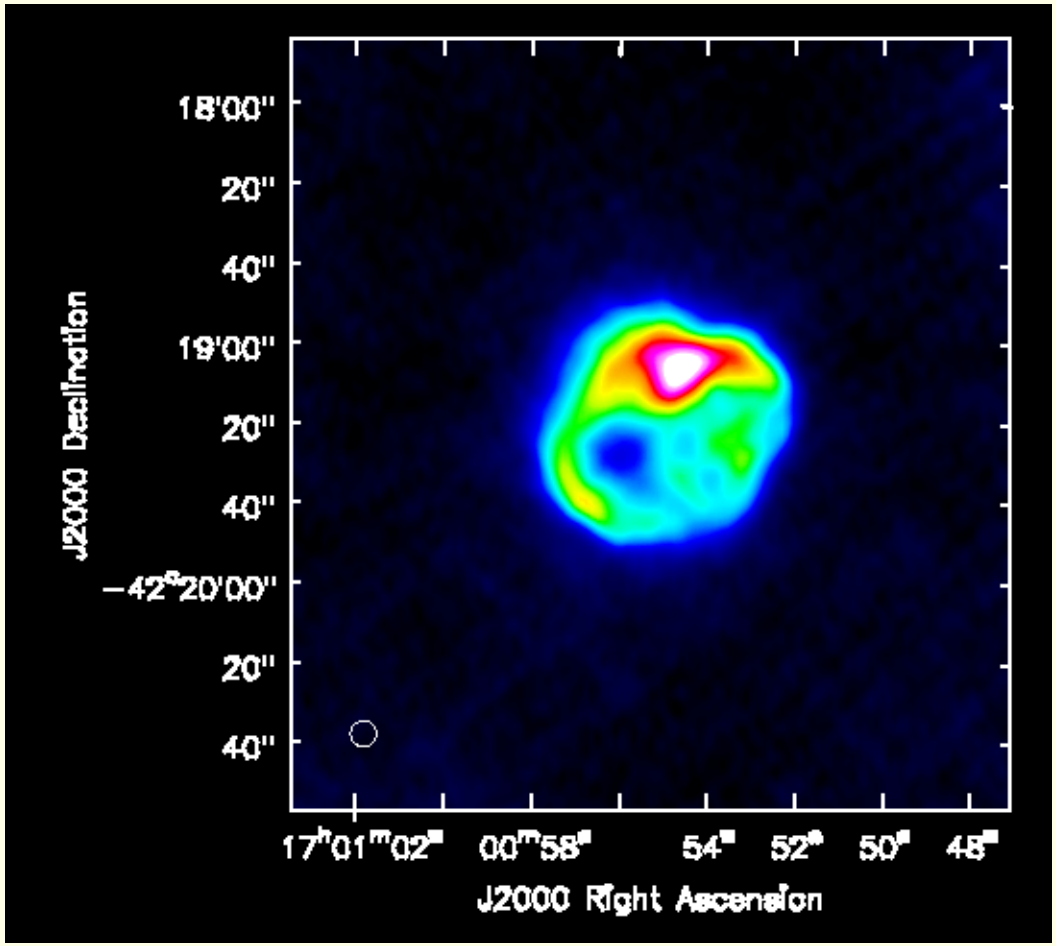
Stokes-*IQUV* maps divided in 7 sub-bands from ATCA data



