LOFAR ERIC
Activity Report
2025

LOFAR
ERIC

LOFAR Low-band antenna station in Netherlands ©ASTRON

PREFACE

We are delighted to present the second annual report of the LOFAR ERIC. The Low Frequency Array (LOFAR) European Research Infrastructure Consortium (ERIC), established by the European Commission in December 2023, is now in its third year of operation. It builds on the legacy of the International LOFAR Telescope Foundation, which inaugurated the world's largest and most sensitive low-frequency radio telescope for short and ultrashort radio waves in 2010. The array combines long international baselines, wide-field imaging, multi-beam capability, and exceptional sensitivity at low frequencies. These capabilities enable research across cosmology, large-scale sky surveys, pulsars and transients, cosmic rays, solar and heliospheric physics, and studies of the ionosphere and space weather. Through this infrastructure, LOFAR ERIC provides a sustainable, pan-European framework for cooperation in low-frequency radio astronomy.

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1. EXECUTIVE SUMMARY

In 2025, LOFAR ERIC consolidated its role as a mature European research infrastructure while advancing toward the LOFAR 2.0 era. Activities during the year focused on completing key elements of the upgrade, preparing the associated science programme, and strengthening the organisational and resource framework required for long-term sustainability.

Scientific efforts in 2025 centred on preparing for the implementation of the Large Research Programmes selected in response to the 2023 call. These programmes will be executed under the LOFAR 2.0 science programme from 2027 onwards. Support included observation planning, pipeline development, and coordination between scientific teams, operations, and computing partners. At the same time, open time access remains integral to the future programme, ensuring continued community engagement.

A major milestone was the rollout of the LOFAR 2.0 upgrade. By the end of 2025, 32 of the 38 Dutch stations had been successfully upgraded and handed over to operations. The remaining stations are scheduled for completion in early 2026. This upgrade will deliver enhanced sensitivity, imaging quality, and survey efficiency, forming the technical foundation for the next decade of LOFAR science.

Following the transition from the ILT Foundation to LOFAR ERIC in 2024, 2025 was characterised by organisational consolidation and forward planning. The Council and advisory bodies provided stable governance, with strong in-kind contributions from Members and operational support from ASTRON. Particular attention was given to identifying and coordinating the computing and data storage resources required to support the LOFAR 2.0 Large Programmes. These discussions helped align Members on shared priorities, long-term costs, and sustainable resource planning.

LOFAR ERIC's international footprint continued to expand. Community growth in 2025 included further engagement with partners in United Kingdom, Sweden, and the Czech Republic, and preparations advanced for new stations at Rozhen (Bulgaria) and Medicina (Italy). Scientific output increased, with LOFAR-related publications reaching more than 1,000 by the end of the year, underlining the infrastructure's scientific impact across astronomy and allied fields.

Community engagement remained strong. The LOFAR Family Meeting held in Paris demonstrated the vitality of the collaboration and supported coordination between scientists, engineers, and operations teams. From 2026 onwards, this event will continue as the LOFAR Annual Meeting, reflecting the transition to a stable, long-term research infrastructure.

Overall, 2025 marked a year of transition from upgrade deployment toward science delivery. With LOFAR 2.0 nearing completion in the Netherlands and preparations underway for international deployment, LOFAR ERIC is positioned for its next phase of operations. Continued focus on sustainable computing, coordinated investment, and efficient infrastructure use will be central to ensuring long-term scientific excellence and impact.

LOFAR ERIC Director
Dr. Michiel van Haarlem

2. INTRODUCTION TO LOFAR ERIC
2.1 Low frequency Array (LOFAR) ERIC

LOFAR (the Low Frequency Array) is a world-leading very-low-frequency, long-baseline radio interferometer, operating between 10 and 240 MHz. It integrates over 100,000 antennas distributed across 52 stations in eleven European countries, forming a highly sensitive and agile research infrastructure with planned future expansion. LOFAR's combination of continental-scale baselines, high sensitivity, wide field of view, multi-beam capability, and broad frequency coverage delivers unmatched angular resolution at low radio frequencies. No existing or planned facility currently combines this range of capabilities.

Overview of one of the LOFAR stations at the core of the radio telescope, in Exloo (NL)

By leveraging advanced digital beamforming, high-performance computing, and distributed European data infrastructures, LOFAR enables transformative science across a broad range of disciplines, including cosmology, large sky surveys, the formation of the first stars and galaxies, pulsars and transient phenomena, cosmic magnetism, ultra-high-energy cosmic rays, solar and heliospheric physics, and studies of the ionosphere, atmosphere, and space weather. It also attracts users from fields beyond astronomy.

As a unique, fully operational pan-European research infrastructure, LOFAR ERIC drives scientific discovery across multiple domains and strengthens Europe's leadership in radio astronomy. The infrastructure complements Europe's participation in the Square Kilometre Array, helping maintain European leadership in radio astronomy and ensuring continued access to advanced low-frequency capabilities.

LOFAR ERIC was established in January 2024 as a European Research Infrastructure Consortium (ERIC) under Regulation (EC) No 723/2009, as amended by Regulation (EU) No 1261/2013, with its statutory seat in Dwingeloo, the Netherlands. LOFAR ERIC builds on the achievements of the International LOFAR Telescope (ILT).

The transition from ILT to LOFAR ERIC reflected the growth in the number of participating countries and the need for a more sustainable governance model. As an ERIC, LOFAR gains a stronger legal foundation and a unified intergovernmental structure to implement a long-term strategy, secure stable funding, and coordinate development across the distributed infrastructure. This evolution preserves continuity while enhancing European visibility and supporting future expansion.

ASTRON (the Netherlands Institute for Radio Astronomy) plays a central role in the development and operation of LOFAR and in supporting its international governance through LOFAR ERIC. The institute founded the earlier ILT, which later evolved into LOFAR ERIC. ASTRON oversees the design, construction, operation, and technical evolution of the LOFAR infrastructure, including its central systems and data processing facilities in the Netherlands. ASTRON also hosts LOFAR ERIC and provides key organisational services that support its effective operation as a European research infrastructure.

2.2 LOFAR ERIC's Mission

LOFAR ERIC's primary objective is to maximise scientific use of the LOFAR infrastructure by supporting high-quality research, ongoing technical innovation, and coordinated science services for its members and the wider international community. To achieve this, LOFAR ERIC offers an efficient framework for joint operation, unified management, a shared long-term strategy, and common policies.

LOFAR ERIC promotes broad scientific use of LOFAR by enhancing its unique capabilities and facilitating access to data, services, and openly available archive products in accordance with peer-review and open-science principles. It advances infrastructure development, including the LOFAR2.0 upgrade programme. LOFAR ERIC fosters cross-disciplinary international collaboration and supports the growth of scientific and technical expertise in Europe. It also participates in European and national research programmes, expands partnerships and membership, and represents the consortium to national, European, and global stakeholders. These efforts strengthen Europe's leadership in low-frequency radio astronomy and support its strategic role in the SKA era.

3. LOFAR ERIC's STRUCTURE
3.1 Membership status

LOFAR ERIC commenced operations in 2024 with six founding Member Countries. In 2025, the consortium expanded significantly through the addition of three new countries, demonstrating the increasing interest in the LOFAR research infrastructure across Europe.

The LOFAR network spans Europe, forming a virtual radio telescope with a baseline of up to 2,000 km.

At the beginning of 2025, the Kingdom of Sweden and the United Kingdom were formally approved for membership. Later that year, the Czech Republic completed all procedures for full membership and was accepted as a Member Country. This steady expansion highlights the increasing engagement within the LOFAR ERIC community and provides a strong basis for continued collaboration and scientific progress.

