

The OAdM and its relationship with the SVO



J. Colomé, P. Gil, I. Ribas, J. Sanz, **F. Vilardell**

1. The OAdM

2. The TJO

3. Robotization of the TJO

4. Scientific results

1. The OAdM

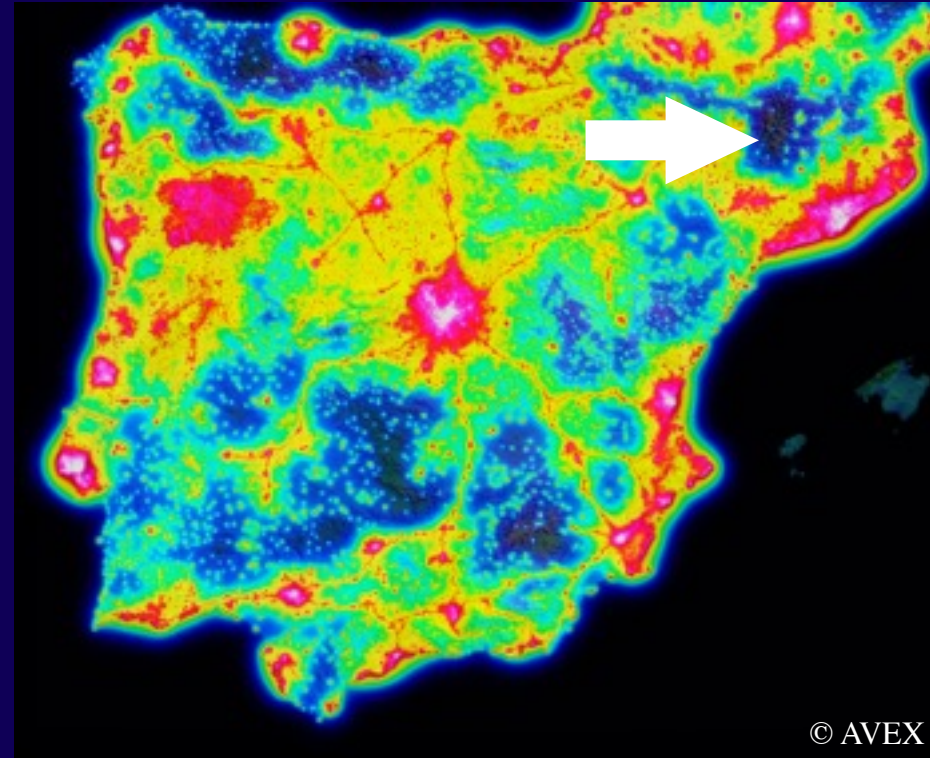
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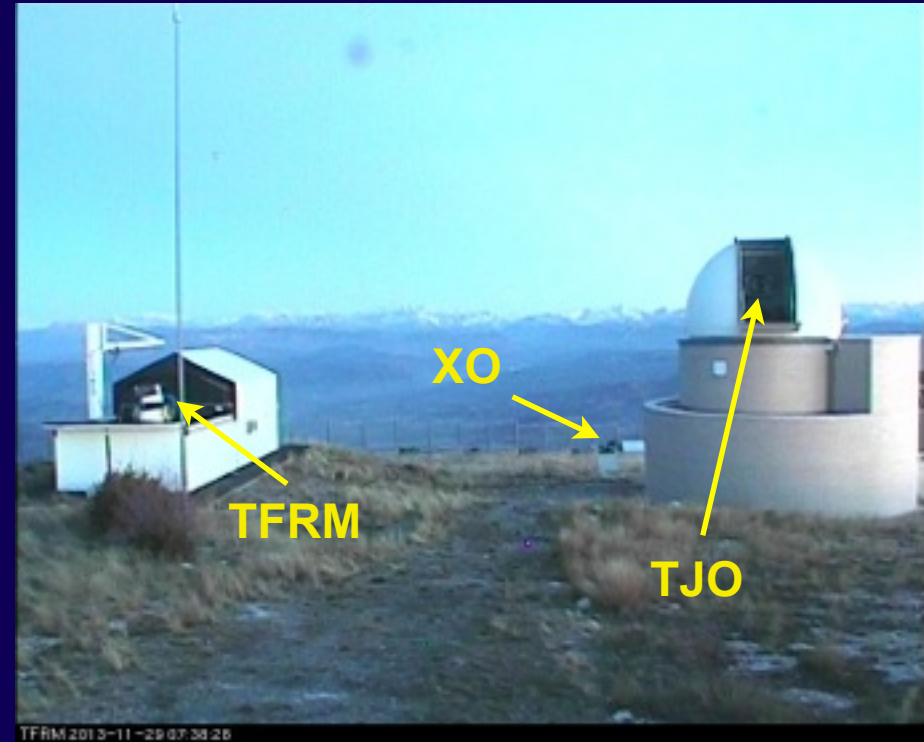
The Observatori Astronòmic del Montsec (OAdM)

- Main astronomical observatory in Catalunya
- Western part of Catalunya (1570 m):
 - ✓ Dark skies
 - ✓ Good weather (similar to Calar Alto)
 - ✓ Good seeing (median ~ 1 arcsec)
- **Observatory operations:** IEEC (since 2007)
- Six facilities of six institutions operating
 - ✓ **SMC:** XEMA weather station
 - ✓ **ICTJA-CSIC:** XVPCA air pollution network
 - ✓ **ICE-CSIC:** Allsky camera for meteors detection
 - ✓ **STScI:** XO exoplanet search network
 - ✓ **RACAB & ROA:** TFRM 0.5m Baker-Nunn camera
 - ✓ **Generalitat de Catalunya:** TJO 0.8m Ritchey-Crétien telescope