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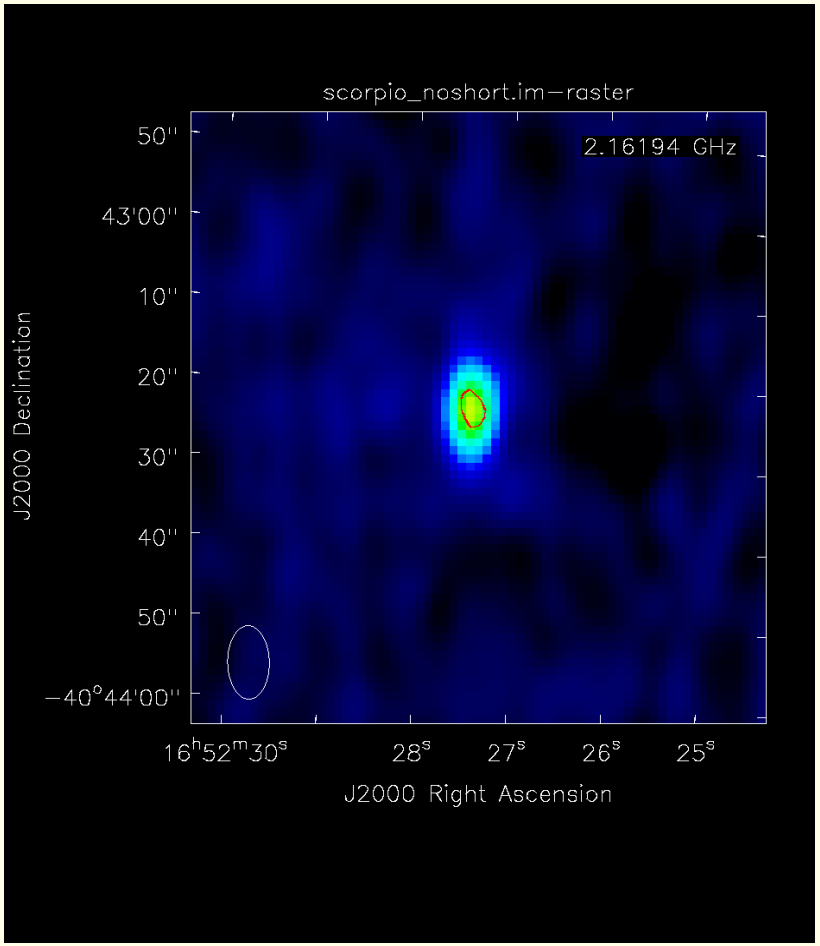

What have we done so far?

Data analysis

Point source extraction and catalogue (Umana et al. 2015)

ID	l (deg)	b (deg)	RA (J2000)	Dec (J2000)	S (mJy)	ΔS (mJy)	Area (beam)	Matching catalogues
SCORPIO1_001	343.0025	1.7604	16:50:12.21	−41:48:56.2	33.33	1.03	1.0	–
SCORPIO1_002	343.0051	0.2234	16:56:39.13	−42:47:08.2	0.49	0.09	1.0	–
SCORPIO1_003	343.0134	0.6086	16:55:02.85	−42:32:15.5	7.74	0.29	1.4	NMGm
SCORPIO1_004	343.0138	1.7208	16:50:24.33	−41:49:56.4	1.60	0.17	1.0	N
SCORPIO1_005a	343.0139	1.1508	16:52:46.37	−42:11:42.1	12.80	0.50	2.0	N
SCORPIO1_006	343.0152	0.1166	16:57:08.49	−42:50:39.6	1.27	0.16	1.7	NMGW
SCORPIO1_007	343.0157	−0.1830	16:58:25.48	−43:01:49.4	1.51	0.12	1.2	NMG
SCORPIO1_005b	343.0186	1.1577	16:52:45.61	−42:11:13.0	106.56	3.20	1.4	–
SCORPIO1_009	343.0201	1.5248	16:51:14.28	−41:57:09.1	1.34	0.11	1.0	–
SCORPIO1_010	343.0203	0.3109	16:56:19.93	−42:43:08.3	20.97	0.64	1.2	Gmw
SCORPIO1_011	343.0216	0.7407	16:54:31.13	−42:26:53.1	1.12	0.10	1.3	G
SCORPIO1_012	343.0277	0.8702	16:53:59.71	−42:21:42.3	1.17	0.09	1.2	NMXAH
SCORPIO1_013	343.0317	0.8579	16:54:03.63	−42:21:59.3	0.44	0.08	1.0	NMH
SCORPIO1_014	343.0322	0.9655	16:53:36.65	−42:17:53.0	1.21	0.12	1.3	NH
SCORPIO1_015	343.0356	0.2182	16:56:46.68	−42:45:53.7	8.06	0.25	1.0	N
SCORPIO1_016	343.0394	1.5983	16:50:59.99	−41:53:26.8	2.49	0.13	1.0	I
SCORPIO1_017	343.0415	1.2316	16:52:31.80	−42:07:20.7	1.46	0.13	1.0	NM
SCORPIO1_018	343.0428	0.0266	16:57:37.15	−42:52:43.9	5.29	0.22	1.0	–
SCORPIO1_019	343.0457	0.8848	16:53:59.73	−42:20:18.9	71.55	2.15	1.0	Hm
SCORPIO1_020	343.0461	1.2752	16:52:21.85	−42:05:28.5	4.71	0.25	2.2	I
SCORPIO1_021	343.0468	0.3010	16:56:27.87	−42:42:16.1	0.47	0.06	1.0	NMGW
SCORPIO1_022a	343.0489	0.9666	16:53:39.77	−42:17:04.1	109.20	3.28	1.6	Gm
SCORPIO1_023	343.0501	1.6133	16:50:58.45	−41:52:22.7	1.75	0.17	2.1	NMWAI
SCORPIO1_024	343.0502	0.4249	16:55:57.01	−42:37:27.4	1.04	0.09	1.0	NMGH
SCORPIO1_022b	343.0514	0.9634	16:53:41.09	−42:17:04.3	23.35	0.72	1.6	m