Table 1. LOFAR ERIC Member countries (Status: February 2026)

Country	**Republic of Bulgaria**	**Czech Republic**	**Federal Republic of Germany**
Founding member	Yes	No	Yes
Member since	2024	2025	2024
Delegate	Kalin Mutavchiev *Science Directorate of the Ministry of Education and Science of Bulgaria*	Dr. Jan Buriánek *Ministry of Education, Youth and Sports*	Patrick Hartmann *Federal Ministry of Research, Technology and Space*
Scientific Delegate	Dr. Kamen Kozarev *Institute of Astronomy of the Bulgarian Academy of Sciences*	Dr. Miroslav Bárta *Astronomical Institute, Czech Academy of Sciences*	Prof. Dr. Matthias Hoeft *German Long Wavelength Consortium (GLOW; LOFAR consortium)*

Country	**Ireland**	**Italian Republic**	**Kingdom of the Netherlands**
Founding member	Yes	Yes	Yes
Member since	2024	2024	2024
Delegate	Peter Healy / Lola Hourihane *Department of Further and Higher Education, Research, Innovation and Science*	Dr. Cecilia Di Carlo *Ministry of University and Research*	Dr. Peter Spijker *NWO-I, Foundation for Dutch Scientific Research Institutes*
Scientific Delegate	Prof. Aaron Golden *University of Galway*	Dr. Gianfranco Brunetti *LOFAR-IT*	Dr. Jessica Dempsey *ASTRON, Netherlands Institute for Radio Astronomy*

Country	**Republic of Poland**	**Kingdom of Sweden**	**United Kingdom**
Founding member	Yes	No	No
Member since	2024	2025	2025
Delegate	Dr. Dariusz Drewniak *Ministry of Science and Higher Education*	Dr. Daniel Snitting *Swedish Research Council*	Jessica Atkinson *UK Research & Innovation Council*
Scientific Delegate	Prof. Dr. Andrzej Krankowski *POLFAR (LOFAR consortium)*	Dr. John Conway *Onsala Space Observatory & LOFAR-Sweden Consortium*	Prof. Dr. Martin Hardcastle *LOFAR-UK (LOFAR Consortium)*

LOFAR ERIC works together with Collaborating Organisations that eventually are expected to apply for membership. From the outset, the French Republic and the Republic of Latvia have been valued collaborators and have shown continued commitment to LOFAR ERIC's efforts.

Table 2. LOFAR ERIC Collaborating Organisations (Status: December 2025)

Country	**French Republic**	**Republic of Latvia**
Collaborator since	2024	2024
Delegates	Dr. Chiara Ferrari *Centre National de la Recherche Scientifique (CNRS-INSU)* Dr. Michel Tagger *FLOW (LOFAR Consortium)*	Märcis Donerblics *Ventspils International Radio Astronomy Centre (VIRAC/ VUAS) & LOFAR-LV (LOFAR Consortium)*

Each Member and Collaborating Organisation hosts one or more LOFAR stations that form part of the International LOFAR Telescope or has agreed to host a station in the coming years. This includes Bulgaria and Italy, whose stations are expected to be completed in 2026. Each Member Country contributes a fixed annual amount per station, set by the Council. These contributions may be provided partially in kind, typically through personnel or by offering compute and data storage resources.

3.2 Governance

LOFAR ERIC is governed by the Council, its highest decision-making body, which is responsible for the organisation's strategic direction, governance, and oversight. As defined in the LOFAR ERIC Statutes and governance framework, the Council sets long-term scientific and technical priorities, approves policies, access frameworks, and the annual budget, and ensures the sustainable development of the research infrastructure. It appoints and supervises the Executive Director, monitors organisational performance, and decides on matters related to membership, partnerships, and major institutional developments.

LOFAR ERIC Members are represented on the Council by up to two delegates, while Collaborating Organisations may appoint up to two non-voting representatives. The Council elects a Chair and Vice-Chair for a two-year term, renewable twice. Both the Chair and Vice-Chair act impartially and do not represent national positions in the Council's deliberations. The current Chair is Prof. Dr. Peter Gallagher from Ireland, supported by the Vice-Chair Dr. Gianfranco Brunetti from Italy. The director of the hosting Institute of LOFAR ERIC has a standing invitation to attend Council meetings in an advisory role. The LOFAR ERIC Council is further supported by two advisory committees, responsible for financial and scientific-technical matters, whose members are appointed by the Council on the recommendation of Members and Collaborating Organisations. A Scientific Advisory Committee is also foreseen for future implementation. A Programme Committee further supports the Council and Executive Director by advising on the planning and coordination of LOFAR ERIC's scientific programme.

<u>Council Meetings</u>
After the transition from the ILT Foundation to LOFAR ERIC in 2024, 2025 was a year of consolidation. In 2025, the Council maintained an active meeting schedule, convening four times: online on 26 March and 3 June, followed by in-person sessions on 24 September during the Annual Meeting in Paris and on 24 November in The Hague. The Finance Committee complemented this work with five online meetings on 25 February, 14 May, 22 July, 5 September, and 30 October,

ensuring continuous attention to budgetary and financial matters. The Scientific and Technical Committee also met five times over the year, including an extended session, gathering on 25 February, 7 and 13 May, 3 July, 2 September, and 19 November to address scientific priorities and technical developments.

<u>Highlights of Council Activities</u>

Membership expansion

A major focus of the Council's work in 2025 was the expansion of LOFAR ERIC's membership. At the March meeting, the Kingdom of Sweden and the United Kingdrom were unanimously approved as full Members. At the September meeting, the Czech Republic's request for full membership was also endorsed by consent. The accession of these three countries significantly broadened the consortium and demonstrated the continued European interest in strengthening collaboration through LOFAR ERIC.

Leadership transition

At the June Council meeting, the Chair, Jacqueline Mout-Leurs (Netherlands), announced that she would not stand for re-election at the end of her term in December 2025. During its final meeting in November 2025, the Council elected Prof. Dr. Peter Gallagher (Ireland) as the new Chair, marking a smooth transition in leadership. Prof. Gallagher is Head of Astrophysics and Director of Dunsink Observatory at the Dublin Institute for Advanced Studies (DIAS). He was also Head of I-LOFAR, the Irish station of the LOFAR network located at Birr Castle, County Offaly, which he has led since its establishment.

User Representation and Committee Integration

LOFAR ERIC inherited the LOFAR User Committee (LUC) from the ILT. LUC had represented the scientific user community and provided coordinated input on scientific priorities and operational matters. In June, the Council decided to dissolve the LUC and integrate its functions into the remit of the Scientific and Technical Committee.

LOFAR 2.0 Upgrade

The Council spent considerable time discussing the financial and programme challenges of the LOFAR 2.0 upgrade. A key issue is securing computing and data storage resources for the LOFAR 2.0 Large Programmes. To address this, the Council established a Task Force at its September meeting, together with the Executive Director.

Adjustment of membership fee

Following discussion during the September Council meeting, the Council agreed in November to introduce a 4% increase to the membership contribution for 2026. The adjustment was considered necessary to address rising operational costs, including inflation, particularly in the Netherlands, and to ensure continued financial sustainability. The Council subsequently approved the 2026 operations budget.

Adoption of a document classification policy

During LOFAR ERIC's first full year of operations, the need for a more formal approach to document management became evident. At the November meeting, the Council reached consensus on the proposed approach and approved a document classification policy to support consistent and secure information handling.

New Council meeting structure
In 2025, the Council met four times, while the Financial Committee and the STC convened more than ten times combined. Recognising the administrative workload created by this frequency, the Council agreed in November to adopt a more sustainable meeting structure from 2026 onward. Under the new approach, two formal Council meetings will be complemented by interim Committee of Council meetings that provide space for discussion without the procedural requirements of formal sessions dictated by the LOFAR ERIC Statutes.

Renaming the annual meeting
At its November meeting, the Council agreed to rename the "LOFAR Family Meeting" to the "LOFAR Annual Meeting" to better reflect the event's purpose and audience.

3.3 Management

LOFAR ERIC is governed by the Council and supported by the Financial, Scientific and Technical, and Programme Committees. The Director and Office team are responsible for administrative, operational, and preparatory tasks. The Office is small, comprising the Executive Director, Finance Officer, Policy Officer (since late 2025), and support staff. Most operational coordination and scientific exploitation capacity is provided in-kind by ASTRON, the Netherlands Institute for Radio Astronomy.

3.4 Data Infrastructure

Data from LOFAR antennas are transmitted to the central processing facility in Groningen (the Netherlands) via high-capacity national and international fibre networks. In 2025, Dutch LOFAR operations were in offline mode, while a limited number of international stations continued stand-alone observations.

Real-time processing, including correlation of data streams, is carried out at the central facility. The resulting data are transferred to offline processing systems, where standard pipelines are applied, including flagging of radio-frequency interference, averaging, calibration, self-calibration, and imaging. Processed data are archived and distributed via partner data centres in Amsterdam (the Netherlands), Jülich (Germany), and Poznań (Poland).

