



ANNUAL REPORT 2024

YEBES OBSERVATORY



GOBIERNO
DE ESPAÑA

MINISTERIO
DE TRANSPORTES
Y MOVILIDAD SOSTENIBLE



+34 949 290 311

Cerro de la Palera S/N, 19141, Yebes, Guadalajara

Título:

ANUAL REPORT 2024. YEBES OBSERVATORY

Catálogo de Publicaciones de la Administración General del Estado:

<https://cpage.mpr.gob.es/>

Editado en diciembre de 2025

Publica:

© De esta edición, O. A. Centro Nacional de Información Geográfica (CNIG), 2025.

NIPO Digital: 198-25-066-X

DOI: 10.7419/163.23.2025

Los derechos de la edición son del O. A. Centro Nacional de Información Geográfica como editorial.

Impreso en los talleres del Instituto Geográfico Nacional. En esta publicación se ha utilizado papel certificado libre de cloro de acuerdo con los criterios medioambientales de la contratación pública vigente.

Los derechos de esta edición son del O. A. Centro Nacional de Información Geográfica como editorial. Este Organismo agradece que la difusión electrónica masiva de la edición digital se realice a través de un enlace al apartado correspondiente de la página web oficial.



Calle General Ibáñez de Ibero, 3

28003 - Madrid (España)

www.ign.es - www.cnig.es - consulta@cnig.es

Yebes

OBSERVATORY

ANNUAL **2024**
REPORT





Index

PREFACE

By Pablo de Vicente

01

02

OVERVIEW

The Yebes Observatory

FACILITIES

Description of facilities

03

04

THE 40M RADIO TELESCOPE

- Open access to the 40m radio telescope
- Scientific activity & highlights

NON ICTS INSTRUMENTS

- Yebes RAEGE & VGOS radio telescope and correlator
- Satellite Laser Ranging at the Yebes Observatory

05

TECHNOLOGICAL HIGHLIGHTS

- Developments for the 40m RT
- Receiver Developments for VGOS
- Cryogenic Amplifiers for the next generation ALMA
- Technical developments for other instruments
- Protection measures of the Observatory
- Fundamental geodetic station

06

EDUCATION & OUTREACH

07

08

STAFF

Staff as of 31 December 2024

ICTS COMMITTEES

Members as of 31 December 2024

09

10

LIST OF PUBLICATIONS

LIST OF PROPOSALS

- Approved proposals for single dish observations
- Approved & observed proposals within the EVN
- List of technical Reports
- Approved & observed proposals within the Global Millimetre VLBI Array

11

12

CDT TECHNICAL REPORTS



Preface

This is the first annual report published in print for Yebes Observatory (OY) as an ICTS (Infraestructura Científica y Técnica Singular). Although previous annual reports for OY have been included since 2007 in the corresponding IGN annual reports across different sections, we plan to publish online a complete record of the observatory's activities per year since 2018.

The ICTS map compiles all Spanish research infrastructures since 2007 and is reviewed every four years. Yebes Observatory has been included in the map since its creation in 2007 and remains part of the current one, which covers the 2021–2024 interval. While this report focuses primarily on OY's activities as an ICTS, we have also included information on related projects and initiatives, as the infrastructure serves as a technological development centre in radio astronomy and has recently been designated a fundamental geodetic station.

The 40-metre radio telescope, which confers ICTS status on OY, remains a leading international facility dedicated chiefly to astrochemical research and observations. With 87 confirmed detections of interstellar molecules out of 330 known species (approximately 26%), the telescope maintains the highest detection record globally. The facility continues to attract increasing international interest, with growing participation from foreign principal investigators. In 2024, 50 peer-reviewed papers were published based on observations from the 40m telescope: 44% derived from VLBI observations conducted through the European VLBI Network and the Global Millimetre Array, and 56% from single-dish projects. Four representative papers are highlighted as exemplars of the scientific achievements realised.

Yebes Observatory continues to be recognised internationally as a technological development centre. The most significant milestone this year has been the construction and installation of an 18–32 GHz receiver, currently undergoing commissioning. Additionally, the commissioning of the wobbler system has been completed, and observations using this facility were offered to users for the first time in 2024. Ongoing technical developments include improvements to receiver cryogenics and operational reliability, with collaborative work on amplifier and receiver development for partner institutes continuing. The relocation of staff to the new building has enabled the modern laboratories and workshops to become fully operational, with all equipment successfully commissioned.

Two important milestones have also been achieved: the commissioning of the Satellite Laser Ranging telescope, which has been integrated into the ILRS network and established OY as a fundamental geodetic station, and the successful opposition to construction licences for two large-scale solar photovoltaic plants in the proximity to the observatory.

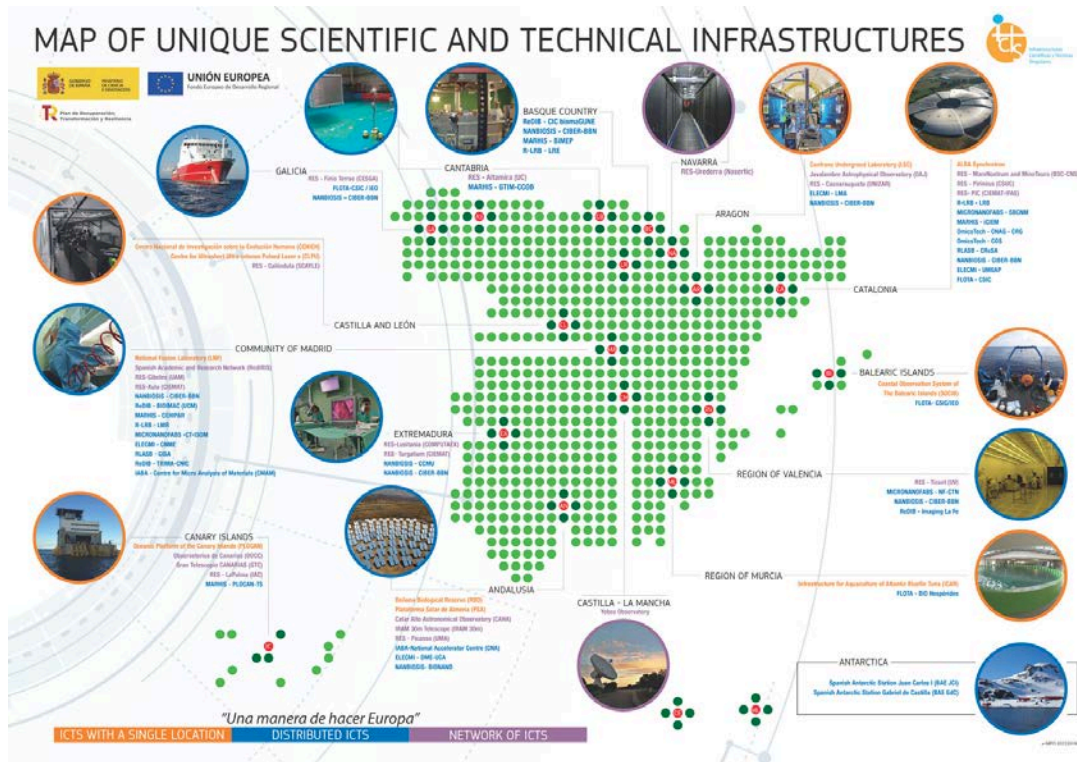
All these accomplishments reflect the dedication and expertise of the observatory's staff.

Pablo de Vicente
Director of Yebes Observatory



Overview

The Yebes Observatory ("Observatorio de Yebes", OY) is a unique scientific and technical infrastructure (ICTS) in Spain. It belongs to the Ministerio de Transportes y Movilidad Sostenible and is managed by the Instituto Geográfico Nacional (IGN). Located in the province of Guadalajara, approximately 80 km east of Madrid, the OY sits on a plateau at an altitude of 1,000 metres and experiences typical Spanish dry weather.



HISTORY

The OY was created in the 1970s, and its observing instruments started operations in 1975 and 1976. It is a Scientific and Technical Singular Infrastructure (ICTS) since 2007 and it is also a Technological Development Center for Radio Astronomy, designing and building devices and equipment for its own instruments and for external ones. This character of CDT is officially recognized by the International VLBI Service.

RAEGE

The OY is also the central node of the Red Atlántica de Estaciones Geoespaciales (RAEGE), which consists of 4 telescopes: Yebes (13.2 m), Santa María (Açores Islands), Gran Canaria (Canary Islands, under construction) and Flores (planned). RAEGE is part of the VLBI Global Observing System (VGOS) and the International VLBI System (IVS).



Facilities

The Observatory of Yebes owns and manages several facilities of which the 40m radio telescope is the main one and the flagship that confers the center its ICTS status.



40 M RADIO TELESCOPE	
Frequency Range	2–90 GHz
Operation Period	2007 – now
Application	Radio astronomy, Geodesy



13 M RADIO TELESCOPE	
3–14 GHz	Frequency Range
2016 – now	Operation Period
VLBI, VGOS, RAEGE	Application

SATELLITE LASER RANGING (SLR)	
Wavelength	532 nm & 1064 nm
Operation Period	2023 – now
Application	High-precision Geodesy



Facilities



14 M RADIO TELESCOPE	
2, 8 & 43 GHz	Frequency Range
1979 – 2003	Operation Period
Retired	Application

DOUBLE ASTROGRAPH	
Frequency Range	-
Operation Period	1976 – 2000
Application	Outreach



SOLAR TELESCOPE	
-	Frequency Range
1976 – 2005	Operation Period
Outreach	Application

Anechoic Chamber	
Frequency Range	4–140 GHz
Operation Period	2009 – now
Application	Technological Development

RF Laboratories & Workshops	
Frequency Range	up to 116 GHz
Operation Period	1986 – now
Application	Technology Development



The 40m radio telescope

The 40m RT, which has been in operation since 2007, is a Nasmyth-Cassegrain antenna that operates in the centimetre and millimetre wave bands (between 2 and 90 GHz). It functions both as a single-dish telescope and as a vital component of various VLBI arrays, including the European VLBI Network (EVN), the Global Millimetre VLBI Array (GMVA) and the International VLBI Service (IVS), among others.

It is currently equipped with several cryogenic receivers developed at the OY at 2, 4.5-9, 8, 18-32, 31.5-50, and 71.5-90 GHz. While all receivers can be used for both single dish and VLBI applications, the 2 GHz, 4.5–9 GHz and 8 GHz receivers are primarily employed for VLBI. The sky frequency bands described are instantaneous and are downconverted to be fully accessible in a single observation, at least in one polarisation.



The 40m radio telescope

The 40m radio telescope is operated by a team of operators and provides service mode operations, both in VLBI and single dish observations, and delivers reliable calibrated data to PIs, supported by the Observatory's team of Astronomers on Duty.

SINGLE DISH

Single dish observations use fast Fourier spectrometres (FFTS) as backends providing a full coverage of the instantaneous bandwidth of the receivers with a resolution of 38 kHz for the high frequency receivers (above 32 GHz) and 15 kHz for the low frequency ones. For the 18-26, 26-32, 31.5-50, and 71.5-90 GHz ranges full coverage instantaneous observations can be performed at two polarizations. The OY was created in the 1970s, and its observing instruments started operations in 1975 and 1976. It is a Scientific and Technical Singular Infrastructure (ICTS) since 2007 and it is also a Technological Development Center for Radio Astronomy, designing and building devices and equipment for its own instruments and for external ones. This character of CDT is officially recognized by the International VLBI Service.

VLBI OBSERVATIONS

VLBI observations use 2 DBBC2 (Digital BaseBand Converters) and one DBBC3 and three Flexbuffs with a total capacity of 750 TB, which act as recorders. The DBBCs allow simultaneous recording of four frequency bands with a bandwidth of 1 GHz or 4 GHz. The recorders are connected to the Internet at 100 Gb/s via Rediris, the Spanish NREN, allowing real-time 8 Gb/s transfers to any correlator in the world with sufficient bandwidth. The OY is also the central node of the Red Atlántica de Estaciones Geoespaciales (RAEGE), which consists of 4 telescopes: Yebes (13.2 m), Santa María (Açores Islands), Gran Canaria (Canary Islands, under construction) and Flores (planned). RAEGE is part of the VLBI Global Observing System (VGOS) and the International VLBI System (IVS).

The 40m radio telescope

The following table summarizes the basic properties of the 40 m radio telescope receivers. The spectral resolution in single-dish (SD) mode depends on the backend connected. Note that the CX receiver is available only in single-dish mode under Director's Discretionary Time.

