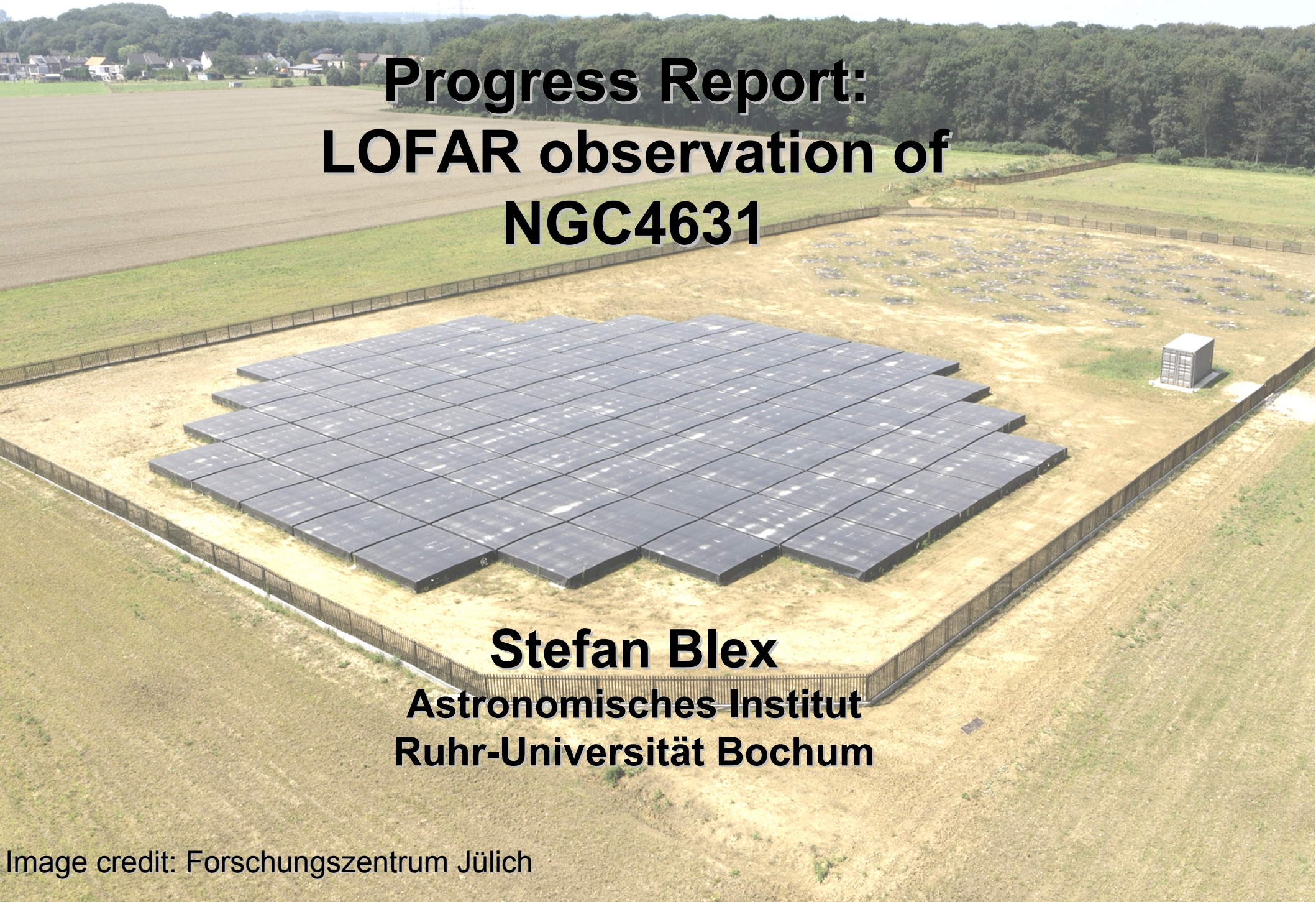
Progress Report: LOFAR observation of NGC4631



Stefan Blex
Astronomisches Institut
Ruhr-Universität Bochum

Image credit: Forschungszentrum Jülich

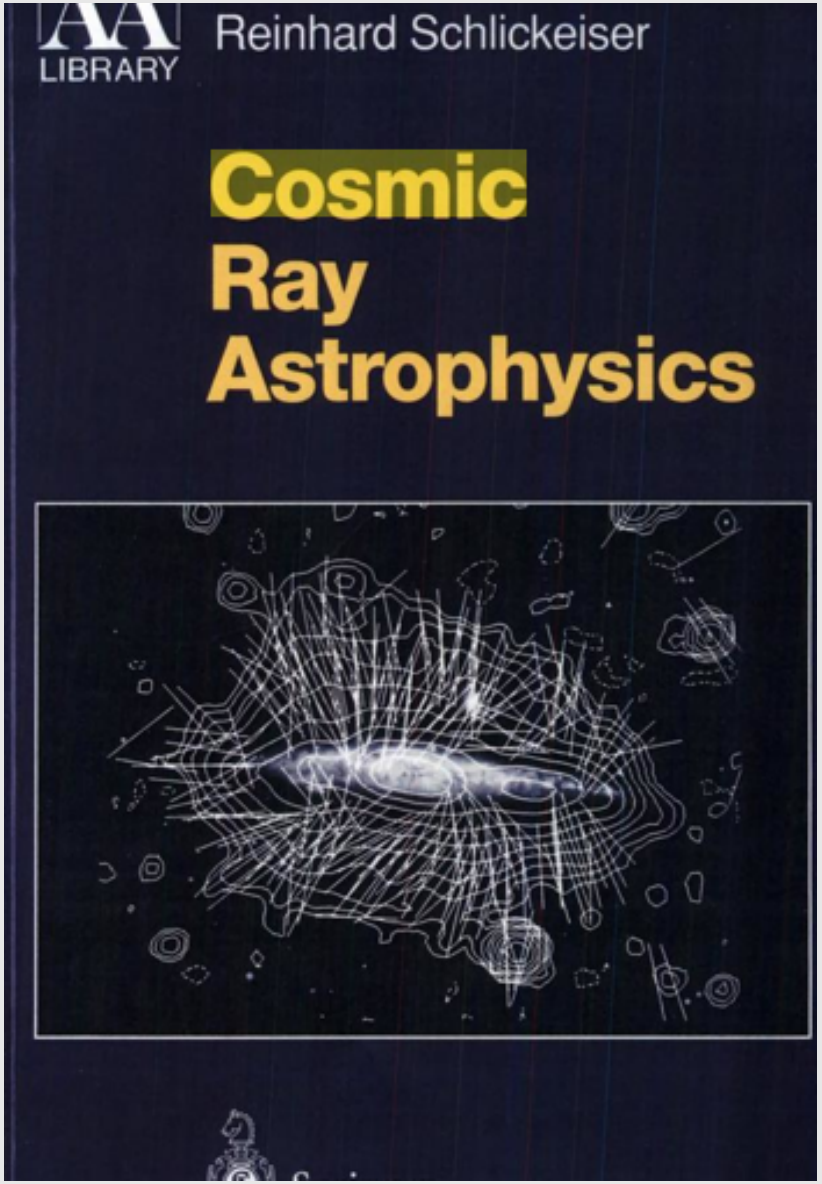
Contents

- Motivation
- Observation data
- Processing steps:
  - Manual
  - After Prefactor
  - 'After' Factor
- Basic Analysis

Motivation

- large edge-on spiral galaxy
- distorted: interaction with NGC4627 and 4656/7
- central starburst
- galactic wind, X-ray halo

Motivation


AA
LIBRARY
Reinhard Schlickeiser
Cosmic
Ray
Astrophysics

Motivation

Image credit: Pöpsel & Binnewies 07
(APOD 12. Oct 07)

