

LOFAR

current status and observing opportunities

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Introduction

LOFAR (Low Frequency Array) is a distributed network of multipurpose sensors. It is composed mainly of a networked radio telescope operating between 15 and 250 MHz but also hosts geophysical and agricultural sensors. Designed and constructed by ASTRON (<http://www.astron.nl>), it has facilities in several countries, that are owned by various parties (each with their own funding sources), and that are collectively operated by the International LOFAR Telescope (ILT) foundation under a joint scientific policy.

The telescope is distributed in several stations: 24 core stations (6 of them located in a central compact area called "Superterp"), 14 remote Dutch stations and 8 international stations. Each station is composed of two sets of antennas: the Low Band Array (LBA) of antennas operating from 15 to 80 MHz, and the High Band Array (HBA) of antennas operating from 110 to 250 MHz. Each set of antennas can log raw data or work as a phased array. They can form one or many steering synthetic beams pointing to selected regions of the sky.

There are six key science projects:

- Epoch of Reionisation
- Deep extragalactic surveys
- Transient sources
- Ultra high energy cosmic rays
- Solar science and space weather
- Cosmic magnetism

Technical specifications

Frequency range: 15 - 80 MHz 110 - 250 MHz
Polarisations: 2
Bandwidth: 48 MHz
Stations: 18+6 core, 14 remote, 8 international
Baseline length: 100 m to 1500 km
Simultaneous digital beams: > 8 (configurable)
Spectral resolution: 0.76 kHz

Sensitivity

The nominal sensitivity depends on the frequency band, the integration time, the bandwidth, and the number and distribution of stations.

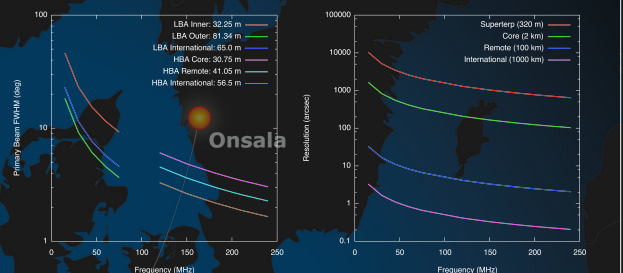
Sensitivity					
Freq. (MHz)	λ (m)	Superterp (mJy)	NL Core (mJy)	Full NL (mJy)	Full EU (mJy)
15	20.0	547.00	127.00	75.80	63.80
30	10.0	101.00	23.60	14.00	9.76
45	6.67	43.50	10.10	6.03	4.28
60	5.00	33.70	7.86	4.67	3.33
75	4.00	26.20	13.10	7.79	5.56
120	2.50	1.94	0.47	0.28	0.20
150	2.00	1.54	0.37	0.22	0.16
180	1.67	1.76	0.43	0.25	0.18
200	1.50	1.91	0.46	0.28	0.20
210	1.43	1.99	0.48	0.29	0.21
240	1.25	2.21	0.53	0.32	0.23

Theoretical LOFAR sensitivity for 1 hour integration time, an effective BW of 3.57 MHz, and dual polarization.

Resolution and Field of View

The field of view (primary beam) and resolution of each beam depend on the frequency band and the distribution of the stations used for the observation.

Resolution					
Freq. (MHz)	λ (m)	$L = 320$ m (arcsec)	$L = 2$ km (arcsec)	$L = 100$ km (arcsec)	$L = 1000$ km (arcsec)
15	20.0	1.031E+04	1.650E+03	3.300E-01	3.300E+00
30	10.0	5.157E+03	8.251E+02	1.650E-01	1.650E+00
45	6.67	3.438E+03	5.500E+02	1.100E-01	1.100E+00
60	5.00	2.578E+03	4.125E+02	8.251E-01	8.251E-01
75	4.00	2.063E+03	3.300E+02	6.600E-01	6.600E-01
120	2.50	1.289E+03	2.063E+02	4.125E-01	4.125E-01
150	2.00	1.031E+03	1.650E+02	3.300E-01	3.300E-01
180	1.67	8.594E+02	1.375E+02	2.750E-01	2.750E-01
200	1.50	7.735E+02	1.238E+02	2.475E-01	2.475E-01
210	1.43	7.367E+02	1.179E+02	2.357E-01	2.357E-01
240	1.25	6.446E+02	1.031E+02	2.063E-01	2.063E-01



Current status

LOFAR is currently in its commissioning phase. All the international and core stations and nine of the fourteen remote Dutch stations are operative.

- An all-sky survey denominated MSSS (Multifrequency Snapshot Sky Survey) is taking place. The goal of MSSS is to produce a model of the sky at low frequencies. This model will be used for the calibration of LOFAR images.
- A new computer cluster (called CEP-II) is in place to speed up the observing and data reduction processes.
- An automated data reduction pipeline is under construction, although currently the noise level this achieves is more than an order of magnitude above thermal noise.
- Individual observations with the international stations are possible but the data reduction process takes a significant additional amount of time.
- See also: <http://www.nature.com/news/radio-array-starts-work-1.9762>

Observing opportunities

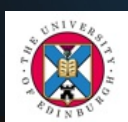
An open call for proposals will be announced early this summer (2012).



LOFAR station at Chilbolton, U.K. (Credit: STFC)

Further information

LOFAR - <http://www.lofar.org>
MSSS - <http://www.astron.nl/radio-observatory/lofar-msss/lofar-msss>
LOFAR-UK - <http://www.lofar-uk.org/>
Obs. props. - <http://www.astron.nl/radio-observatory/astronomers/asking-time/asking-time-0s>



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An electronic version of the poster can be found at: <http://www.iaa.es/~jsm/SEA2012/>

Credits: View of the Superterp core stations (upper background image) - ASTRON and Top-foto; Assen; distribution of LOFAR stations (lower background image) - ASTRON; tables and figures - ASTRON.