Receiver	Frequency range	Polarization	SD spectral resolution	Trec	Usage
S	2.2 – 2.37 GHz	L	-	80 K	Geodetic VLBI
X	8.1 – 8.9 GHz	L	-	40 K	Geodetic VLBI
CX	4.5 - 9 GHz	LCP & RCP	7.8 KHz (SD)	< 20 K	VLBI + SD (Only DDT)
K	18 – 32.3 GHz	H & V	19 KHz	< 15 K	SD + VLBI
Q	31.5 – 50 GHz	H & V	38 KHz	< 20 K	SD + VLBI
W	72 – 90.5 GHz	H & V	38 KHz	< 30 K	SD + VLBI



Open access to the 40m radio telescope

The Yebes 40m radio telescope is available to the national and international scientific community through periodic, open calls since 2018. In 2024, single dish observations were currently offered in two main frequency bands: 32-50 GHz, and 72-90 GHz, although the 2.1-2.3 GHz and the 4.5-9 GHz bands are also available. These frequency bands are crucial for studies of molecular inventory and spectroscopy inside and outside of our Galaxy. Access to the telescope to perform single dish observations and VLBI not included in the EVN or GMVA is open to all scientists around the world through 2 annual calls in December and June.

VLBI observations are made in conjunction with other radio telescopes worldwide. The observing frequency bands are centered around 5, 6, 8.4, 22, 43 and 86 GHz. EVN observations are grouped in three different epochs in the year (February/March, May/June, October) and in more than 10 eVLBI sessions, 3 days each, spread throughout the year. The 40m radio telescope usually dedicates approximately between 500 and 900 hours to EVN per year. GMVA observations are restricted to 2 weeks in the year, usually in April and September/October and require around 80 hours per year.

The following table provides a summary of the number of hours available per year since 2021 and the time granted for open competitive access projects. Operating time is calculated by subtracting maintenance time, failure time, engineering testing time, and weather-related downtime from the total time.

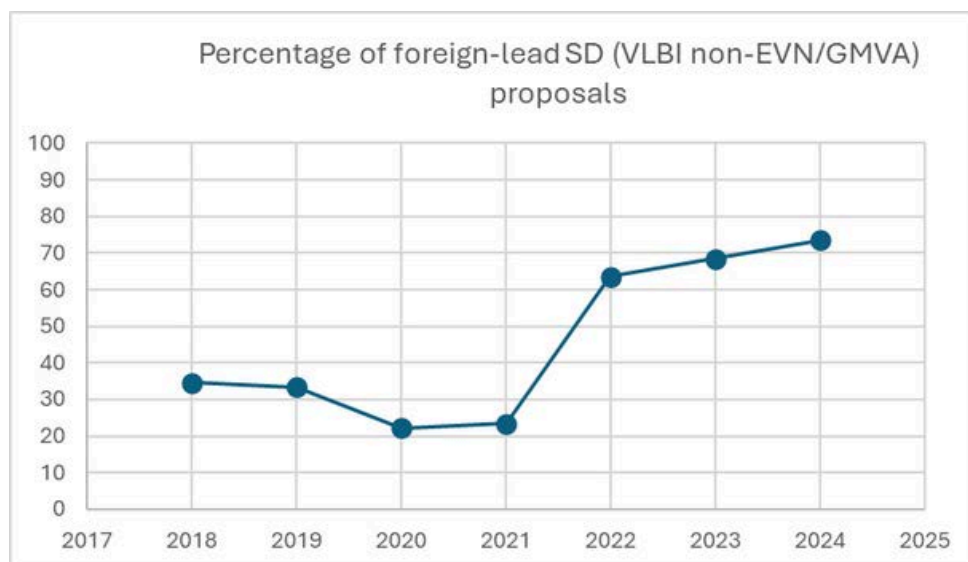
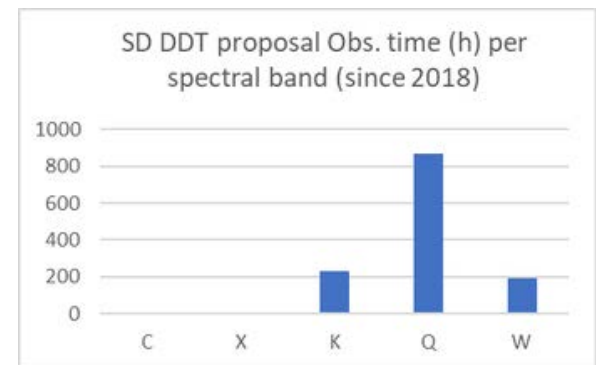
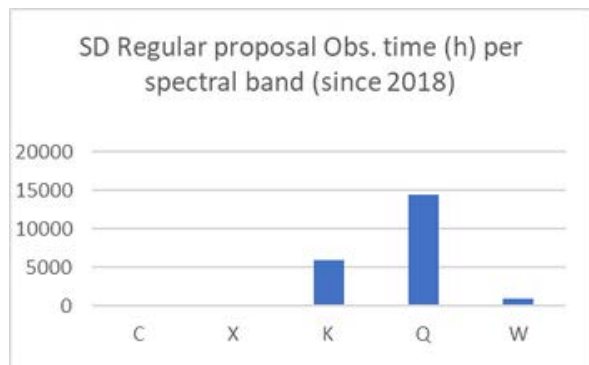
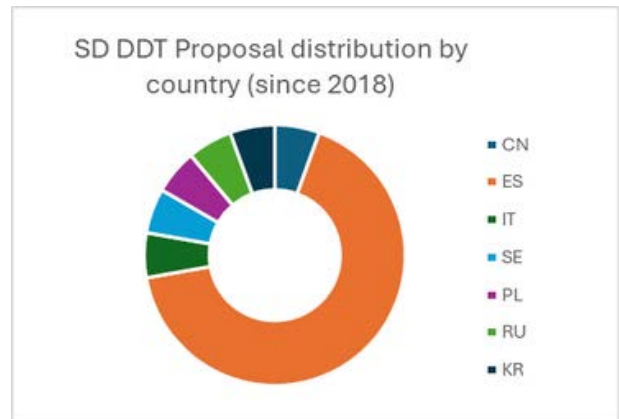
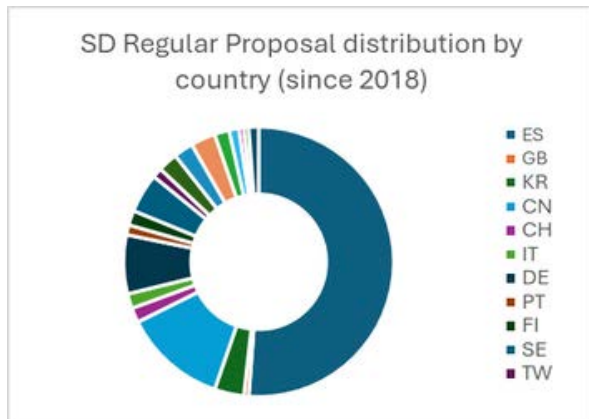
RT40m	2021	2022	2023	2024
Capacity: total access available (hours)	5.520	6.902	4.186	5.525
Open access effectively granted (hours)	3.206,80	5.535,10	3.330,05	3.708,30
Percentage of open access vs available time	58%	80%	80%	67%

Access to the telescope by researchers is described in this page: <https://rt40m.oan.es/>. An in-house designed system for managing the observing time proposals was implemented in 2020, RAYO¹ (Radio telescope Administration of the Yebes Observatory). Using RAYO¹, external investigators can apply to the 40 m radio telescope call of proposals, find all relevant information of their projects (schedules, support astronomer...) and retrieve their data.

¹<https://rt40m.oan.es/rayo/>

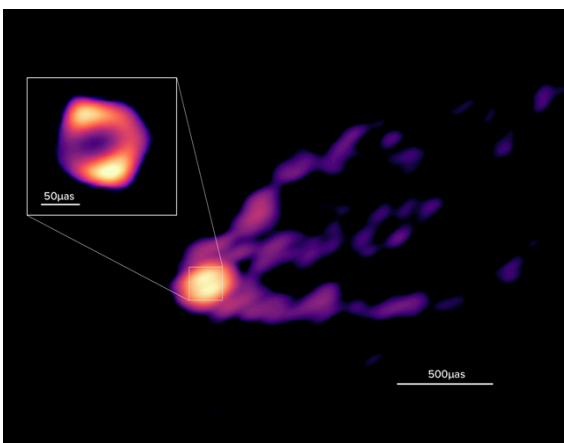
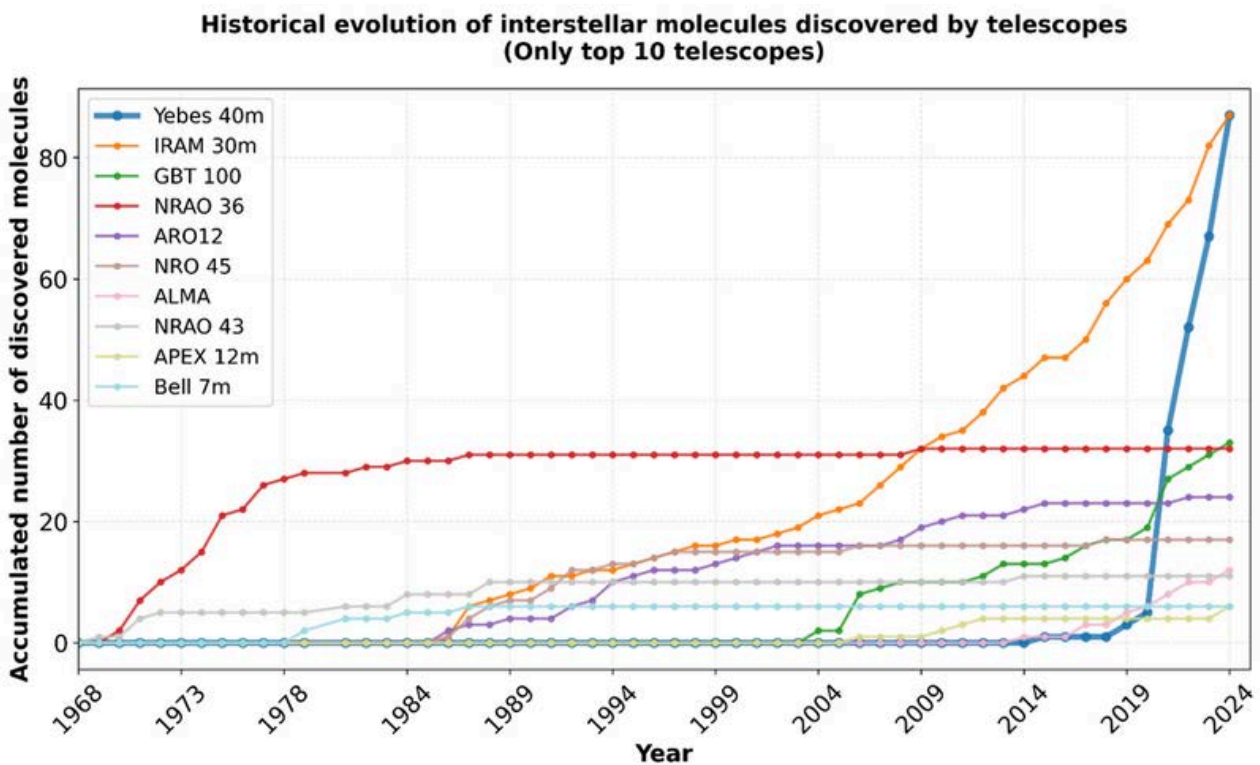
Open access to the 40m radio telescope

There is a growing interest in the international community in accessing the 40m RT, as is demonstrated by the fact that since 2022, over 60% of single dish proposals (plus non-EVN, non-GMVA VLBI proposals) approved in the regular Call for proposals are led by IPs from international institutions (see next figure).



Scientific activity & highlights

The main research activities served by Yebes Observatory as an ICTS are scientific and cover several areas. As a single dish instrument, the 40m RT is highly competitive in the field of astrochemistry. Astrochemistry studies the chemistry of the interstellar medium through the emission and absorption of molecular lines. This information also allows us to study the physical conditions of molecular clouds and circumstellar envelopes. Notably, more than 90 interstellar molecules have been discovered in space for the first time using 40 m RT data, accounting for around 30 % of the currently known interstellar molecular species. This has resulted in almost 100 scientific papers since 2019.



