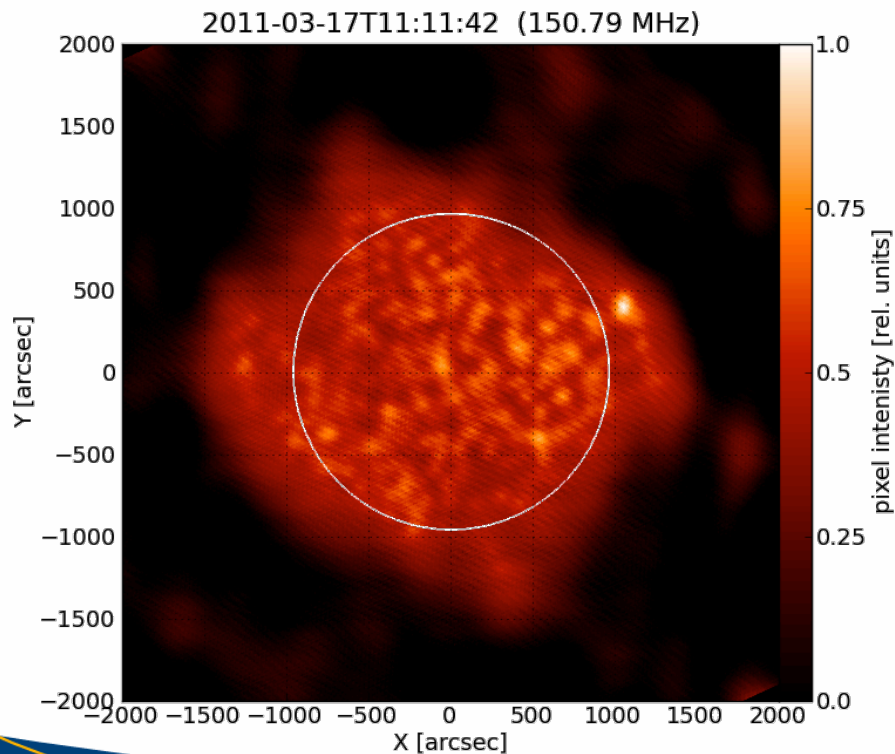


Status of the LOFAR KSP

Solar Physics and Space Weather with LOFAR

Gottfried Mann
Leibniz-Institut für Astrophysik Potsdam (AIP)
An der Sternwarte 16, D-14482 Potsdam, Germany
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LOFAR's first observation
of solar radio burst
(Type I burst) on March 17, 2011

KSP Workshops



1st workshop in Potsdam	Oct. 5/6, 2006
2nd workshop in Potsdam	June 24/25, 2009
3rd workshop in Potsdam	July 5/6, 2010
LOFAR splinter meeting in Graz	Sept. 14, 2010
4th workshop in Potsdam	Nov. 8/9, 2010
5th workshop in Aberysthwyth	June 28/30, 2011
LOFAR splinter meeting in Graz	June 5, 2012
6th workshop in Potsdam	June 28/29, 2012
7th workshop in Dublin	April 24-26, 2013
8th workshop in Dwingeloo	May 6-7, 2014
9th workshop in Brussels	May 26/27, 2015

http://www.aip.de/groups/osra/german/de_lofar.html



Management Structure



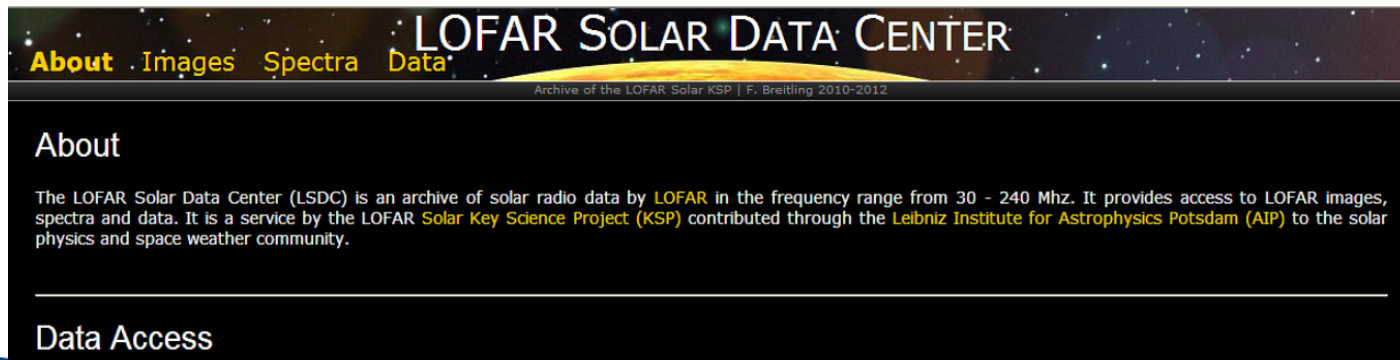
	Name	Affiliation	Country
PI	Prof. Dr. Gottfried Mann	AIP	Germany
core members	Dr. Mario Mark Bisi Dr. Richard Fallows Dr. Peter Gallagher Dr. Alain Kerdraon Dr. Alexander Konovalenko Dr. Jasmina Magdalenic Dr. Alec McKinnon Prof. Dr. Helmut Rucker Prof. Dr. Bo Thide Dr. Christian Vocks	Univ. Aberystwyth ASTRON Trinity College Dublin Obs. de Paris-Meudon Institute of Radio Astronomy Royal Obs. of Belgium Univ. Glasgow IWF Graz Univ. Uppsala AIP	UK Netherlands Ireland France Ukraine Belgium UK Austria Sweden Germany
(project manager)			
ordinary members	Dr. Jens Berdermann Frank Breitling Eoin Carley Dr. Harry Enke Dr. Norbert Jakowski Dr. Eduard Kontar Diana Morosan Dr. Jürgen Rendtel Dr. Hamish Reid Pietro Zucca	DLR Neustrelitz AIP Trinity College Dublin AIP DLR Neustrelitz Univ. Glasgow Trinity College Dublin AIP Univ. Glasgow Trinity College Dublin	Germany Germany Ireland Germany Germany UK Ireland Germany UK Ireland
associated memb.	Dr. Philippa Browning Dr. Bartosz Dabrowski Prof. Dr. Carsten Denker Dr. Lyndsay Fletcher Prof. Dr. Arnold Hanslmeier Dr. Matthias Hoefft Dr. Karl-Ludwig Klein Dr. Christophe Marqué Dr. Hanna Rothkaehl Dr. Astrid Veronig Dr. Alexander Warmuth	Univ. Manchester Royal Obs. of Belgium AIP Univ. Glasgow Univ. Graz Thür. LSW Tautenburg Obs. de Paris-Meudon Royal Obs. of Belgium SRC Warsaw Univ. Graz AIP	UK Belgium Germany UK Austria Germany France Belgium Poland Austria Germany

32 members
of
10 countries

Results of 2014/15



- development of the **solar imaging pipeline**
 - with self-calibration
 - with an external calibrator
- simultaneous **dynamic radio spectra** from imaging data
- studying of type III burst
- studying of the ionospheric influences
- submission of regular proposals (C 3 & 4) with 1 envelope sheets
- establishment of the **LOFAR Solar Data Center** (LSDC) at AIP: <http://lsdc.aip.de>



LOFAR SOLAR DATA CENTER

About Images Spectra Data

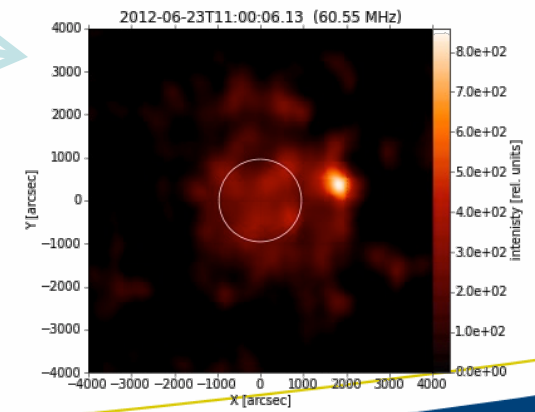
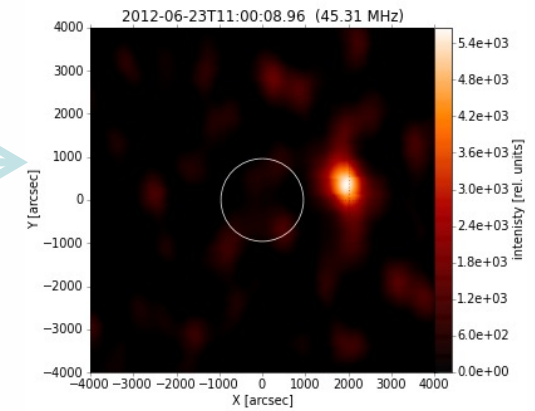
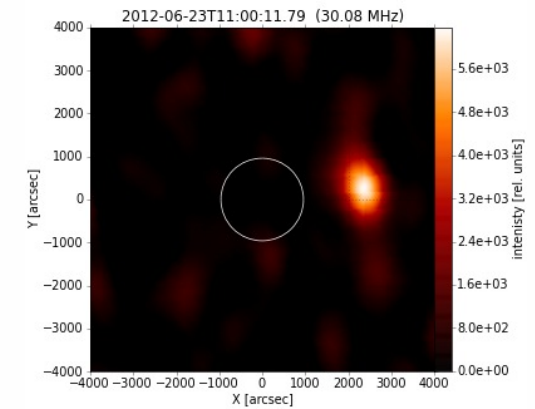
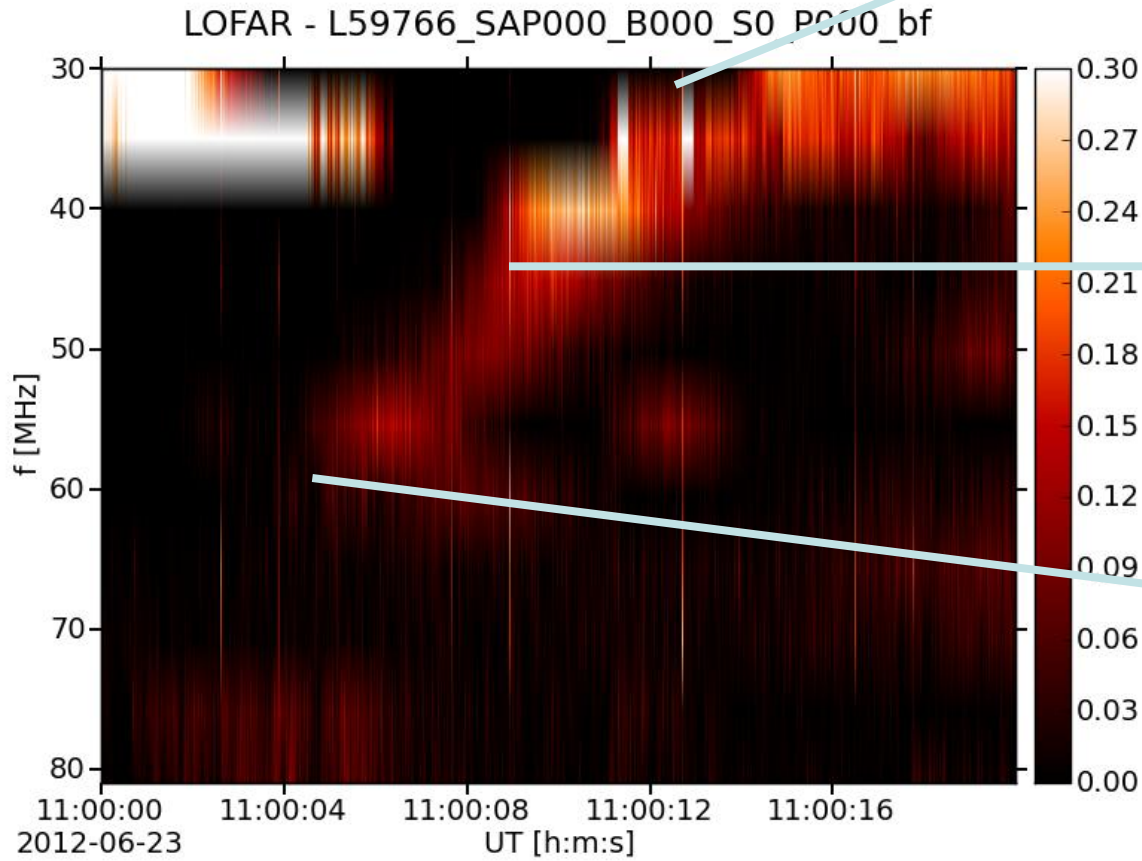
Archive of the LOFAR Solar KSP | F. Breitling 2010-2012

About

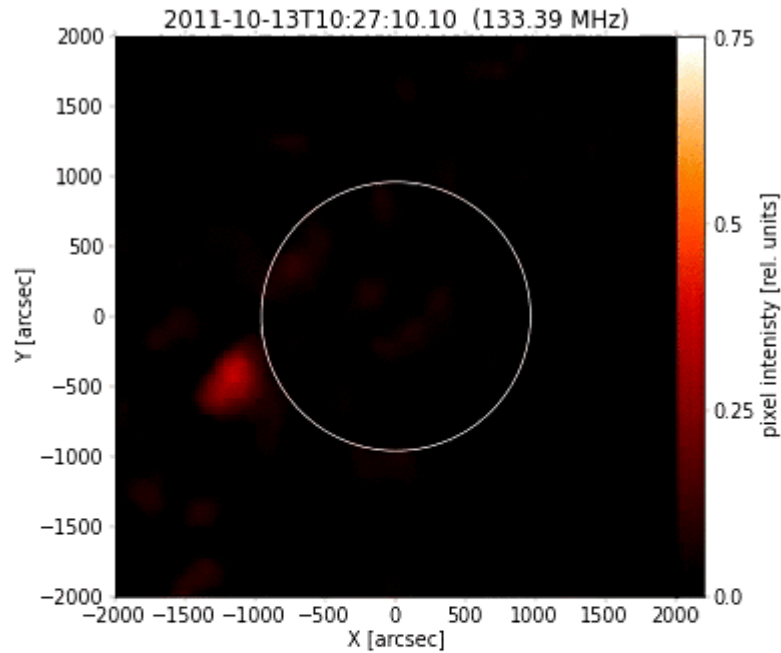
The LOFAR Solar Data Center (LSDC) is an archive of solar radio data by LOFAR in the frequency range from 30 - 240 Mhz. It provides access to LOFAR images, spectra and data. It is a service by the LOFAR Solar Key Science Project (KSP) contributed through the Leibniz Institute for Astrophysics Potsdam (AIP) to the solar physics and space weather community.

Data Access

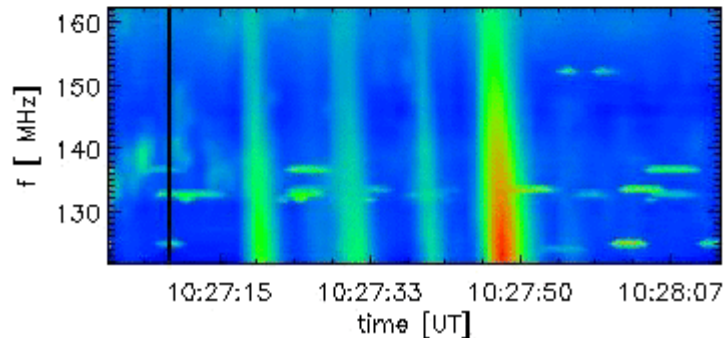
LOFAR – Dynamic Spectroscopic Imager of the Sun



Type III Bursts (HBA Range)



**LOFAR can really work as a
*dynamic spectroscopic
radio imager of the Sun.***



Cycle 3 & 4



Cycle 3:

LC3_002, PI R. Fallows, "Monitoring Ionospheric Scintillation above LOFAR",
1600 hours (piggy-back) requested, awarded time in gaps between regular
LOFAR observations

LC3_005: PI D. Morosan, "Imaging Coronal Mass Ejections with LOFAR", 0 hours

LC3_012: PI E. Kontar, "Quantitative diagnostics of electron beams in the solar corona",
20 hours

LC3_021, PI G. Mann, "Radio emission from coronal shock waves", 48 hours

Cycle 4:

LC4_001: PI C. Vocks, "Quiet Sun studies with LOFAR", 24 hours

LC4_002: PI G. Mann, "Radio emission from coronal shock waves and nascent CMEs",
24 hours

LC4_006: PI G. Mann, "Energetic electrons generated in solar flares", 17.5 hours

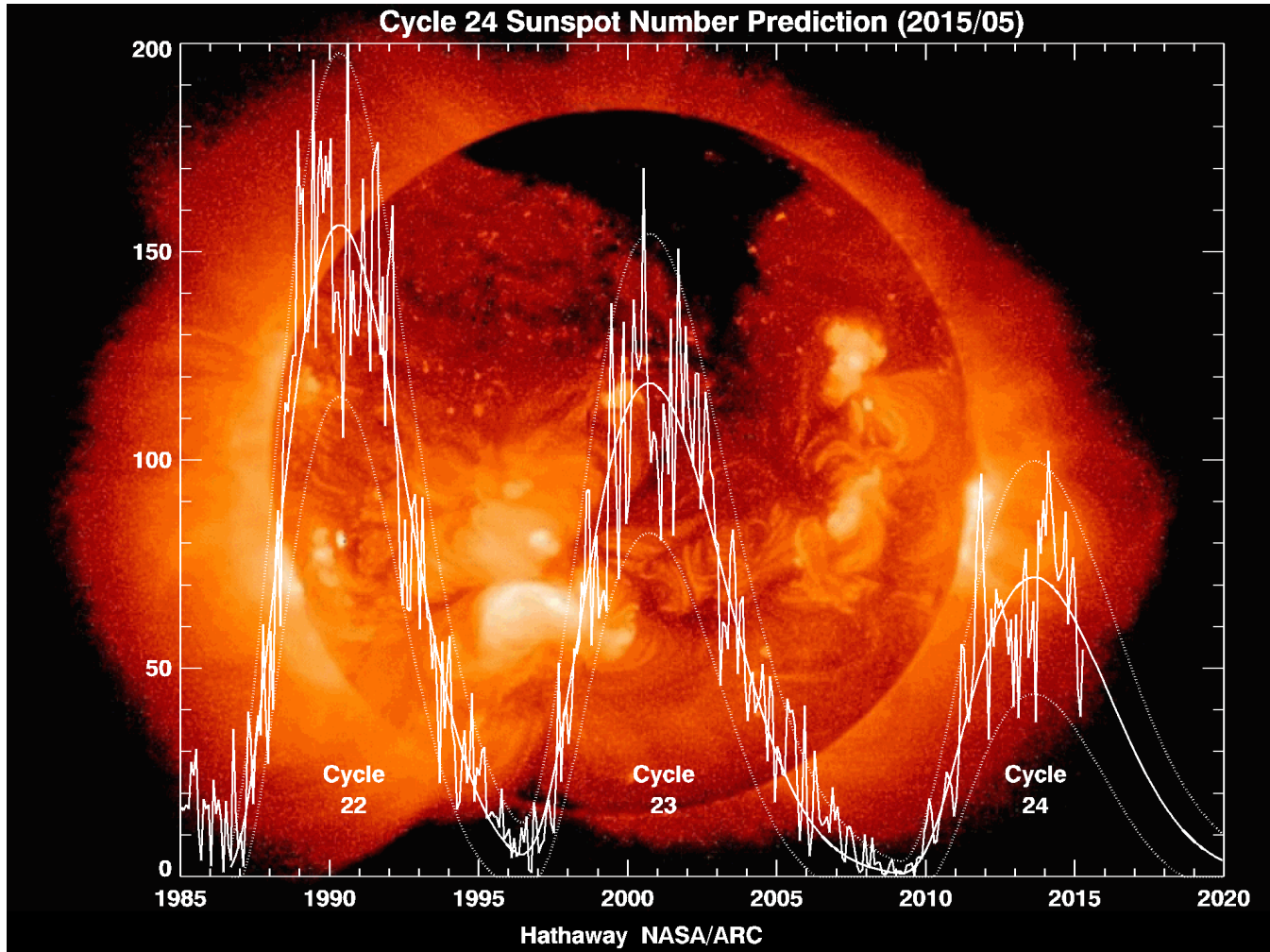
LC4_016: PI E. Kontar, "Fine structures in solar radio emission", 40 hours

Problems Which Should be Discussed



- LOFAR observations of the Sun
 - **The Sun is a special target !!!**
 - * regularly observations of the Sun by spacecraft Hinode, RHESSI, and SDO
 - * We must wait up to the Sun provides us an event, which we can scientifically study.
→ We ask for a long term proposal.
 - **external triggering** (→ solar activity)
 - * alert time to ASTRON (3 days or 1 hour) ???
 - * Could a single LOFAR station be used only for solar observations i.e. as a spectrometer ?
 - * potential triggers !!!
 - Would it be possible to record regularly an image of the Sun e.g. every minute ?

Solar Activity



Problems Which Should be Discussed



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Thank you for your attention!



This work was done
in collaboration
with the solar KSP and
LOFAR/ASTRON team

Allocation Time I



8740 h (365 x 24 h) are available per year

- further commissioning (33 %)
- maintenance (7 % = 612 h)
- director's discretionary time (5 % = 437 h)
- available for science (88 %)

for the first semester

- open skies access (5.5 %)
- NL reserved access (31.9 %)
- GLOW reserved access (9.35 % = 818 h) → 409 h per semester → 81 h per station
- France, Sweden, UK (2.75 %)

in reality: 48 h solar observations in the first semester

Allocation Time



in future

	NL	DE	PL	FR, IT, SE, UK each	Open Skies
Year 1	0.49	0.14	0.09	0.04	0.12
Year 2	0.44	0.13	0.08	0.04	0.19
Year 3	0.36	0.10	0.07	0.03	0.35
Year 4	0.27	0.08	0.05	0.02	0.52
Year 5	0.19	0.06	0.04	0.02	0.63

365 d x 24 h = 8760 h per year (4380 h per semester)

German time: DE

Potsdam time: DE/5

example: DE = 0.1 → 88 h per semester should be sponsored time for the solar KSP

Funding



- by German government:
 - D-LOFAR I + II
400 k€ for 2 x 3 years (Frank Breitling)
07/2009 - 06/2014
 - **D-LOFAR III**
230 k€ for 3 years (Frank Breitling)
07/2014 – 06/2017
- by Irish government:
 - Diana Morosan
 - Pietro Zucca
- by UK government:
 - Hamish Reid
- by AIP - operation costs:
 - ≈ 80 k€ for ASTRON
 - ≈ 35 k€ for costs
 - ≈ 15 k€ data link
 - ≈ **120 k€ in total per year**
- 1 staff position (Christian Vocks LOFAR scientist at AIP)

Cycle 0 & 1



Cycle 0:

LC0_027, PI G. Mann, "Solar activity studies with LOFAR", 72 h requested, 47 h awarded
LC0_030, PI G. Mann, "LOFAR studies of the evolution of coronal mass ejections in the heliosphere", 24 h requested, 24 h awarded

Cycle 1:

LC1_012, PI P. Gallagher, "LOFAR Imaging and Spectroscopy of Quiet Sun Variability", 24 h requested
LC1_022, PI G. Mann, "Energetic electron production in solar flares", 36 h requested
LC1_025, PI G. Mann, "Coronal mass ejections and type II radio bursts", 24 h requested
LC1_044, PI. J. Magdalenic, "Propagation of Electron Beams in the Solar Corona and Associated Type III Radio Emission as Seen by LOFAR", 36 h requested

Awarded time for LC1_022, LC1_025, and LC1_044 under one envelope sheet is 48 h

LC1_057, PI. R. Fallows, "Observing the Interplanetary Magnetic Field with LOFAR", 110 h requested, 39 h awarded

Cycle 2



Cycle 2:

LC2_001, PI R. Fallows, "Investigating Refraction Through the Solar Wind using Intensity and Phase Scintillation", 5 h

LC2_002, PI R. Fallows, "Probing a Coronal Mass Ejection with Scintillation Arcs", 12 h

LC2_003, PI R. Fallows, "Monitoring Ionospheric Scintillation above LOFAR",
1600 h (piggyback mode)

LC2_027, PI G. Mann, "Energetic electron propagation in solar flares", 14.5 h

LC2_028, PI G. Mann, "Solar coronal mass ejections", 35 h

LC2_031, PI C. Marque, "Solar noise storms in the decametric and metric range:
a study with LOFAR and the Nançay Radioheliograph", 22 h

LC2_033, PI J. Magdalenic, "Observations of solar type II radio bursts by LOFAR", 16 h

LC2_035, PI H. Reid, "The LOFAR Quiescent Sun", 16 h

total: 120.5 h (1600 h piggyback mode)