VLBI studies of Radio Sources at Low-Frequencies

Hayden Rampadarath
JIVE & Sterrewacht Leiden

Supervisor:
Prof. M. Garrett
ASTRON, Leiden & Swinburne

4th ESTRELA Workshop,
19-22 January 2009, Bologna

Outline

Research Projects:

A List of Potential Calibrators and (Early) Targets for LOFAR and RadioAstron

Hanny's Voorwerp

A List of Potential Calibrators and (Early) Targets for LOFAR and RadioAstron

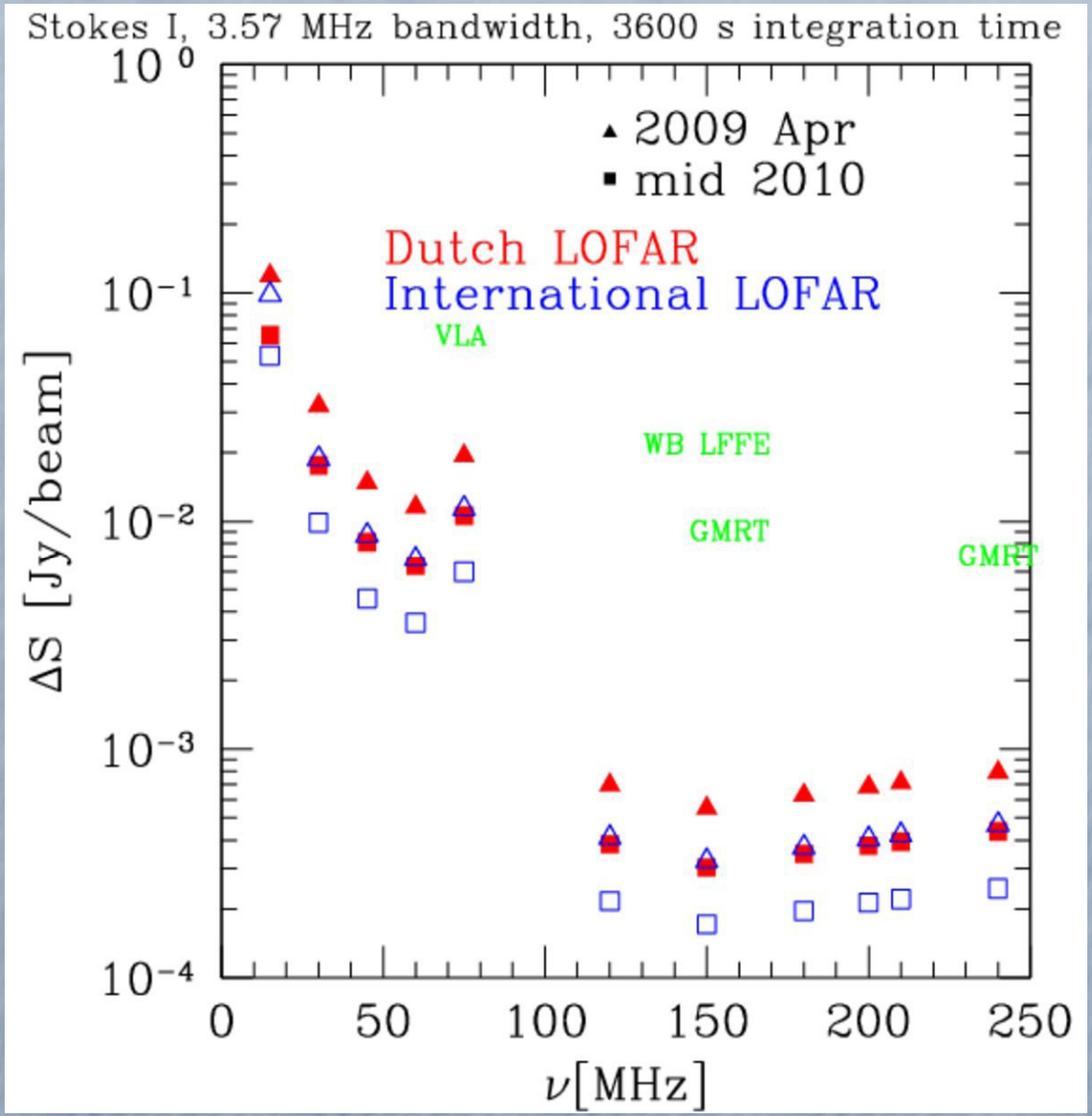
LOFAR

Base LOFAR Configuration (Dec, '08)