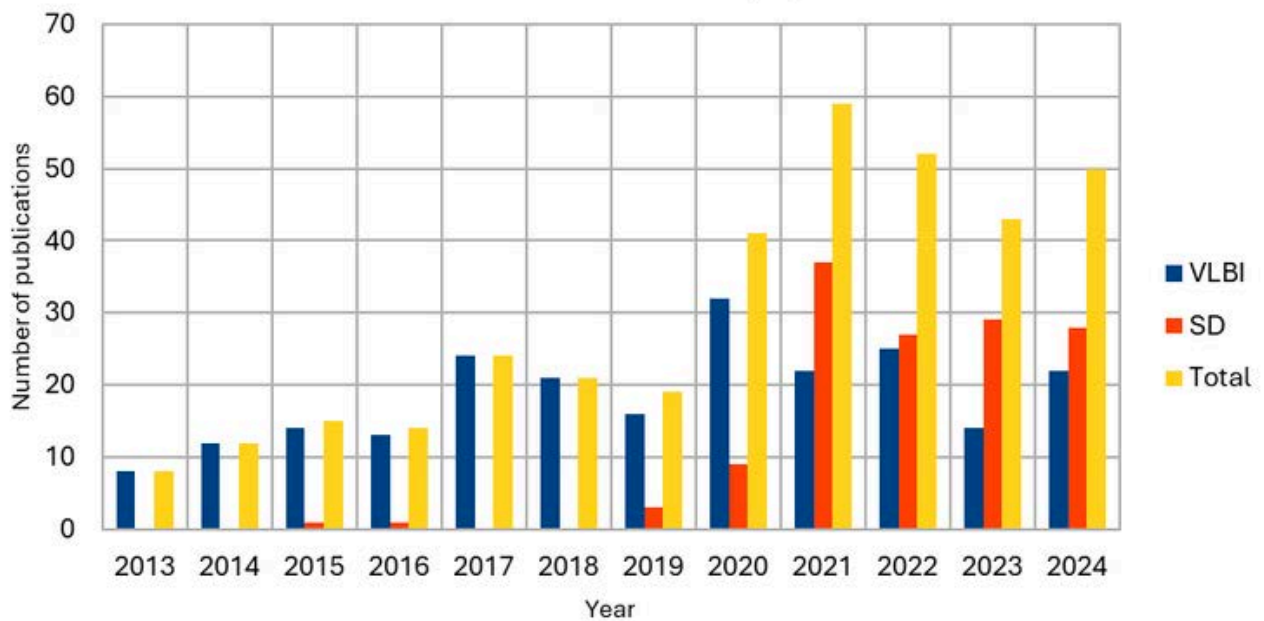
As part of interferometric networks, the 40m RT is used for studying the environment of black holes, relativistic jets, maser distribution in star forming regions and in circumstellar envelopes, relative astrometry in the Galaxy and global astrometry with quasars to define the International Celestial Reference Frame. The telescope therefore serves the national and international community of researchers dedicated to the areas mentioned above.

Scientific activity & highlights

Nowadays, the 40m RT is one of the most competitive instruments in the international panorama to address fundamental questions in these areas of research by providing a high sensitivity and an instantaneous ultra-wide frequency range (see next figure). The scientific papers published in 2024 with 40m data are summarized in Appendix A.



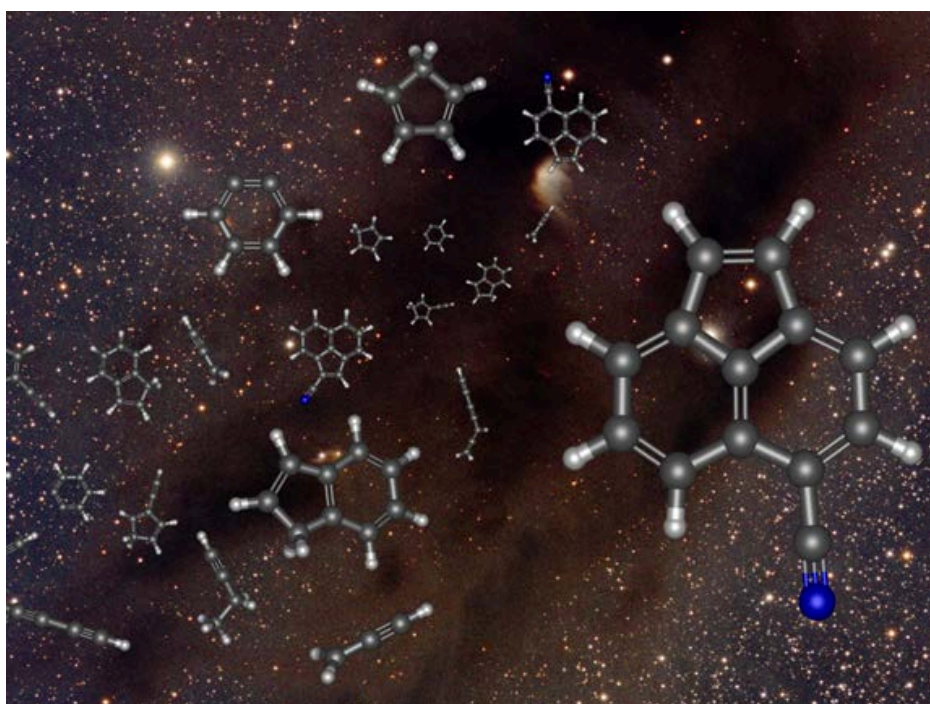
Publications of refereed papers



The scientific papers published in 2024 with 40m data are summarized in Appendix A. Below we highlight four of these works.

Discovery of two cyano derivatives of acenaphthylene (C₁₂H₈) in TMC-1 with the QUIJOTE line survey by Cernicharo et al. (2024)

One of the most significant results in 2024 is the one by Cernicharo et al. (2024) who detected the largest molecules ever found in space by October of that year. In a paper published in the astrophysical journal *Astronomy & Astrophysics* and entitled 'Discovery of two cyano derivatives of acenaphthylene (C₁₂H₈) in TMC-1 with the QUIJOTE line survey', an international team led by scientists and astronomers from the Observatorio Astronómico Nacional (OAN) and the Centro Superior de Investigaciones Científicas (CSIC) identified two 21-atom molecules located in the cold interstellar molecular cloud TMC-1, using data of the 40 m RT.



This scientific result had a significant impact on the media, with several press releases being published and disseminated. (MITMS Press note², CSIC press note³, radio interview⁴, press news⁵).

² Astrónomos del ministerio lideran la detección de moléculas en el medio interestelar (https://www.transportes.gob.es/recursos_mfom/sala_prensa/241113_np_transportes_deteccion_moleculas.pdf).

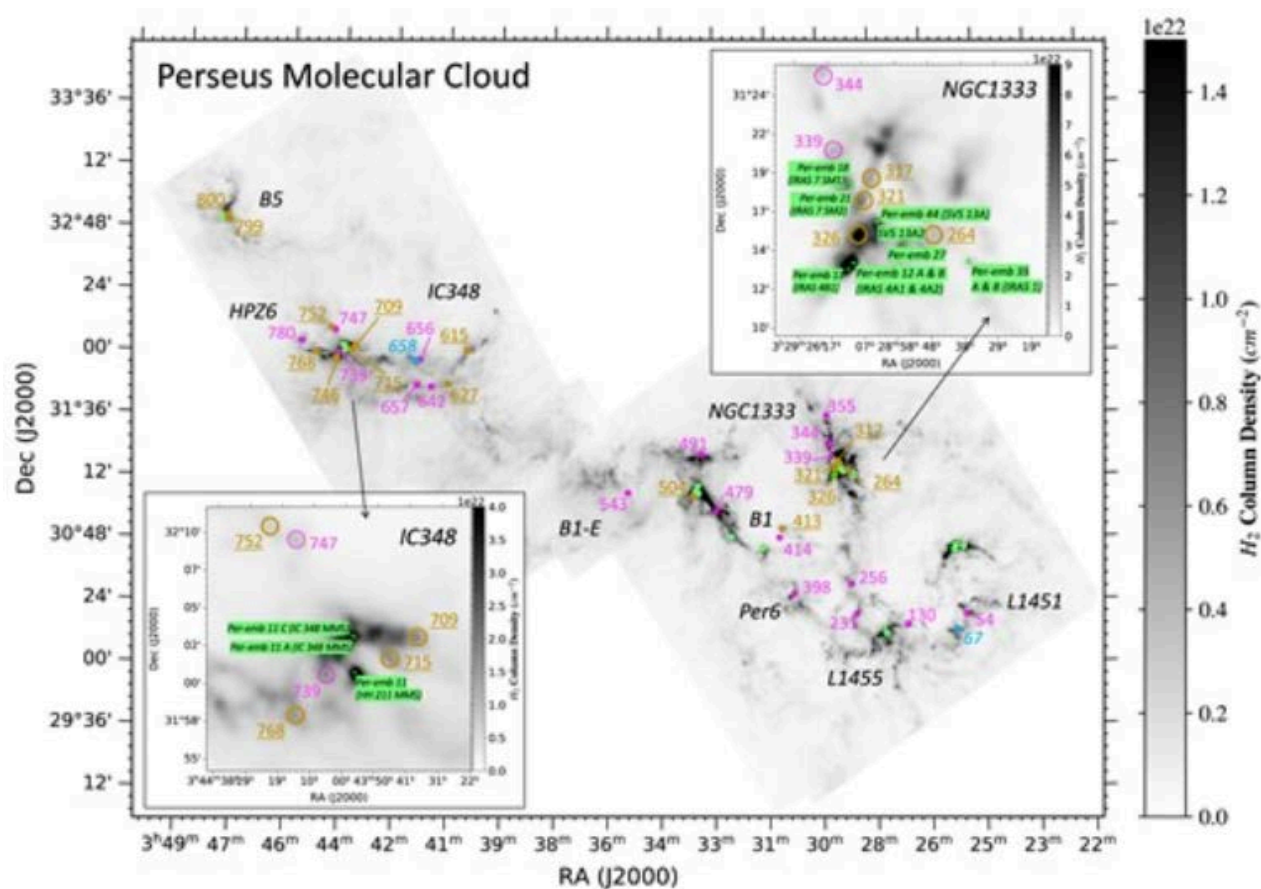
³ Científicos del CSIC lideran la detección de las moléculas más grandes halladas en el espacio (<https://www.csic.es/es/actualidad-del-csic/cientificos-del-csic-lideran-la-deteccion-de-las-moleculas-mas-grandes-halladas-en-el-espacio>).

⁴ Las moléculas interestelares desvelan nuestro origen (<https://www.rtve.es/play/audios/las-mananas-de-rne-lara-hermoso/mananas-rne-josep-cuni-moleculas-interestelares-clave-para-entender-nuestro-origen/16301063/>).

⁵ Moléculas y vida (https://www.cope.es/emisoras/castilla-la-mancha/guadalajara-provincia/guadalajara/noticias/observatorio-yebes-particulas-vida-universo-20241018_3030405.html#google_vignette).

Survey of complex organic molecules in starless and pre-stellar cores in the Perseus molecular cloud by Scibelli et al. (2024)

Another interesting, published result is the one by Scibelli et al., which studies starless cores. This study surveyed 35 starless and pre-stellar cores in the Perseus molecular cloud, thereby demonstrating that a significant proportion of COMs are formed in the early stages of the star formation process, preceding the subsequent development of stars and planets and seed later stages like protostellar discs and comets. This increases the number of sources where Complex Organic Molecules (COMs) have been detected.

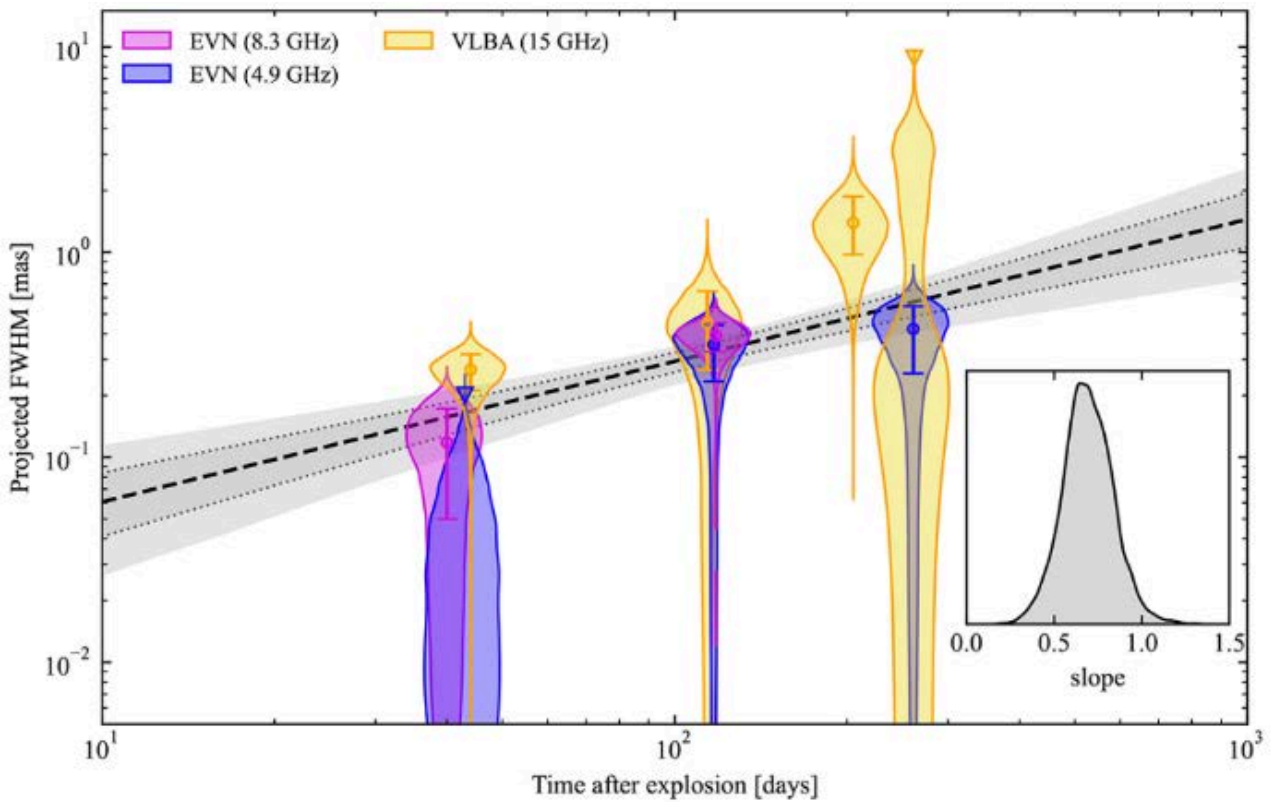


The authors have doubled the detection statistics of these kinds of molecules in cold cores and concluded that they are prevalent in the gas in several cold cores in the Perseus molecular cloud. Abundances and column densities have been obtained at different stages of low-mass star formation.

