

# Observatorio Astronómico Nacional

*Francisco Colomer*

## Abstract

This report describes the OAN facilities as a network station in IVS. The 14 meter radiotelescope at Yebes participates regularly in the geodetic VLBI campaigns (EUROPE and CORE). The institute staff is also involved in technical development and geodetic research.

## 1. The OAN Facilities

The Observatorio Astronómico Nacional (OAN) of Spain operates a 14 meter radiotelescope at Yebes (Guadalajara, Spain). This facility is a network station in IVS, and participates regularly in the geodetic VLBI campaigns to study the tectonic plate motions in Europe (project EUROPE), Earth rotation, and pole motion (project CORE). The institute is currently involved in the construction of a new 40 meter radiotelescope that will be available for geodetic VLBI observations in the next few years.



Figure 1. The 13.7 meter radiotelescope of OAN at Yebes (Guadalajara, Spain).

Table 1. OAN location and addresses.

<b>Institute Headquarters:</b>	
Observatorio Astronómico Nacional	
Physical address	Mail address
Campus Universitario Ctra. N-II, km 33.6 E-28871 Alcalá de Henares	Apartado 1143 E-28800 Alcalá de Henares
<a href="http://www.oan.es/">http://www.oan.es/</a>	
<b>Yebes radiotelescope:</b>	
Centro Astronómico de Yebes	
Physical address	Mail address
Cerro de la Palera s/n E-19041 Yebes	Apartado 148 E-19080 Guadalajara
Longitude (WGS84)	3° 5' 21"893 W
Latitude	40° 31' 26"968 N
Height	980.946 m

## 2. Description of the Station

The main instrument at OAN is the radio telescope [1], used for VLBI. The technical parameters of the radio telescope are summarised in Tables 2 to 4. The instrument is equipped with a dual frequency receiver (S and X bands) used in geodetic VLBI experiments, and also a Q band receiver (41 to 49 GHz) used for astronomical observations. The radio telescope is controlled by two computers (HP1000 and HP2100), that run independently of (but synchronised with) the Field System PC.

Table 2. Technical parameters of the Yebes telescope for geodetic VLBI.

owner and operating agency	OAN (IGN, MFOM)
year of construction	1976
radio telescope system	altazimutal
receiving feed	cassegrain focus
diameter of main reflector $d$	13.72 m
focal length $f$	5.080 m
$f/d$	0.37026
diameter of geodetic subreflector $d_s$	2.2 m
focal length $f_s$	3.547 m
excentricity $\epsilon$	1.557
$f/d$ of equivalent paraboloid	1.7 m
azimuth range	-358...358°
azimuth velocity	1°/s
elevation range	4...89°
elevation velocity	1°/s

Table 3. Receivers used in geodetic VLBI at the Yebes telescope.

Receiver	X-band	S-band
Frequency range (GHz)	8.13 – 8.63	2.21 – 2.35
$T_{sys}$	77 K	87 K
$S_{SEFD}$	3300 Jy	3800 Jy
$\eta$	0.47	0.38
Polarization	RCP	RCP

Table 4. Characteristics of the VLBI equipment.

VLBI terminal type	VLBA4 (Mark IV formatter, VLBA-G rack and VLBA recorder)
recording media	thick and thin tape, 1" wide
Telescope control computer	HP1000 + HP2100
VLBI system computer	Pentium II/350
Operating system	Debian 2.0r4 (kernel 2.0.34)
Field System version	9.3.25 and 9.3.207
GPS receiver	6 channel TrueTime XL-DC-602
Meteorological station	SEAC-300

The engineers at the OAN laboratories have been involved in the design and construction of low noise HEMT microwave amplifiers at cryogenic temperatures since 1985. These are used at the Yebes telescope, and in other European radio astronomy observatories (e.g. IRAM, Bordeaux, Meudon in France; INPE in Brazil). These amplifiers have been used as well for atmospheric research (Ozone concentration) by other European research projects, like PRONOS (France) and EMCOR (European Minor Constituent Radiometer, European Union).

### 3. OAN Staff Working in VLBI

Table 5 lists the OAN staff which are involved in the VLBI studies, some of which can be found at the telescope (CAY) address. The associated members of IVS are indicated with an asterisk.

Table 5. Staff in the OAN VLBI group (Email: [vlbi@oan.es](mailto:vlbi@oan.es)).

Name	Background	Role	Dedication	Address
Jesús Gómez-González*	Astronomer	Director	25%	OAN
Alberto Barcia	Engineer	Chief engineer	25%	CAY
Francisco Colomer*	Astronomer	VLBI coordinator	75%	OAN
Pablo de Vicente*	Astronomer	Technical responsible	50%	CAY
Isaac López-Fernández	Engineer	Technical support	30%	CAY
María Rioja*	Astronomer	Geodesy researcher	100%	OAN

#### 4. Status of the Geodetic VLBI Activities at OAN

The OAN radio telescope at Yebes has participated in several geodetic VLBI experiments since 1995. The campaigns were performed with partial success, due to a failure of the formatter in the VLBI DAR which prevented the participation of the station in any interferometric observations since the end of 1997. The module was substituted by a Mark IV formatter in February 1999, when successful observations were resumed.

The main contribution of OAN to IVS is the realization of geodetic VLBI observations in the EUROPE and CORE projects. The institute also participates in the European VLBI Network (EVN) for astronomy, taking part in its logistics and carrying out technical development.

Recently, geodetic studies making use of VLBI and GPS data are being performed by OAN staff. These investigations intend to accurately measure the vertical component of the interferometer baselines.

#### 5. Outlook

The OAN radio telescope at Yebes has resumed operations after the faulty VLBA formatter has been replaced by a new Mark IV one. The station participates regularly in the campaigns for the EUROPE and CORE projects.

The construction of a new 40 meter radiotelescope at Yebes has started. This telescope will operate at S/X bands. It is expected to be operational in the next few years.

#### References

- [1] Barcia, A., Bujarrabal, V., Gómez-González, J., Martín-Pintado, J., Planesas, P.: First spectroscopic observations with the 14-m radio telescope at the Centro Astronomico de Yebes - SiO masers in evolved stars. *Astronomy and Astrophysics*, vol. 142, p. L9, 1985.