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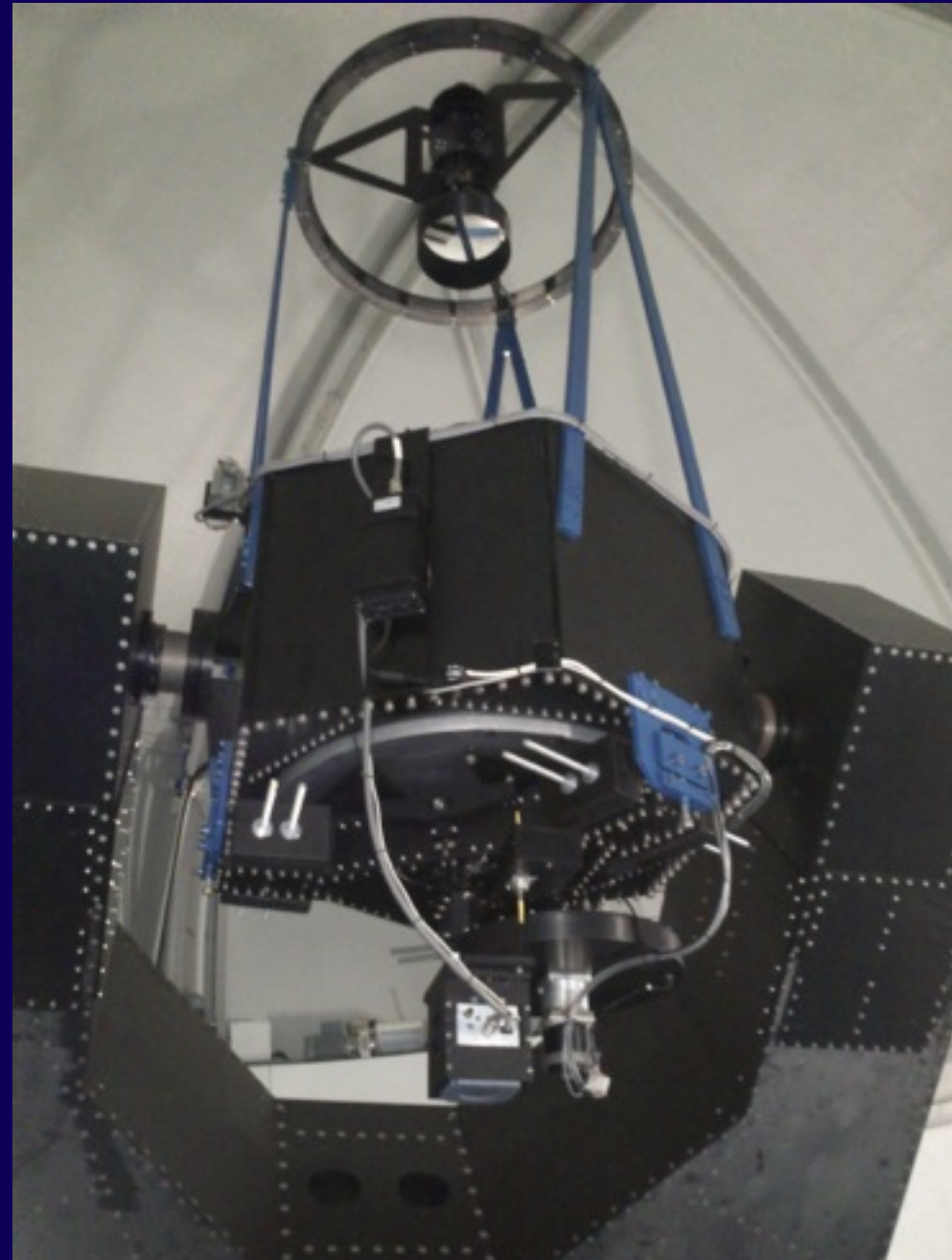
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The Telescopi Joan Oró (TJO)

- **The largest telescope in Catalunya:**
 - ✓ Primary mirror: 0.8 m
 - ✓ Ritchey-Chrétien optical configuration (f/9.6)
- **Scientific & technical exploitation: IEEC**
 - ✓ Three FTE (including OAdM management)
 - ✓ 100 k€/year
- **Open to institutions all around the world since February, 2013**
- **Robotic supervised operations (May 1, 2013)**
 - ✓ No human intervention, only scheduling

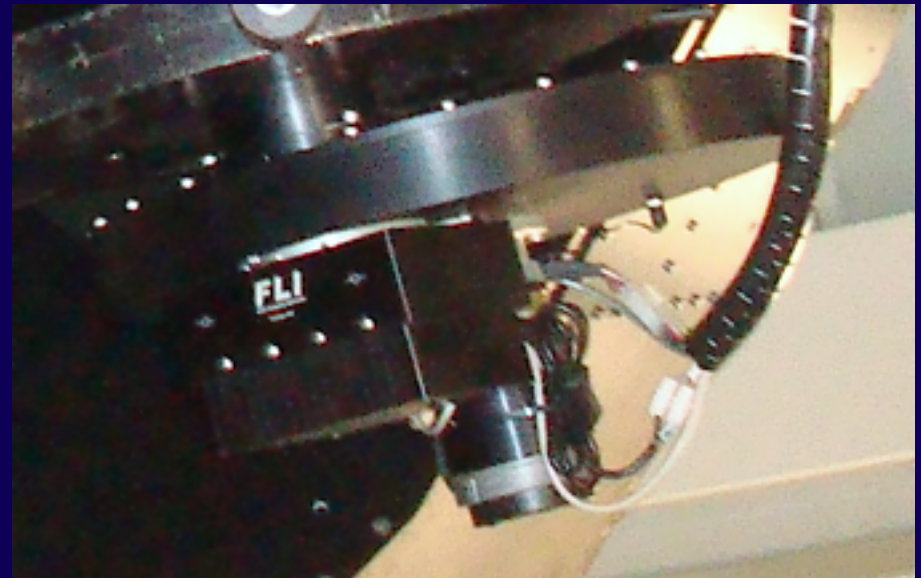


Current TJO instrumentation

MEIA:

- Imaging camera
- **Manufacturer:** Finger Lakes Instrumentation
- 2k×2k back illuminated chip
- **Pixel size:** 0.36×0.36 arcsec
- **Field of view:** 12.3×12.3 arcmin
- **Five Johnson-Cousins filters:** U, B, V, R_C, I_C

Band	S/N~100 in 300 seconds
U	13.2
B	17
V	17
R	17.2
I	17

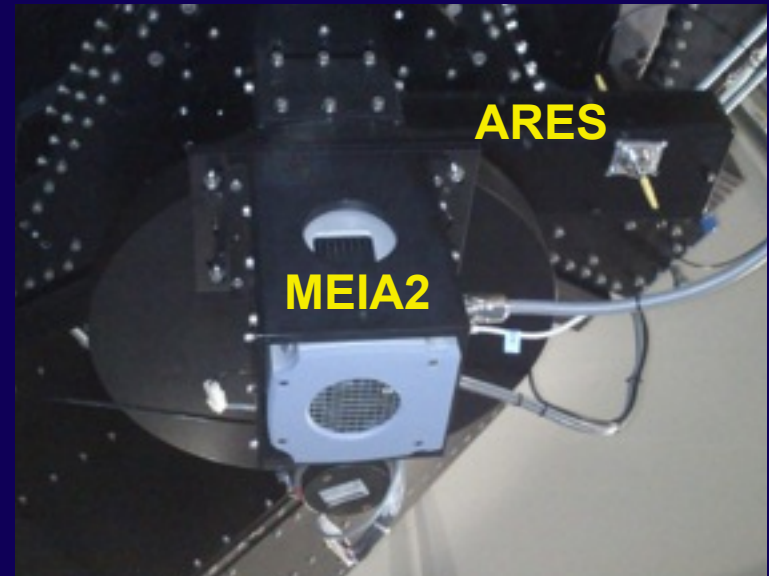


Imminent TJO instrumentation

MEIA2:

- Imaging camera
- **Manufacturer:** Andor Technology™
- 2k×2k back illuminated chip
- **Pixel size:** 0.36×0.36 arcsec
- **Field of view:** 12.3×12.3 arcmin
- **Five Johnson-Cousins filters:** U, B, V, R_C, I_C
- **First light:** September, 2013

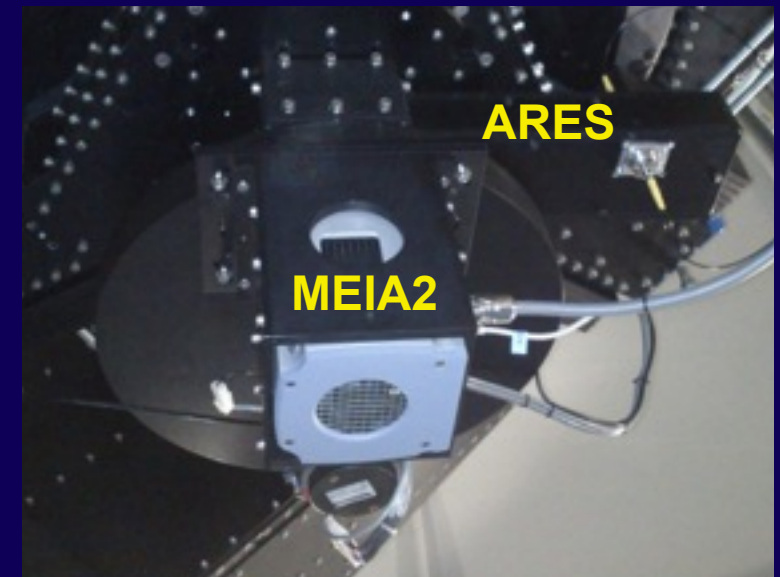
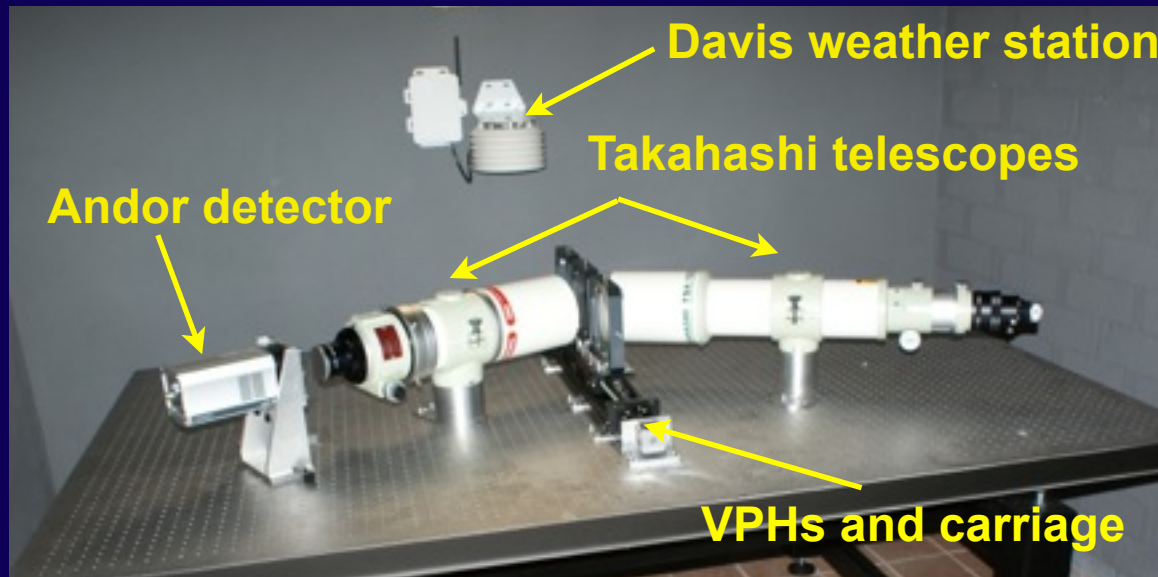
Band	S/N~100 in 300 seconds
U	13.2
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Imminent TJO instrumentation