The expansion of the GRB 221009A afterglow by Giarratana et al. (2024)

This work monitored the expansion of the brightest Gamma-Ray Burst, GRB 221009A, with the EVN and the Very Long Baseline Array (VLBA) at 5, 8 and 15 GHz and confirmed its apparent superluminal expansion. Long-duration gamma-ray bursts are powerful explosions that may arise from the death of a massive star and the subsequent formation of a stellar mass black hole or neutron star with spin. These objects can generate relativistic jets of ejected matter that, when expanding, interact with the ambient medium and produce shocks. The expansion rate derived in this work is consistent with a spherical relativistic wave.

A summary of this work was published in the January 2025 EVN newsletter⁶. The expansion of the source over time, as observed at different frequencies, is illustrated in the accompanying figure.

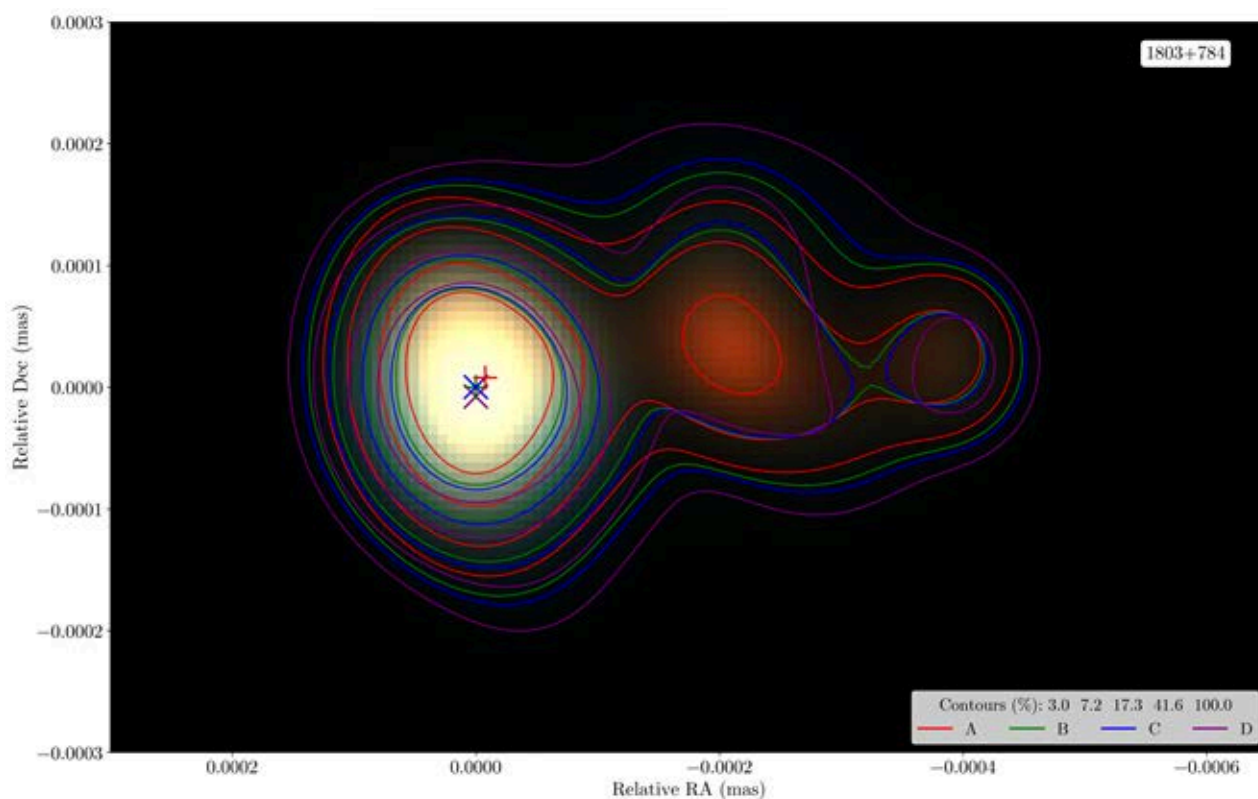


⁶ The expansion of the GRB 221009A afterglow (<https://www.evlbi.org/evn-newsletter/january-2025>).

Extragalactic research based on new-generation geodetic data by Pérez-Díez et al.

Another important result was obtained using new-generation VLBI geodetic data. The paper demonstrated that geodetic data can also be used for astrophysical studies. This international team, led by scientists and astronomers from the OAN, has developed a new technique to exploit geodetic data for extragalactic research. The data used are part of the next-generation geodetic VLBI system, the VGOS, accounting with the observations from 8 antennas from the net. In particular, the Yebes 13m antenna was used in the observations. The figure shows the capabilities of the technique creating the image of the most observed source, 1803+784, a powerful blazar.

This work was also published in the January 2025 EVN/JIVE Newsletter⁷



⁷ Extragalactic research based on new-generation geodetic data (<https://www.evlbi.org/evn-newsletter/january-2025/extragalactic-research-based-new-generation-geodetic-data>).

— NON ICTS INSTRUMENTS —

Yebes RAEGE & VGOS radio telescope and correlator

The VGOS 13.6 m radio telescope is not a facility included in the ICTS because it does not have open access, being an instrument dedicated to service observations of the International VLBI Service (IVS) to contribute to the determination of the Earth Orientation parameters, the International Terrestrial Reference Frame (ITRF) and the International Celestial Reference Frame (ICRF).

We include below some information about its usage:

The radio telescope participates in three programs under the umbrella of the VLBI Global Observing System initiative:

- VGOS Research and Development (VGOS-R&D) (24h sessions)
- VGOS Operations (VO) (24h sessions)
- VGOS Intensives (VGOS-INT) (1h sessions)



Yebes RAEGE & VGOS radio telescope and correlator

Besides its duties within the regular IVS program, four experimental observations to test new frequency sequences for VGOS were also conducted in April 2024. These aim to identify frequency channels that provide the best precision in geodetic VLBI while remaining eligible for governmental radio interference protection in accordance with ITU-R recommendations. The efforts are continuing in 2025. Unfortunately, on April 24th, the cable wrap suffered severe damage, leading to the suspension of operations for the rest of the year. In the following table, we present a summary of the number of sessions over the last five years, including the number of scheduled experiments for 2024.

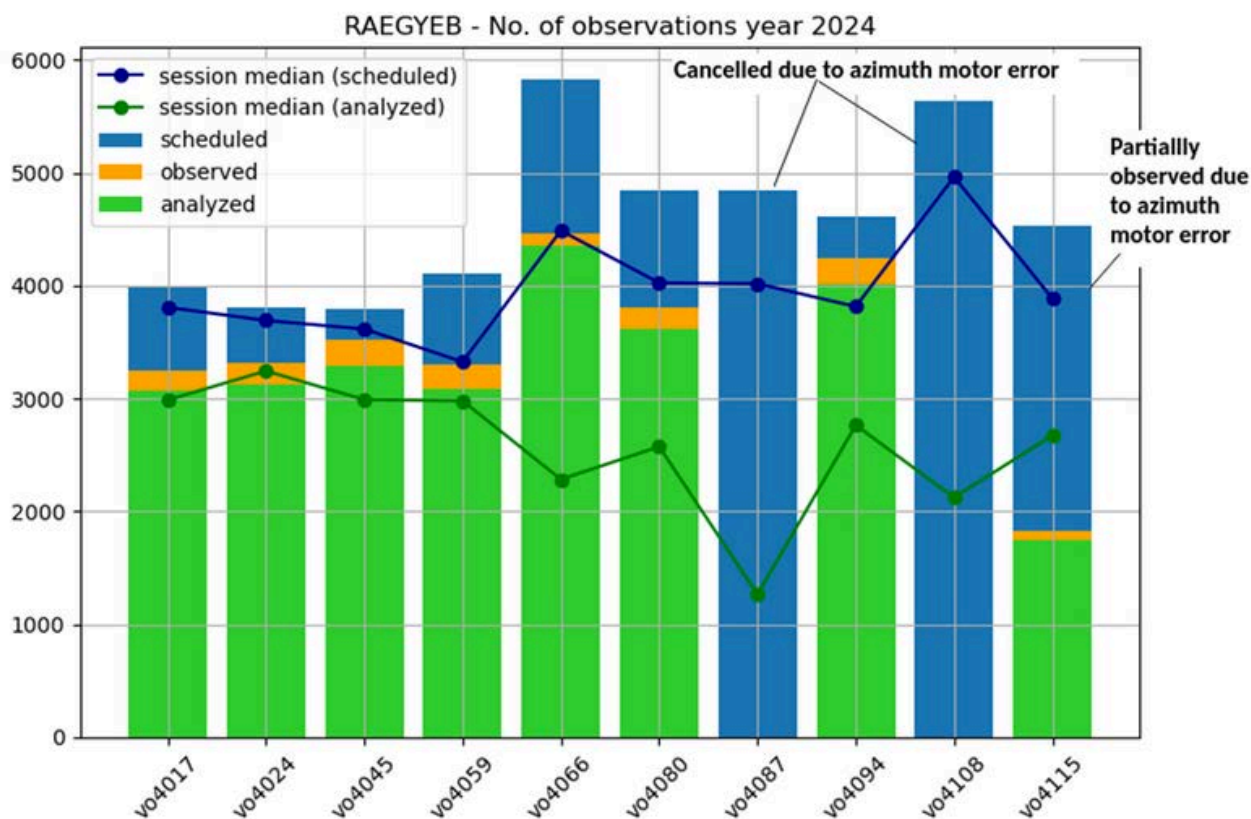
No of sessions/year

Year	2019	2020	2021	2022	2023	2024 (completed / scheduled)
VGOS-OPS	23	33	11	43	24	8/10
VGOS-INT					71	26/27
VGOS-RD					4	1/1
EU-VGOS	9	15	1	1	1	0
Others	1	8	4	16	2	4

Despite not being a fruitful year, the operational statistics were acceptable for the period during which the station was active, as can be seen from the following chart. To aid interpretation, the bars represent data relative to the station indicated in the figure title – in this case, the 13.2 m telescope at Yebes Observatory. In contrast, dots represent the session median across the results from all stations scheduled for that session.

- Blue represents the number of observations scheduled for the station.
- Orange represents the number of observations that were successfully observed.
- Green represents the number of observations that were analyzed by an IVS Analysis Center. Observations with no detections or big residuals are typically discarded by the analysis center and do not enter this qualification. A well-behaved station would have all its observations analyzed.

Yebe RAEGE & VGOS radio telescope and correlator



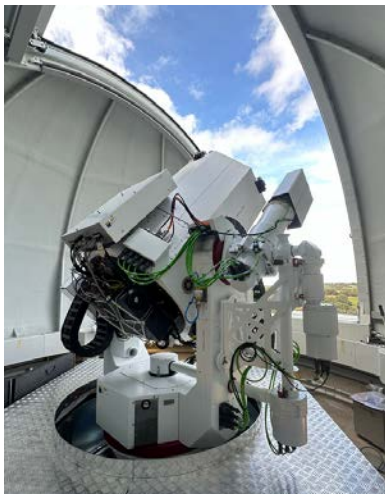
The observatory also operates a DiFX correlator to process VLBI observations. Currently it is devoted to the Intensive campaigns VGOS-INT-G and VGOS-INT-Y. Following is the summary of the activities related to the correlator in the year 2024:

- INT-Y programme: 26
- INT-G programme: 10
- Support for equipment debugging (DBBC3).
- Support in several fringe-test during the commissioning of the Matera VGOS Station.
- Presented at the 13th IVS General Meeting, held in Tsukuba, Japan, from March 4 to 9.