36 NL stations
5 De, 1 Se, 1 Fr, 1 UK
More expected (It, Pl, Au, Ua, UK)
1000-2000 km baselines
~ 0.2" @ 240 MHz

First International baseline (Bonn – ExLoo) expected early 2009.

LOFAR



- Full (international) LOFAR about 2 times better than NL LOFAR

RadioAstron

Space-VLBI project led by the Astro Space Center of Lebedev Physical Institute in Moscow, Russia.

Space Radio Telescope, contains a 92cm receiver.

Very little is known about the morphology of radio sources at low frequencies and high resolutions.

Fringe spacing at 92cm ~ 0.5-10 mas

Situation, similar to LOFAR

Calibrators and (Early) Targets for LOFAR & RadioAstron

Analysed 23 NRAO VLBA 90cm archive projects

unpublished data - 1 January 2003 to December 31 2006

42 observed sources, 40 detected

29 imaged (AIPS task IMAGR)

11 were unable to be imaged

Calibrators and (Early) Targets for LOFAR & RadioAstron

Most sources are compact, with few showing extended structures.

All were detected on baselines > maximum baseline of LOFAR.

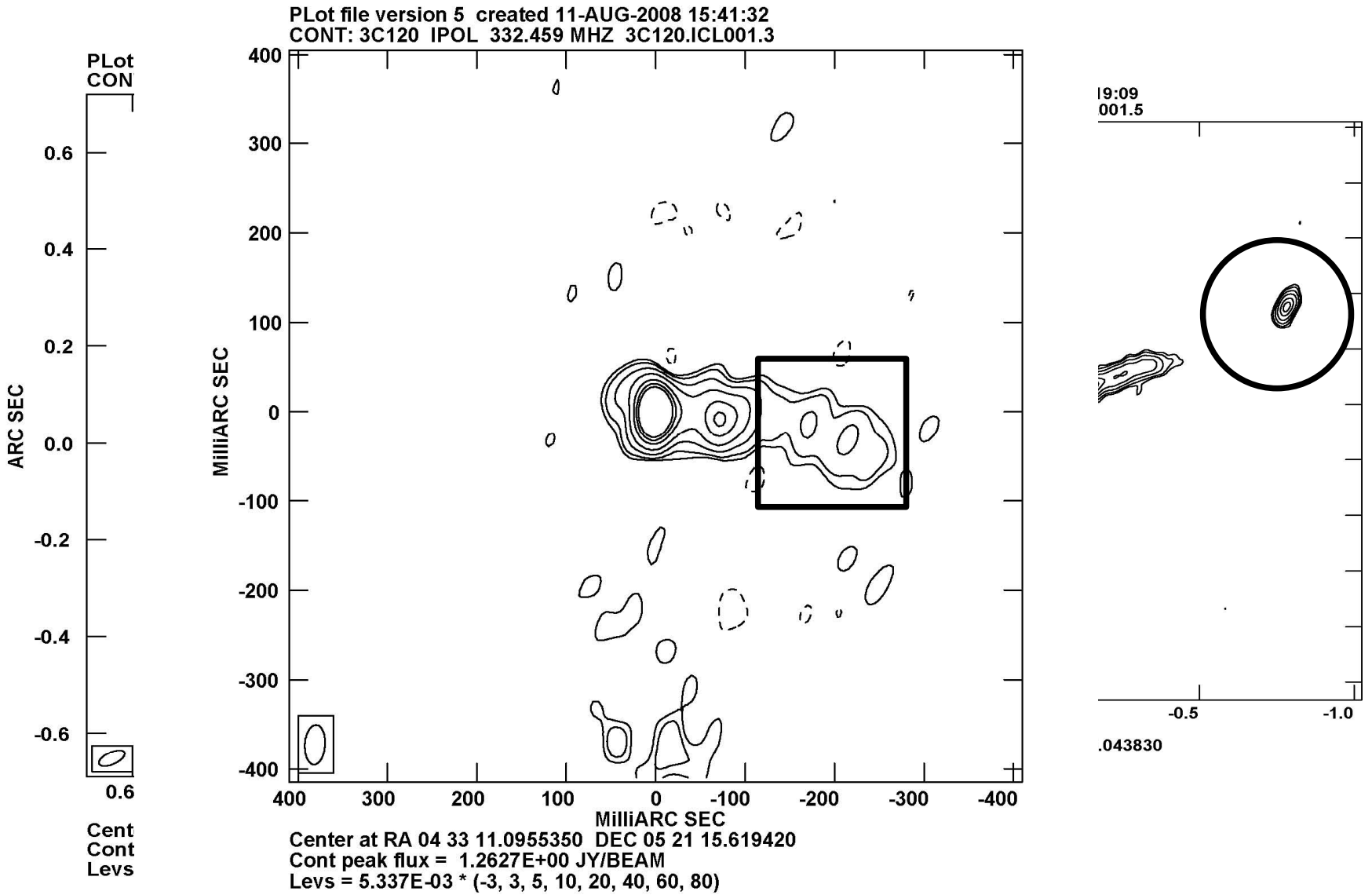
Compact in VLBA => Unresolved on LOFAR longest baseline => good calibrators