Problems in Stokes-I maps

Imaging artefacts caused by:

a wide band ($\Delta\nu/\nu \sim 1$)

b diffuse Galactic emission

c extended Galactic sources

d bright barely resolved sources (mainly extragalactic)

Problems in Stokes-I maps

Imaging artefacts caused by:

- **a** wide band ($\Delta\nu/\nu \sim 1$)
- **b** diffuse Galactic emission
- **c** extended Galactic sources
- **d** bright barely resolved sources (mainly extragalactic)

Solutions:

> **a** mitigated by Taylor expansion and sub-band division
> **b** and **c** mitigated by short-baselines
> **d** unresolved, other CLEAN algorithm?

Problems with Galactic extended sources

Poorly imaged even with short baselines (LAS $\sim 4'$ at 3 GHz):

- no accurate flux density measurement
- no spectral index maps
- morphology misinterpretation

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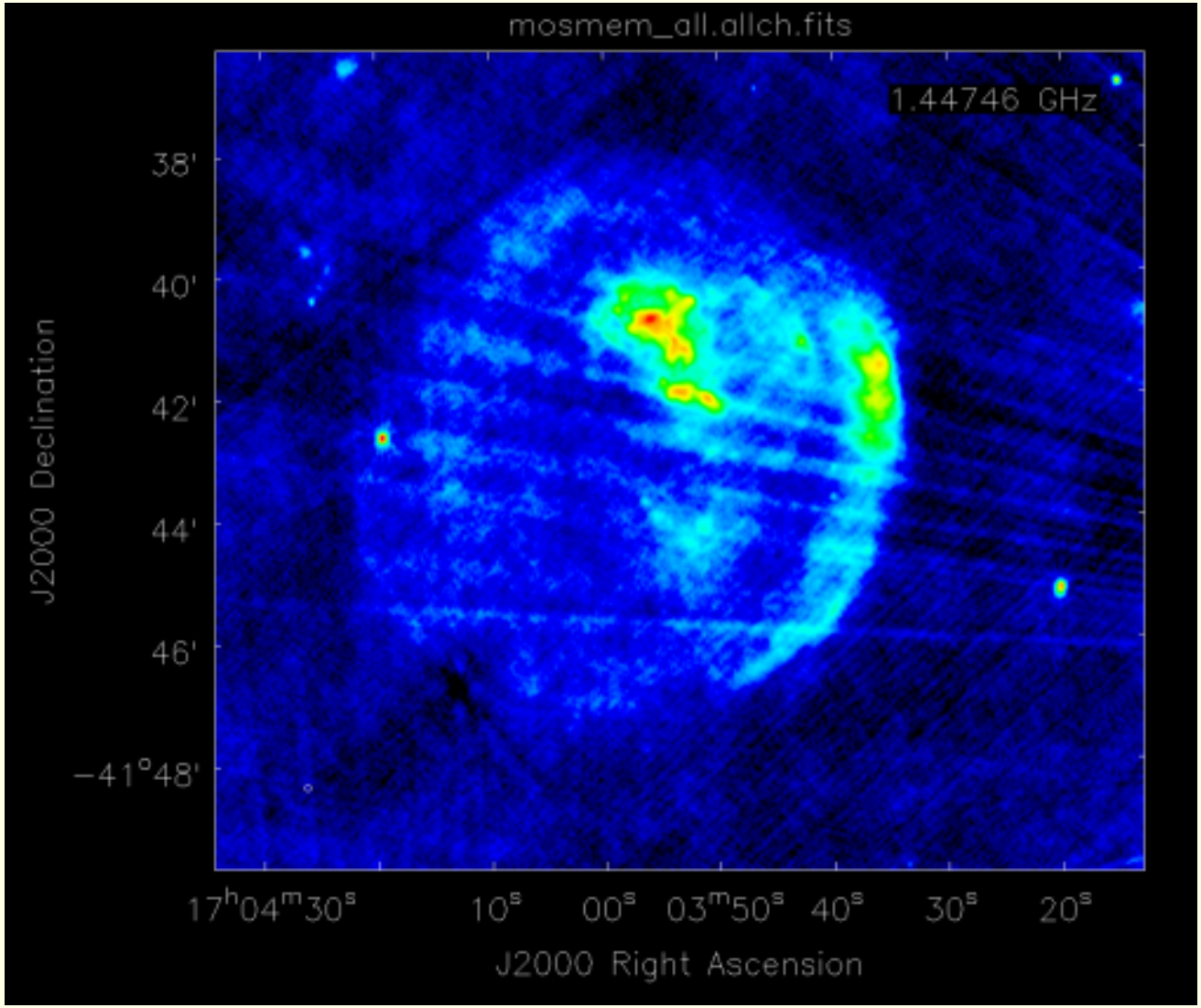
Poorly imaged even with short baselines (LAS $\sim 4'$ at 3 GHz):