ARES:

- Optical spectrograph
- **Manufacturer:** Fractal SLNE
- **Spectral resolution:** $R=12.000$
- **Overall throughput:** $>10\%$
- **Magnitude limit at the TJO:**
 $V < 11$ mag (up to 1 million stars)
- Up to three spectral windows (VPHs):
 - ✓ **Blue:** 439 - 469 nm \Rightarrow postponed
 - ✓ **Green:** 495 - 529 nm \Rightarrow MgI triplet
 - ✓ **Red:** 634 - 678 nm \Rightarrow H α line
- Non-dedicated instrument
- **First light:** September, 2013



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1. The OAdM

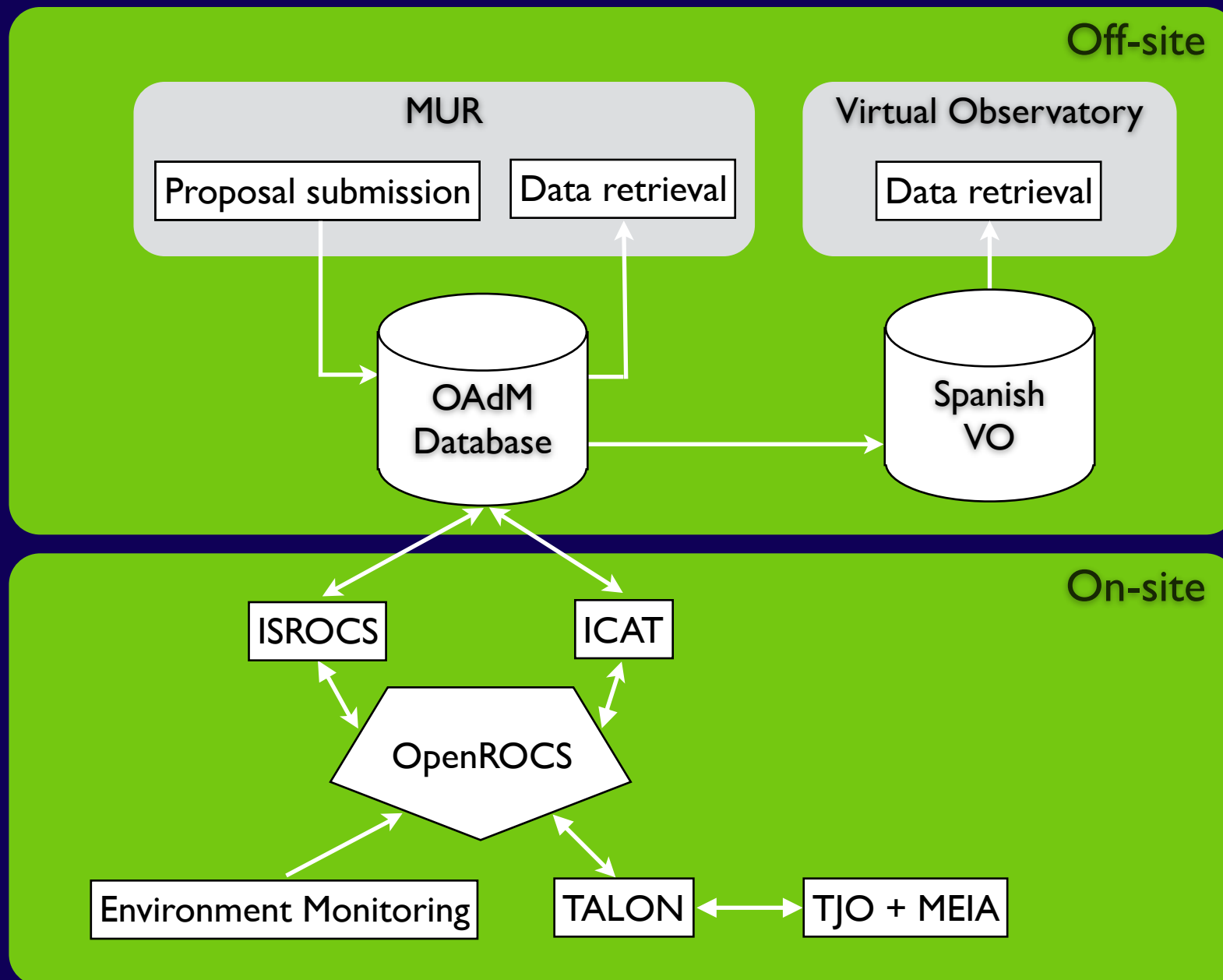
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The robotization concept

Highly modular with two main nodes: on-site and off-site



Proposal submission procedure **entirely on-line** since November 1, 2011:

www.oadm.cat

But similar to other robotic telescopes

The screenshot shows the OAdM website interface. At the top, there's a navigation bar with links like 'Context', 'Username', 'Password', 'Login', 'Register', 'Remember', 'Contact', 'Contact Us', and 'English'. Below this is the IECC logo and the OAdM logo. A navigation menu includes 'Home', 'OAdM', 'TOD', 'Observing', 'Environment', 'Media', and 'Image'. The main content area features a large video player showing a robotic telescope. To the right of the video is a 'Weather data' section with a table of current conditions. Below the video is a 'Media' section with a list of recent news articles, each with a date and a brief description. At the bottom, there's a footer with 'IECC - Institut d'Estudis Espacials de Catalunya' and 'Developed with WebOS'.