Following the transition to LOFAR ERIC in 2024, 2025 focused on consolidation and forward planning. Particular attention was given to the computing and data storage requirements for the LOFAR 2.0 upgrade and its Large Programmes, which are due to start in 2027. To address these challenges, the Council established a Task Force at its September meeting, together with the Executive Director, and work continues towards a sustainable data and computing infrastructure.

Table 3. LOFAR ERIC Governance Overview (Status: December 2025)

Leadership	
Prof. Peter Gallagher	Chair
Dr. Gianfranco Brunetti	Vice-Chair
Executive Team	
Dr. Michiel van Haarlem	Director
Janneke Wubs	Finance Officer
Dr. Claudia-Corina Giese	Policy Officer
Simone Kajuiter	Office Support staff
Finance Committee	
Dr. Kamen Kozarev	Institute of Astronomy of the Bulgarian Academy of Sciences
Dr. Pavel Jáchym	Astronomical Institute, Czech Academy of Sciences
Prof. Dr. Dominik Schwarz; Chair	Bielefeld University & German Long Wavelength Consortium
Lola Hourihane	Department of Further and Higher Education, Research, Innovation and Science
Dr. Cecilia Di Carlo	Ministry of Education, University and Research
Yvonne Roghair	NWO-I, Foundation for Dutch Scientific Research Institutes
Chris Prins	ASTRON, Netherlands Institute for Radio Astronomy
Dr. Dariusz Drewniak	Ministry of Science and Higher Education
Prof. Dr. John Conway	Onsala Space Observatory & LOFAR-Sweden Consortium
Laura Green	STFC-UKRI (UK Research & Innovation Council)
Scientific and Technical Committee	
Prof. Dr. Antoneta Antonova	Institute of Astronomy of the Bulgarian Academy of Sciences
Prof. Dr. Anna Nelles	Friedrich-Alexander University of Erlangen-Nuremberg
Dr. Evan Keane	Trinity College Dublin
Dr. Francesco De Gasperin	Istituto Nazionale di Astrofisica Istituto di Radioastronomia
Dr. Harish Vedantham	ASTRON, Netherlands Institute for Radio Astronomy
André Gunst	ASTRON, Netherlands Institute for Radio Astronomy
Dr. John Swinbank	ASTRON, Netherlands Institute for Radio Astronomy
Dr. Roberto Pizzo	ASTRON, Netherlands Institute for Radio Astronomy
Dr. Reinout van Weeren; Chair	Leiden University
Prof. Dr. Hanna Rothkaehl	Space Research Center of the Polish Academy of Sciences
Dr. Tobia Carozzi	Onsala Space Observatory/Chalmers University of Technology
Prof. Dr. Leah Morabito	University of Durham
Dr. Philippe Zarka	Observatoire de Paris, CNRS-INSU

4. SCIENTIFIC OPERATIONS AND USER PROGRAMS

4.1. Observing status and telescope capabilities

In August 2024, LOFAR 1.0 was formally shut down, marking the end of more than a decade of scientific observations in low-frequency radio astronomy its data processing. The transition to LOFAR 2.0 represents a major step forward. The upgrade will provide a tenfold increase in computing power at each station, continuous access to all antenna data, a doubled field of view for more efficient surveys, nanosecond-level antenna synchronisation, improved filtering, and significantly enhanced imaging capabilities. These advances will substantially strengthen LOFAR's sensitivity, accuracy, and overall scientific performance. In 2025, LOFAR ERIC and ASTRON continued preparations for the upgrade, advancing both the station work and the related governance adjustments to ensure a smooth transition and support the successful rollout of LOFAR 2.0.

LOFAR 2.0 is expected to enter operation by the end of 2026. Until then, scientific activity focuses on the standalone use of remaining capabilities, continued analysis of existing data, and further development within LOFAR ERIC. The transition to LOFAR 2.0 is supported by sustained activity across the consortium. The following highlights illustrate how Member Countries and Collaborating Organisations contributed to this progress throughout the year.

Bulgaria

Aerial view of future side of Bulgarian LOFAR station © LOFAR-BG

In 2025, the LOFAR-BG project advanced the establishment of the Bulgarian LOFAR station within the European LOFAR ERIC research infrastructure. Efforts centred on preparing the physical site and enhancing scientific capacity.

Following initial terrain levelling, geodetic measurements confirmed the station site's suitability for antenna installation. At the National Astronomical Observatory Rozhen, technical infrastructure, including dedicated servers, control systems, and UPS-protected power equipment, was installed and tested to ensure reliable long-term operation.

Coordination with LOFAR ERIC and ASTRON supported the technical integration of LOFAR-BG into the upcoming LOFAR2.0 system. This included ongoing development of new high-band antenna electronics (DANTE HBA), which are essential for next-generation LOFAR observations.

Alongside technical progress, scientific activities increased. Bulgarian research teams participated in international LOFAR meetings, advanced solar radio burst analysis using interferometric techniques, developed automated detection methods with computer vision and machine learning, and prepared papers for peer-reviewed journals.

Education and public engagement were enhanced through student internships, doctoral training, public lectures, and expanded international research collaborations.

Czechia

Czechia joined LOFAR ERIC at the Council meeting in Paris on 24 September 2025. In the months that followed, the Czech research community focused on building a national LOFAR network and exploring potential sites for the future Czech LOFAR station.

To raise awareness and introduce LOFAR to a wider audience, introductory seminars were held at Charles University in Prague and Masaryk University in Brno. Information about the LOFAR Large Programmes was shared within the community to identify possible Czech co-investigators. Additional institutions across the country were also contacted to ensure that the emerging Czech LOFAR consortium becomes broad, inclusive, and representative.

Preparations began for a Czech LOFAR community kick-off meeting to be held in early spring 2026. At the same time, the team submitted a major funding proposal in December 2025 to secure long-term support for the Czech Large Research Infrastructure for 2027–2035, including all anticipated LOFAR-related operational costs. Recruitment activities were also launched to strengthen national expertise by hiring LOFAR-oriented specialists.

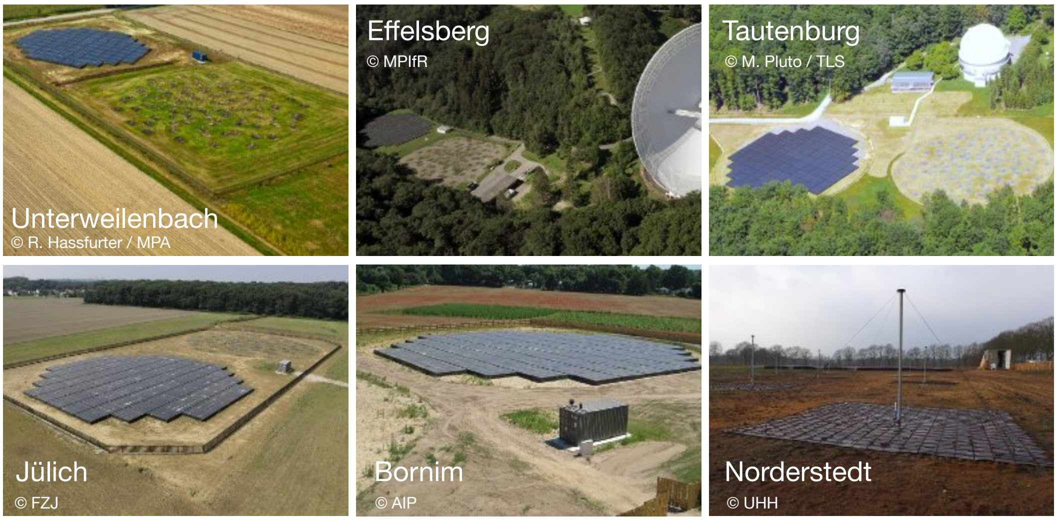
Throughout this period, Czech representatives participated actively in LOFAR ERIC meetings and activities, including DANTE as observers. Discussions with partners on possible locations for the Czech LOFAR station were initiated and will continue into 2026.

United Kingdom

The LOFAR station at Chilbolton has been making semi-automated observations of interplanetary scintillation (IPS) and the ionosphere for space weather science and forecasting demonstration 24/7 since February 2025. Observations consist of ~100 IPS measurements to probe the solar wind and Coronal Mass Ejections (CMEs) throughout the inner heliosphere, feeding into space weather modelling and forecasting activities, and overnight observations of ionospheric scintillation, including all-sky imaging using the LBAs. This has encompassed periods of high solar and space weather activity, with fast-moving CMEs impacting our magnetosphere and ionosphere, resulting in disruption to communication and satellite systems and some spectacular aurora seen across Europe. 24/7 monitoring using the UK station has enabled us to observe the CMEs and solar wind associated with these events, along with their ionospheric impact, providing valuable data to feed into space weather modelling and forecasting efforts.