- no accurate flux density measurement
- no spectral index maps
- morphology misinterpretation

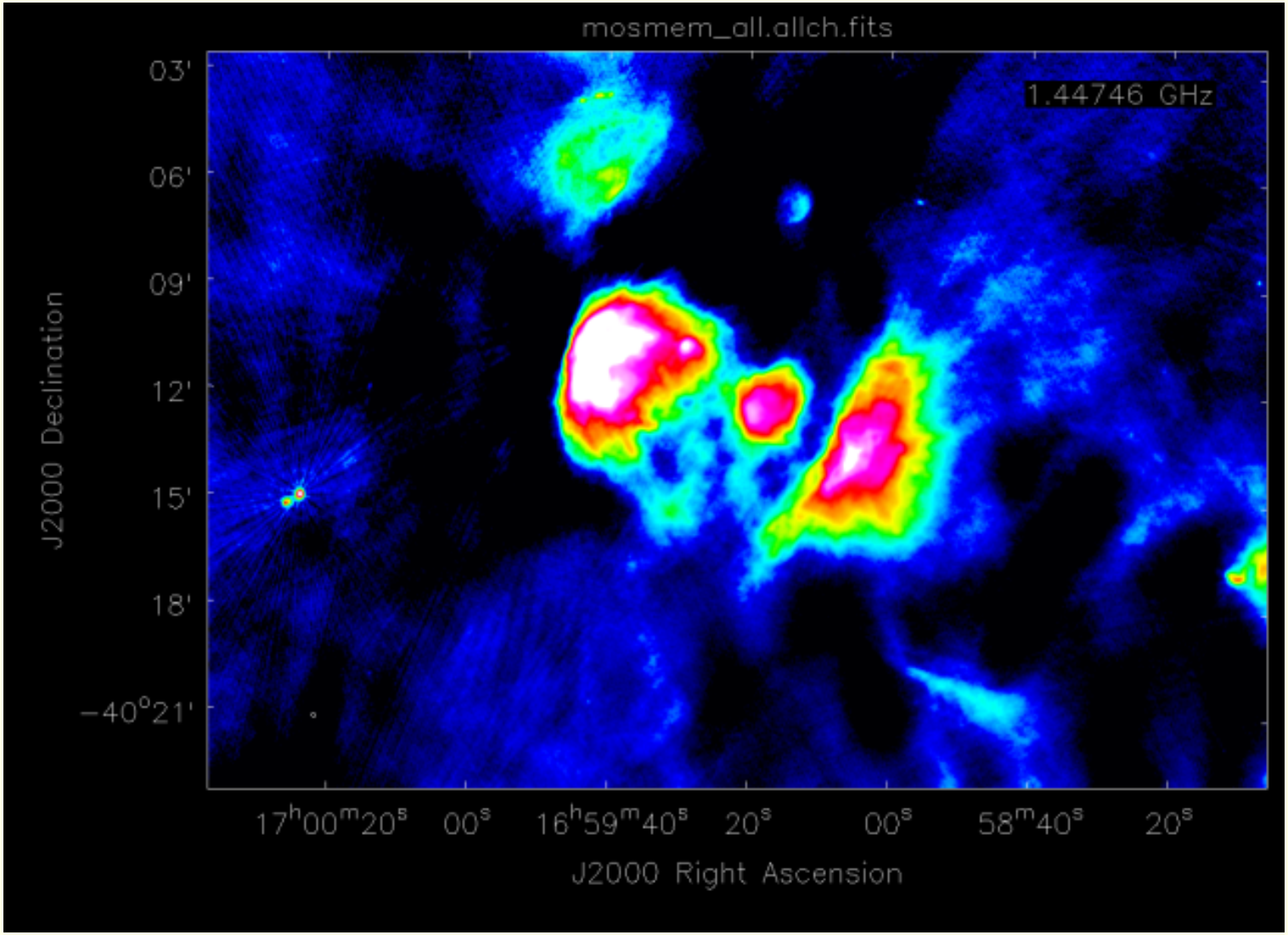
Solutions:

- single-dish data from Parkes (under reduction)

Examples of poorly imaged sources



Examples of poorly imaged sources



Problems in Stokes-Q and -U maps

Artefacts similar to Stokes-I maps:

- polarized bright resolved extragalactic sources?
- polarized diffuse emission?

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- polarized bright resolved extragalactic sources?
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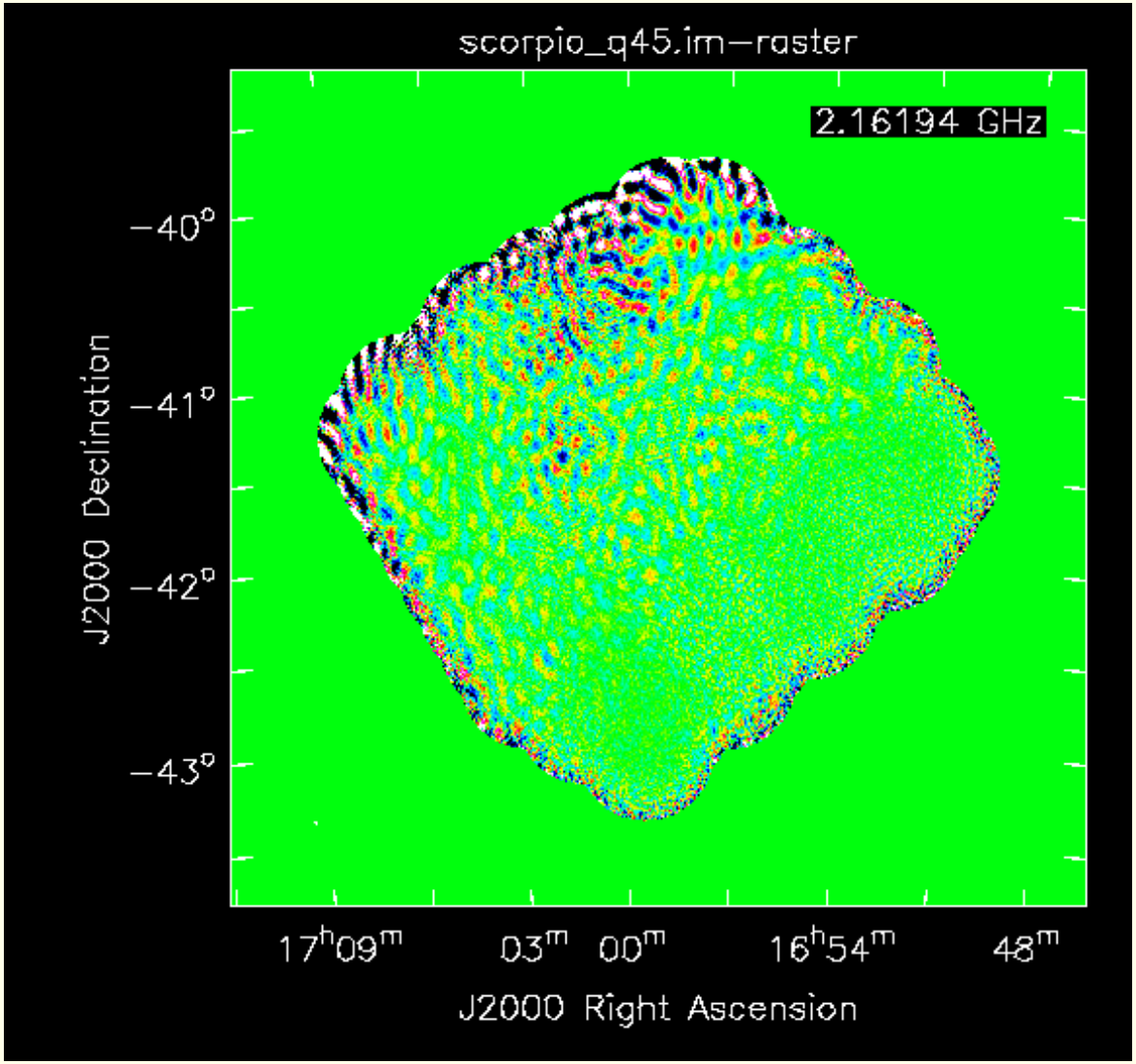
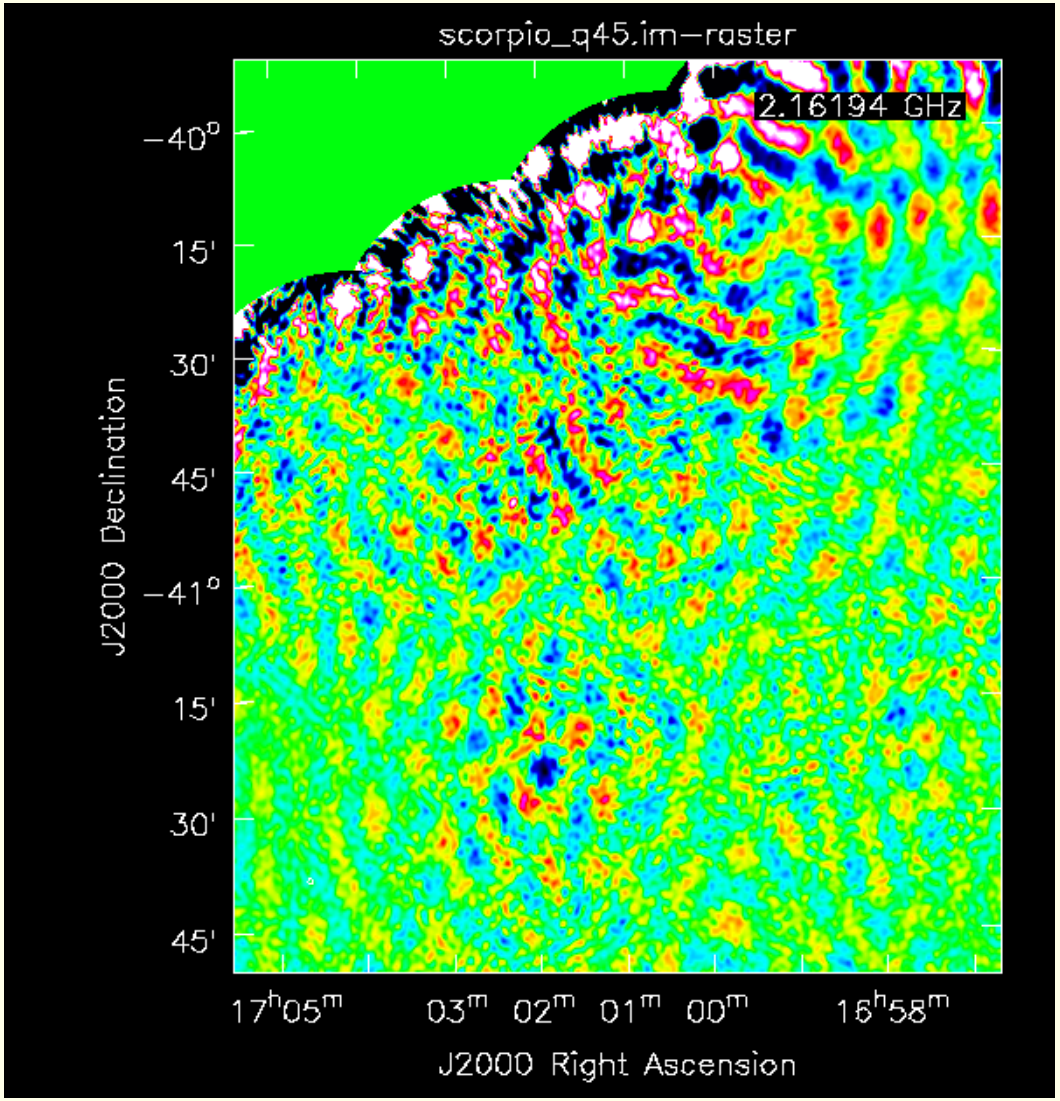
Solutions:

- none, please help!

Problems in Stokes-Q and -U maps



Problems in Stokes-Q and -U maps



Results

Despite difficulties, three papers already produced:

- Umana et al. 2015 (pilot region)
- Riggi et al. 2016 (extended source extraction)
- Cavallaro et al. *submitted* (spectral indices)