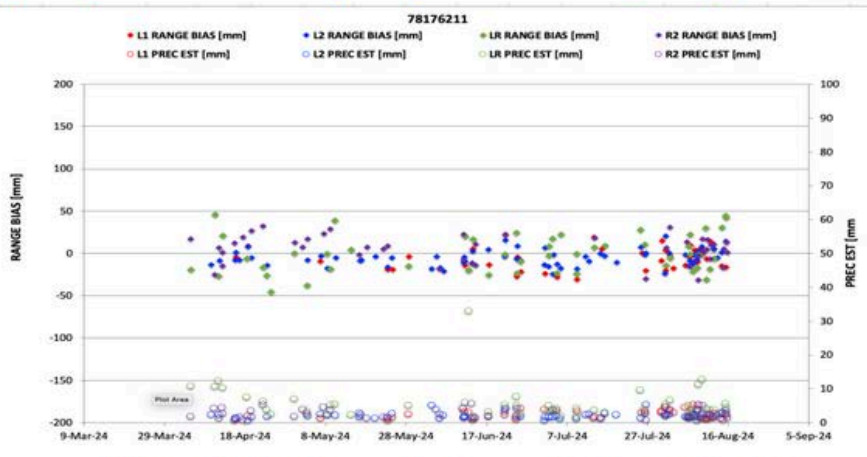


Satellite Laser Ranging at the Yebes Observatory

A very remarkable milestone was also achieved; the Satellite Laser Ranging at the Yebes Observatory became part of the International Laser Ranging Service (ILRS) network in 2024. The first satellite observation was completed in May 2023. Following a year dedicated to optimizing all subsystems and training observatory staff, regular satellite observations commenced in April 2024, with the aim of successfully completing the ILRS quarantine process. These observations demonstrate the station's high quality, as it can determine the distance to satellites with an accuracy of less than 6 mm. On 7 October, it was confirmed that the Yebes station had successfully completed the quarantine process and joined the ILRS network after the ILRS Analysis Standing Committee had analyzed the collected data.



LAGEOS-1			LAGEOS-2			LARES-2			LARES		
78176211 L1	PREC EST [mm]	RANGE BIAS [mm]	78176211 L2	PREC EST [mm]	RANGE BIAS [mm]	78176211 R2	PREC EST [mm]	RANGE BIAS [mm]	78176211 LR	PREC EST [mm]	RANGE BIAS [mm]
Mean	2.4	-6.5	Mean	2.1	-5.3	Mean	2.7	5.3	Mean	5.6	-0.2
STD	1.2	13.5	STD	1.0	9.3	STD	1.5	16.0	STD	4.9	22.4
RMS	2.7	14.9	RMS	2.3	10.6	RMS	3.1	16.7	RMS	7.4	22.2
Passes	40	40	Passes	65	65	Passes	44	44	Passes	50	50



NASA/GSFC & UMBC: M. Kuzmich-Cieslak, F. G. Lemoine, A. Belli. October 3, 2024

Technological Highlights

The Yebes Observatory is a Technological Development Center for Radio Astronomy with a long tradition and experienced scientific and engineering staff. The facility designs, develops and tests receivers, feeds, amplifiers and auxiliary equipment on site, serving both national and international partners.

Developments for the 40m RT

The most significant developments for the 40 m RT in 2024 have been:

Full commissioning of a wobbler, installed by the German company OHB in 2023, following the specifications provided by the OY. This project was funded by ERDF European Regional Developments Funds under project YNART (Infrastructures for the Upgrade of Yebes Observatory Telescopes) in the 2020-2023 period.



European Regional
Development Fund - ERDF

"A way of making Europe"

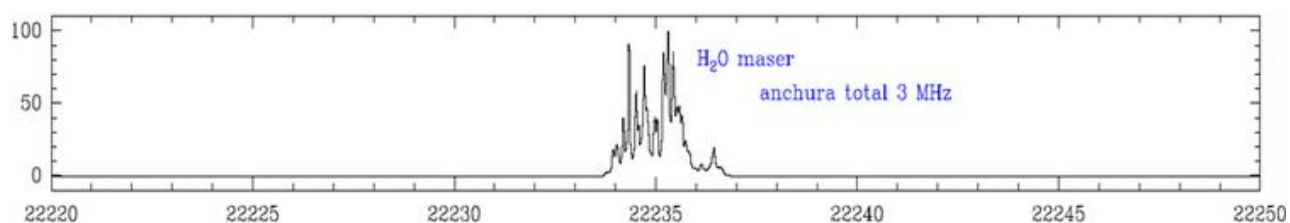
Developments for the 40m RT

The commissioning phase required software changes to synchronize the data acquisition of the spectral backends with the wobbling system. These were tested with observations of galactic and extragalactic sources.

Installation and commissioning of the ASTROREC 18-32 GHz receiver, fully designed at Yebes Observatory and partially built, the Intermediate Frequency block, by a Spanish Company with the guidance of the OY staff. The frontend block and the final integration of the whole chain were completed at the OY by its staff. This receiver was partially funded (10%) by the Spanish Research Agency project AEI/10.13039/501100011033 whereas 90% was provided by the IGN's annual own funds.



The commissioning consisted of long integration observations of sources to monitor radio frequency interferences (RFIs), both external and internal origin, and to uncover potential instrumental problems.

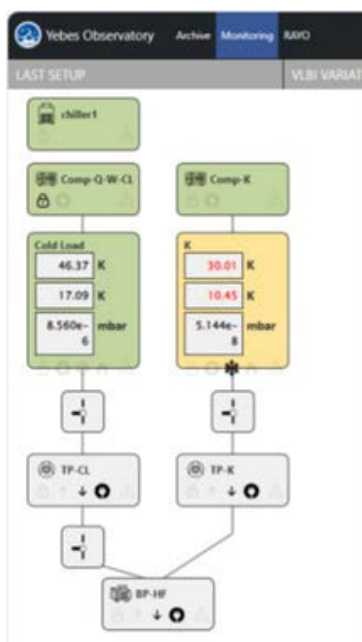


Developments for the 40m RT

Installation of new water compressors, a chiller and cold-water lines to handle the heat generated by the seven cryostats installed in the receiver room of the 40 m RT. This update is very important to ensure continuous operations of the radio telescope during summer. The figure on the left shows the water-cooled compressors inside the cabin, while the figure on the right shows the chiller located outside.



Development of a remote-control system for monitoring and controlling the physical conditions of the cryostats (vacuum and cryogenics), including a web interface.



Receiver Developments for VGOS

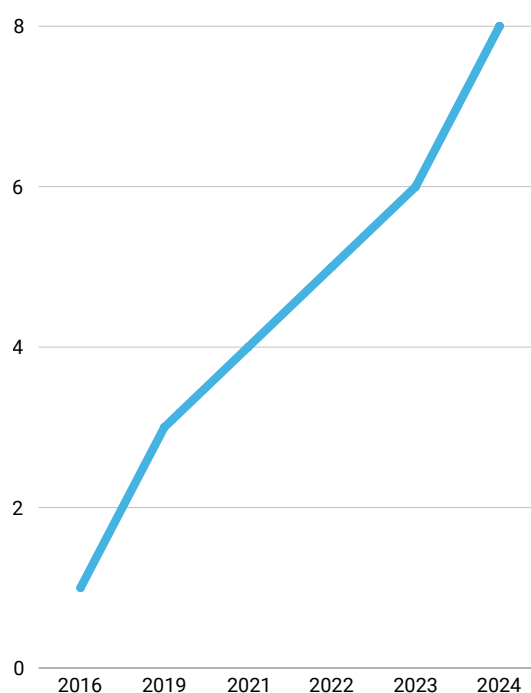
Yebes Observatory is an international reference center for designing and manufacturing radioastronomy and geodetic receivers, particularly advanced VGOS (VLBI Global Observing System) receivers. These broadband, cryogenic receivers (2–14 GHz) are built in-house and enable high-precision VLBI geodetic observations with simultaneous multi-band detection and dual polarization capabilities. The observatory designs the complete system, from the cryogenic front-end to phase and delay calibration.



Recent installations in 2024 showcase the observatory's expertise: in February 2024, a team installed a VGOS receiver at South Africa's HartRAO facility, followed by another at Italy's ASI-VLBI station in Matera in April 2024. To date, Yebes has developed eight VGOS receivers for the international community, deployed at RAEGE Yebes, RAEGE Santa María (Azores), NMA north and south (Norway), Metsähovi (Finland), NARIT (Thailand), HartRAO (South Africa), and Matera (Italy).

NUMBER OF VGOS RECEIVERS DESIGNING AND MANUFACTURING BY YEBES

STATION	YEAR	LOCATION
RAEGE	2016	YEBES
NMA1	2019	NORWAY
FGI	2019	FINLAND
NMA2	2021	NORWAY
RAEGE	2022	AZORES (SANTA MARIA)
NARIT	2023	THAILAND
HartRAO	2024	SOUTH AFRICA
MATERA	2024	ITALY (MATERA)

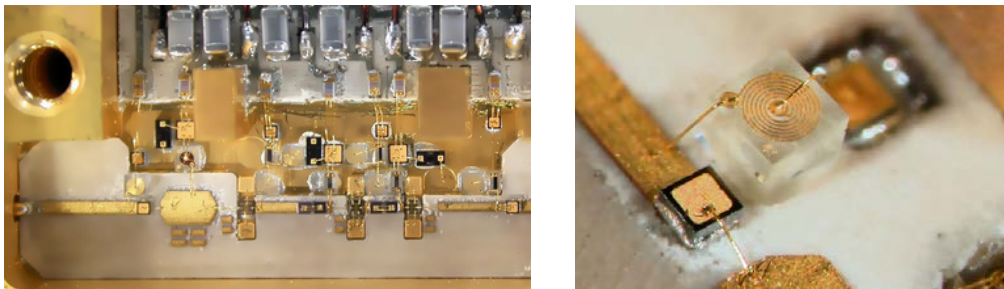


Cryogenic Amplifiers for the next generation ALMA

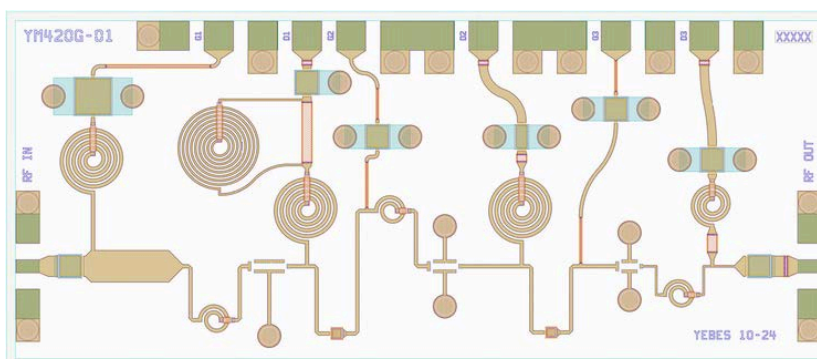
The Yebes Observatory amplifiers group has been actively involved, from its inception, in the instrumental development of receivers for the international ALMA observatory, the world's largest radio astronomy facility, located in the Atacama Desert (Chile). In recent years, the group's proposals to improve the next generation of low-noise cryogenic amplifiers (LNAs) have received funding in several competitive calls from the European Southern Observatory (ESO).

As a result of the studies carried out, prototypes have been developed that will allow twice the instantaneous bandwidth without any loss of sensitivity, effectively doubling the instrument's productivity. Building on this research, the article titled "A 16-GHz Bandwidth Cryogenic IF Amplifier With 4-K Noise Temperature for Sub-mm Radio-Astronomy Receivers" was published this year in the peer-reviewed journal IEEE Transactions on Terahertz Science and Technology.

Another milestone has also been reached this year by incorporating in the amplifier the biasing components of the mixers without degrading its performance. This eliminates the need for additional parts, simplifying the receiver, and improving its characteristics. Part of the RF and bias circuitry of one of these LNAs, as well as a detail of the key bias-T components can be seen in the microphotographs.



Work has also begun on integrating this LNA into a single chip (a monolithic microwave integrated circuit, MMIC) based on Indium Phosphide, in collaboration with the Swiss foundry Diramics, with which the amplifier group has been working for many years. Among other advantages, these chips, if successful, would enable future focal plane arrays in ALMA antennas. The image shows one of the first designs (a 3-stage MMIC with a size of 2x1.2 mm), which have already been sent for fabrication and are expected to yield results in the second quarter of next year.



Technical developments for other instruments

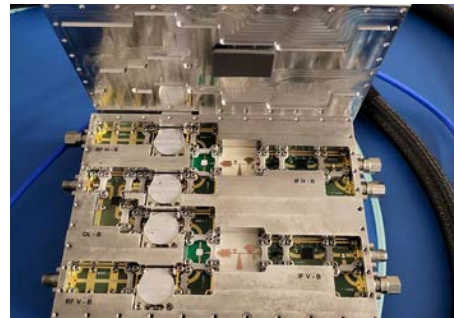
Several relevant technological developments and deployments not directly related to the 40m RT have taken place at Yebes Observatory during 2024.

◦ Superconducting high-temperature filter innovations

The development and measurement of high superconducting filters has continued and some results were presented in Pablo Garcia's PhD thesis.

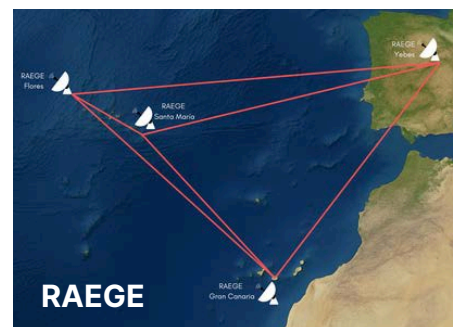
◦ Compact Downconverters tests

The work with compact downconverters continued and a prototype made of discrete SMD components was mounted on a milled aluminium box with high RFI isolation.



◦ VLBI Correlator Installation

The geodetic difX software correlator for the RAEGE has been used in the VGOS network for the determination of DUT1. 35 intensive sessions between SHAO, Ishioka, Santa Maria and Yebes 13m radio telescopes have been correlated and processed.



◦ Laboratory Expansion & Equipping

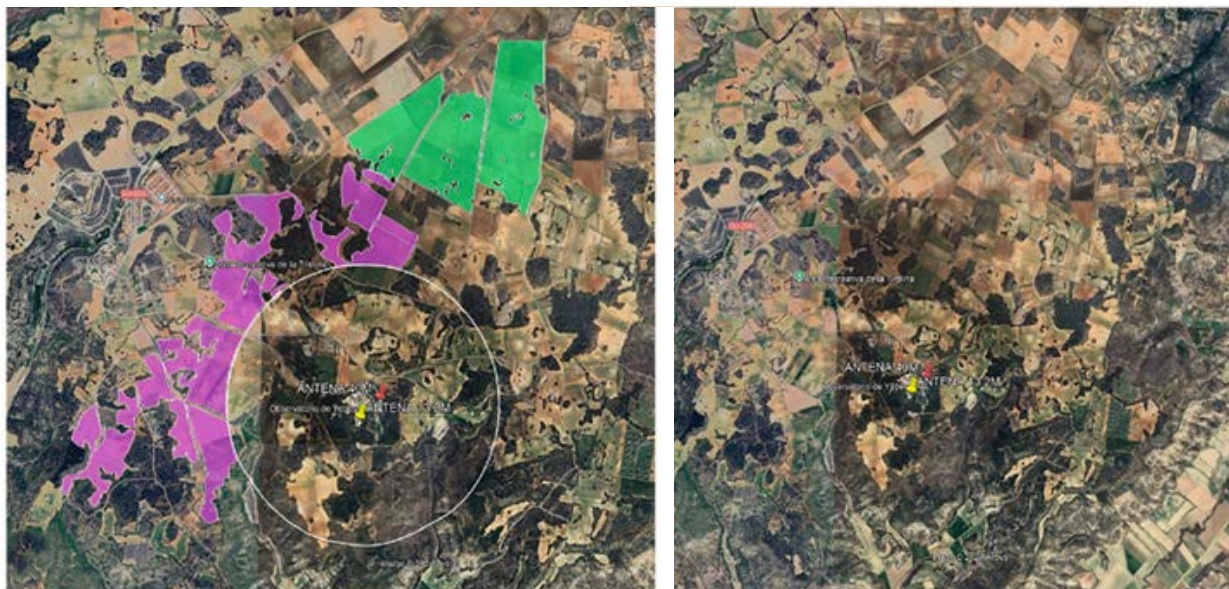
The relocation of the mechanical workshop and amplifiers laboratory was finally completed, and all equipment, materials, and infrastructure, such as helium and compressed air pipe distribution systems, were finally deployed in the new building. A new ISO 10000 clean room was put into operation together with a new metrology room, which allows the measurement of pieces with a precision of 1 micron.



Protection measures of the Observatory

This year Yebes Observatory requested to update an internal Ministerial Order to expand the Radio Quiet Zone (RQZ) protection to 3 km through and to update the radioelectric protection law with new emission thresholds. The protection also includes a previous request to the Secretary of State of Telecommunications and Digital Infrastructure for High Altitude Platforms Station (HAPS/HIPS) This order will be published in the BOE and entry into force in 2025.

On the other hand, after a long administrative procedure, the claims submitted by the Observatory to prevent the construction of two large photovoltaic plants in the surroundings of the Observatory were successful and therefore the construction license was not granted.



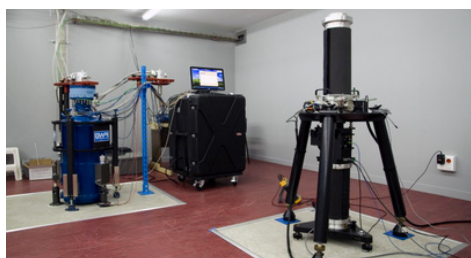
Fundamental geodetic station

This year Yebes Observatory received the status of fundamental geodetic station after the integration of the Yebes Laser Ranging Station in the International Laser Ranging Network. This station adds to the Global Navigation Satellite System (GNSS) and the VLBI radio telescope observing instruments and provides 3 independent observing techniques which contribute to the determination of the International Terrestrial Frame and the Earth Orientation Parameters. Other systems which contribute are the superconductive gravimeter to measure the local gravitational field and the local tie which relates all the three systems together. This places Yebes Observatory in a very exclusive and small community in the world.



Richard A. Gross
Richard Gross, Chair
Global Geodetic Observing System

Michael R. Pearlman
Michael Pearlman, Director
GGOS Bureau of Networks and Observations



Education & Outreach

The Yebes Observatory has a long-standing presence in the regional education system. Through an agreement between the Observatory and Yebes Town Hall, we host around 6,500 visits from schools and families each year. Additionally, the Observatory staff handle around 20 visits per year from university groups, associations and Spanish public institutions.



We regularly participate in university employment fairs to promote careers in research and development. We also offer internships for undergraduate students and four-year IGN scholarships to train the next generation of staff. In 2024, the Yebes Observatory tutored five graduate students from the University of Alcalá de Henares.

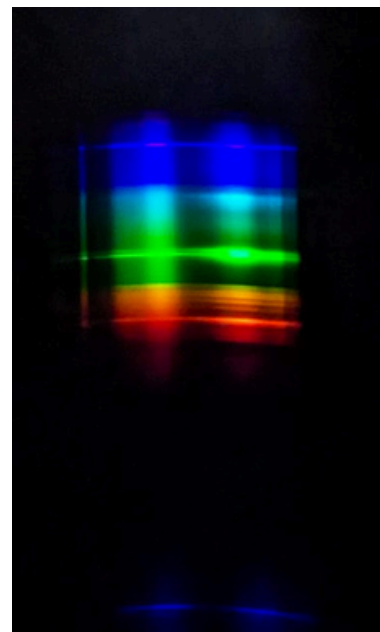
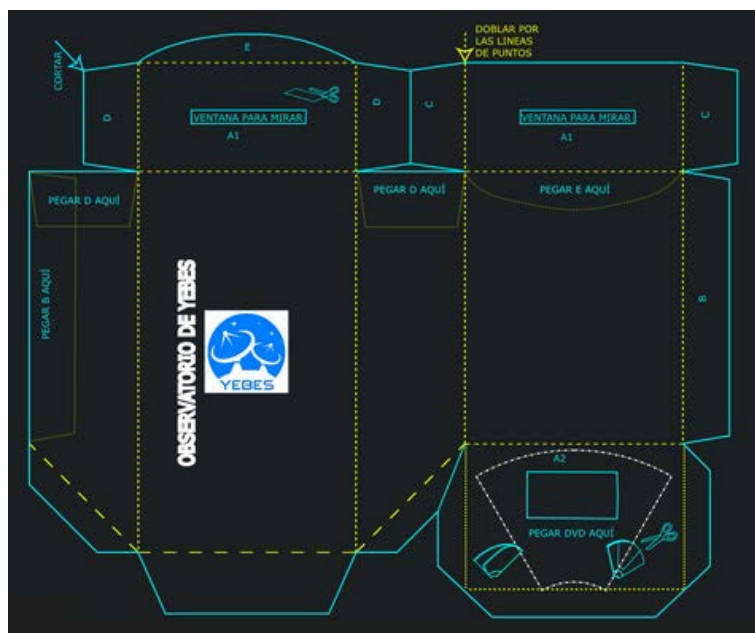


The Observatory usually responds to around five media enquiries each year about its research and development activities. These enquiries primarily involve television and radio interviews. We also issue one or two press releases per year to highlight astronomical discoveries made with the 40m RT and European funding secured by the ICTS.

Education & Outreach

We actively participate in events that promote scientific research to girls and women, and we organise an Open Week that showcases the Observatory's daily operations. This includes video presentations by staff.

On 11 February 2024, for instance, the Yebes Observatory participated in the International Day of Women and Girls in Science celebrations in a very special way. Four female scientists from the observatory took part in the 'Divulgaciencia' programme, a series promoted by the Culture Department of Guadalajara City Council which aims to make science accessible to all. Scientists Marta Bautista Durán and Andrea Martínez Parra ran an educational workshop entitled 'The universe in colours: build your own spectroscope' at the Francisco Sobrino Museum, aimed at children aged 10 to 12. Participants built their own spectroscope to discover what light is and learn about its properties. Elena Martínez Sánchez gave a talk at the Guadalajara municipal library entitled 'Observing the Earth from Yebes', in which she explained the geodetic and Earth observation activities carried out at the observatory to a family audience. To conclude the day's events, the observatory's astronomer Cristina García Miró delivered an educational and awareness-raising talk at the Buero Vallejo Theatre. Entitled 'How did I get hooked on antennas?', the talk was aimed especially at girls. In this talk, Cristina shared her passion for antennas and radio astronomy with primary school students in Years 5 and 6 from across the province.



Staff⁸

Director:
P. de Vicente

Coordination:
Laura Barbas

Administration:
Marifé Barriopedro
Elena González
Elena Tarifa
Antonio Miguel

Geodetic Applications:
Adolfo García-Marín
Elena Martínez
Ana Sancho
Beatriz Vaquero

Operations:
Rubén Fernández
Daniel Sastre
Daniel Valero
Ángel Vicente

Engineering:
Carlos Albo
Ricardo Amils
Marta Bautista
Maria del Carmen Diez
Juan Daniel Gallego
Alberto García
Óscar García
Pablo García
Aarón González
Javier González
José Manuel Hernández
Isaac López
José Antonio López-Pérez
Inmaculada Malo
Andrea Martínez
Francisco Muñoz
María Patino
Gabriel Gómez
David Regajo
Javier Sánchez
Félix Tercero

⁸ Staff working for Yebes Observatory as of 31 December 2024. Subcontractors are not included.

Staff⁸

Laboratory and workshop technical staff:

José Antonio Abad

Adrián Alonso

Alfonso Bollo

Jesús Carpintero

Joaquín Fernández-Paniagua

Rafael García

Álvaro Gómez

Sergio Henche

Juanjo Llamas

Gonzalo Martínez

Óscar Padrino

Hector Martín Pérez

José María Yagüe

Astronomers on duty:

Alba Aller

Jairo Díaz-Luis

Gisela Espluges

Iván Gallardo

Cristina García-Miro

Miguel Gómez

María Jesús Jiménez-Donaire

Nuria Marcelino

Víctor Pérez

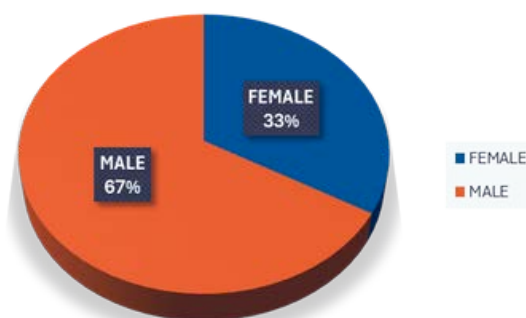
Miguel Santander

Paula Tarrío

Belén Tercero

Alba Vidal

STAFF



⁸ Staff working for Yebes Observatory as of 31 December 2024. Subcontractors are not included.

ICTS Committees¹⁰

Evaluation / Programme Committee
Ivana Beslic (OBSPM)
José Carlos Guirado (UV)
Aina Palau (UNAM)
Carmen Sánchez (CAB) ¹¹
Miguel Santander (OAN-IGN) ¹²
Kazi Rygl (INAF)

Scientific Advisory Committee
Belén Galocha (UPM)
Izaskun Jiménez-Sierra (CAB) ¹¹
Juan Ramón Pardo (CSIC)
María Rioja (ICRAR)
Álvaro Sánchez Monge (ICE-CSIC)
Miguel Sánchez-Portal (IRAM)
Belén Tercero (OAN-IGN)

¹⁰ Members as of 31 December 2024

¹¹ Chair

¹² Technical Advisor

List of publications

List of scientific papers published in peer-reviewed journals in 2024 that used data from Yebes telescopes. Projects used to obtain the results are highlighted in bold face and in parenthesis. We distinguish between single dish and VLBI data by using these keywords in brackets at the end of each line.