UK scientists continue to make significant contributions to LOFAR science results, including carrying out the bulk of the data processing for the recent LoTSS DR3 release (Shimwell et al 2026), generating the largest ever samples of radio-selected active galaxies (Hardcastle et al 2025), and making use of the international baselines to separate active galaxy and star-formation activity (Morabito et al 2025).

Germany



LOFAR Station in Tautenburg -with the new SolarLab under construction on the left, enabling future combined optical and radio observations of the Sun. ©GLOW

Germany has a large LOFAR community conducting a wide range of scientific research. This resulted in many publications in 2025. The research includes studies of solar outbursts, radio showers caused by cosmic ray particles entering Earth's atmosphere, and time-variable sources such as pulsars. Other topics use LOFAR's excellent imaging capabilities, including studies of galaxies and galaxy clusters, cosmology, and the epoch of the first galaxies in the Universe. Germany operates six LOFAR stations and contributes significantly to the LOFAR Long-Term Archive with storage at FZJ. It also supports data processing on the JUWELS supercomputer and software development through the federal ErUM-pro programme. Ten German institutes participate in LOFAR under the German Long Wavelength (GLOW) Consortium. Although there were no integrated LOFAR observations in 2025, the six German stations operated continuously in stand-alone mode. These activities are coordinated with international LOFAR partners. The stand-alone observations were used for regular pulsar monitoring and experimental projects. These included searching for radio flashes from the Moon caused by cosmic ray hits and meteor impacts, studying interplanetary scintillation using the Crab pulsar and Jupiter during a close conjunction with the Sun, refracting Jupiter signals in the solar corona, and observing radar scatter from ionospheric aurorae and the re-entry of Kosmos 482, a descent craft from the Venera programme launched in 1972. Furthermore, 'LOFAR-live' was presented to the general public at the German 'Highlights of Physics' event.

Within the LOFAR ERIC, Germany holds the position of Financial Committee Chair and Science and Technology Committee Vice-Chair.

At the annual assembly of radio astronomers in Germany in 2025, many highlights of research based on LOFAR data were presented at the Haus der Astronomie in Heidelberg. These included findings on magnetic structures in the solar corona and new results using LOFAR Low Band data.

Ireland

Drone image of the I-LOFAR station (IE613) taken on the grounds of Birr Castle, Birr, County Offaly during a student training meeting in the summer of 2025 © S. Susarla/O. Johnson/ I-LOFAR

The LOFAR community regularly and actively used station IE613. Daily observations of the Sun were conducted, and nightly observations focused on transient sources. This included long-term monitoring programmes for several pulsars, supporting the European Pulsar Timing Array. It also involved paired observations with station SE607 in Sweden to search for technosignatures as part of the LOFTS project, funded by Breakthrough Listen. In addition, the team conducted target-of-opportunity observations of fast radio bursts and continued work on characterising the station's sensitivity.

The student internship programme continued into its sixth year in 2025 and provided valuable training opportunities for undergraduate and graduate students from across the I-LOFAR consortium. The station remains an important pathfinder facility for Ireland's ongoing engagement with international radio astronomy initiatives. Researchers trained within I-LOFAR contributed significantly to the 2025 update of the SKAO science case. The SKA Ireland team, a working group of the Astronomical Society of Ireland that includes active members of the I-LOFAR community, hosted a breakout meeting at the 2025 EAS meeting in Cork. The event explored Ireland's role in SKAO activities with SKAO colleagues, representatives of the Irish astronomy community, and public officials. It was well attended by participants from across all career stages, including the incoming Director General of the SKAO, Dr Jessica Dempsey, who assumes office in June 2026.

Italy

Italy actively participated in all meetings of the LOFAR ERIC Council (with one Italian representative as Vice-Chair), the Financial Committee, and the LOFAR Scientific and Technical Committee. Italy also participated in Council working groups supporting the ERIC Director's programme.

After contributing to the ERIC for acquiring LOFAR 2.0 station hardware and the DANTE program, INAF amended the contract with ASTROTec in 2025 to deploy the LOFAR 2.0 station at the Medicina (BO) radio astronomy station. Ground preparations began the same year. Installation is scheduled for the second half of 2026. In 2025, INAF strengthened its role in DANTE through second-beam design activities. At the end of 2025, INAF and ASTRON were tasked with exploring solutions for second-beam functionality, including radio-over-fibre (RoF) signal transport.

The Italian scientific community has strongly contributed to LOFAR data analysis and interpretation. In 2025, the Italian community, one of the largest within LOFAR, contributed to about 60 scientific papers, coordinating around 20 of them.

In addition, INAF has made the Pleiadi HPC cluster at IRA-INAF in Bologna available to the collaboration. This enabled analysis of the entire LBA survey (LoLSS) and supported LoTSS DR3 data analysis. The Italian community participated extensively in proposals for Large Programs for LOFAR 2.0.

Starting in 2025, INAF has ensured adequate computing and storage capacity for LOFAR 2.0 and helped define programme-wide requirements.

Netherlands

Satellite image of the Dutch LOFAR station ©European Union, Copernicus Sentinel

In 2025, ASTRON's Astronomy & Operations experienced an exceptionally busy year, driven by the national rollout and commissioning of LOFAR2.0, including large-scale testing at Dutch stations. Parallel HBA and LBA observations, along with major pipeline and data model developments, ensured readiness for full operations.

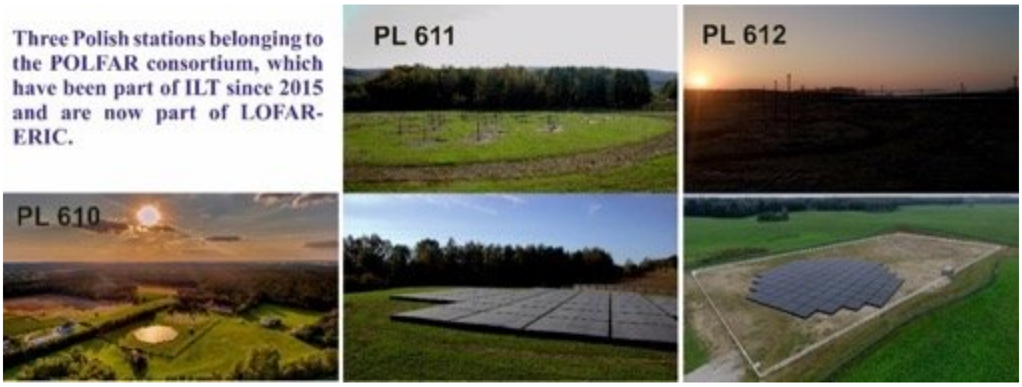
A major strategic development was the award of the LENSS grant (NWO). LENSS accelerates data processing, strengthens VLBI pipelines, and automates workflows from acquisition to calibration delivery. This investment enhances ASTRON's ability to manage growing LOFAR2.0 and VLBI data volumes, improving reliability, scalability, and user accessibility.

In parallel, ASTRON groups delivered high-impact scientific results. A key highlight was the Nature publication by Callingham et al. (2025), reporting the first clear detection of a giant stellar eruption beyond the Solar System, comparable to a coronal mass ejection. This result demonstrates the detectability of extreme stellar outbursts at low radio frequencies and constrains their impact on planetary systems and habitability.

Another breakthrough by Bloot et al. (2025) revealed an unusual long-period radio transient with polarised bursts and choreographed pulses, providing evidence for a white dwarf–normal star binary and defining a new transient class.

Survey science through LoTSS remained impactful. Data Release 3 (2026) expanded sky coverage and depth at 144 MHz, enabling studies from galaxy evolution to large-scale structure. Additionally, Rijkers et al. (2025) recovered 80 pulsars, improving flux measurements and search criteria.

Poland



Polish LOFAR stations ©POLFAR

In 2025, the POLFAR consortium celebrated the 10th anniversary of the participation in the ILT/LOFAR ERIC framework. As part of the review of the Polish Roadmap for Research Infrastructures, the Minister of Science and Higher Education decided on November 7, 2025, to retain "POLFAR – Poland's contribution to the LOFAR-ERIC collaboration" on the current list. Poland actively participated in all meetings of the LOFAR ERIC Council , the Financial Committee and the LOFAR Scientific and Technical Committee

12 scientific institutions are involved in the POLFAR consortium. The year 2025 was an intensive period of stand-alone operations for the three Polish LOFAR stations: PL610, PL611 and PL612. POLFAR members extensively used these stations for 1) pulsar observations, 2) advanced solar radio burst analysis using interferometric techniques and IPS observations 3) monitoring of the ionosphere for space weather science and other activities 4) other non-astronomical applications, such as passive radar sensing. A large part of those activities is conducted with international LOFAR partners. In 2025 POLFAR members contributed to about 30 scientific papers with international authors.

The PCSS LOFAR LTA storage has been expanded (preparing for LOFAR2.0), which should enable flexible data processing. In addition, PCSS has made the Eagle II and Proxima supercomputers available to the POLFAR consortium for the purpose of performing LOFAR computations.

Sweden

Aerial picture of SE607 from 2025 ©Swedish LOFAR

The year 2025 was an intensive period of stand-alone operations for the Swedish LOFAR station SE607. This followed the end of the International LOFAR1.0 Telescope (ILT) mode and the emergence of a grassroots European initiative to coordinate single-station science, in which SE607 played an integral role. The result was several cross-station collaborations that leveraged the stations' geographic distribution and diverse local infrastructure.

EXOPLANET & TECHNOSIGNATURE CAMPAIGNS.
SE607 conducted joint observations with the Irish station IE613 in support of TESS targets and continued its campaign with Breakthrough Listen (Berkeley), with both stations simultaneously observing exoplanets. This dual-station setup enabled robust rejection of terrestrial radio-frequency interference (RFI), improving sensitivity to genuine technosignatures (Johnson et al. 2023).

BEAM MODELLING AND CALIBRATION.
Through extended observations, SE607 contributed to characterising LBA and HBA station beams. These were incorporated into the dreamBeam software, improving Jones-matrix beam models. European pulsar groups use these models to enhance polarisation calibration and pulse-profile fidelity.

SPACE-WEATHER AND IONOSPHERIC STUDIES.
Time on the GMRT enabled coordinated observations of the Crab pulsar during its solar occultation in summer 2025, aiming at Faraday tomography of CMEs. In parallel, SE607 supported ionospheric research via satellite-to-topside sounder transmissions, advancing understanding of low-frequency propagation and the potential of LOFAR as a space-weather monitoring platform.

France

Aeriel picture of French LOFAR station ©French LOFAR

The national LOFAR effort is closely aligned with the integration of NenuFAR as a high-sensitivity stand-alone array and its future connection to the ILT. To support this objective, three coordinated R&D activities are underway to address key technical aspects of the NenuFAR–ILT future usage.

The CAMELEON project is developing a new phasing system for the analogue dual-beamforming of the NenuFAR mini-arrays. This modernises the current architecture and enables two independent analogue beams, enabling fully simultaneous, conflict-free operation in local and ILT modes. In parallel, signal-transport solutions are being explored: i) « RF-over-Fibre » approach with ASTRON and a FM multiplexing solution « DualBeam FM » to channel two beams onto a single RF cable using frequency transposition. These developments optimise observation time and support efficient integration with the ILT.

Observing time at station FR606 is allocated through regular calls and TAC, with local programmes representing most observations. Operationally, NenuFAR continues to demonstrate strong scientific performance. The NenuFAR core is now complete with 96 mini-arrays and four (out of 8) remote mini-arrays. and the instrument is operating reliably in production (Cycle 7 ongoing; Cycle 8 starting June 2026). Commissioning of the LSS observing mode is underway, and NenuFAR contributed 13% of talks at SALF-XI.

4.2. User Access and the Programme Committee

LOFAR ERIC offers access to the international scientific community through competitive proposal calls that prioritise scientific excellence and Open Science. The independent Programme Committee oversees peer review and allocation of observing time, computing, and data resources for both Short and Large Programmes, ensuring a balanced and impactful science portfolio.

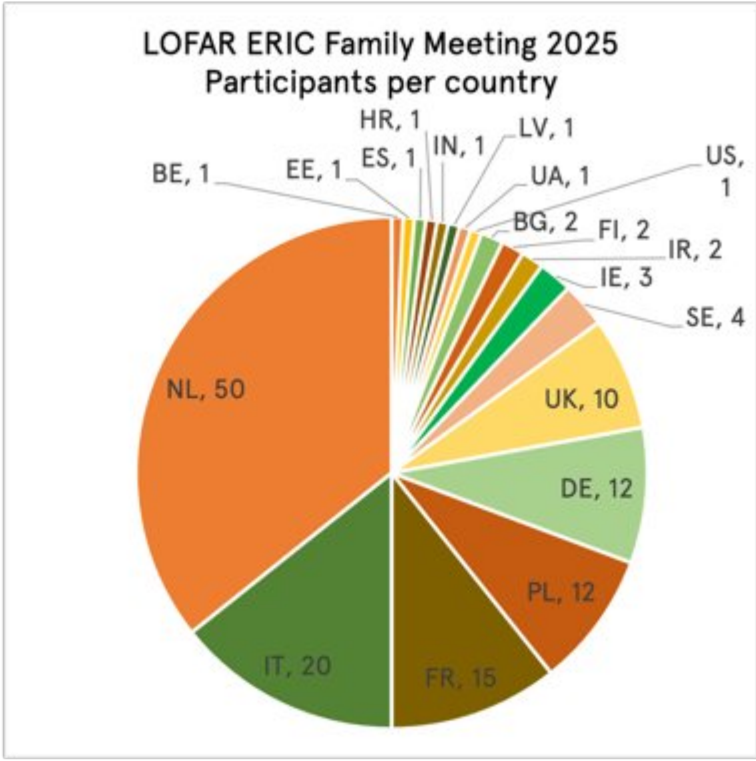
In 2025, the Programme Committee began assessing LOFAR 2.0 Large Programme proposals submitted in 2023, preparing for allocations before the programmes start in 2027. The Council and Executive Director established a dedicated Task Force to address the computing and data storage requirements needed to support these programmes.

After the transition from the ILT foundation to LOFAR ERIC, user representation was streamlined by integrating the former LOFAR User Committee into the Scientific and Technical Committee. This change strengthens the connection between community input, scientific priorities, and operational planning.

4.3. Community Engagement

LOFAR ERIC will provide access to the LOFAR array through the LOFAR2.0 Large Programmes. The call for proposals closed in October 2023, when access to the telescope was still coordinated through the International LOFAR Telescope Foundation. Proposals were evaluated by the Programme Committee, which assessed submissions and allocated observing time based on scientific merit and technical feasibility. An expected start of the project depends on the progress of the LOFAR2.0 upgrade and is expected by end of 2026.

Beyond providing access to the infrastructure, LOFAR ERIC fosters interaction and exchange within the community through its annual LOFAR Family Meeting, now called LOFAR Annual Meeting. The 2025 LOFAR Family Meeting took place from 22–26 September in Paris, France, hosted at the Institut de Physique du Globe de Paris (IPGP). The meeting brought together around 140 members from 19 different countries of the international LOFAR community. Most participants came from the Netherlands, followed by Italy and France, and one third of the participants were affiliated with institutions in only one country.



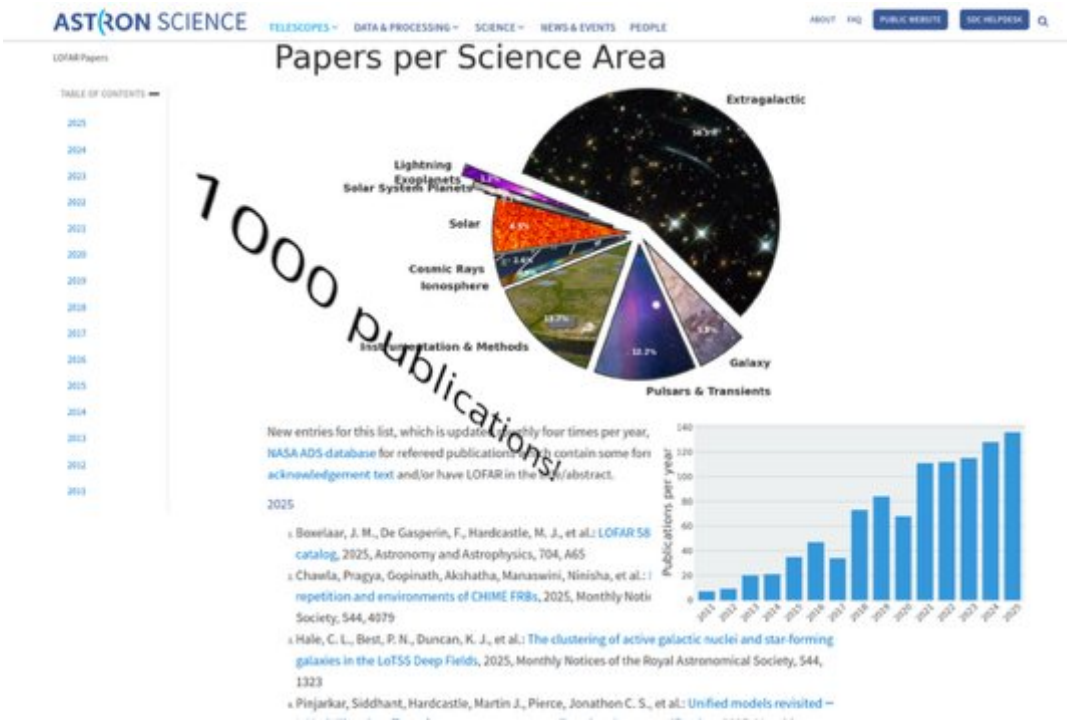
The meeting offered a broad scientific programme covering topics such as surveys and methods, galaxy clusters, the Sun and space weather, cosmic rays, lightning, active galactic nuclei, transients and pulsars, high-redshift galaxies, the Epoch of Reionisation, the magnetised Universe, planets, and the interstellar medium. Complementing these sessions, an Observatory Session highlighted progress on the LOFAR2.0 upgrade and preparations for upcoming operations. The programme further allowed for informal exchange, including a free afternoon to explore Paris and a workshop dinner on the Seine.

Looking ahead, the LOFAR Annual Meeting 2026 will take place at Trinity College Dublin, Ireland, from 8–12 June and will further build on the momentum of the Paris meeting.

4.4 Outreach and Training

Alongside its scientific activities, LOFAR ERIC supports training and public engagement through regular outreach initiatives.

The LOFAR Data School is organised biannually and accommodates up to 50 students. The programme takes place over one week in late summer in Dwingeloo and provides hands-on training in the fundamentals and practical aspects of working with LOFAR data. Participants stay on-site, fostering an immersive learning environment, and have the opportunity to experience the surrounding Dwingelderveld National Park and to visit LOFAR stations. No Data School was held in 2025. The next edition is scheduled for 16–23 September 2026.



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4.5. Scientific output

During the upgrade to LOFAR2.0, LOFAR continues to deliver strong and growing scientific output across a broad range of research areas. By the end of 2025, the cumulative number of refereed publications based on LOFAR data had surpassed 1,000, marking a significant achievement for the community. In 2025, over 120 new papers were published, underscoring the vitality of the user community and the telescope's expanding scientific reach. These results highlight LOFAR's growing influence in the international research landscape and its continued contributions to cutting-edge low-frequency radio astronomy.

The Science Data Centre Operations (SDCO) team from ASTRON maintains a dedicated, ADS-sourced database of refereed LOFAR publications dating back to 2011 and monitors publication trends. which continue to show a steady annual increase. The full overview of LOFAR-based publications is made publicly available on the LOFAR science website:
https://science.astron.nl/telescopes/lofar/science-with-lofar/lofar-papers/.

List of Publications
The following refereed publications, officially published in 2025, highlight the scientific, technical, and methodological advances achieved through LOFAR observations and related collaborative research activities. Publications receiving notable public media or institutional coverage are highlighted and accompanied by short summaries.

Active Galactic Nuclei, Radio Galaxies & Jets

Advances in understanding AGN physics, jet formation, and feedback processes across cosmic time using large radio surveys and multi-wavelength data.

- Andernach, H. & Brüggen, M. (2025). Properties of giant radio galaxies larger than 3 Mpc. Astronomy & Astrophysics, 699, A257. *DOI: 10.1051/0004-6361/202452961*
- Chen, Z.-F. & Ho, L., C (2025). The Detection Rate of Associated Mg ii Absorption Lines in Quasars Depends on Their Radio Emission. The Astrophysical Journal, 980, 159. *DOI: 10.3847/1538-4357/adaea2*
- Chilufya, J., Hardcastle, M. J., Pierce, J. C. S., Drake, A. B., Baldi, R. D., Röttgering, H. J. A., & Smith, D. J. B. (2025). The nature of HERGs and LERGs in LoTSS DR2 – a morphological perspective. Monthly Notices of the Royal Astronomical Society, 539(1), 463–486. *DOI: 10.1093/mnras/staf508.*
- Clews, L., Croston, J. H., Dickinson, H., Mingo, B., Hardcastle, M. J., Barkus, B., de Jong, J. M. G. H. J., & Röttgering, H. J. A. (2025). Radio-loud AGN morphology and host-galaxy properties in the LOFAR Two-metre Sky Survey Data Release 2. Monthly Notices of the Royal Astronomical Society, 541(4), 3452–3467. *DOI: 10.1093/mnras/staf966*.
- Eckert, D., Gastaldello, F., Lovisari, L., McGee, S., Pasini, T., Brienza, M., Kolokythas, K., O'Sullivan, E., Simionescu, A., Sun, M., Ayromlou, M., Bourne, M. A., Chen, Y., Cui, W., Ettori, S., Finoguenov, A., Gozaliasl, G., Kale, R., Mernier, F., Oppenheimer, B. D., Schellenberger, G., Seppi, R., & Tempel, E. (2025). Extreme AGN feedback in the fossil galaxy group SDSSTG 4436. Astronomy & Astrophysics, 701, A127. *DOI: 10.1051/0004-6361/202555212*.
- Escott, E. L., Morabito, L. K., Scholtz, J., Hickox, R. C., Harrison, C. M., Alexander, D. M., Arnaudova, M. I., Smith, D. J. B., Duncan, K. J., Petley, J., Kondapally, R., Calistro Rivera, G., & Kolwa, S. (2025). Unveiling AGN outflows: [O III] outflow detection rates and correlation with low-frequency radio emission. Monthly Notices of the Royal Astronomical Society, 536(2), 1166–1179. *DOI: 10.1093/mnras/stae2645*.
- von Fellenberg, S. D., Arcodia, R., Benke, P., Goodwin, A., Kovalev, Y. Y., Ros, E., Janssen, M., Giustini, M., & Miniutti, G. (2025) Radio properties of the quasi-periodic eruption source RXJ1301.9+2747 at parsec scales. Astronomy & Astrophysics, 704, A327. *DOI: 10.1051/0004-6361/202556067*
- Hardcastle, M. J., Pierce, J. C. S., Duncan, K. J., Gürkan, G., Gong, Y., Horton, M. A., Mingo, B., Röttgering, H. J. A., & Smith, D. J. B. (2025). Radio AGN selection in LoTSS DR2. Monthly Notices of the Royal Astronomical Society, 539(2), 1856–1877. *DOI: 10.1093/mnras/staf622*.
- Horton, M. A., Hardcastle, M. J., Miley, G. K., R., Tasse, C. & Shimwell, T. W. (2025). Complex morphology and precession indicators of active galactic nuclei jets in LoTSS DR2. Astronomy & Astrophysics, 699, A338. *DOI: 10.1051/0004-6361/202453559*.
- Hota, A., Dabhade, P., Machado, P., Das, J., Muley, A., & Purohit, A. (2025) RAD@home discovery of extragalactic radio rings and odd radio circles: clues to their origins. Monthly Notices of the Royal Astronomical Society, 543, 1048–1057. *DOI: 10.1093/mnras/staf1531*
- Igo, Z., & Merloni, A. (2025). The global energetics of radio AGN kinetic feedback in the local Universe. Astronomy & Astrophysics, 697, A196. *DOI: 10.1051/0004-6361/202452888*.
- Jin, G., Kauffmann, G., Best, P. N., Shenoy, S., & Małek, K. (2025). The host galaxies of radio AGN: New views from combining LoTSS and MaNGA observations. Astronomy & Astrophysics, 694, A309. *DOI: 10.1051/0004-6361/202451974*.
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- Spectral indices in active galactic nuclei as seen by Apertif and LOFAR. Astronomy & Astrophysics, 700, A63. *DOI: 10.1051/0004-6361/202554375*
- Liang, W.-Q., Chen, Z.-F., Lu, R.-J., Li, J., & Chen, Z.-G. (2025). Impact of Radio-mode Feedback on the Covering Fraction of the Circumgalactic Medium of Quasars. The Astrophysical Journal, 990, 55. *DOI: 10.3847/1538-4357/adf32f*.
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- Paliya, V. S., Saikia, D. J., Bruni, G., Dominguez, A., & Stalin, C. S. (2025) Radio Morphology of Gamma-ray Sources. II. Giant Radio Galaxies. The Astrophysical Journal, 989, 36. *DOI: 10.3847/1538-4357/adef0c*
- Pan, T., Fu, Y., Röttgering, H. J. A., van Weeren, R. J., Drake, A. B., Yue, B.-H., & Petley, J. W. (2025). The environments of radio galaxies and quasars in LoTSS data release 2. Astronomy & Astrophysics, 695, A69. *DOI: 10.1051/0004-6361/202453154*.
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- Yue, B.-H., Duncan, K. J., Best, P. N., Arnaudova, M. I., Morabito, L. K., Petley, J. W., Röttgering, H. J. A., Shenoy, S., & Smith, D. J. B. (2025). A novel Bayesian approach for decomposing the radio emission of quasars – II. Link between quasar radio emission and black hole mass. Monthly Notices of the Royal Astronomical Society, 537(2), 858–875. *DOI: 10.1093/mnras/staf077*.

