An update on the observational facilities at CASLEO

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Resumen / Presentamos una puesta al día sobre los diferentes telescopios e instrumentos disponibles en el Complejo Astronómico El Leoncito (CASLEO), Argentina. Todos los telescopios y sus instrumentos están completamente automatizados, y se operan rutinariamente en modo remoto. Los observadores pueden utilizar el telescopio Jorge Sahade (JS) de 2.15 m para imágenes, polarimetría CCD, y espectroscopía (tanto en baja como alta resolución), mientras que se encuentran en estudio nuevos desarrollos instrumentales. Actualmente, cerca del 70 % de los astrónomos optan por observar en forma remota. El telescopio Helen Sawyer Hogg (HSH) de 0.6 m también se encuentra disponible para observación remota, y puede usarse para obtener imágenes con un campo de 9.26×9.26 arcmin^2. También operan en el CASLEO dos telescopios menores, a través de sendos convenios con el Nicolaus Copernicus Astronomical Centre (NCAC, Polonia) y el Instituto de Astrofísica de Andalucía (IAA, España). La comunidad argentina tiene acceso al 20 % del tiempo disponible en cada uno de estos instrumentos (solo en modo servicio).

Abstract / We present an update on the different telescopes and instruments available at the Complejo Astronómico El Leoncito (CASLEO), Argentina. All the telescopes and their instruments are fully automated, and are routinely operated in remote mode. Observers can use the 2.15 m Jorge Sahade (JS) telescope for imaging, CCD polarimetry, and spectroscopy (both low and high resolution), future instrumental developments are also in progress. Presently, about 70 % of the astronomers opt to observe remotely. The Helen Sawyer Hogg (HSH) 0.6 m telescope is now also available for remote observing, and it can be used to obtain images with a 9.26×9.26 arcmin^2 field of view. Two smaller telescopes, operated under agreements with NCAC (Poland) and IAA (Spain), respectively, are also operational at CASLEO. The Argentine community has access to 20 % of the available time at each of these instruments (only in service mode).

Keywords / astronomical instrumentation, methods and techniques — telescopes

1. Introduction

The Complejo Astronómico El Leoncito (El Leoncito Astronomical Complex, CASLEO) is Argentina's national facility, operating astronomical telescopes. Access to CASLEO is open to the whole Argentine scientific community, as well as to foreign projects.

CASLEO began its observations in 1986, and it operates under an agreement between CONICET and the National Universities of La Plata, Córdoba, and San Juan, Argentina.

2. Optical telescopes and instruments

The main telescope at CASLEO is the 2.15 m Jorge Sahade reflector, belonging to the National University of La Plata (UNLP). It is an $f/15$ Ritchey-Chrétien system, which can be used either at its Cassegrain or Nasmyth foci. Its present instrumentation is:

- Imaging camera: Roper Scientific Versarray 2048B, 2048×2048 pix; its maximum field of view (FOV) using a focal reducer is 9 arcmin in diameter, with a scale of 0.45 arcsec pix^{-1} (see Fernández-Lajús et al., 2016, for further details).
- CasPol CCD polarimeter (presently used with a Tektronix 1024×1024 pix chip).
- Reosc spectrograph: for long-slit spectroscopy with low- and medium- ($R = 12600$) resolutions.
- EBaSim bench (fiber-fed) spectrograph: high-resolution ($R \approx 40000$) (Pintado & Adelman, 2003).

All instruments are equipped with liquid Nitrogen-cooled CCDs.

The JS telescope can be used either in visitor, remote, or service modes. A new TILT (telescope free time) mode has recently been implemented, in order to fill-in unused time slots.

Three smaller telescopes are operating at Cerro Burek ($\sim$ 7 km from the main CASLEO buildings); all of them are used solely for imaging. Table 1 lists the main characteristics of these telescopes, along with their respective cameras. Columns 1-8 show, respectively: name, primary mirror diameter, system focal ratio, owner institution, field of view with the currently installed camera, plate scale, available filter set(s), and the observing mode(s) currently offered. The HSH telescope is on loan from the University of Toronto, