LOFAR KSP
Commissioning Data

Björn Adebahr

FAKULTÄT FÜR PHYSIK UND ASTRONOMIE
Astronomisches Institut

The Observations

ASTRON

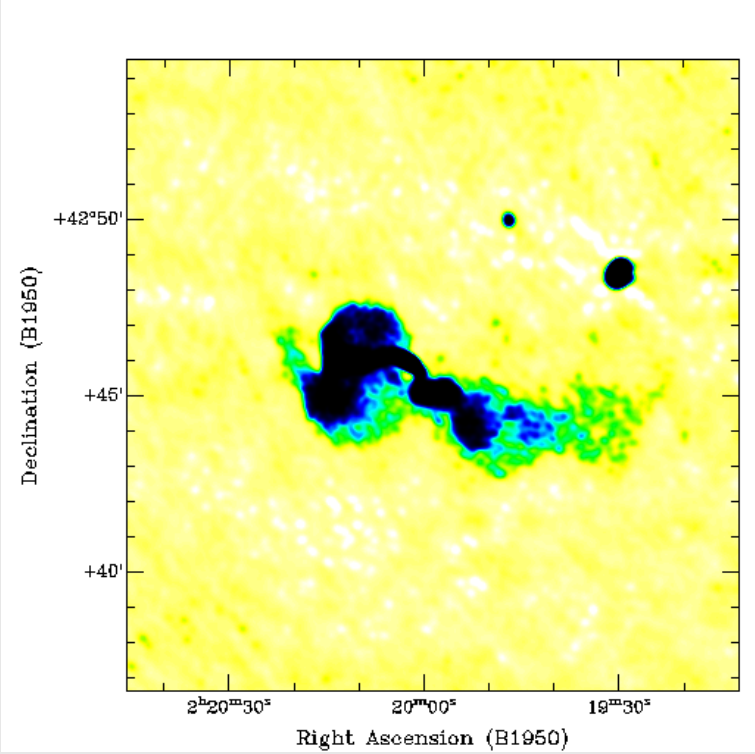
LOFAR High-Band-Data (125 MHz – 174 MHz)

- 6-hour observation
- 16 stations (11 core + 5 remote) → 120 Baselines
- 3 seconds integration time
- All four polarizations
- 248 subbands (256 channels each) spanning 0.2 MHz each
- 5 TB of data

ASTRON

The Observed Field: 3C66

- Two strong radio sources
- Complex structure
- Two other interesting objects in the field
- Extremely large field of view



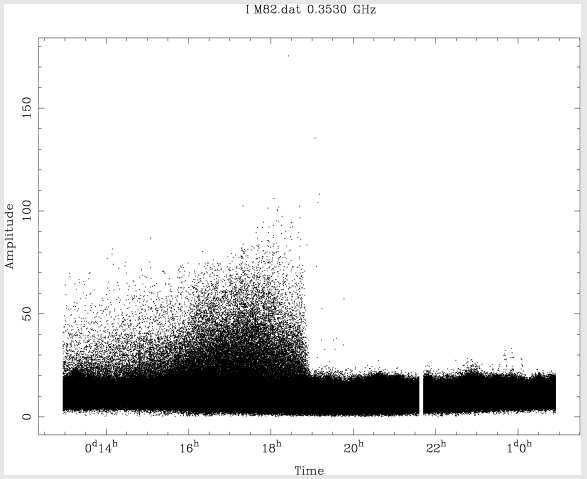
Hardcastle et al., 1996MNRAS.278..273H

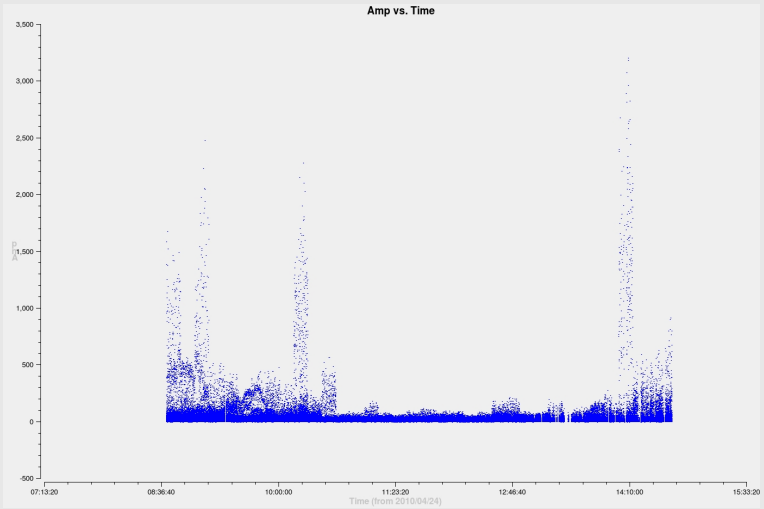
Calibration problems:

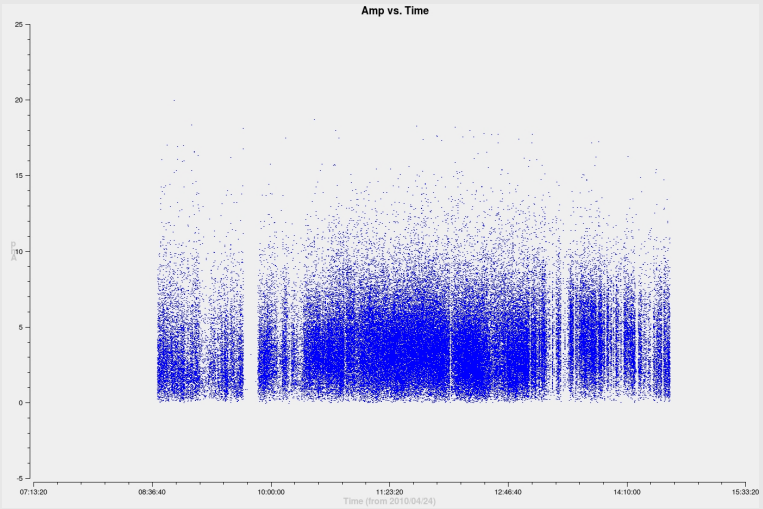
- No calibrators (amplitude, phase or polarization)
- No beam correction (cable length are not measured)

Calibration: First Steps

1. Flagging baselines shorter than 400 meters
2. Flagging XX- and YY-correlations
3. Compressing each subbands channels into one channel
4. Flagging the data again



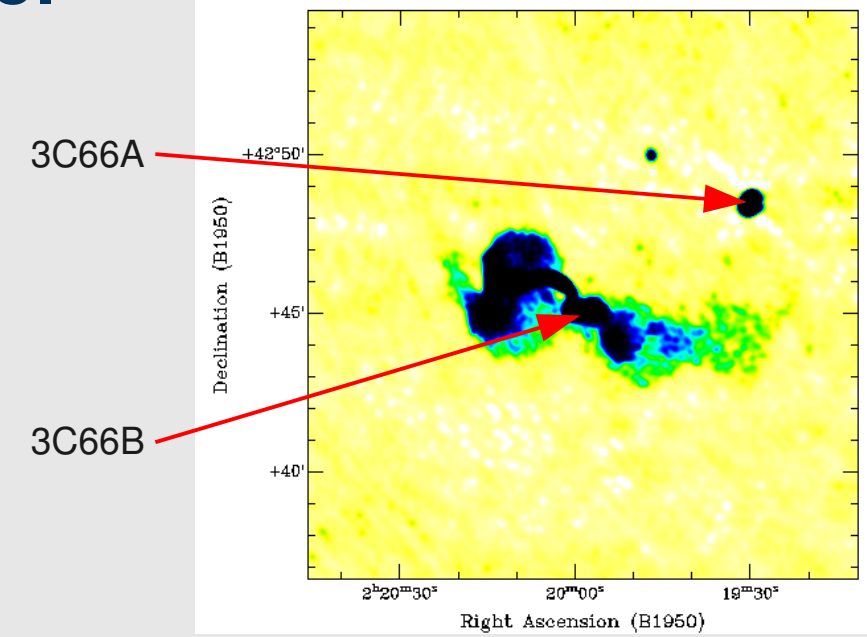




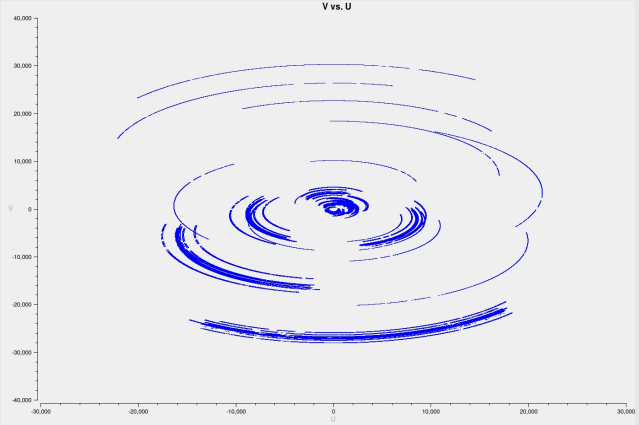
Calibration: The right model

- Possible models: Point and gaussian
- Spectral index / curvature can be given
- Flux ratio between sources is important

Object	Flux	SI	SC
3C66A	10.16 Jy	-0.65	0
3C66B	46.05 Jy	-0.80	0



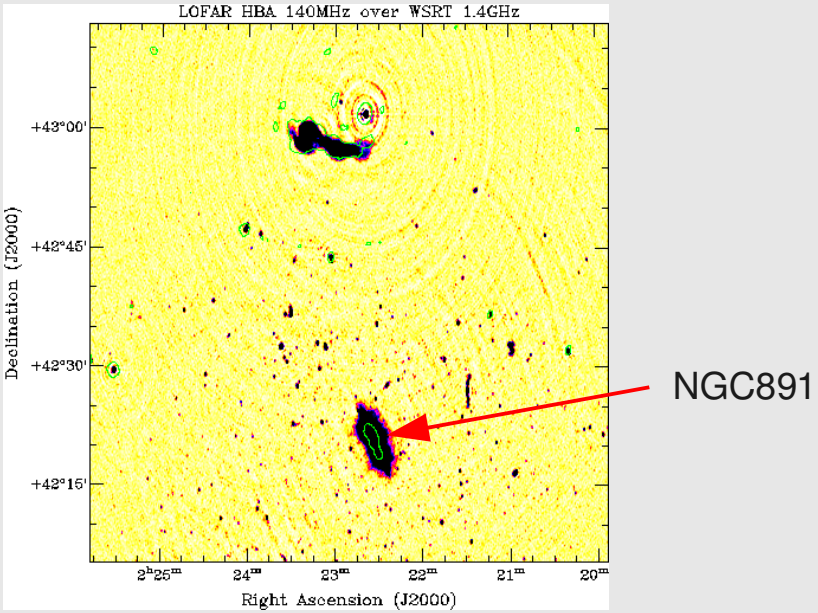
Hardcastle et al., 1996MNRAS.278..273H

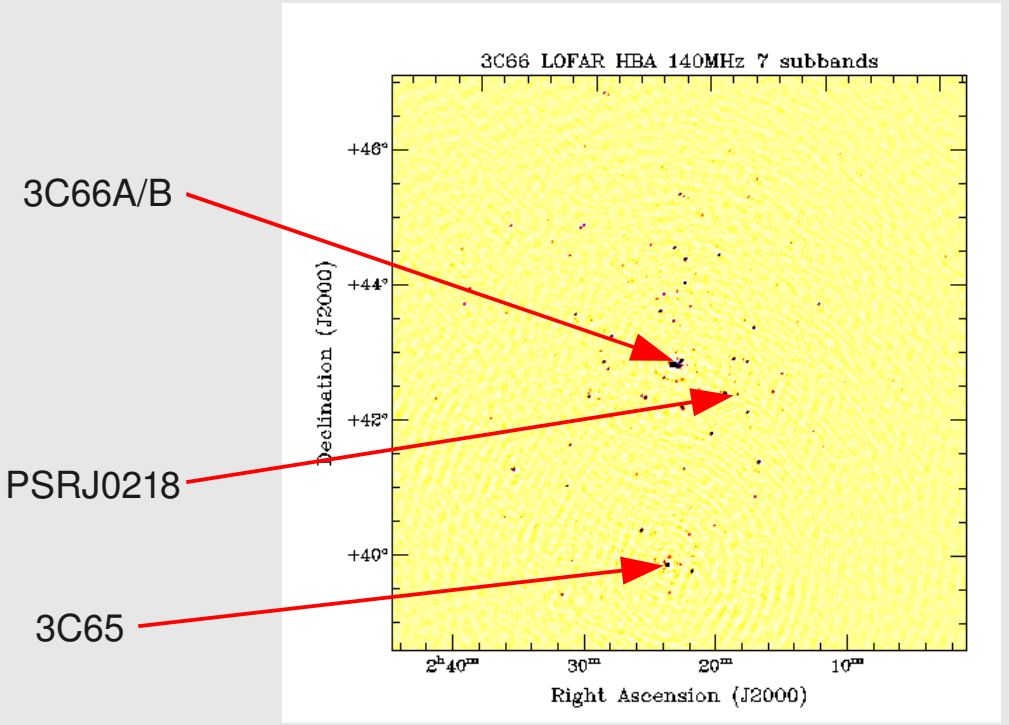


- Combination of subbands in the u,v-domain possible
- u,v-coverage with 7 subbands still sparse

Imaging the whole field

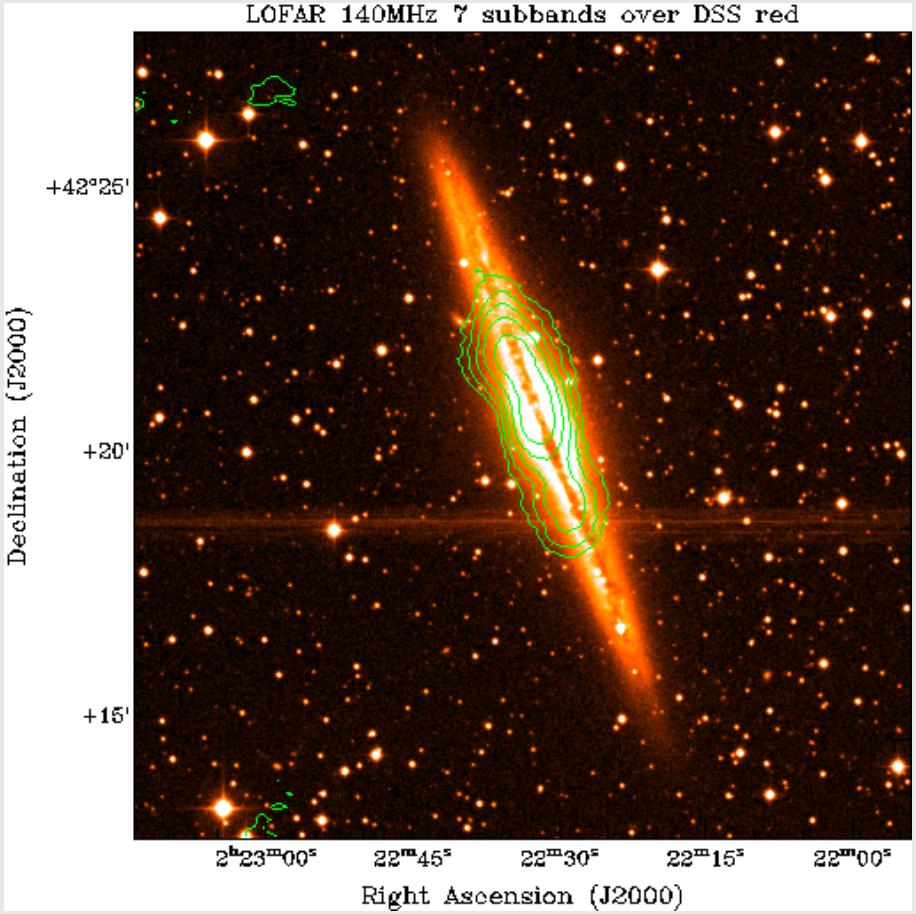
- Dynamic range ~ 750
- Synthesized beam: 120" x 100"
- Direction dependent gains and subtraction of 3C65 necessary