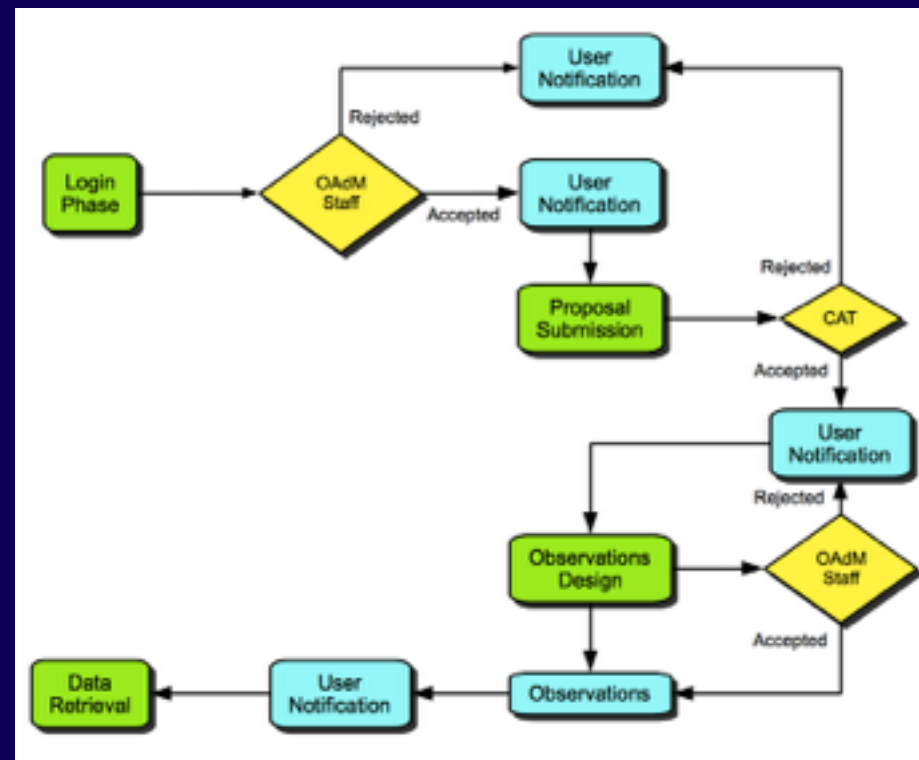
Date	2014-04-07 11:50:01
Temperature	15.0°
Humidity	44%
Rain detector	NOT RAINING
Clouds	0.0 (0/100)
Wind speed	4.0 m/s
Wind dir.	247.0°
Pressure	840.0 hPa
Solar rad.	786.2 W/m²

Media

- 01/02/2014 (Latest news) Following Gais: On the right between March 6th and 7th, several of the telescopes placed at the OAdM the TIO and the TIRPS observed the Gais satellite while it was passing...
- 01/02/2014 (Latest news) The Chelabinsk superbolide: The impact risk of small asteroids with the Earth. Article published in the Astronomy magazine. More information in Spanish here.
- 11/02/2014 (Press releases) The birth of the MNG/MNRG comet: Comet MNG/MNRG photographed by the Robotic Telescope team Gais of 0.8 m in diameter, of the OAdM last May 13, 2013. Further information in Catalan...
- 08/02/2014 (Scientific results) Optical and near-infrared observations of SN 2013B: The first TIO day. Further information here.
- 28/04/2014 (Scientific results) The 2014 October Chelabinsk rebound: 11 optical elements, infrared filter, and 2014 Gais detector delivered mass to Earth. Further information here.
- 26/02/2014 (Public events) Announcement of opportunity - 2014: The TIO announces its first public call for proposals for observations to be taken in robotic mode from April 1st, 2014. The call is open to observers...
- 16/02/2014 (Latest news) Observations of the asteroid 2013 DPM: Two of the telescopes placed at the OAdM, the TIO and the TIRPS, observed the asteroid 2013 DPM on the night between February 15th and 16th.
- 01/02/2014 (Press releases) Installation of the TIO unit at the OAdM: During the week, the Space Telescope Science Institute (STScI) Baltimore, USA, which controls and manages the operations of the Hubble Space Telescope...