Galaxy Clusters, Diffuse Emission & Cosmic Web

New insights into diffuse radio emission, cluster dynamics, and magnetised large-scale structure in the cosmic web.

- Ahn, E., Cho, H., Jee, M. J., Lee, W., Stroe, A., Rajpurohit, K., Finner, K., Forman, W., Jones, C., & van Weeren, R. J. (2025) PSZ2 G181.06+48.47. III. Weak-lensing Analysis and Merging Scenario Reconstruction of a Low-mass Cluster with Exceptionally Distant Radio Relics. The Astrophysical Journal, 984, 26. *DOI: 10.3847/1538-4357/adbc99*
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- Brienza, M., Rajpurohit, K., Churazov, E., Heywood, I., Brüggen, M., Hoeft, M., Vazza, F., Bonafede, A., Botteon, A., Brunetti, G., Gastaldello, F., Khabibullin, I., Lyskova, N., Majumder, A., Röttgering, H. J. A., Shimwell, T. W., Simionescu, A., & van Weeren, R. J. (2025) Non-thermal filaments and AGN recurrent activity in the galaxy group Nest200047: A LOFAR, uGMRT, MeerKAT, and VLA radio spectral analysis. Astronomy & Astrophysics, 696, A239. *DOI: 10.1051/0004-6361/202553676*
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- Carretti, E., Vazza, F., O'Sullivan, S. P., Vacca, V., Bonafede, A., Heald, G., Horellou, C., Mtchedlidze, S., & Vernstrom, T. (2025). The nature of LOFAR rotation measures and new constraints on magnetic fields in cosmic filaments and on magnetogenesis scenarios. Astronomy & Astrophysics, 693, A208. *DOI: 10.1051/0004-6361/202451333*.

- Chatterjee, S., & Datta, A. (2025) Deciphering the spectral properties of the atypical radio relic in A115 using uGMRT, VLA, and LOFAR. Journal of Astrophysics and Astronomy, 46, 1. *DOI: 10.1007/s12036-024-10026-8*
- De Rubeis, E., Bondi, M., Botteon, A., van Weeren, R. J., de Jong, J. M. G. H. J., Rudnick, L., Brunetti, G., Rajpurohit, K., Gheller, C., & Röttgering, H. J. A. (2025). Revealing the intricacies of radio galaxies and filaments in the merging galaxy cluster Abell 2255: I. Insights from deep LOFAR-VLBI sub-arcsecond resolution images. Astronomy & Astrophysics, 699, A229. *DOI: 10.1051/0004-6361/202555268*.
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- Groeneveld, C., van Weeren, R. J., Botteon, A., Cassano, R., de Gasperin, F., Osinga, E., Brunetti, G., & Röttgering, H. J. A. (2025) Serendipitous decametre detection of ultra steep spectrum radio emission in Abell 655. Astronomy & Astrophysics, 10, A99. *DOI: 10.1051/0004-6361/202452687*
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- **Stuardi, C., Botteon, A., Sereno, M., Umetsu, K., Gavazzi, R., Bonafede, A., & Gheller, C. (2025). Radio emission from a massive node of the cosmic web: A discovery powered by machine learning.** Astronomy & Astrophysics, 695, L16. *DOI: 10.1051/0004-6361/202452581*.
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Cosmology & Epoch of Reionization

Tightening constraints on the late and early Universe through continuum and 21-cm observations, statistical methods and simulations.

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Surveys, Catalogs & Data Products

Major survey releases and catalogs enabling population studies and statistical astronomy at unprecedented scale.

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Transients, Pulsars & Compact Objects

Expanding knowledge of pulsars, transient radio sources, and precision timing through low-frequency observations.

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Stellar, Solar & Planetary Radio Emission

High-resolution LOFAR observations improve understanding of stellar activity, particle acceleration, and solar radio bursts relevant to space-weather processes.

- Bracco, A., Padovani, M., Galli, D., Pezzuto, S., Cipriani, A., & Drabent, A. (2025) Are stellar embryos in Perseus radio-synchrotron emitters? Statistical data analysis with Herschel and LOFAR paving the way for the SKA. Astrophysics and Astronomy, A148, 13. *DOI: 10.1051/0004-6361/202452010*
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- Scholten, O., Lourens, M., Buitink, S., Cummer, S., Dwyer, J., Hare, B. M., Huege, T., Liu, N., Mulrey, K., Nelles, A., Sterpka, C., Trinh, T. N. G., Turekova, P., & ter Veen, S. (2025) Measuring location and properties of very high frequency sources emitted from an aircraft flying through high clouds. Nature Communications, 16, 10572. *DOI: 10.1038/s41467-025-65667-2*

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- Source location and evolution of a multilane type II radio burst. Astronomy & Astrophysics, 703, A271. *DOI: 10.1051/0004-6361/202554348*

Instrumentation, Methods & Computing

Significant advances in calibration, imaging, and computational techniques improve the quality and efficiency of next-generation radio astronomy observations.

- Brackenhoff, S. A., Offringa, A. R., Mevius, M., Koopmans, L. V. E., Chege, J. K., Ceccotti, E., Höfer, C., Gao, L., Ghosh, S., Mertens, F. G., & Munshi, S. (2025). Robust direction-dependent gain-calibration of beam-modelling errors far from the target field. Monthly Notices of the Royal Astronomical Society, 541(4), 3993–4012. *DOI: 10.1093/mnras/staf1206*.
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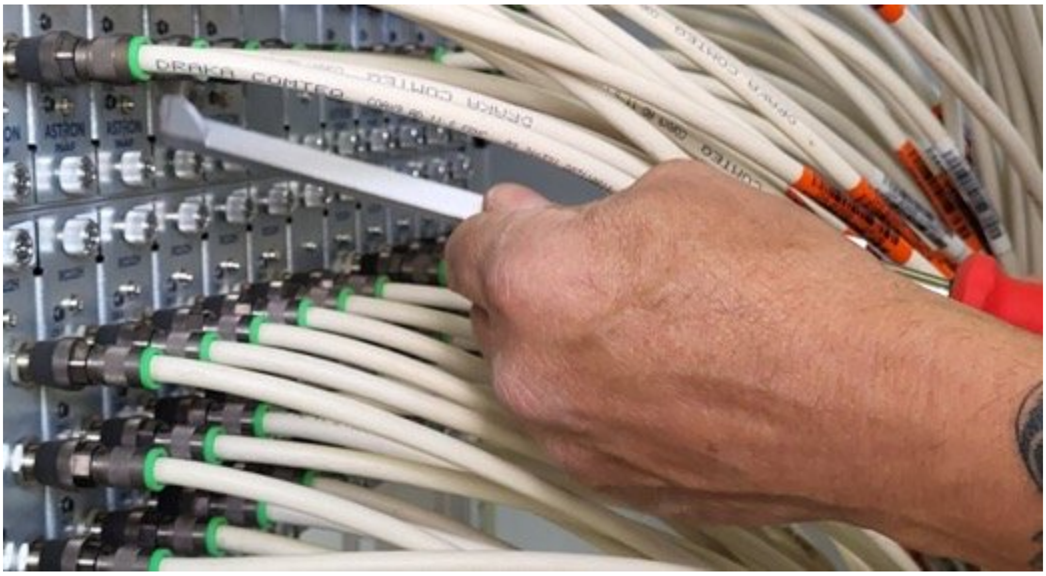
5. TECHNICAL DEVELOPMENTS AND LOFAR 2.0 ROLL-OUT

5.1 LOFAR2.0 Upgrade Programme and Station Development

After LOFAR1 observations ended in August 2024, all effort was directed toward the deployment and commissioning of LOFAR2.0. This major upgrade programme aims to significantly enhance the scientific capabilities of the array. LOFAR2.0 provides substantial improvements in sensitivity, calibration accuracy, field of view, observing flexibility, and operational efficiency. A key new capability of LOFAR2.0 is the simultaneous use of the Low-Band Antennas (LBA) and High-Band Antennas (HBA), enabling broader instantaneous frequency coverage and more efficient observing strategies.