1. Agúndez, M. et al., **The rich interstellar reservoir of dinitriles: Detection of malononitrile and maleonitrile in TMC-1**, *Astronomy & Astrophysics* 688, L31, (19A003, 20A014, 20D023, 21A011, 21D005, 22A007, 22B029, 23A024), [SINGLE-DISH]
2. Algaba, J. C. et al., **Broadband multi-wavelength properties of M87 during the 2018 EHT campaign including a very high energy flaring episode**, *Astronomy & Astrophysics* 692, A140, (ML005), [VLBI]
3. Baczko, A. K. et al., **The putative center in NGC 1052**, *Astronomy & Astrophysics*, 692, A205, (-), [VLBI]
4. Bartkiewicz, A. et al., **Proper motion study of the 6.7 GHz methanol maser rings. I. A sample of sources with little variation**, *Astronomy & Astrophysics*, 686, A275 (EN003, EB031, EB034, EB052), [VLBI]
5. Cabezas, C. et al., **Laboratory and astronomical discovery of cyanothioketene, NCCHCS, in the cold starless core TMC-1**, *Astronomy & Astrophysics*, 686, L3 (19A003, 20A014, 20D023, 21A011, 21D005, 23A024), [SINGLE-DISH]
6. Cernicharo, J. et al., **Discovery of thiofulminic acid with the QUIJOTE line survey: A study of the isomers of HNCS and HNCO in TMC-1**, *Astronomy & Astrophysics*, 682, L4 (19A003, 20A014, 20D023, 21A011, 21D005, 22A007, 22B029, 23A024), [SINGLE-DISH]
7. Cernicharo, J. et al., **Study of the HCCNC and HNCCC isotopologs in TMC-1**, *Astronomy & Astrophysics*, 682, L13 (19A003, 20A014, 20D023, 21A011, 21D005, 23A024), [SINGLE-DISH]
8. Cernicharo, J. et al., **CN and CCH derivatives of ethylene and ethane: Confirmation of the detection of CH₃ CH₂CCH in TMC-1**, *Astronomy & Astrophysics*, 686, A139 (19A003, 20A014, 20D023, 21A011, 21D005, 22A007, 22B029, 23A024), [SINGLE-DISH]
9. Cernicharo, J. et al., **Discovery of two cyano derivatives of acenaphthylene (C₁₂H₈) in TMC-1 with the QUIJOTE line survey**, *Astronomy & Astrophysics*, 690, L13 (19A003, 20A014, 20D023, 21A011, 21D005, 23A024), [SINGLE-DISH]
10. Cernicharo, J. et al., **More sulphur in TMC-1: Discovery of the NC₃S and HC₃S radicals with the QUIJOTE line survey**, *Astronomy & Astrophysics*, 688, L13 (19A003, 20A014, 20D023, 21A011, 21D005, 23A024), [SINGLE-DISH]
11. Cernicharo, J. et al., **QUIJOTE discovery of the cation radicals HC₅N⁺ and HC₇N⁺**, *Astronomy & Astrophysics*, 686, L15 (19A003, 20A014, 20D023, 21A011, 21D005, 22A007, 22B029, 23A024), [SINGLE-DISH]
12. Chen, S. et al., **Windy or not: Radio pc-scale evidence for a broad-line region wind in radio-quiet quasars**, *ApJ*, 975, 35 (EC088), [VLBI]
13. Colzi, L. et al., **Excitation and spatial study of a prestellar cluster towards G+0.693-0.027 in the Galactic centre**, *Astronomy & Astrophysics*, 690, A121 (21A014), [SINGLE-DISH]
14. EHT, et al., **Broadband Multi-wavelength Properties of M87 during the 2018 EHT Campaign including a Very High Energy Flaring Episode**, *Astronomy & Astrophysics*, 692, A140 (ML005),), [VLBI]
15. Esplugues, G. et al., **Evolution of Chemistry in the envelope of H0t CorinoS (ECHOS) II. The puzzling chemistry of isomers as revealed by the HNCS/HSCN ratio**, *Astronomy & Astrophysics*, 692, A5 (22A028), [SINGLE-DISH]

List of publications

16. Fuentetaja, R. et al., **Space and laboratory discovery of iminopentadienylidene, HNC5**, *Astronomy & Astrophysics*, 688, L29 (19A003, 20A014, 20D023, 21A011, 21D005, 23A024), [SINGLE-DISH]
17. Fuentetaja, R. et al., **Discovery of HCCCH₂CCH in TMC-1 with the QUIJOTE line survey**, *Astronomy & Astrophysics*, 688, L15 (19A003, 20A014, 20D023, 21A011, 21D005, 23A024), [SINGLE-DISH]
18. Giarratana, S. et al., **The expansion of the GRB 221009A afterglow**, *Astronomy & Astrophysics*, 690, A74 (RG013), [VLBI]
19. Gupta, H. et al., **Calcium Chemistry in Carbon-rich Circumstellar Environments: The Laboratory and Astronomical Discovery of Calcium Dicarbide, CaC₂**, *ApJ Letters*, 966, L28 (19A010, 20A017, 20B014, 21A019), [SINGLE-DISH]
20. Jaron, F. et al., **Cross-Polarization Gain Calibration of Linearly Polarized VLBI Antennas by Observations of 4C 39.25**, *Radio Science*, 59, 4 (er2201), [VLBI]
21. Kareinen, N. et al., **Mitigating the effect of source structure in geodetic VLBI by re-weighting observations using closure delays and baseline-to-jet orientation**, *Journal of Geodesy*, 98, 38 (CONT17), [VLBI]
22. Kim, J. et al., **Imaging the black hole shadow and extended jet of M87**, *Astronomy & Astrophysics*, 696, A169 (sin código), [VLBI]
23. Krezinger, M. et al., **Proper motion of the radio jets in two blazars at redshift above 3**, *RNAAS*, 8, 121 (ET036), [VLBI]
24. Ladu, E. et al., **IC 485: A new candidate disc-maser galaxy at 100 Mpc. Milliarcsecond resolution study of the galaxy nucleus and the H₂O megamaser**, *Astronomy & Astrophysics*, 682, A25 (ET038), [VLBI]
25. Lattanzi, V. et al., **Advancing spectroscopic understanding of HOCs+: Laboratory investigations and astronomical implications**, *Astronomy & Astrophysics*, 689, A260 (21A014), [SINGLE-DISH]
26. Lico, R. et al., **High-resolution imaging of the evolving bipolar outflows in symbiotic novae: the case of RSophiuchi 2021 nova outburst**, *Astronomy & Astrophysics*, 692, A107 (RG012), [VLBI]
27. Lisakov, M. et al., **Kilogauss magnetic field and jet dynamics in the quasar NRAO 530**, *Astronomy & Astrophysics*, 693, A9 (MB007), [VLBI]
28. Massalkhi, S. et al., **Multiline study of the radial extent of SiO, CS, and SiS in asymptotic giant branch envelopes**, *Astronomy & Astrophysics*, 688, A16 (18B011, 20A017, 20B014, 21A019), [SINGLE-DISH]
29. Miettinen, O. et al., **A 3 mm Spectral Line Study of the Central Molecular Zone Infrared Dark Cloud G1.75-0.08**, *Galaxies*, 12, 32 (23A004, 24A005), [SINGLE-DISH]
30. Miyoshi, M. et al., **The Jet and Resolved Features of the Central Supermassive Black Hole of M87 Observed with EHT in 2017---Comparison with the GMVA 86 GHz Results**, *ApJ Letters*, 963, L18 (ML005), [VLBI]
31. Pabst, C. H. M. et al., **Multiline observations of hydrogen, helium, and carbon radio-recombination lines toward Orion A: A detailed dynamical study and direct determination of physical conditions**, *Astronomy & Astrophysics*, 688, A7 (22A012), [SINGLE-DISH]
32. Paraschos, G. F. et al., **Evidence of a toroidal magnetic field in the core of 3C 84**, *Astronomy & Astrophysics*, 688, L5 (GP058), [VLBI]

List of publications

33. Park, J. et al., **Discovery of Limb Brightening in the Parsec-scale Jet of NGC 315 through Global Very Long Baseline Interferometry Observations and Its Implications for Jet Models**, ApJ, 973, L5 (GP060), [VLBI]
34. Park, J. et al., **Observational evidence to support a dense ambient medium shaping the jet in 3C 84**, Astronomy & Astrophysics, 685, A115 (GP060), [VLBI]
35. Pérez-Díez, V. et al., **Towards an astronomical use of new-generation geodetic observations. I. From the correlator to full-polarization images**, Astronomy & Astrophysics, 688, A151 (VO2187), [VLBI]
36. Rey-Montejo, M. et al., **Discovery of MgS and NaS in the Interstellar Medium and Tentative Detection of CaO**, ApJ, 975, 174 (21A014), [SINGLE-DISH]
37. San Andrés, D. et al., **First Detection in Space of the High-energy Isomer of Cyanomethanimine: H2CNCN**, ApJ, 967, 39 (21A014), [SINGLE-DISH]
38. Sanz-Novo, M. et al., **Interstellar Detection of O-protonated Carbonyl Sulfide, HOCS+**, ApJ, 965, 149 (21A014) [SINGLE-DISH]
39. Scibelli, S. et al., **Survey of complex organic molecules in starless and pre-stellar cores in the Perseus molecular cloud**, MNRAS, 533, 4 (22A022, 23A025), [SINGLE-DISH]
40. Taniguchi, K. et al., **The SOFIA Massive (SOMA) Star Formation Q-band follow-up I. Carbon-chain chemistry of intermediate-mass protostars**, Astronomy & Astrophysics, 692, A65 (22A008, 22B005), [SINGLE-DISH]
41. Tercero, B. et al., **Doubly substituted isotopologues of Hccc in TMC-1: Detection of D13CCCN, DC13CCN, DCC13CN, DCCC15N, H13C13CCN, H13CC13CN, HC13C13CN, HCC13C15N, and HC13CC15N**, Astronomy & Astrophysics, 682, L12 (19A003, 20A014, 20D023, 21A011, 21D005, 22A007, 22B029, 23A024), [SINGLE-DISH]
42. Thomas, C. et al., **Performance of the IVS R1 and R4 sessions**, Advances in Space Research 73, 1 (2016-2020), [VLBI]
43. Traianou, E. et al., **Lost in the curve: Investigating the disappearing knots in blazar 3C 454.3**, Astronomy & Astrophysics, 682, A154 (-), [VLBI]
44. Tu, T. et al., **A Yebes W-band Line Survey towards an Unshocked Molecular Cloud of Supernova Remnant 3C 391: Evidence of Cosmic-Ray-Induced Chemistry**, ApJ, 974, 262 (23A021), [SINGLE-DISH]
45. Tu, T. et al., **Molecular chemistry induced by J-shock toward supernova remnant W51C**, Astronomy & Astrophysics 693, A222 (24A003), [SINGLE-DISH]
46. Veena, V. S. et al., **Star formation in extreme environments: A 200 pc high velocity gas stream in the Galactic centre**, Astronomy & Astrophysics, 689, A121 (21A017), [SINGLE-DISH]
47. Veres, P. M. et al., **European VLBI Network observations of the peculiar radio source 4C 35.06 overlapping with a compact group of nine galaxies**, Astronomy & Astrophysics, 684, A188 (EG098B), [VLBI]

List of proposals

We include the list of proposals requested and observed at the 40m radio telescope as a single dish instrument and as part of the EVN and the GMVA.