Calibrators and (Early) Targets for LOFAR & RadioAstron

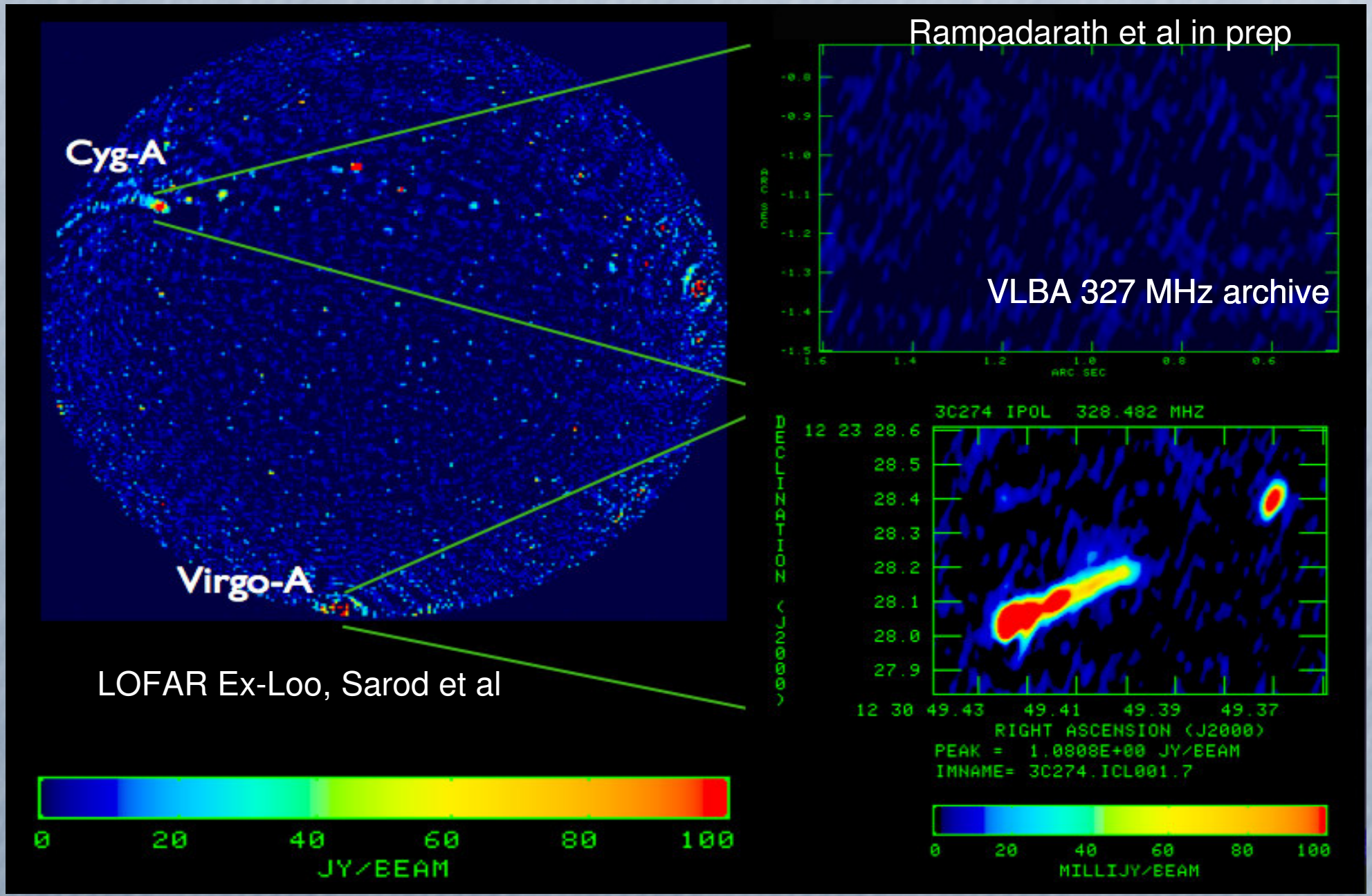
Of the 29 Imaged sources, 13 were detected on the very longest VLBA baselines.

