

### In this issue

- The LOFAR for Space Weather project
- LOFAR4SW Mid-Term Review
- User Workshop and User meeting during ESWW2019
- Upcoming events

### Find us

Visit our website:

<http://lofar4sw.eu/>

We are also on Twitter:

<https://twitter.com/lofar4sw>

If you have any questions or want to learn more about the Project, please contact us ([lofar4sw@cbk.waw.pl](mailto:lofar4sw@cbk.waw.pl)).

## Welcome to the 1<sup>st</sup> edition of the LOFAR4SW project newsletter

We are happy to present the first issue of the LOFAR for Space Weather (LOFAR4SW) project newsletter. In this edition you will find an introduction to the Project and a summary of the LOFAR4SW Mid Term Review which took place this September. In the upcoming events section you can find selected events where you can meet the Project participants and learn more about our activities.

### The LOFAR for Space Weather project

The LOFAR for Space Weather (LOFAR4SW) project addresses the Horizon 2020 Work Programme INFRADEV-1-2017 Call – ‘Design Studies’. The project will deliver the full conceptual and technical design for creating a new leading-edge European research facility for space weather science.

The term “space weather” refers to the conditions on the Sun and within the Solar System, emphasising the impact they have on Earth. This includes: direct powerful electromagnetic emission as a result of, for example, solar flares; the continuous, but highly variable, outflow of hot plasma known as the solar wind, which carries the Interplanetary Magnetic Field (IMF) through the heliosphere; and large ejections of solar material known as Coronal Mass Ejections (CMEs). These conditions drive processes in the Earth’s magnetosphere and ionosphere which can strongly affect many technologies upon which we now rely on, including satellite operations, telecommunications, the aviation industry, navigation systems, and power grids.

The LOFAR4SW project will engage with stakeholders in preparation for the facility that will produce unique research data with key impact on advanced predictions of space weather events affecting crucial technological infrastructures of today’s society. The key aspect of the project is the design of a significant upgrade of hardware, algorithms and software that maximally leverages the technology and infrastructure of the LOw Frequency ARray (LOFAR), the world’s foremost telescope for radio astronomy research in the low-frequency 10-240 MHz observing window, and a widely recognised enabler of technological innovation. The major goal of LOFAR4SW is to deliver the design of a large-scale, high-end research facility, in which simultaneous and independent signal modes and paths will be provided, with continuous access to the radio astronomy and space weather research communities.

Building on the technology and European coverage of the International LOFAR Telescope (ILT), a fully implemented LOFAR4SW system has the potential to enable a wide range of solar and space weather research topics with unique strengths in several high-impact science areas: tracing the initial launch of a CME; detailed tracking of the solar wind and CMEs through interplanetary space; and in-depth studies of micro-structure in the Earth’s ionosphere. The LOFAR4SW facility will aim to provide the data for transformational 3-dimensional tomographic data on velocities and densities that track space weather dynamics throughout space between the Sun and the Earth (the inner heliosphere).

The project is very timely. Cutting-edge low frequency radio observing technology has been advanced with LOFAR in recent years to the stage where a significant upgrade of the ILT can be now designed and constructed. This will immediately allow it to function as a major state-of-the-art observatory for space weather science. The LOFAR4SW project started in December 2017 and since then its conceptual and technical design has been developing at fast-pace.

## LOFAR4SW Mid-Term Review

The European Commission Mid-Term Review of the LOFAR4SW project was conducted on Tuesday 24th September 2019 in Brussels. The Work Package leaders presented the work that has been completed so far and summarised the Project progress.

The definition of the science cases was one of the aspects discussed at the meeting. An important component of the design study is the derivation of the science requirements from the science cases, and the verification that the designed system meets those requirements. The preliminary version of the LOFAR4SW design aims at allowing solar monitoring in imaging and dynamic spectrum, Faraday rotation measurements using observations of pulsars, Interplanetary Scintillation (IPS) monitoring and ionosphere monitoring using dynamic spectrum, and all-sky imaging.

The review also assessed the progress of hardware and software design. The main challenge in the hardware design is to prepare the LOFAR infrastructure to manage two separate data streams and to allow for pointing a second beam using the High Band Antennas (HBAs).

The EC Project Officer and External Reviewer were "impressed by the excellent science use cases, smooth management, and positive attitude within the project team".



The LOFAR4SW team during the Mid Term Review at the European Commission DG Research and Innovation building, 24<sup>th</sup> September 2019.

## User Workshop and User meeting during ESWW2019

The LOFAR4SW User Workshop will take place 13 - 14 May 2020 in Warsaw, Poland. The workshop will gather select project participants and key representative space-weather users from across the community for knowledge exchange, advertisement, and the development of future pathways to maximise the exploitation of products from a fully-implemented LOFAR4SW infrastructure based on the needs of the wider user community. The feedback collected from the Users during the workshop will help to set the final prioritisation of the designed project products and operational modes, taking into account the interest of the wider space weather community. More information can be found here :<http://lofar4sw.eu/wp/?p=461>.

In the meantime, many members of the Project team will be at the 16th European Space Weather Week (ESWW16) and we strongly encourage you, if you would like to have some discussion there, please come and talk to us.

We especially recommend visiting our poster during the poster session:

**"Lofar4SpaceWeather: Towards Space Weather Monitoring with Europe's Largest Radio Telescope: Status at Mid Term Review."**, Mevius, M et al.

## Upcoming events

- **16<sup>th</sup> European Space Weather Week**, Liège, Belgium, 18-22 November 2019
- **Interplanetary Scintillation Workshop**, Arecibo Observatory, Puerto Rico, 04-07 December 2019.
- **AGU Fall Meeting**, San Francisco, 9-13 December 2019
- **Space Weather Workshop**, Boulder, CO, 20-24 April 2020
- **EGU General Assembly 2020**, Vienna, Austria, 3-8 May 2020

If you are interested in the project and would like to help in its development, please take some time and complete the user's questionnaire:

[http://lofar4sw.eu/wp/?page\\_id=766](http://lofar4sw.eu/wp/?page_id=766)

Your valuable inputs and feedback will help us prioritise the designed project products and operational modes.



*LOFAR4SW has received funding from the European Community's Horizon 2020 Programme H2020-INFRADEV-2017-1 under grant agreement 777442.*