Motivation

Hα

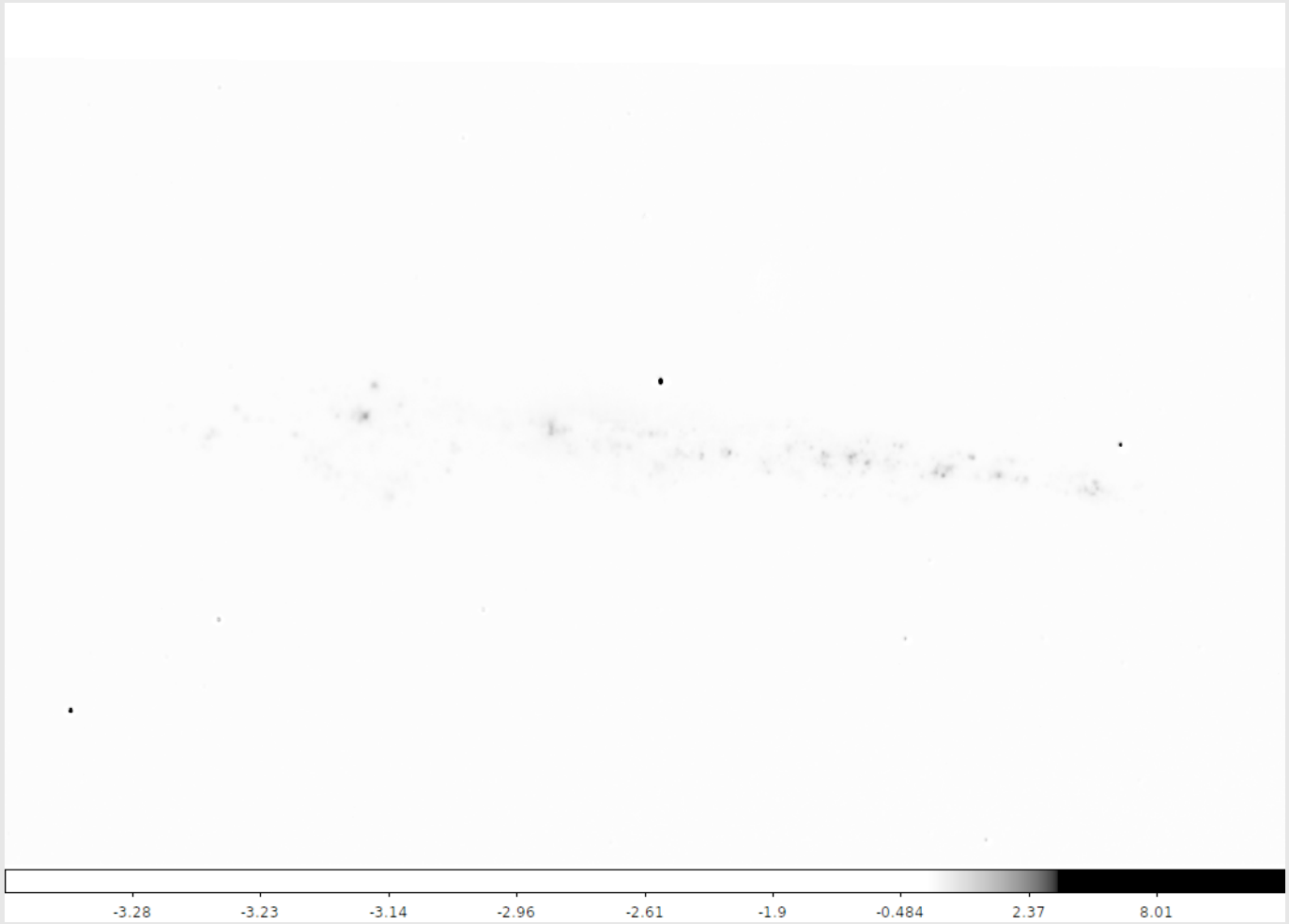


Image credit: Kennicutt et al. 2003
reprocessed: D.J. Bomans 2015

Motivation

18cm

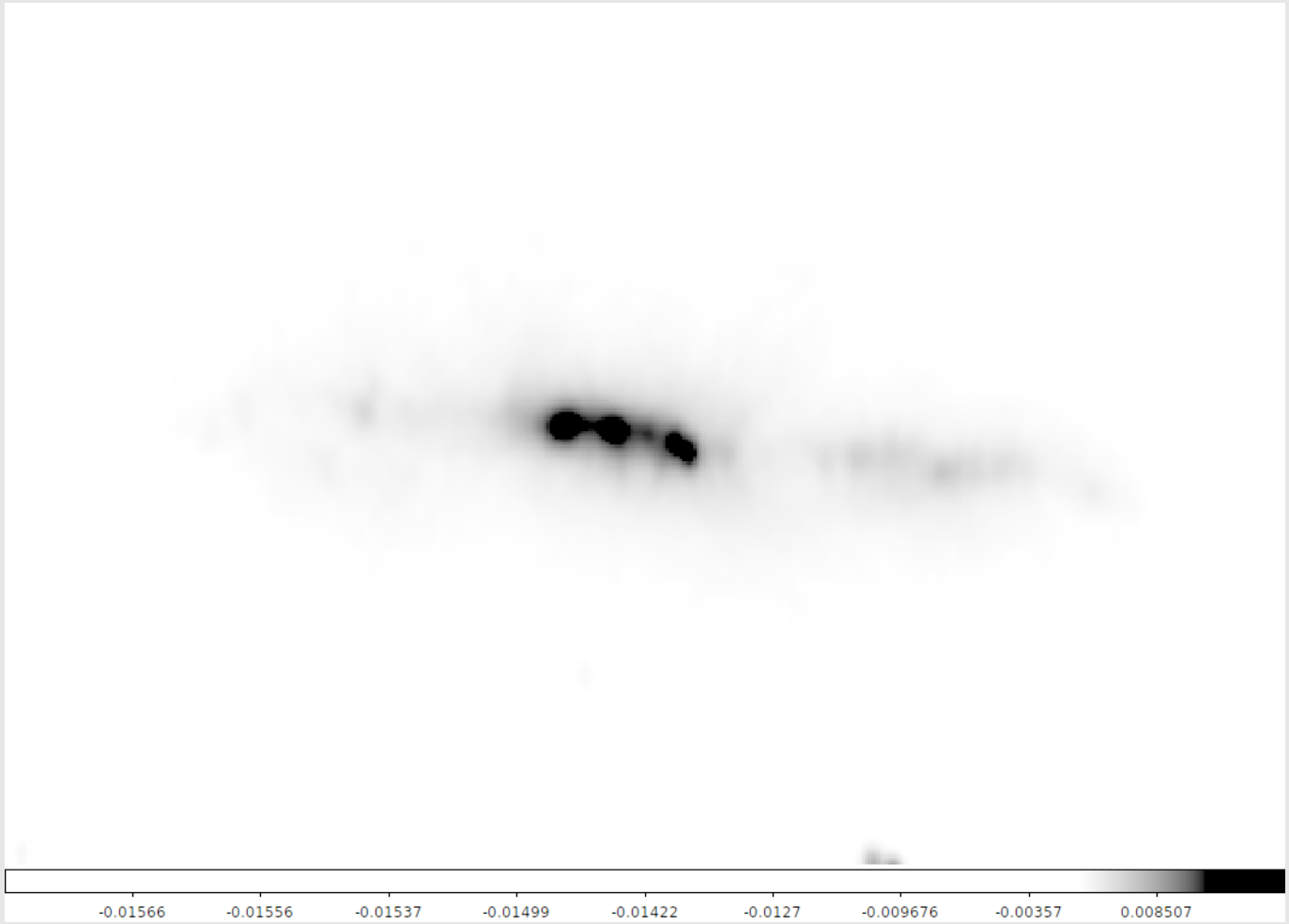


Image credit: Kennicutt et al. 2003
reprocessed: D.J. Bomans 2015

Motivation

NVSS

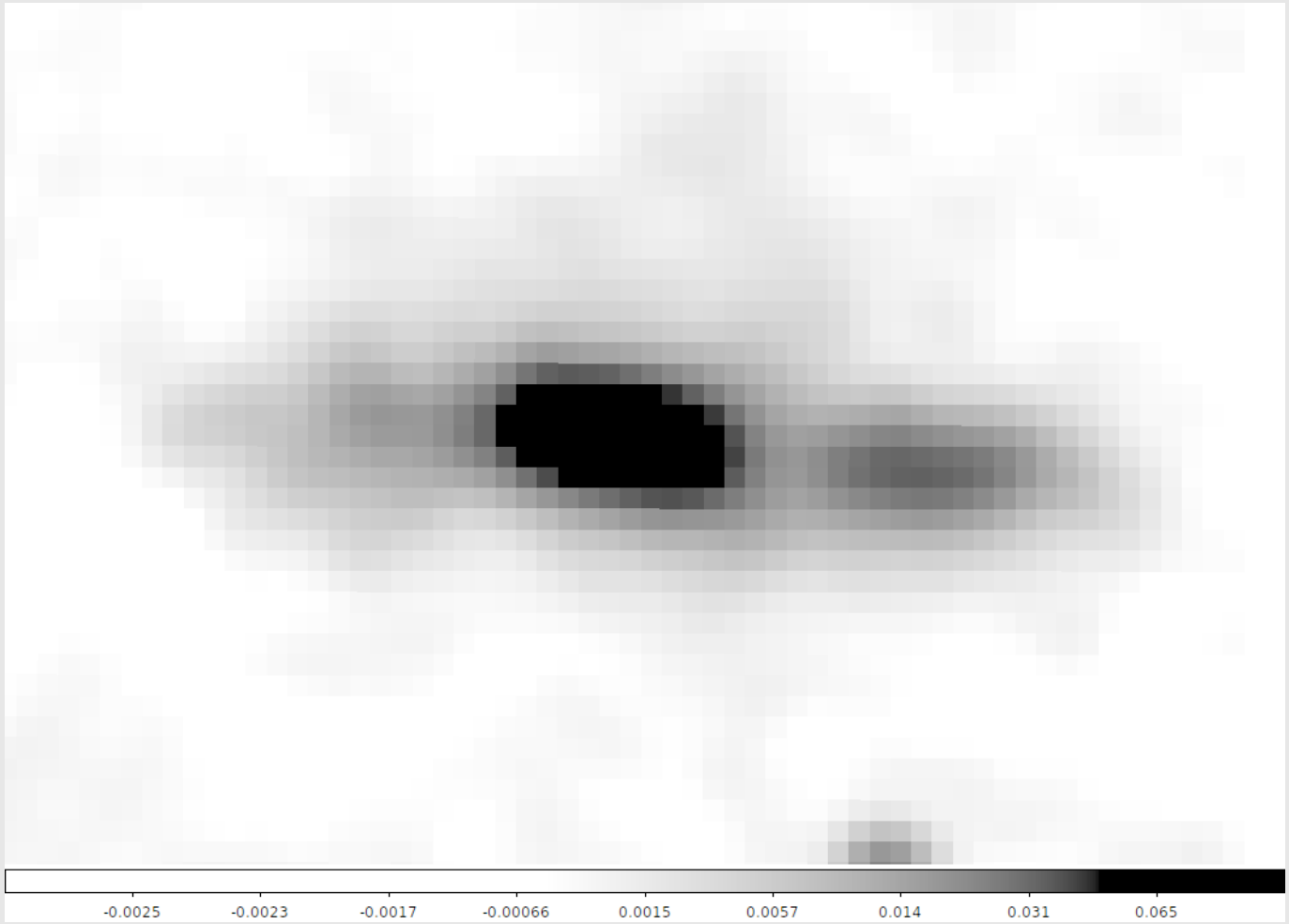


Image credit: Kennicutt et al. 2003
reprocessed: D.J. Bomans 2015

Motivation

VLSS

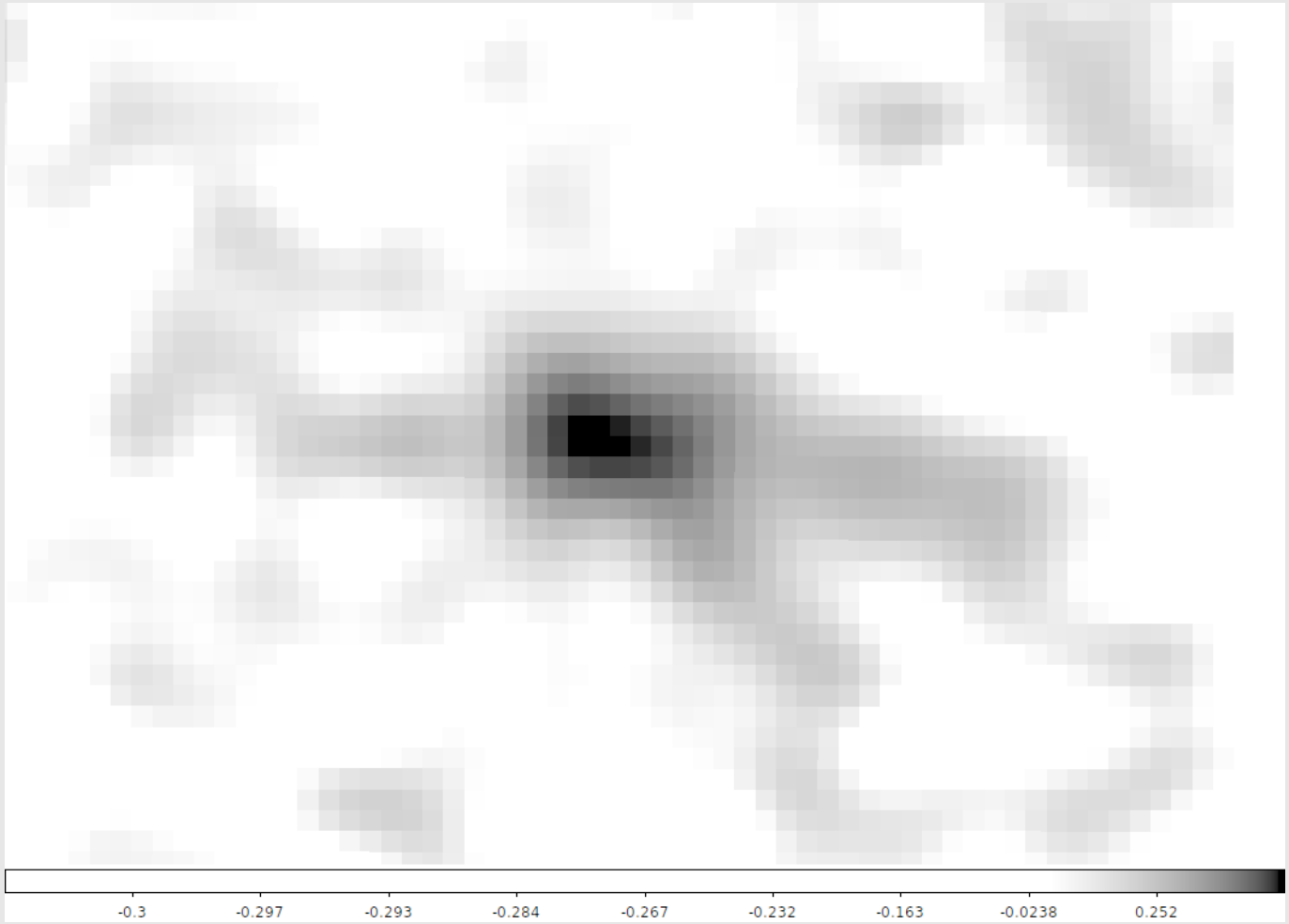


Image credit: Kennicutt et al. 2003
reprocessed: D.J. Bomans 2015

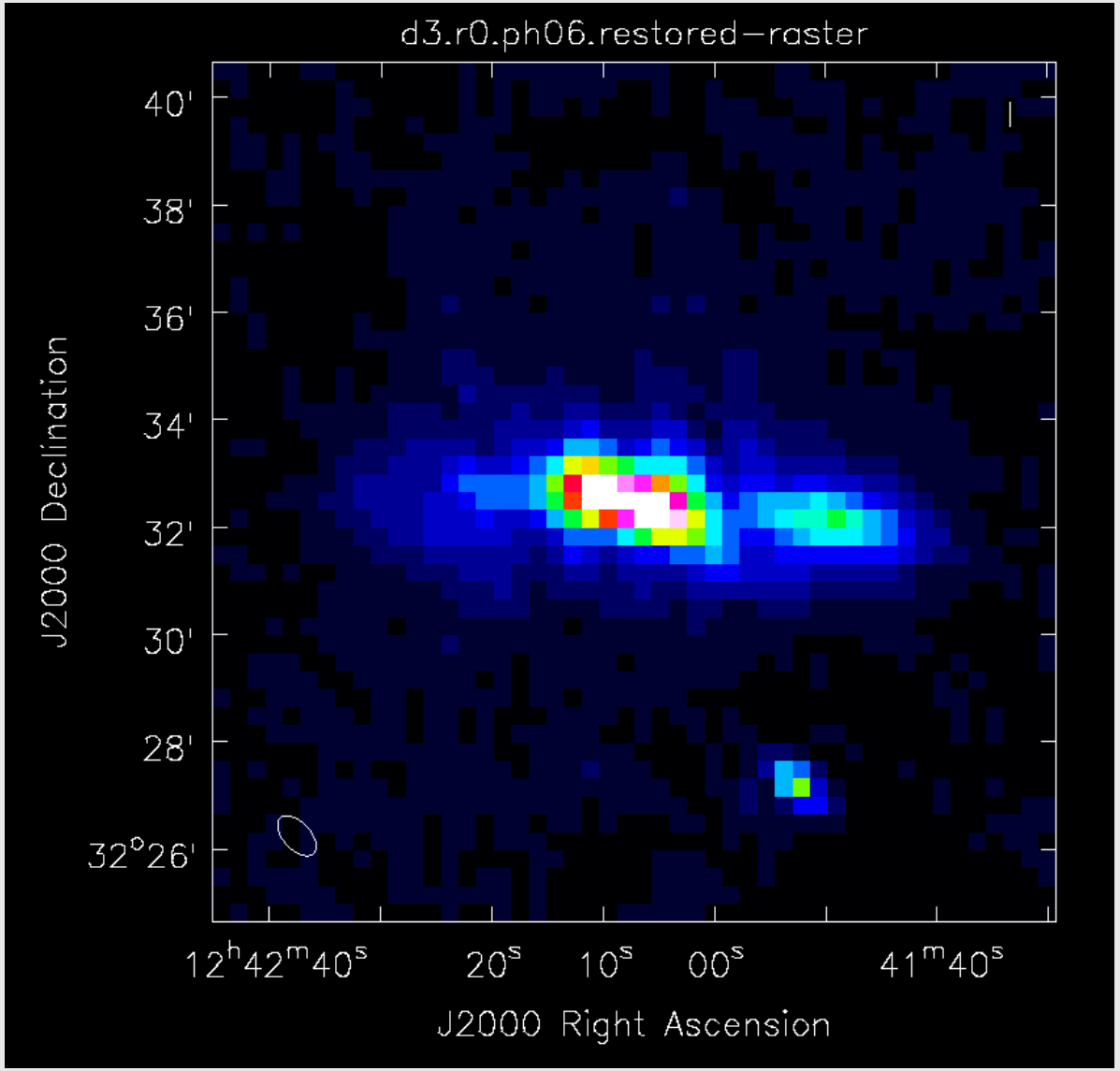
The Observation

- NGC4631, Calibrator: 3C286
- Cycle 0 (18/19.04.13)
- Core & Remote Stations
- HBA, 324 Subbands
- Interlaced, 6.4h target, 1h cal.
- No preprocessing

Manual calibration

- Demixing (trial and error)
- Flagging (AOFlagger, then by hand)
- Self-calibration
- *(Imaging)*

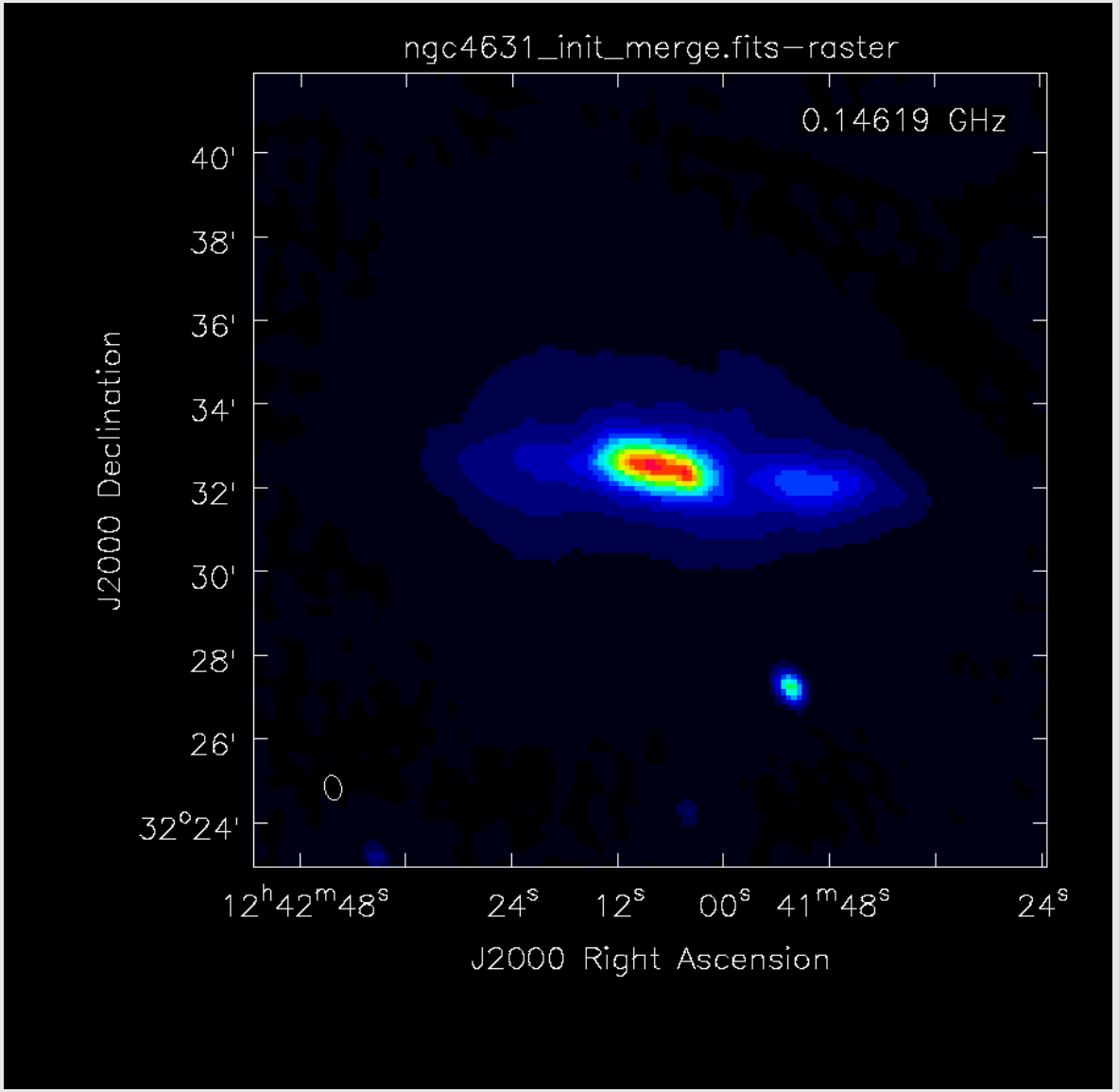
Manual calibration



Prefactor

- Long wait for a version that supports:
  - Data without preprocessing
  - Interlaced observations
- Initially, much fiddling required
- Current version runs a lot smoother
- Local bottleneck problem finally disappeared

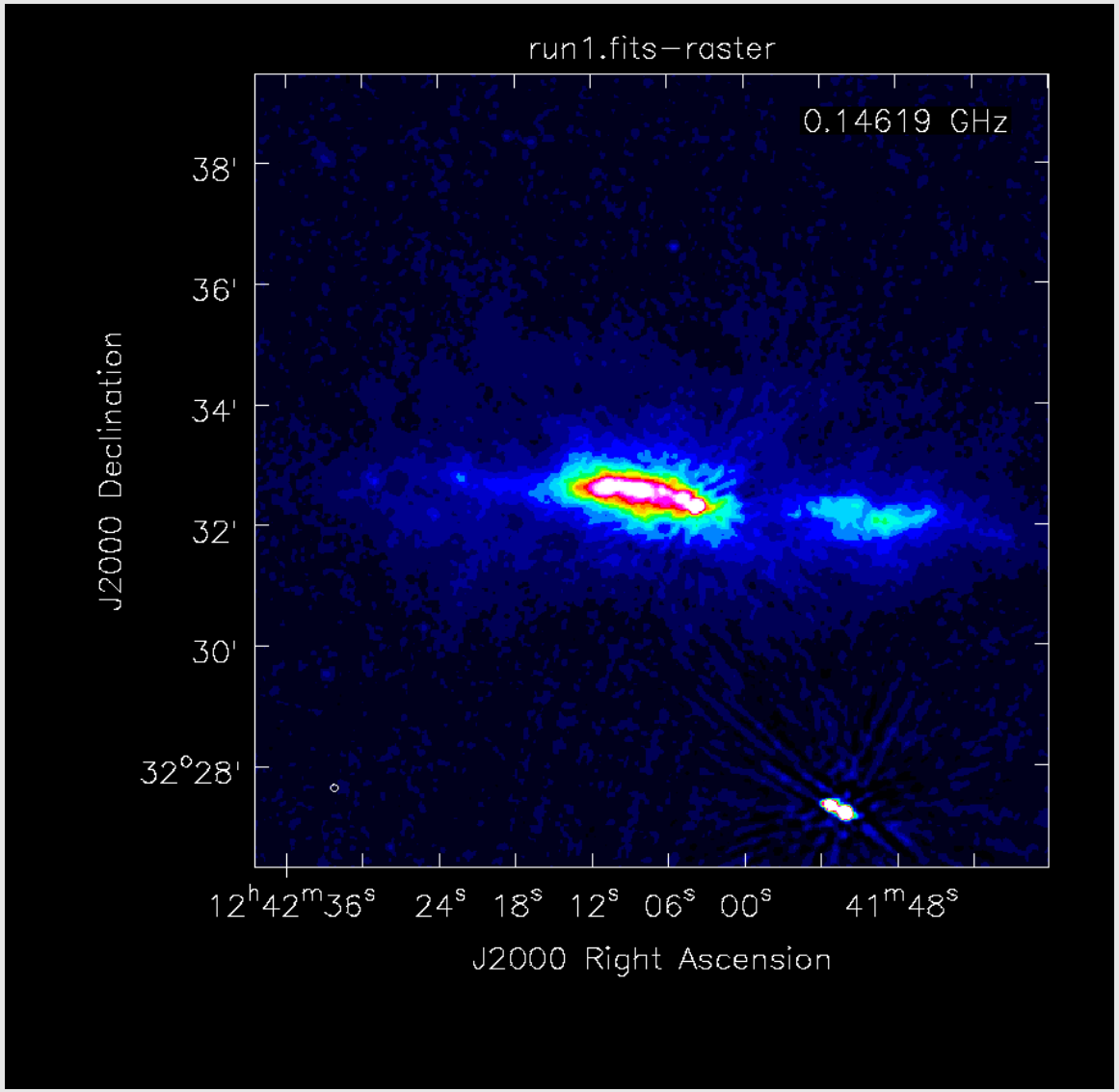
Prefactor


ngc4631_init_merge.fits—raster
0.14619 GHz
40'
38'
36'
34'
32'
30'
28'
26'
32°24'
J2000 Declination
12h42m48s
24s
12s
00s
41m48s
24s
J2000 Right Ascension

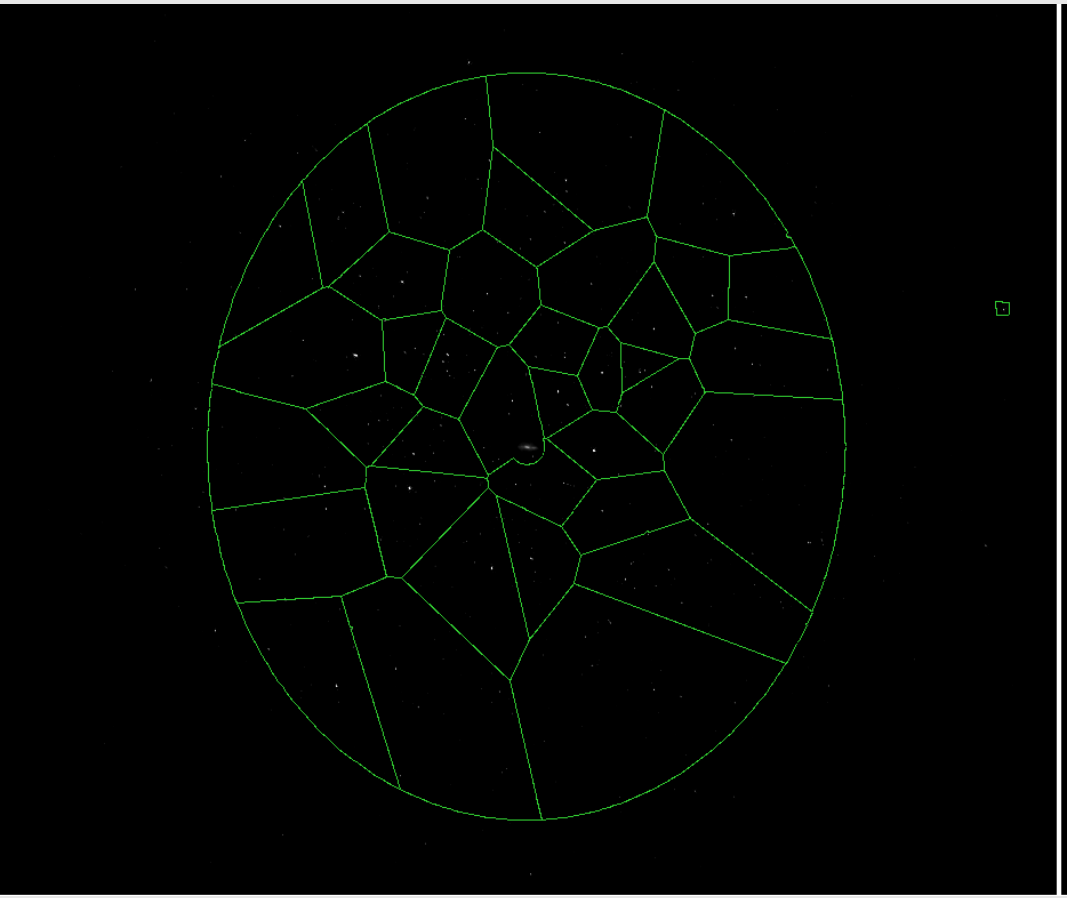
Factor

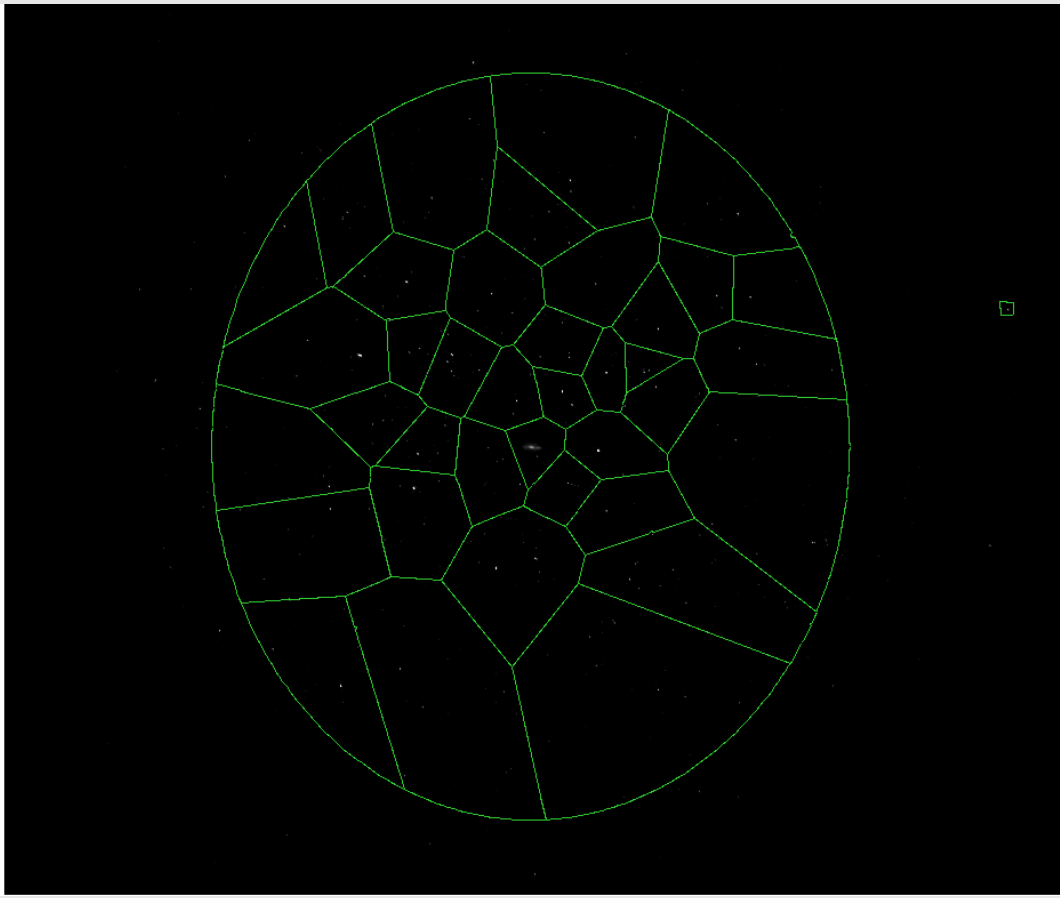
- Disregarding user error and some prerequisite installation trouble, runs smoothly on 1st try!
- Pretty harsh demands on hardware
- Settings are trial and error, at least for me (Andreas Horneffer helped a lot)
- I will need at least 3 full runs of Factor until satisfied with the result, 2nd run just finished