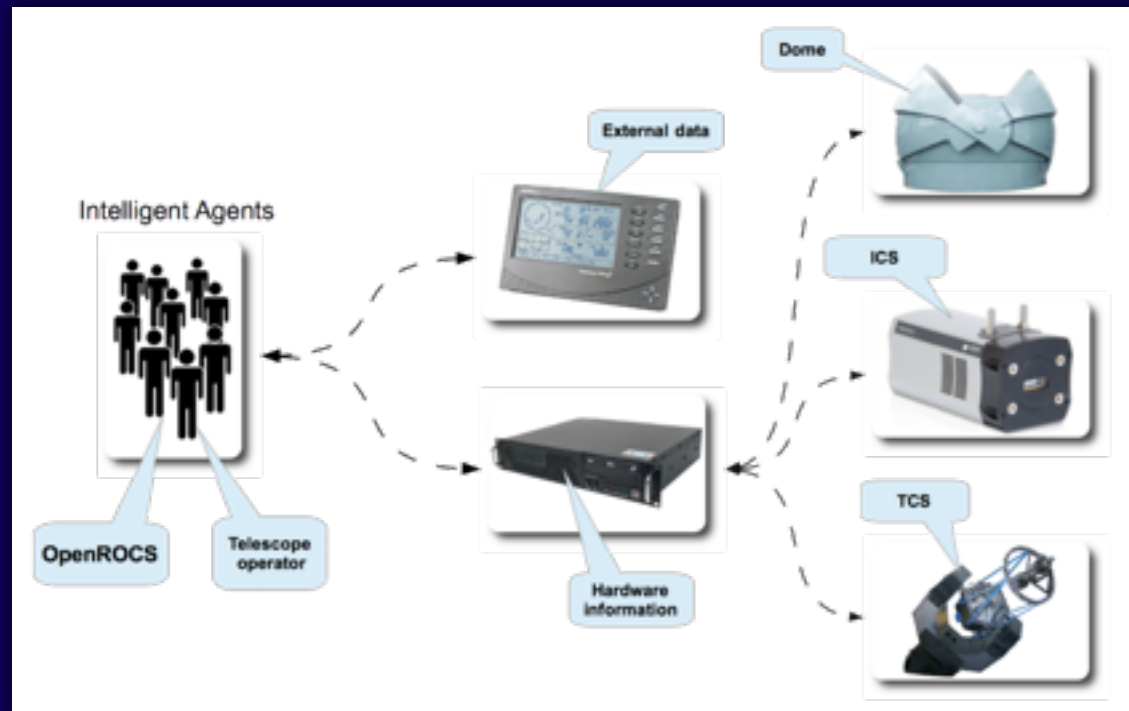
MUR

- **Phase 0:** registration to MUR ➔ OAdM staff
- **Phase 1:** with science case + total required time + targets ➔ CAT
 - ✓ Hans Deeg (IAC)
 - ✓ Glòria Sala (UPC)
 - ✓ Eduard Masana (UB)
- **Phase 2:** with observation details ➔ TJO
- **Phase 3:** preliminary data retrieval method



OpenROCS (Open Robotic Observatory Control System)

- In charge of the **complete operations** of the observatory
- Capable to interact with **all** the different devices
- An **intelligent software** capable to respond to unexpected situations
- Highly **modular and flexible**: any device or software could be used
- **Open source registered** ICE-CSIC/IEEC product:
<http://sourceforge.net/projects/openrocs/>
- Already exported to **SQT** (formerly SAFT)



Proprietary data:

- All observed data is proprietary for a period of **one year**
- Observers download nightly tar balls from MUR

Public data:

- Public images synchronised with **SVO** on a daily basis since April 10, 2011
- Data can be retrieved from the web page:

<http://sdc.cab.inta-csic.es/joro/jsp/homepage.jsp>

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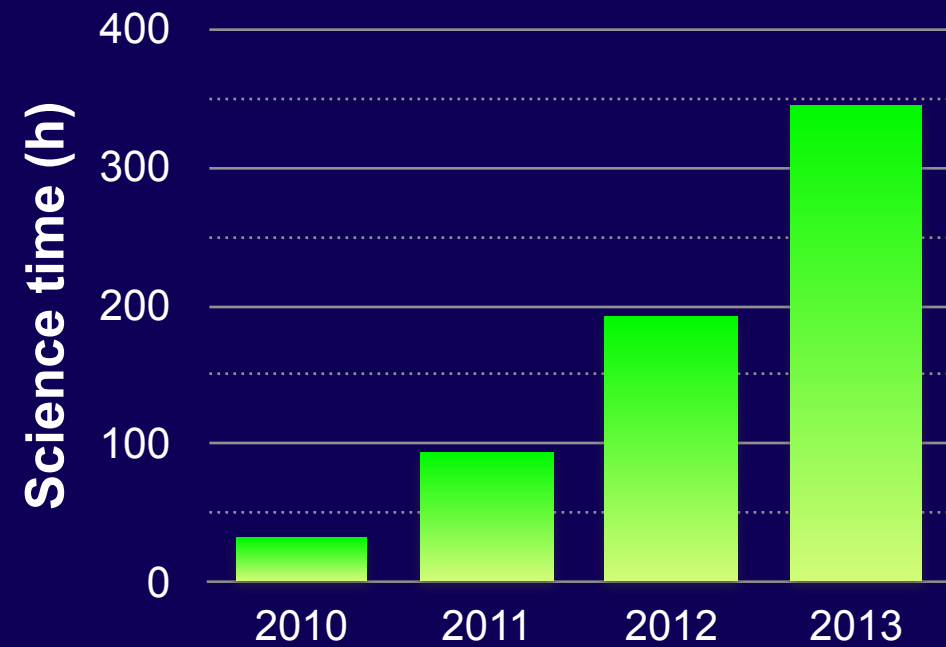
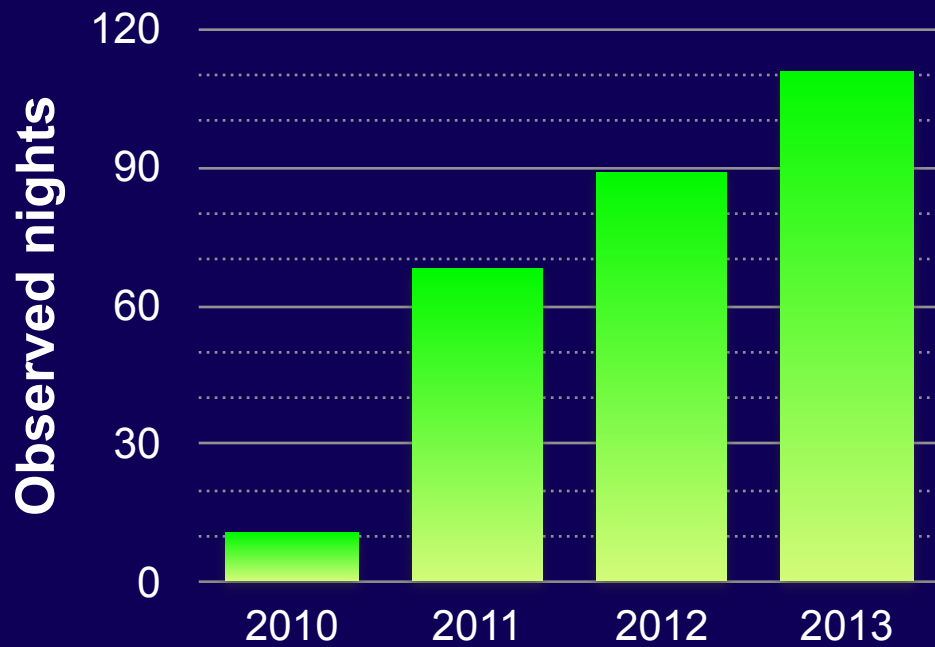
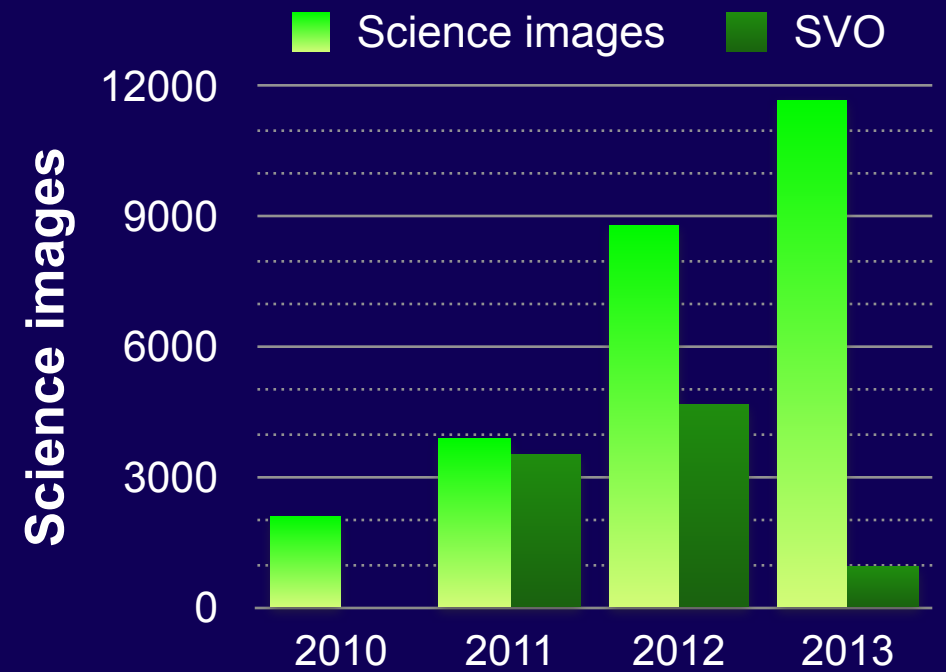
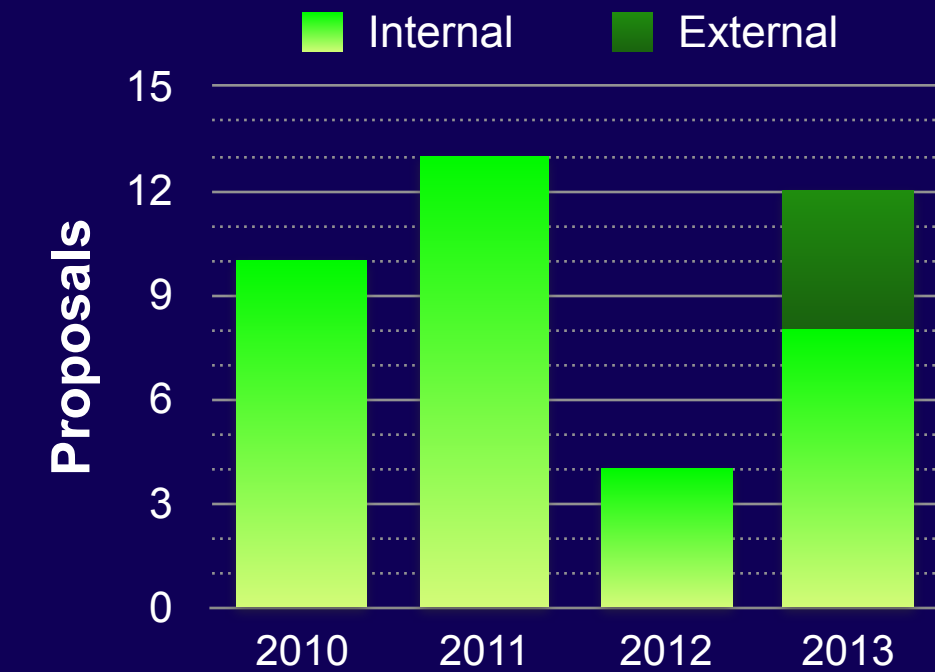
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Statistics of observations



Publications (scientific and technical)

Scientific results:

- M. Ergon, J. Sollerman, M. Fraser, et al., 2014, A&A, 562, A17
- C. von Essen, S. Czesla, U. Wolter, et al., 2014, A&A, 561, A48
- E. Herrero, J. C. Morales, I. Ribas, and R. Naves, 2011, A&A, 526, L10
- J. M. Trigo-Rodríguez, C. E. Moyano-Cambero, K. J. Meech, et al., 2013, EPSC2013, 985
- J. M. Trigo-Rodríguez, D. Rodríguez, J. Lacruz, A. Sánchez, 2013, EPSC2013,1029

Technical publications:

- J. Colomé et al., 2012, Proceedings SPIE
- J. Colomé et al., 2010, Proceedings SPIE
- J. Colomé et al., 2008, Proceedings of the VIII Scientific Meeting of the Spanish Astronomical Society
- J. Colomé et al., 2008, Proceedings SPIE

Additional examples

Solar System bodies

2012 DA14



C/2011 L4 (Panstarrs)



Gaia



Additional examples

Solar System bodies

2012 DA14



C/2011 L4 (Panstarrs)

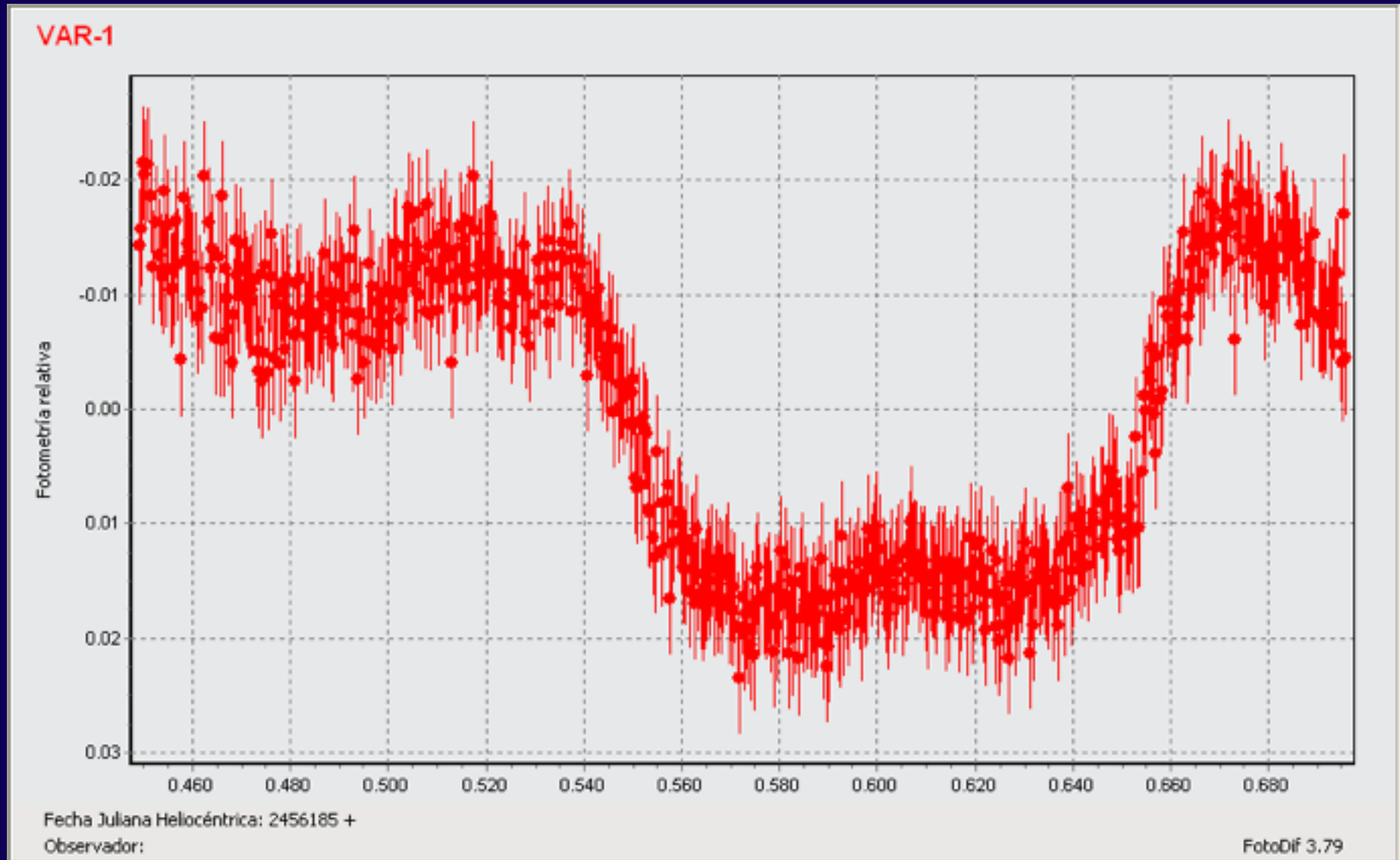


Gaia



Additional examples

Transiting exoplanet obtained in B filter on 2012 Sep, 14
RMS: ~ 3 mmag



Additional examples

Extragalactic objects

Arp 316



NGC 4490



M82 + SN 2014J



Summary

- The **OAdM** is starting to host a **large number of facilities** and becoming international
- New instrumentation (**ARES**) will open a **new science** niche for spectroscopic surveys
- **Two IEEC products:** MUR and OpenROCS
- **Robotization** of the TJO **has matured** providing IEEC a strong know-how on this topic and **already being exported** to other facilities (SQT)
- Obtained **data is being provided to VO** in strong collaboration with SVO
- Robotic TJO **observations** have become **common** and are improving with more proposals, less supervision and better efficiency

Thank you for you attention