- Weighting changed
  - ➔ Higher RMS, but better resolution
- Source positions are right
- Overall shape of sources similar to 1.4 GHz WSRT observations

First nearby galaxy detected with LOFAR: NGC891

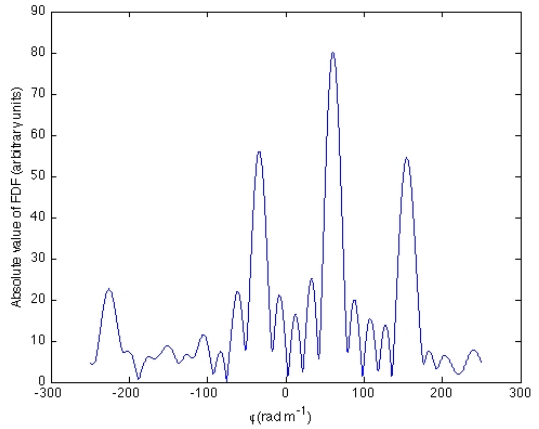


- Edge-on galaxy (Inclination ~89°)
- Known to have a huge radio halo
- Clear detection with LOFAR
- Halo detected
- Asymmetry known from other observations is also visible in LOFAR data
- Image limited by calibration / rms
  - ➔ No outer disc detected

First detection of polarized emission with LOFAR

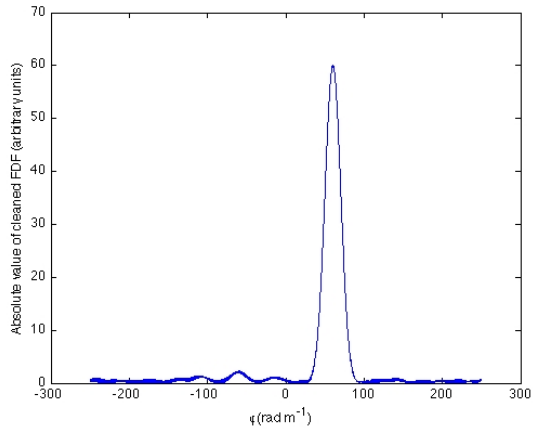
- Source: 2.3 ms pulsar PSRJ0218
- Peak flux: 100-200 mJy
- Polarization: ~40% at low frequencies
- 5 subbands with a total bandwidth of 1 MHz
  - ➔ Subbands at the lower end of band used due to lower RFI (~129 MHz)
- Form Q- and U-maps of the field and measure the flux of the pulsar at each frequency
  - ➔ Angle is wrong, but RM is right

Dirty RM-spectrum



Scaife, Heald, de Bruyn, Trasatti

RM-cleaned spectrum



Scaife, Heald, de Bruyn, Trasatti

Summary and Outlook

- Producing nice images with LOFAR is possible
- First science results (Detection of nearby galaxies, RMs etc.)
- Better automatic flagging routines are in progress
- Implementation of beam server these days
  - → Will enhance dynamic range by a factor of ~10
- MS^3-survey will provide calibrators (amplitude, phase, polarization)
  - → Large enhancement in dynamic range
  - → Calibration of extended polarized emission possible
- High number of channels will give very exact RMs
- Need for complete Data reduction pipeline (WIP)

Thank you for your attention !