Factor – 1st run

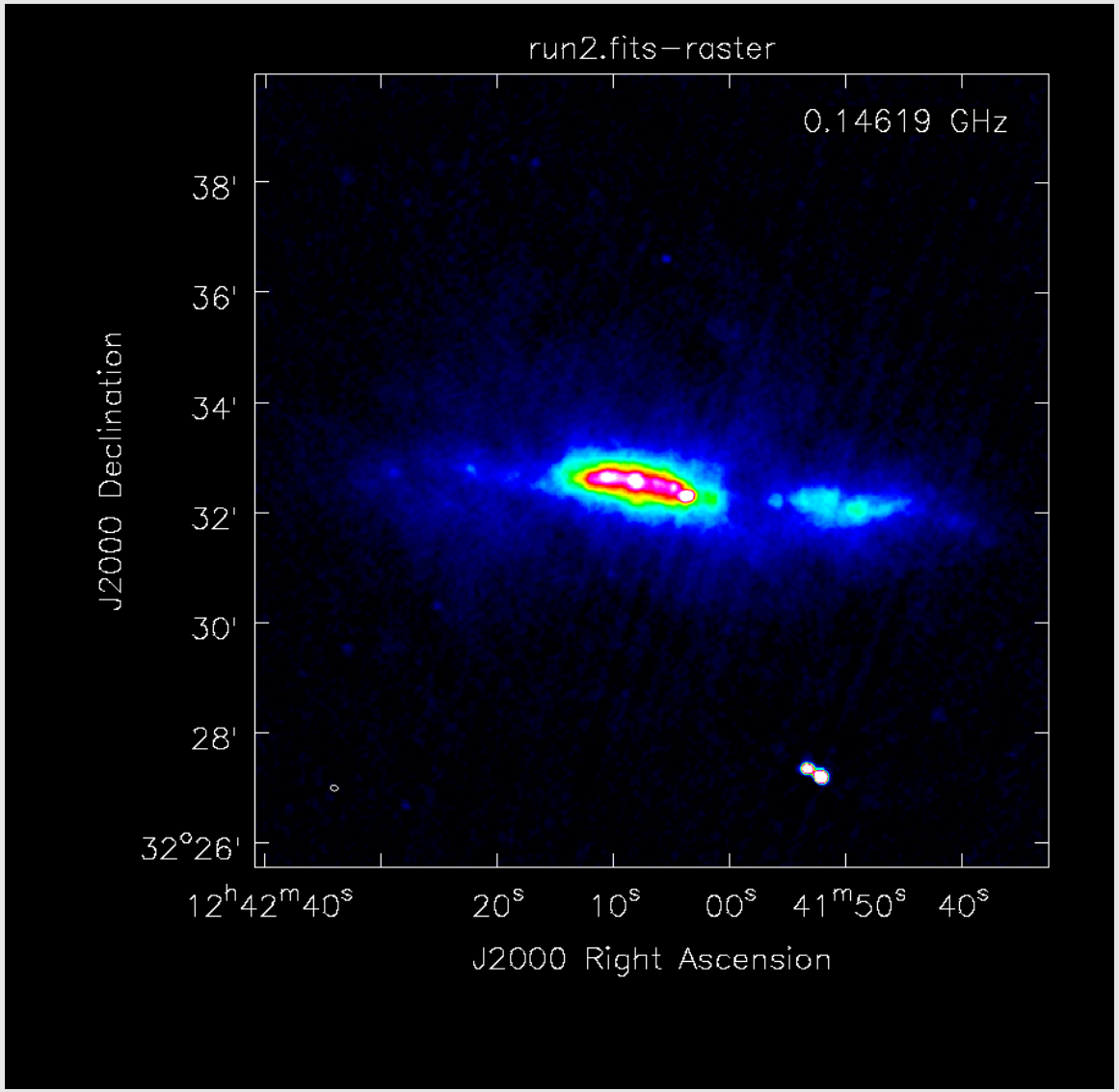


Factor – facet adjustment





Factor – 2nd run



Analysis

Hα

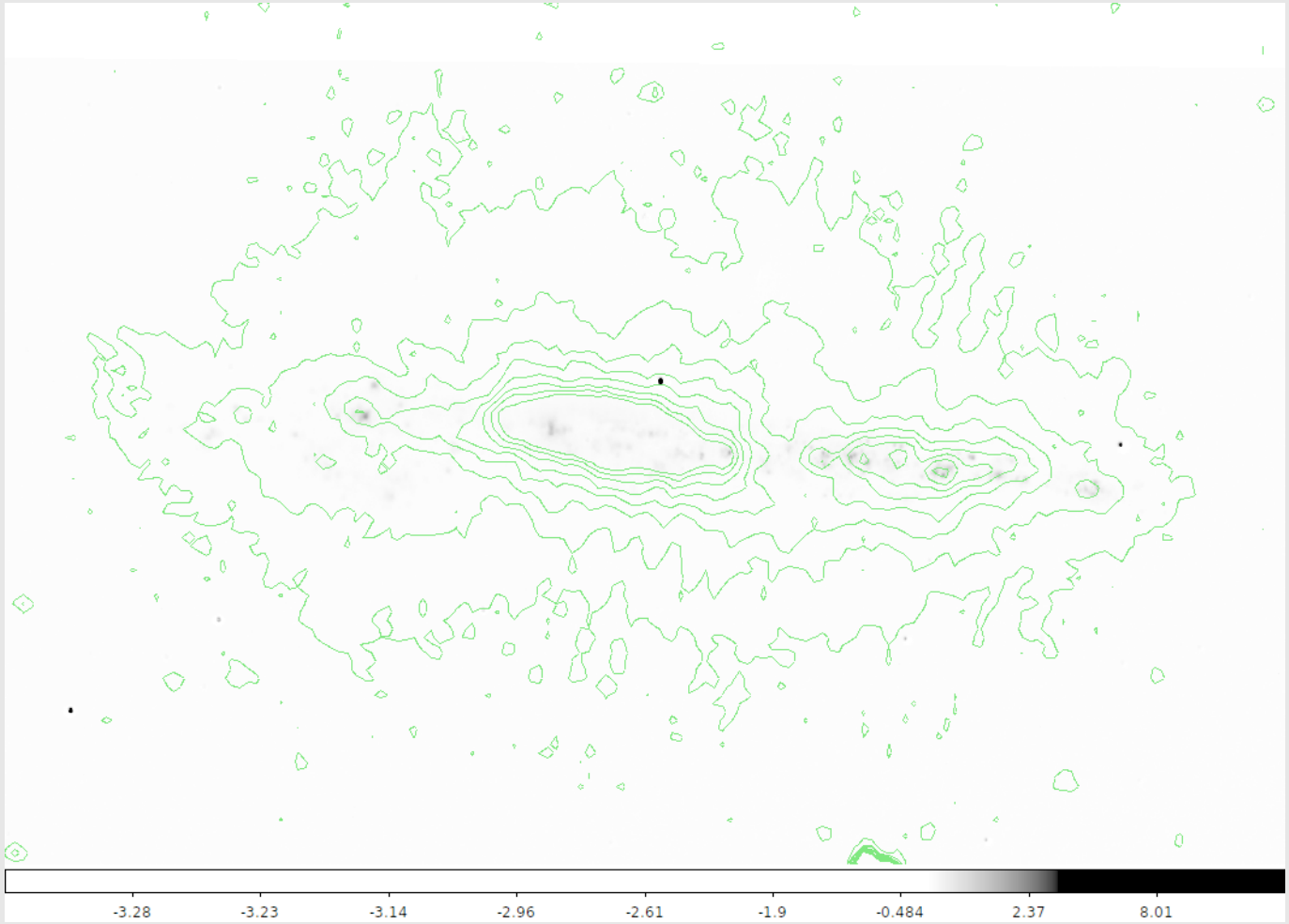


Image credit: Kennicutt et al. 2003
reprocessed: D.J. Bomans 2015

Analysis

18cm

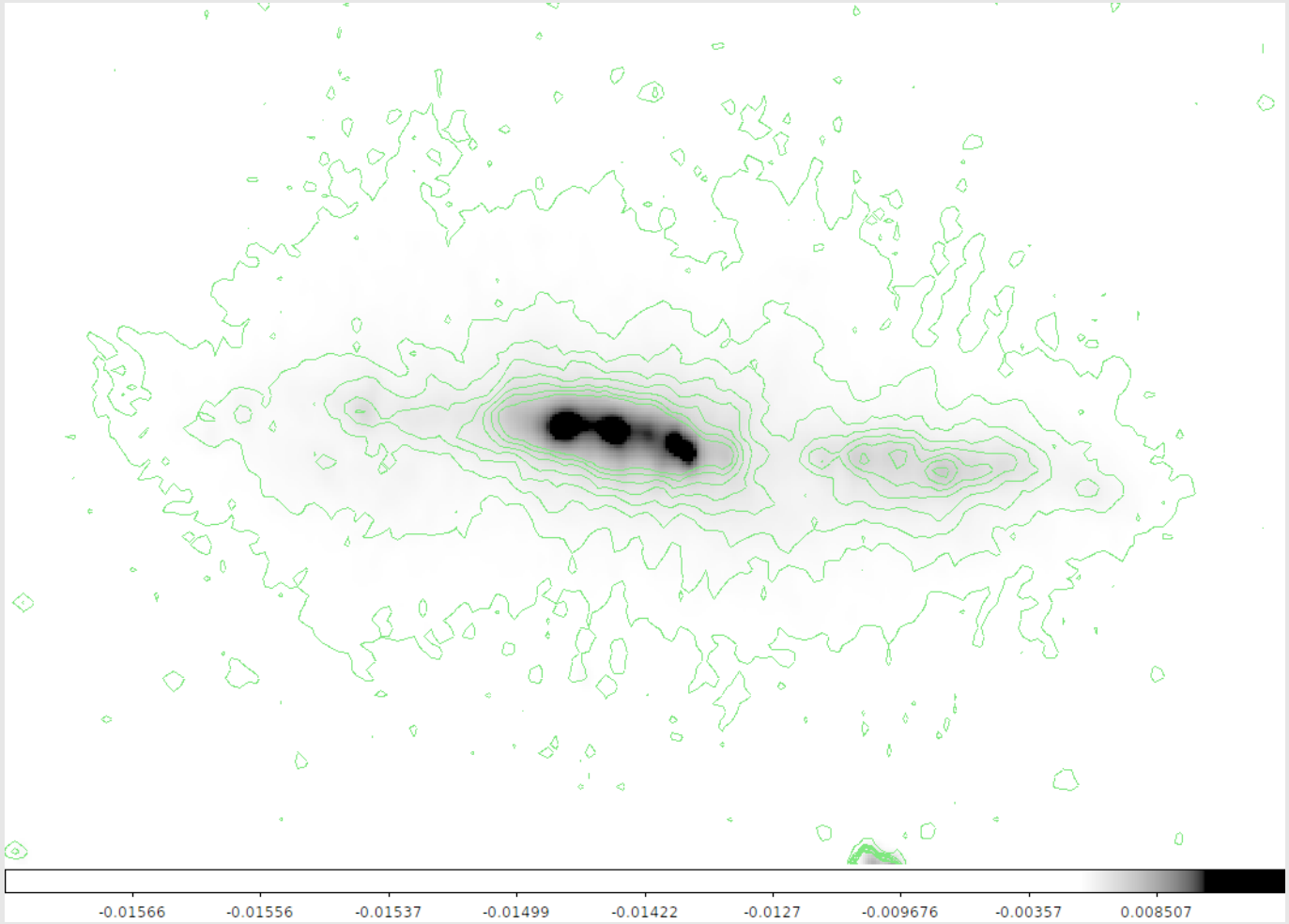


Image credit: Kennicutt et al. 2003
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Analysis

NVSS

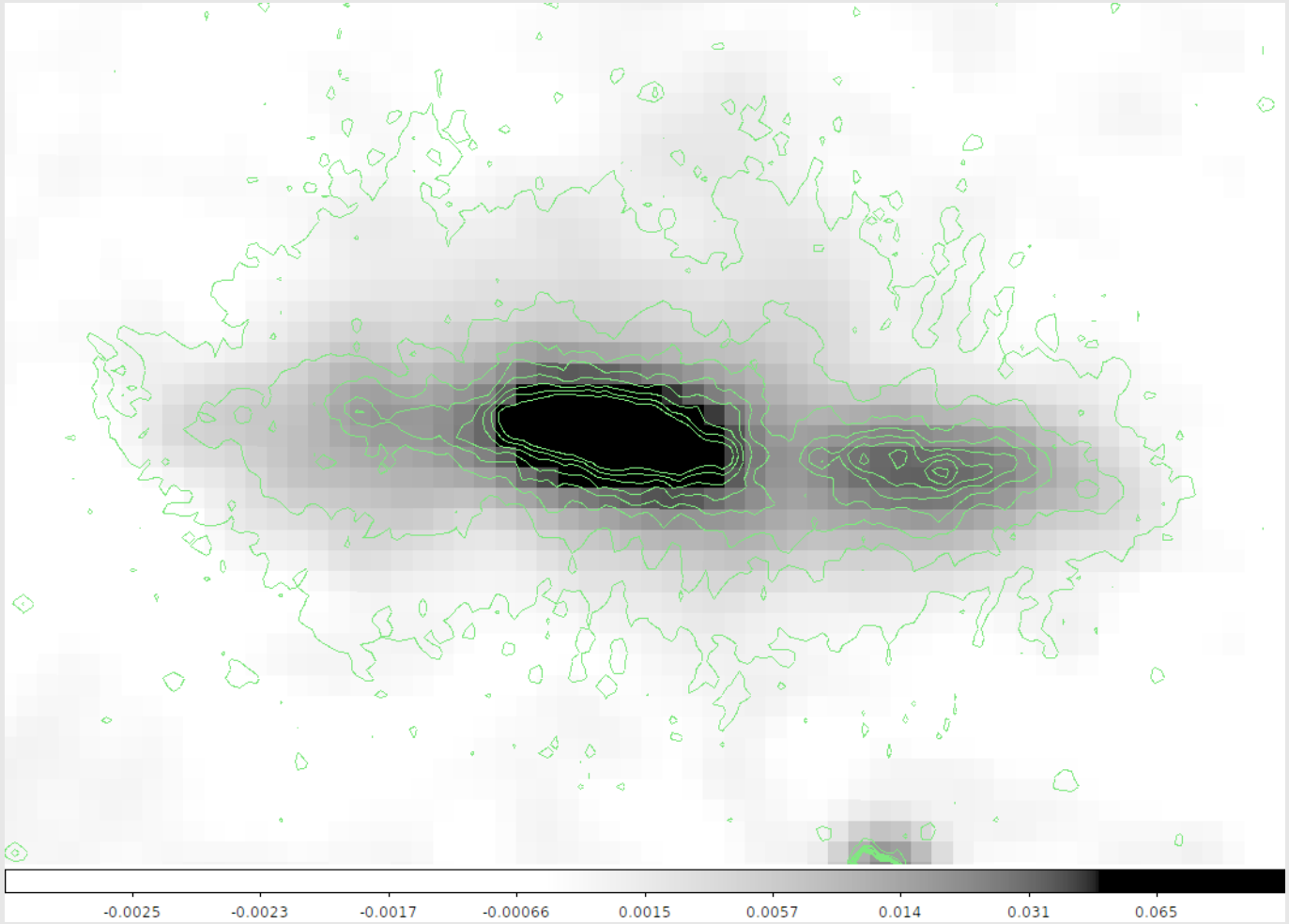

Image credit: Kennicutt et al. 2003
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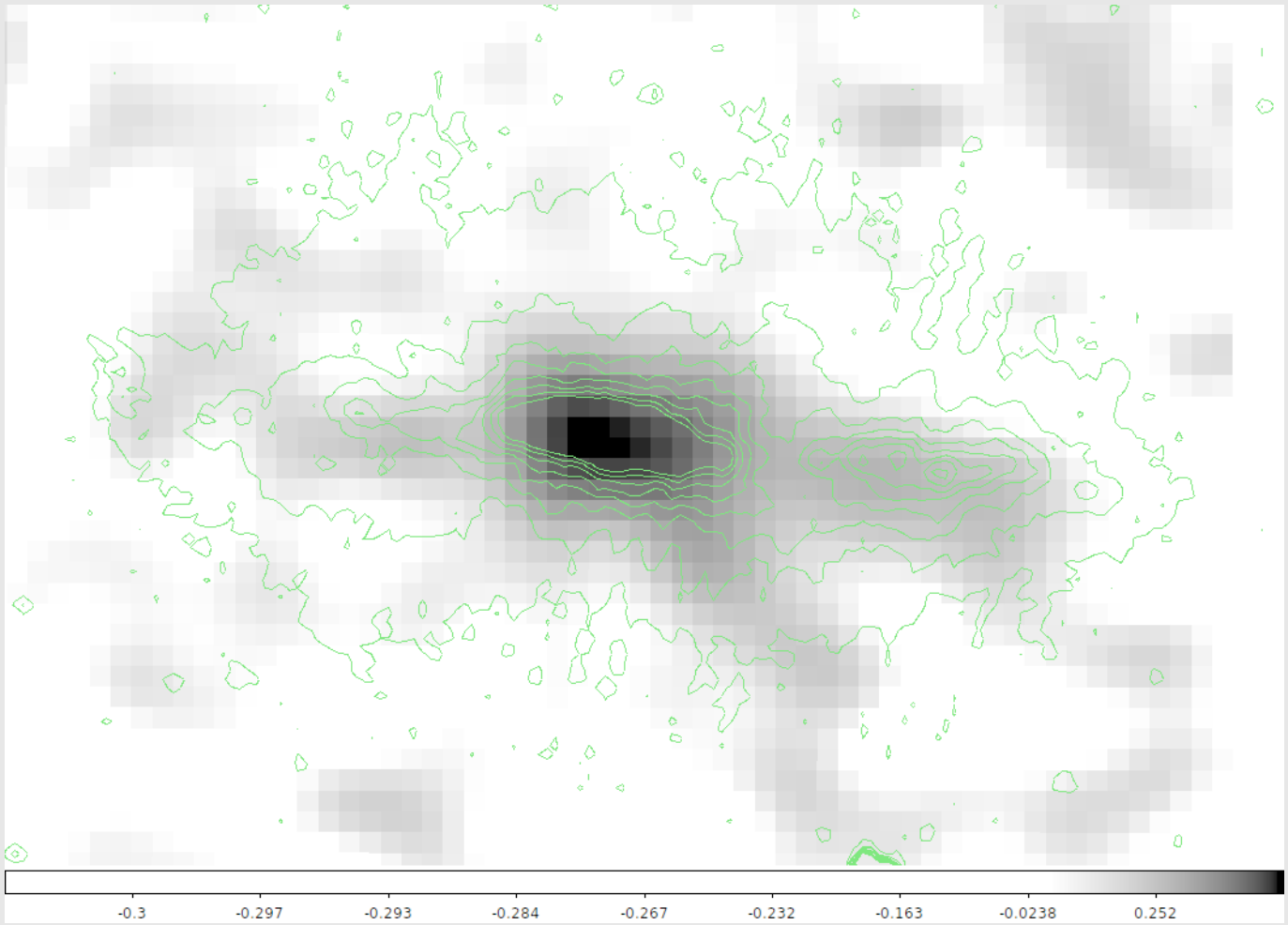
Analysis