May prove to be interesting targets for RadioAstron.

A few of the sources => in-beam calibrators, to detect fainter sources in surrounding fields.

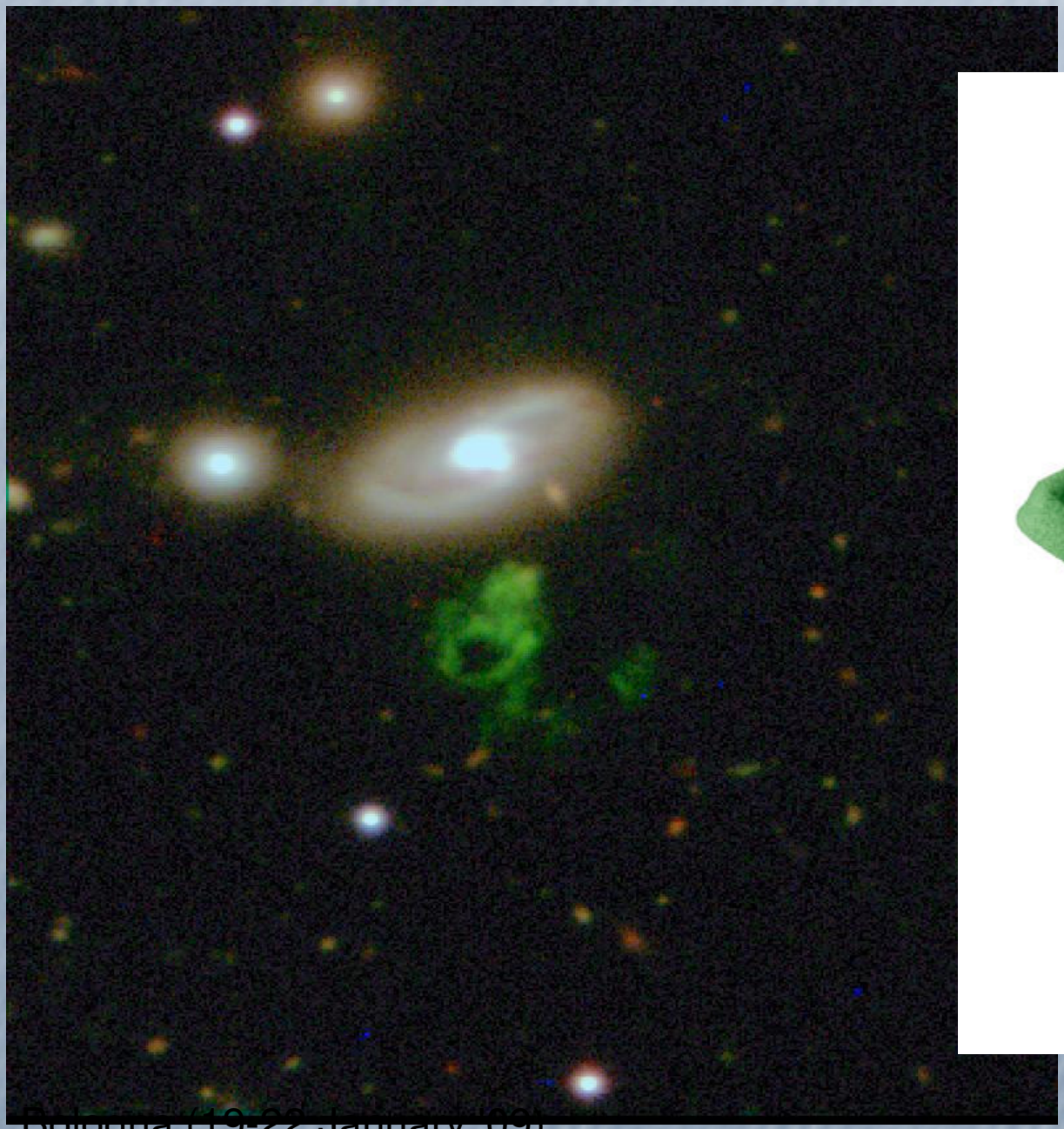

PLot file version 5 created 11-AUG-2008 15:41:32
CONT: 3C120 IPOL 332.459 MHZ 3C120.ICL001.3
PLot
CON
ARC SEC
MilliARC SEC
MilliARC SEC
Cent
Cont
Levs
0.6
Center at RA 04 33 11.0955350 DEC 05 21 15.619420
Cont peak flux = 1.2627E+00 JY/BEAM
Levs = 5.337E-03 * (-3, 3, 5, 10, 20, 40, 60, 80)
9:09
001.5
-0.5
-1.0
.043830