Approved proposals for single dish observations

- **24A001** - *Searching for DCN 1-0, DNC 1-0 and DCO+ 1-0 in early-stage massive star-forming regions* - Yuqiang li
- **24A002** - *How widespread are aromatics in cold clouds?* - Marcelino Agundez
- **24A003** - *Molecular Chemistry Induced by J-shock in Supernova Remnant W51C* - Tianyu Tu
- **24A004** - *Further Investigation of the extended ultra-hot gas in the Galactic center with the Yebes 40m telescope* - Juan Li
- **24A005** - *Dynamical state and deuterium fractionation of the infrared dark cloud G1.75-0.08 near the Galactic Centre* - Oskari Miettinen
- **24A006** - *Cataloging the Complex Chemistry towards the Highly-Deuterated Prestellar Core IRAS 16293 E* - Samantha Scibelli
- **24A008** - *Astrochemical Insight: Q Band Line Survey of High Mass Star-Forming Regions with Yebes 40m Telescope* - suman kumar mondal
- **24A009** - *Linking core and cloud chemistry in the chemically rich star-forming region G31.41+0.31* - Maria Teresa Beltran
- **24A010** - *Expanding the dominions of the RNA prebiotic feedstock in the Galactic Center* - David San Andrés de Pedro
- **24A011** - *Is the extended, narrow SiO tracing different molecular cloud formation scenarios?* - Wonju Kim
- **24A012** - *Monitoring of SiO masers in evolved stars (Continuation)* - Miguel Gómez Garrido
- **24A014** - *Discovering the chemical complexity towards the outer Galaxy source WB89-621* - Laura Colzi
- **24A019** - *Chemical Inventory of a Molecular Cloud Interacting with a Supernova Remnant* - Giuliana Cosentino
- **24A020** - *Origin of DCO+ in cold molecular clouds* - Junzhi Wang
- **24A021** - *3mm spectroscopic mapping observation toward S255 to S257 region* - Shu Li
- **24A023** - *Exploration of the diffuse interstellar gas composition* - gerin
- **24A024** - *Investigating Massive Protostars: A High-Sensitivity Q Band Line Survey with RT40m Telescope* - Prasanta Gorai
- **24A025** - *A Q Band Astrochemical Survey of Extended Green Objects* - Ankan Das
- **24A026** - *Improving the K-band Celestial Reference Frame: Cycle 4* - Aletha de Witt
- **24A028** - *Effect of ionized gas on massive clumps and "lobe" structure in M17 northern cloud* - Zhu Feng-Yao
- **24A029** - *Mapping chemistry in TMC-1: Improving the sensitivity of SANCHO to map rare species and isotopologues* - Jose Cernicharo

List of proposals

- **24B001** - SiO maser monitoring in post-AGB disks - Iván Gallardo Cava
- **24B002** - Tracking SMBH binary orbits using K/Q/W simultaneous VLBI - Hyunwook Ro
- **24B003** - Does X-ray/far-UV emission from companions destroy molecules in the envelope of AGB stars? - José Jairo Díaz Luis
- **24B004** - New potentially aromatic-rich sources - Marcelino Agundez
- **24B006** - A systematic molecular spectral line survey towards mixed chemistry planetary nebulae - Xujia Ouyang
- **24B007** - The Infall Motion of Potential Episodic Accretion Sources - Song Shi-Min
- **24B008** - High-precision AGN Core-shift Measurements using Triple-band Source-frequency Phase-referencing - Guang-Yao Zhao
- **24B009** - Monitoring of SiO masers in evolved stars (Continuation) - Miguel Gómez Garrido
- **24B010** - Chemistry induced by cosmic rays towards supernova remnant Kes79 - Tianyu Tu
- **24B011** - Q-band survey of CO-emitting post-AGB disks - Iván Gallardo Cava
- **24B012** - Complex organics and their precursor radicals in an evolved prestellar core B10-1/L1495 - Anna Punanova
- **24B013** - Investigating the chemical composition evolution of high-mass star-forming regions - Jialiang Chen
- **24B014** - Examining Molecular Gas Chemistry in Dust-Lane Collisions in the Central Molecular Zone - Veena Vadamattom Shaji
- **24B015** - Gas ionisation in M17 - Andrea Socci
- **24B016** - Chemical evolution in the early stages of the formation of intermediate-mass protostars (IMs) - Patricia Fernández Ruiz
- **24B019** - Is spatially-extended, narrow line-width SiO emission caused by accretion shocks onto molecular clouds? - Seamus Clarke
- **24B020** - Mapping chemical complexity and deuteration in the IRAS 16293 E pre-stellar core - Judit Ferrer Asensio
- **24B021** - Cold Carbon-Chain Molecules in Barnard 5 - Anna Punanova
- **24B024** - Mapping the emission of COMs toward the L1544 pre-stellar core - Izaskun Jiménez
- **24B025** - Improving the K-band Celestial Reference Frame: Cycle 5 - Aletha de Witt

List of proposals

Approved & observed proposals within the EVN

- **8EV-2024-47 - ET052** - High resolution imaging of relativistic outflows from neutron star mergers - Troja
- **EV-2024-01 - EM178** - The microblazar candidate IRAS 18293- 0941 - B. Marcote (J. Marti)
- **EV-2024-02 - EC096** - AGN or Starburst? Confirming the Nature of Off-nuclear Radio Emission in NGC2146 - X. Cheng
- **EV-2024-03 - EC097** - Hyper-eddington accretion: pc-scale radio structures in IRAS 04416+1215 - N. Chang
- **EV-2024-04 - EY044** - Search for an unprecedented radio jet from a nearby thermal TDE - J. Yang
- **EV-2024-05 - EL073** - High-resolution imaging of late-time radio rebrightening in SN2022xxf - J. Leung
- **EV-2024-06 - EG131** - Tracing the Radio Outflows in RQ AGN from Pc- to Kpc-scales - S. Ghosh
- **EV-2024-07 - EY045** - Episodic Compact Symmetric Objects: a unique window on relativistic jets - X. Yan
- **EV-2024-08 - EB108** - Triggered VLBI observations of transient maser activity VI - R. Burns
- **EV-2024-09 - EL074** - OH gas in Megamaser Galaxies: imaging the diffuse and compact emission - D. Li
- **EV-2024-10 - EW039** - The nature of the excess radio emission in extremely stable QSOs - HC. Wang
- **EV-2024-11 - EB109** - Revisit two prominent OH MMs - W. Baan
- **EV-2024-12 - EX010** - Deep Imaging Observation of Two Varstrometry Selected Dual-Quasar Candidates - WC. Xu
- **EV-2024-13 - EB111** - Simultaneous optical and radio observations of AM Her - K. Bakowska
- **EV-2024-14 - EN014** - Are blazar jets associated with IceCube neutrinos? - C. Nanci
- **EV-2024-15 - ES112** - Corroborating the resolved radio jet in a candidate "turn-on" AGN - XW. Shu
- **EV-2024-16 - EW040** - Searching for dual-quasar candidates with projected separations < 0.1 kpc - HC. Wang
- **8EV-2024-47 - ET052** - High resolution imaging of relativistic outflows from neutron star mergers - Troja
- **EV-2024-01 - EM178** - The microblazar candidate IRAS 18293- 0941 - B. Marcote (J. Marti)
- **EV-2024-02 - EC096** - AGN or Starburst? Confirming the Nature of Off-nuclear Radio Emission in NGC2146 - X. Cheng
- **EV-2024-03 - EC097** - Hyper-eddington accretion: pc-scale radio structures in IRAS 04416+1215 - N. Chang

List of proposals

Approved & observed proposals within the EVN

- **EV-2024-04 - EY044** - Search for an unprecedented radio jet from a nearby thermal TDE - J. Yang
- **EV-2024-05 - EL073** - High-resolution imaging of late-time radio rebrightening in SN2022xxf - J. Leung
- **EV-2024-06 - EG131** - Tracing the Radio Outflows in RQ AGN from Pc- to Kpc-scales - S. Ghosh
- **EV-2024-07 - EY045** - Episodic Compact Symmetric Objects: a unique window on relativistic jets - X. Yan
- **EV-2024-08 - EB108** - Triggered VLBI observations of transient maser activity VI - R. Burns
- **EV-2024-09 - EL074** - OH gas in Megamaser Galaxies: imaging the diffuse and compact emission - D. Li
- **EV-2024-10 - EW039** - The nature of the excess radio emission in extremely stable QSOs - HC. Wang
- **EV-2024-11 - EB109** - Revisit two prominent OH MMs - W. Baan
- **EV-2024-12 - EX010** - Deep Imaging Observation of Two Varstrometry Selected Dual-Quasar Candidates - WC. Xu
- **EV-2024-13 - EB111** - Simultaneous optical and radio observations of AM Her - K. Bakowska
- **EV-2024-14 - EN014** - Are blazar jets associated with IceCube neutrinos? - C. Nanci
- **EV-2024-15 - ES112** - Corroborating the resolved radio jet in a candidate "turn-on" AGN - XW. Shu
- **EV-2024-16 - EW040** - Searching for dual-quasar candidates with projected separations < 0.1 kpc - HC. Wang
- **EV-2024-17 - ES113** - Detecting the jet/outflow in a post-TDE residing a Narrow-line Seyfert 1 galaxy - J. Sun
- **EV-2024-18 - EG133** - Structural evolution in the afterglows of GRBs detected by Einstein Probe - M. Giroletti
- **EV-2024-19 - EH047** - A potential triple AGN system with 5 kpc separation in a $z = 0.83$ galaxy cluster - M. Hilton
- **EV-2024-20 - ED051** - Is there an obscured active nucleus in MeerKAT's highest-redshift OH megamaser? - R. Deane
- **EV-2024-21 - EL075** - Searching subpc-scale jet from extremely low accretion rate SMBH in M60 - XF. Li
- **EV-2024-22 - GB082** - Measuring Jupiter's temperature structure with Juno radio occultations - T. Bocanegra (A. Akins)
- **EV-2024-23 - GC040** - Improving the K-band celestial reference frame for the next multi-waveband ICRF - P. Charlot (A. de Witt)
- **EV-2024-36 - RSG018** - Calibrators around magnetar XTE J18100-197 - Marcin Gawronski

List of proposals

Approved & observed proposals within the EVN

- **EV-2024-37 - RSG019** - VLASS J233532.86-000424.9 test observation - Tongtian Ren
- **EV-2024-38 - RK002** - Precisely locating FRB 20240114A - Franz Kirsten
- **EV-2024-39 - RG014** - High-resolution imaging of late-time radio rebrightening in SN 2022xxf - James Leung
- **EV-2024-40 - RN002** - Searching for a compact radio nebula associated with FRB 20221022A - Kenzie Nimmo
- **EV-2024-41 - RA007** - e-EVN observation of EP240425a - Tao An
- **EV-2024-42 - RM020** - The Lorentz factor of the jet from a tidal disruption event - James Miller-Jones
- **EV-2024-43 - EY049** - The hidden ULX CygX-3: probing its geometric beaming effect - Yang
- **EV-2024-44 - EB114** - Triggered VLBI observations of transient maser activity VI - Burns
- **EV-2024-45 - EW045** - Exploring unknowns: a new class of soft X-ray transients discovered by EP - Wang
- **EV-2024-46 - EC100** - Unveiling the nature of the elusive radio nucleus of the megamaser galaxy IC485 - Castangia
- **EV-2024-47 - EM180** - Probing the radio cores of dwarf galaxy mergers with EVN+eMERLIN - Mezcua
- **EV-2024-48 - ET052** - High resolution imaging of relativistic outflows from neutron star mergers - Troja
- **EV-2024-49 - EP133** - Zooming on XTE J1810-197 - an active, bursting magnetar - Puchalska
- **EV-2024-50 - EB115** - Astrometric observations of an ultra-long period transient - Bloot
- **EV-2024-51 - EM181** - Parsec-scale polarisation properties of a young radio source: 4C 31.04 - Murthy
- **EV-2024-52 - EN016** - Collimation and acceleration of the M84 jet: synergy with EVN+eMERLIN and EHT - Nair
- **EV-2024-53 - EB116** - An EVN follow-up of three new candidate PRS – Bruni

List of proposals

Approved & observed proposals within the Global Millimetre VLBI Array

- **23B-067 - MP010** - Peering into M87's black hole in multiple colors - Park
- **23B-068 - MT005** - Probing Relativistic Jets through mm-VLBI of X-ray Binaries - Tetarenko
- **23B-152 - MG010** - Imaging supermassive binary black hole candidate OJ287 with GMVA+ALMA - Gomez
- **24A-150 - MX001** - A Geodetic and Astrometric mm-VLBI Observation with GMVA - Xu S
- **24B-043 - MP012** - Assessing Temporal Variations in Polarization Leakages within GMVA Observations - Park
- **24B-138 - MV007** - In light of the shadow: mm-VLBI study of M81 in the context of Sgr A* and M87** - von Fellenberg
- **24B-360 - MN005** - Jet Launching and Black Hole Demographics: the 'Gold Sample' - Nagar
- **24B-371 - MR020** - Probing Characteristic Signatures of Neutrino Production in Blazars - Roesch

CDT Technical Reports

- **2024-1** - Matera VGOS Receiver Integration Report - Yebes Observatory Receiver Group
- **2024-2** - Matera VGOS Receiver Maintenance Plan - Yebes Observatory Receiver Group
- **2024-3** - Matera VGOS Receiver Operating Manual - Yebes Observatory Receiver Group
- **2024-4** - Equivalent circuits of small size chip resistors up to 50 GHz (update) - JD Gallego, I. López, C. Diez González, I. Malo, R. Amils
- **2024-5** - Adaptation of the 40-meter radio telescope servo system to the new subreflector control - C. Albo
- **2024-6** - Accurate calibration of diode noise sources with the PNA-X noise receiver (updated) - JD Gallego, C. Diez, R. Amils, I. López, I. Malo
- **2024-7** - Monitoring system for the blinds on the enclosure of the 40-meter radio telescope cabin - C. Albo, J. Sánchez, J. Fernández
- **2024-8** - DBBC3 installation report for the Matera VGOS receiver - J. González García
- **2024-9** - Mark6 unit installation report for the Matera VGOS receiver - J. González García
- **2024-10** - Characterization and measurements of a 10 GHz oscillator and a frequency doubler - S. de la Fuente, P. García
- **2024-11** - Characterization and measurements of high pass filters and notch filters - S. de la Fuente, P. García



YEBES