VLSS



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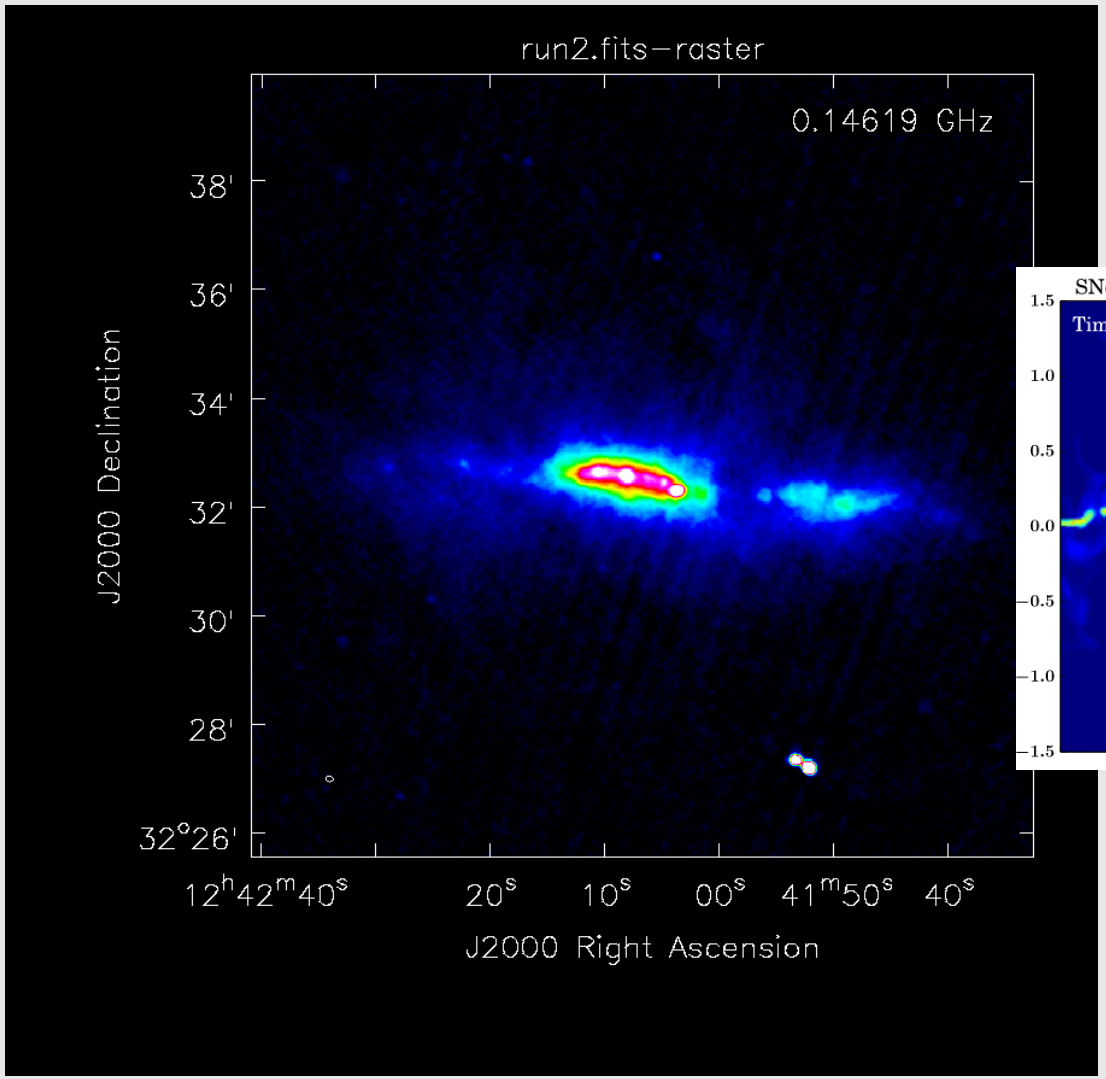
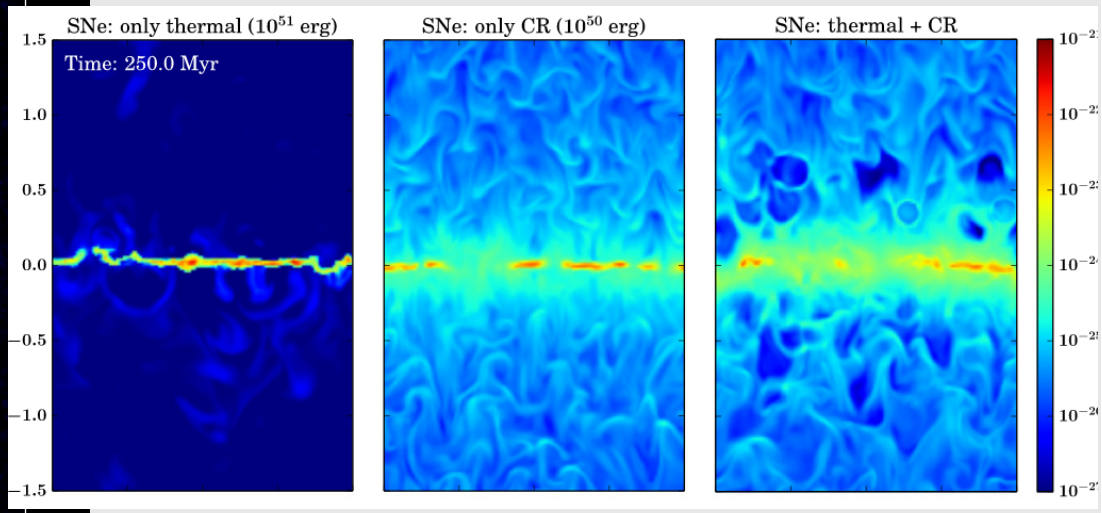
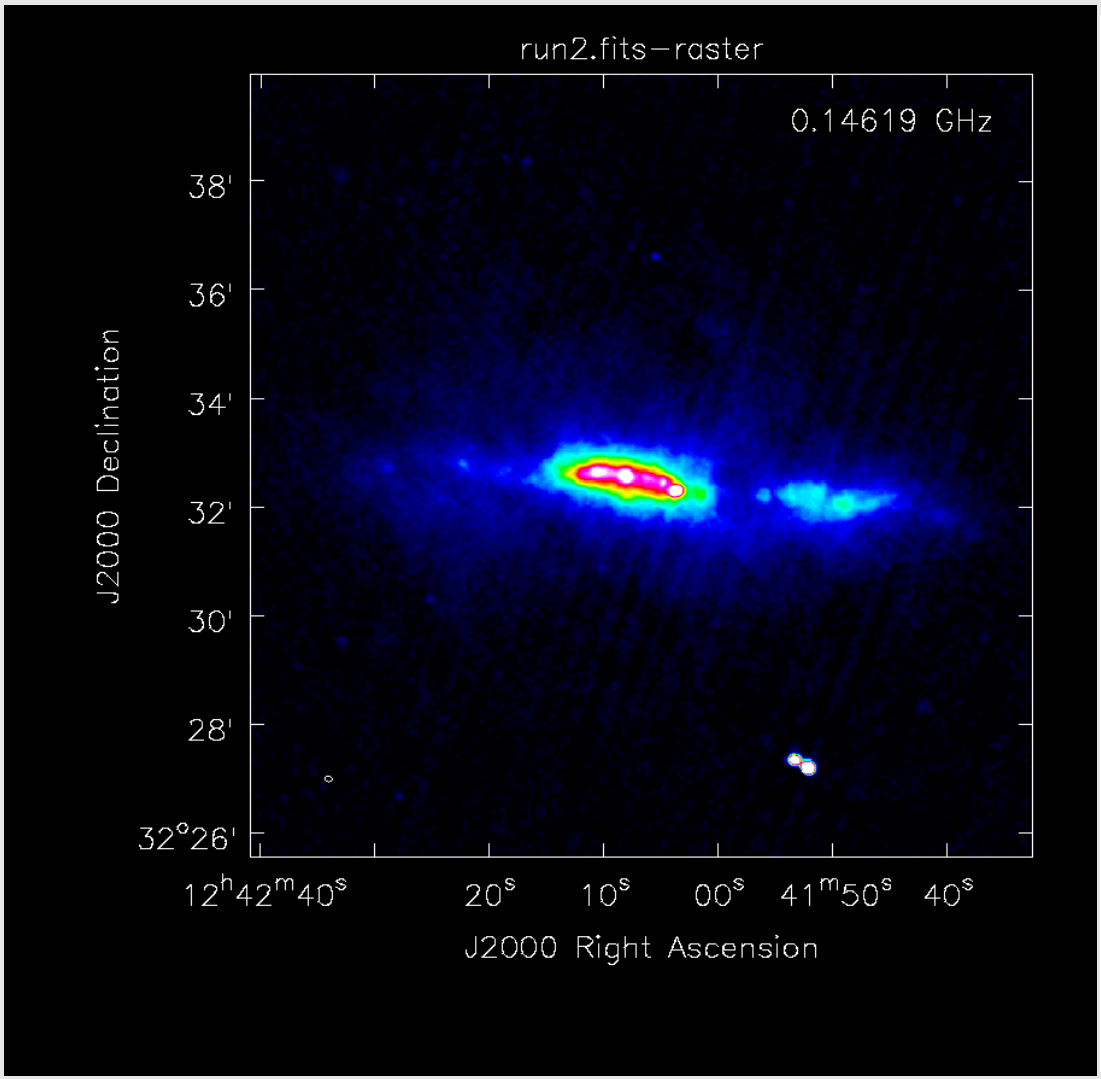
Analysis