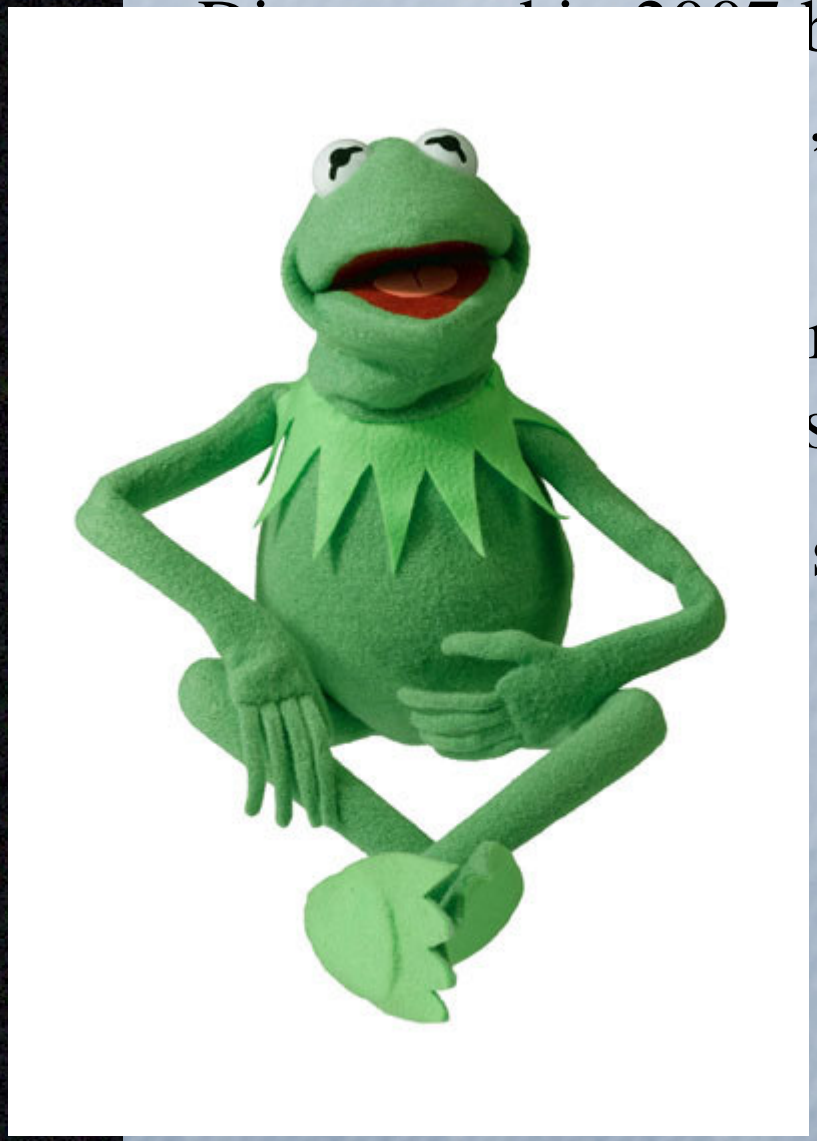
Characterising the low ν sky at high resolutions



Hanny's Voorwerp

“Hanny's