Dismantling a LOFAR1 station ©ASTRON

A major component of the upgrade is the replacement of station electronics. During 2025, 197 new subracks containing upgraded receiver units and digital processing boards were assembled and integrated into the Dutch stations. The new electronics provide a tenfold increase in station-level computing power and enable continuous access to all antenna signals. The deployment of a common clock system across the Dutch array further improves calibration precision and imaging fidelity, particularly at the lowest observing frequencies. In parallel, the DANTE development programme completed the Delta Critical Design Review for the new analogue HBA front-end electronics following successful testing at the LOFAR2.0 test station CS001. This milestone marked the transition toward production of several thousand boards for the future stations in Bulgaria and Italy. By the end of 2025, 32 of the 38 Dutch stations had been upgraded and handed over for commissioning, while preparations also continued for the roll-out of LOFAR2.0 to the international stations and for the construction of new stations in Bulgaria and Italy.

5.2 Central Processing, Networking and Data Infrastructure

Significant progress was made in upgrading LOFAR's central processing and data infrastructure. At the Central Processing Facility hosted by the University of Groningen's Centre for Information Technology, the replacement of the COBALT2 correlator and CEP4 processing cluster with the new COBALT3 and CEP6 systems continued throughout 2025. The upgraded infrastructure delivered increased processing capacity and supports the higher data volumes and observing flexibility required for LOFAR2.0. In parallel, the network and timing infrastructure was modernised through the deployment of high-speed switching hardware and multicast networking capabilities, supporting more efficient transport of data between stations and processing facilities and preparing the system for future 100 Gbps connectivity.

Cobalt3 cluster delivery and install ©ASTRON

At the same time, the LOFAR Data Valorisation (LDV) project continued to strengthen the distributed archive and processing infrastructure across the Long-Term Archive sites in Amsterdam (at SURF), Jülich (Supercomputing Centre), and Poznań (PCSS). Data curation, compression, and archive optimisation activities reduced storage requirements and operational costs while preparing the infrastructure for future LOFAR2.0 science operations.

5.3 Software Systems, Pipelines and User Services

Development of the LOFAR2.0 software ecosystem continued across telescope operations, workflow management, and science processing. Work progressed on the Telescope Manager Specification System (TMSS), which will support scheduling, workflow orchestration, and telescope control within the upgraded observatory. In parallel, the new proposal-management platform TULP entered active commissioning and was used operationally to support wider LOFAR2.0 commissioning activities. Feedback from users and commissioning teams continues to support further development of the system.

Progress was also made in modernising processing pipelines and workflows. The preprocessing pipeline framework was migrated to a new Common Workflow Language (CWL)-based environment compatible with CEP6 and future processing systems. ASTRON's Science Data Centre team also completed the initial framework of a new image-plane transient detection and monitoring pipeline (TraP) designed for integration into LOFAR2.0 operations. In addition, Federated Authentication and Authorisation Infrastructure (FAAI) capabilities were introduced, allowing users to access LOFAR services using institutional credentials.

5.4 Commissioning and Minimum Production System

Commissioning activities expanded significantly during 2025 following the deployment of upgraded hardware and software systems. The Observatory commissioning programme focused on three main areas: telescope systems, software pipelines, and operations. The effort involved members of the broader scientific community, including Large Programme teams and international station representatives. Dedicated workgroups supported validation activities to verify compliance with the scientific and technical requirements of the LOFAR2.0 programme.

During 2025, preparations continued for the delivery of the Minimum Production System (MPS), targeted for completion by the end of the year. The MPS was developed as the first operational LOFAR2.0 environment, including the upgraded Dutch stations and supporting both beamformed and imaging observations with limited functionality.

5.5 Preparation for LOFAR2.0 Science Operations

Preparations for the scientific exploitation of LOFAR2.0 continued throughout 2025. The LOFAR ERIC Programme Committee met for the first time to carry out a preliminary scientific assessment of the proposed Large Programmes submitted during the earlier International LOFAR Telescope phase. The assessment supported the prioritisation of observing modes and operational capabilities required for the first phase of LOFAR2.0 science operations. Large Programmes are expected to occupy the majority of observing time during the initial operational years of the upgraded telescope.

In parallel, preparations continued for future open-time observing opportunities and long-term operational planning. The deployment of new processing capabilities, science pipelines, archive services, and user systems further strengthened the readiness of the observatory for the start of the LOFAR2.0 science programme, currently expected in 2027.

5.6 Long-Term Sustainability and Future Development

LOFAR ERIC continued strengthening the long-term sustainability and future development of the infrastructure. Work progressed on strategies to ensure the performance and reliability of the low-band and high-band antenna systems over time.

Planning advanced for future infrastructure expansion, sustainable computing, and archive operations. New stations in Bulgaria and Italy will enhance the long-baseline capabilities of the array. In parallel, early planning also began for a future station in the Czech Republic. LOFAR ERIC also continued working with national partners and computing centres to secure the long-term processing and storage capacity needed for the LOFAR2.0 science programme.

6. FINANCIAL ASPECTS OF LOFAR ERIC

LOFAR ERIC's financial framework reflects the distributed and collaborative nature of the infrastructure, combining direct financial contributions, in-kind support, and shared responsibilities among its members. Further details, including the audited financial statements and notes to the accounts, are provided in the Annual Report. The tables below present the financial statements for 2025.

Table 4. LOFAR ERIC Financial Report 2025: Balance sheet as at 31 December 2025 (after profit appropriation)

Assets – amounts x EURO's	**2025**	**2024**
Current assets		
Tangible fixed assets	19.595.363	0
Other claims	784.213	1.475.167
Liquid assets	9.979.279	11.485.459
Total current assets	**30.358.855**	**12.960.626**
Total Assets	**30.358.855**	**12.960.626**

Liabilities & Equity – amounts x EURO's		
Equity capital		
Total Equity Capital	3.886.663	3.228.967
Current liabilities		
Debt International Partners	26.064.401	8.857.060
Other depts	407.791	874.599
Total current liabilities	**26.472.192**	**9.731.659**
Total liabilities & Equity	**30.358.855**	**12.960.626**

Table 5. Statement of Financial Performance 2025

Revenues – amounts x EURO's	**2025**	**2025**	**2024**
	Actual	**Budget**	**Actual**
Contribution International Partner	5.035.000	5.035.000	5.035.000
Other revenues	528.840	71.795	428.543
Total Revenues	**5.563.840**	**5.106.795**	**5.463.543**

Expenses – amounts x EURO's			
	Actual	**Budget**	**Actual**
Office & General activities	457.705	526.500	540.917
Online operations	984.580	1.103.061	1.086.031
Offline operations	1.662.000	1.662.000	1.727.000
Maintenance and infrastructure	773.192	800.000	565.548
Development	806.000	806.000	884.000
Other – Project costs	326.007	-	80.365
Total Expenses	**5.009.484**	**4.897.561**	**4.883.861**
Result current year	**554.356**	**209.234**	**579.682**

Interest and other Expenses – amounts x EURO's	**2025**	**2025**	**2024**
	Actual	**Budget**	**Actual**
Interest	113.469	4.000	211.832
Leave debt movement	-8.365		-30.780
	-1.764		
Total interest and other expenses	**103.340**	**4.000**	**181.052**
Total result	**657.696**	**213.234**	**760.734**

Profit and loss appropriation	**2025**		**2024**
General reserve	134.084		760.634
Designated funds	523.612		
Result	**657.696**		**760.634**

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