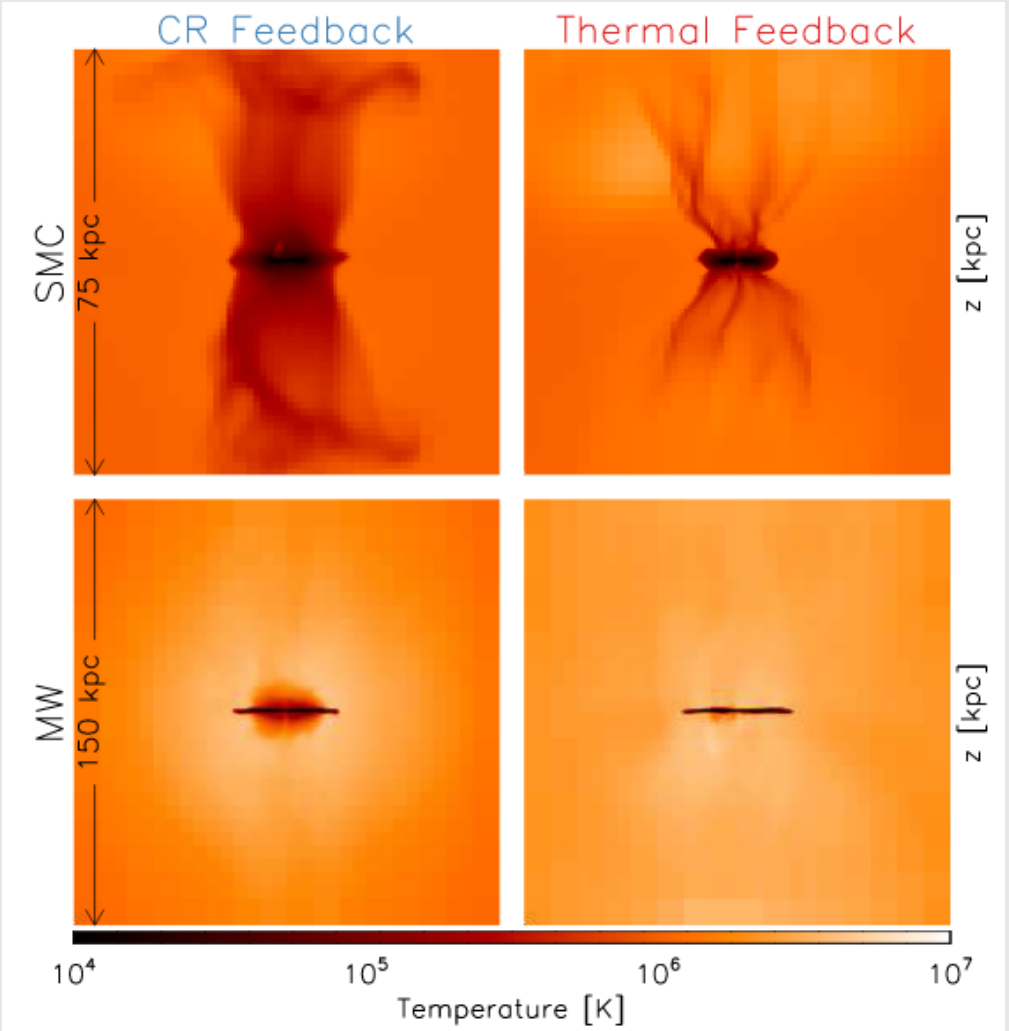




Girichidis et al., 2016

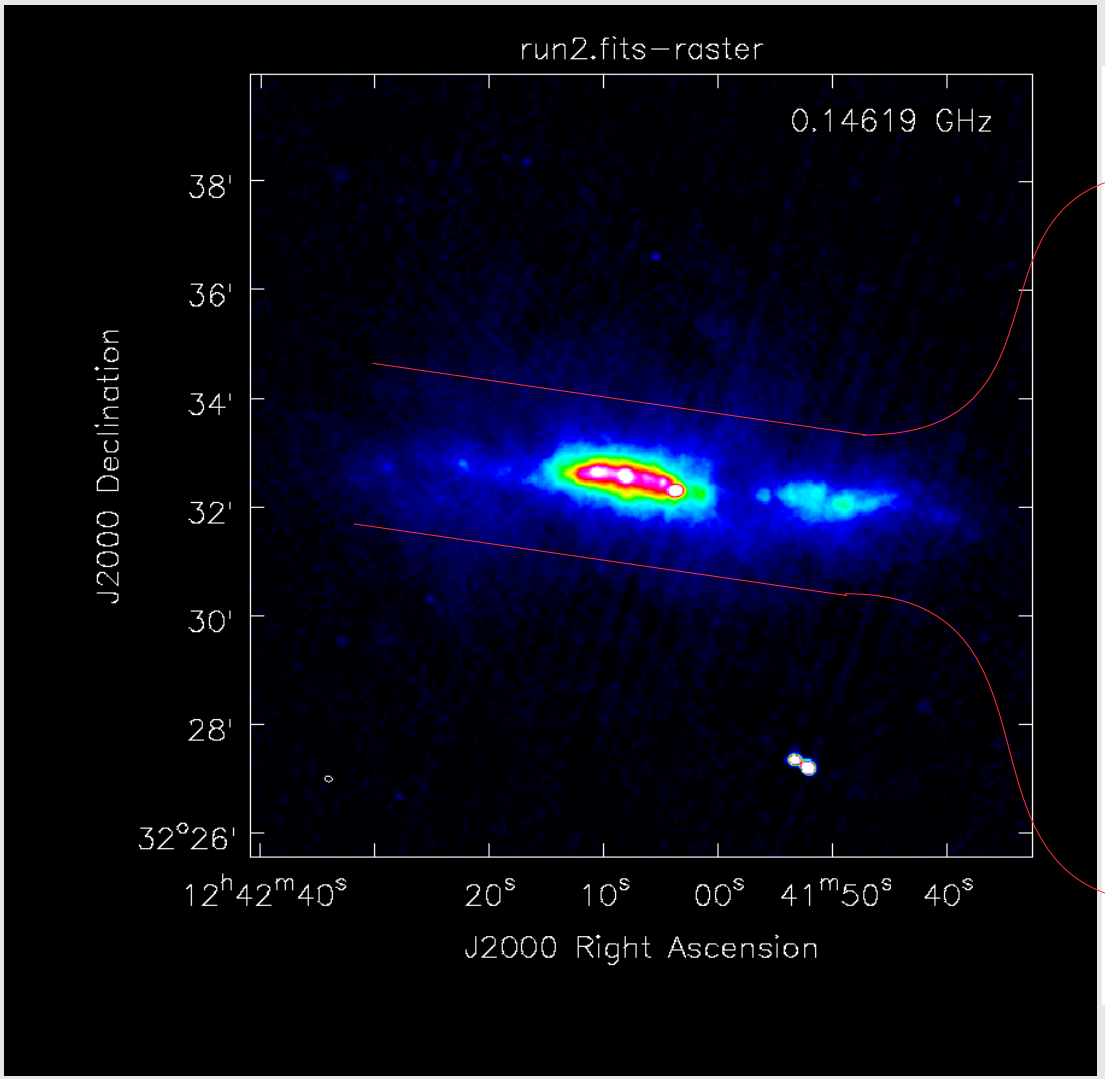
Analysis

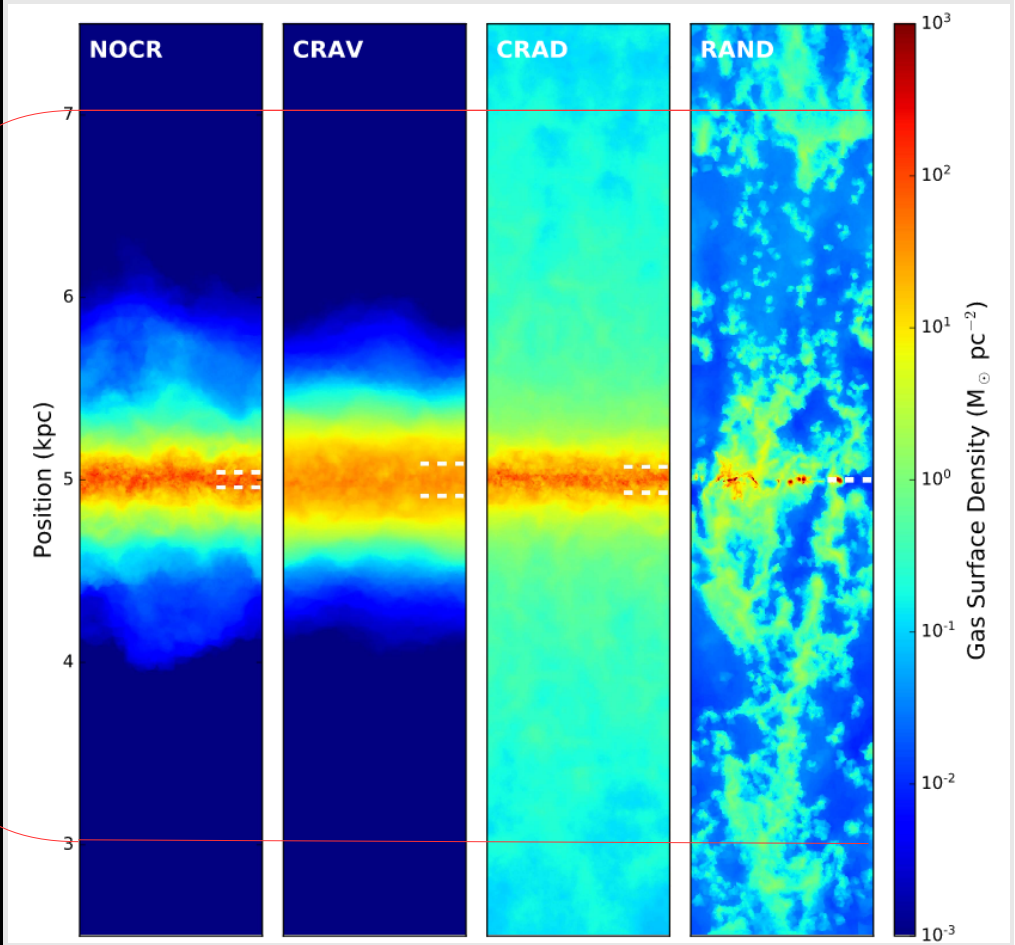




Booth et al., 2013

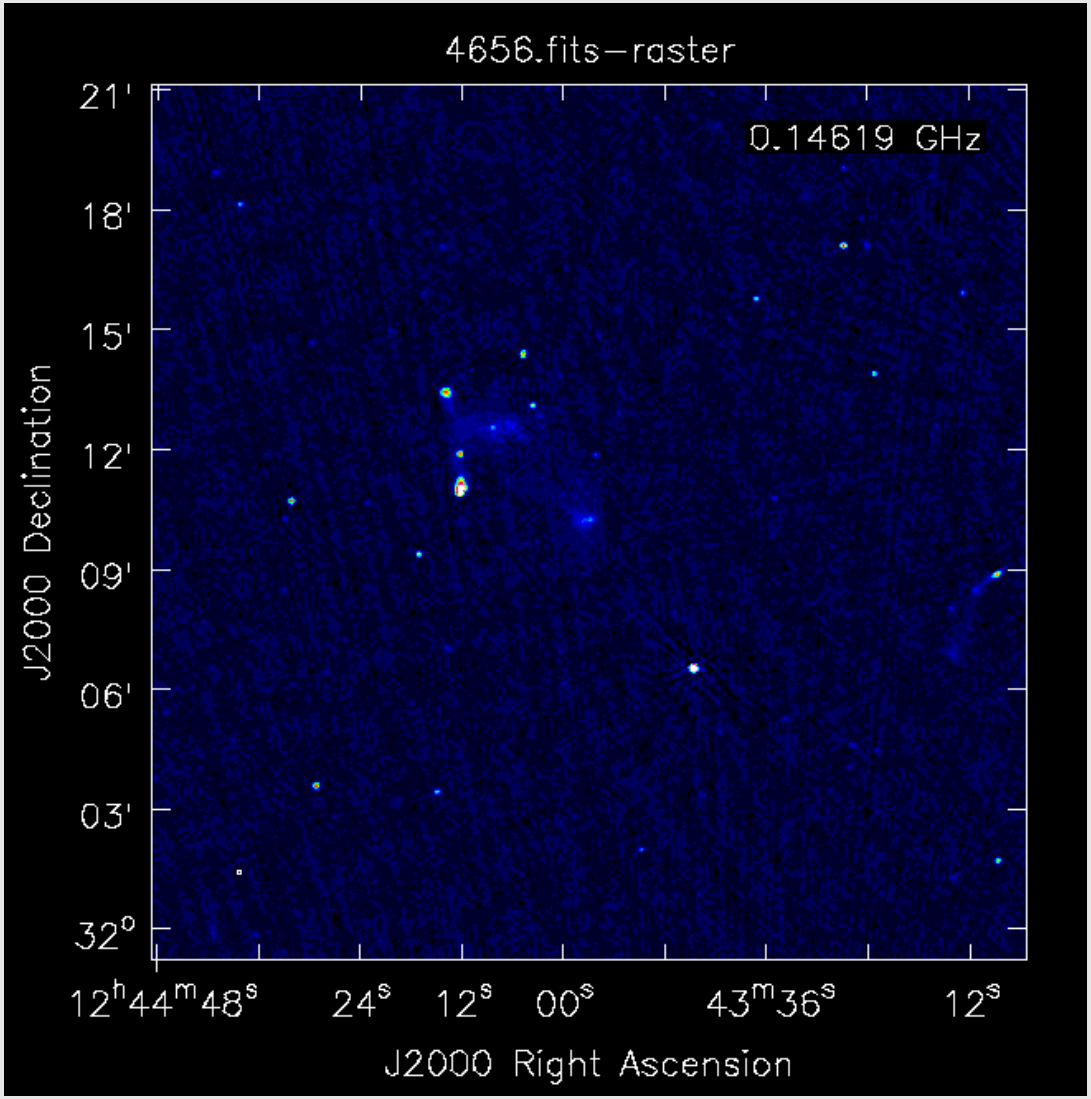
Analysis





Simpson et al., 2016

NGC 4656


4656.fits−raster
0.14619 GHz
21'
18'
15'
12'
09'
06'
03'
32°
J2000 Declination
12h44m48s
24s
12s
00s
43m36s
12s
J2000 Right Ascension

Summary

- Data reduction:
  - The current pipelines are great, manual labor is obsolete
  - Some fiddling still required
  - Factor is worth the effort
- Science:
  - Large outflows, consistent with other halo obs.
  - Filaments on north side up to 10 kpc
  - CR influence on halo clearly visible