Voorwerp” (SDSSJ094103.80+344334.2)





by

,

rg

s

sive

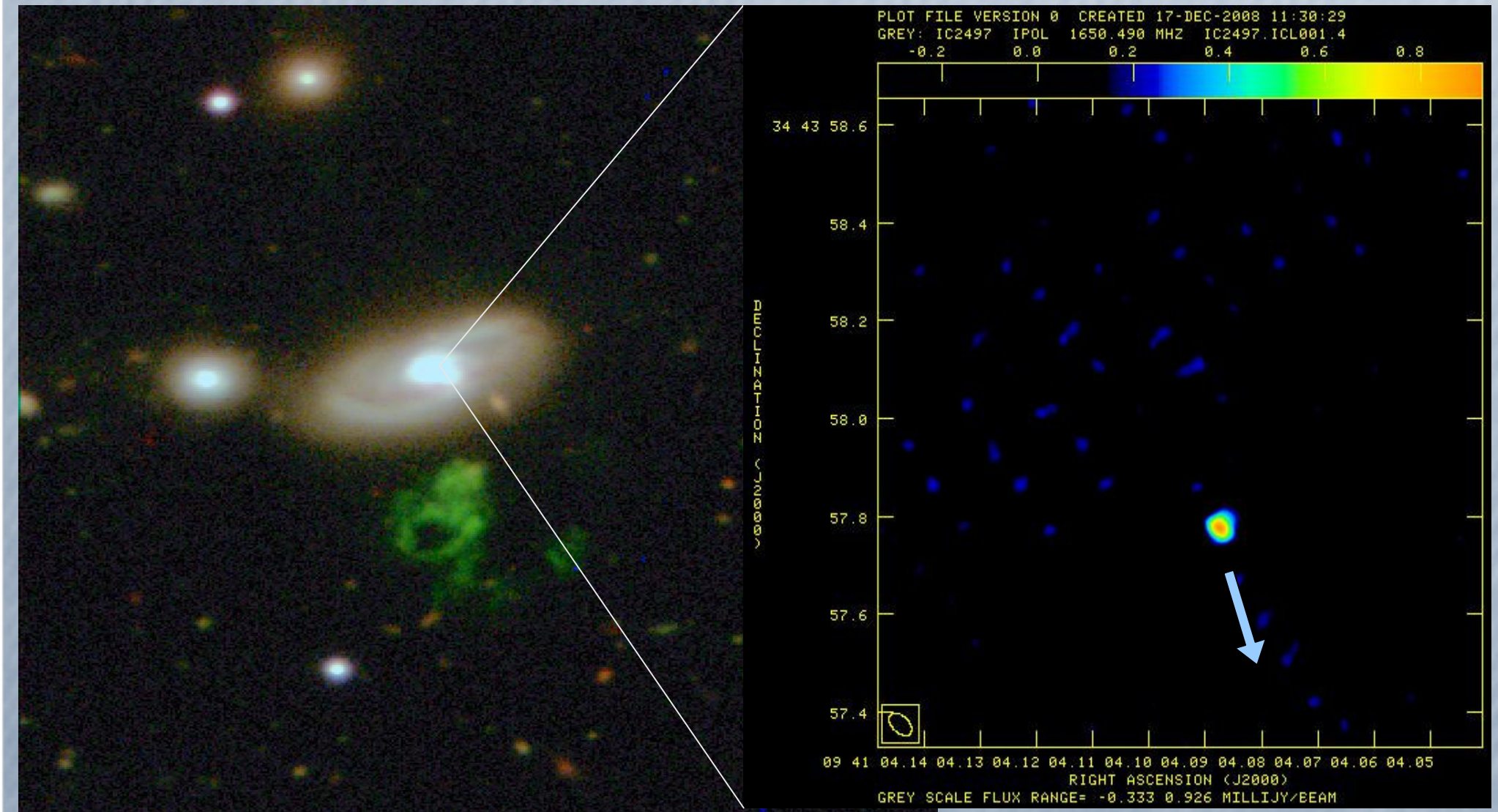
“Hanny's Voorwerp” (SDSSJ094103.80+344334.2)

- WHT spectrum => very strong emission, with high-ionisation lines (He II, [Ne V])
- 15-20,000 K
- rich in highly ionized gas => shock ionization or photoionization by an AGN
- Obscured AGN in IC2497 to us, but not the gas?
- Quasar event, that turned off 100,000 years ago?
- Or a jet??

“Hanny's Voorwerp” (SDSSJ094103.80+344334.2) e-VLBI observation of IC2497

- 2hr obs on 30th Sept. 2008 @ 1.6 GHz
- WB,MC,ON,TR,EF,JB
- 1.04 mJy => L = $1.2284.10^{09}$ W
- VLA FIRST – 14.4 mJy
- > 95 % of radio emission missing
- nuclear starburst or a complex extended jet?
- WSRT observations, detected HI in and around the Voorwerp

“Hanny's Voorwerp” (SDSSJ094103.80+344334.2)
e-VLBI observation of IC2497



Bologna (19-22 January '09)

HR (JIVE & Leiden)

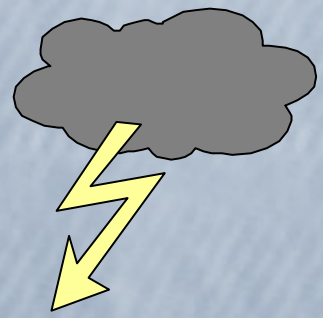
“Hanny's Voorwerp” (SDSSJ094103.80+344334.2)

Submitted a Global VLBI obs. @ 1.6 GHz on IC2497 VLBA, EVN and MERLIN (October 2, 23:42 GMT)

Proposed the use of 8 EVN, VLBA, VLA, GBT and Arecibo => to observe IC2497 for 12 hrs.

NRAO rejected the VLBA/VLA/GBT

EVN liked the proposal .... maybe



A jet from the AGN in IC2497, heating the gas??

Future work

..... If given the chance

- Extend the 327 MHz survey => VLBA
- We want to see the jet (?)

Shorter baselines and longer observation times are important

Apply for a VLA, another e-VLBI or EVN obs.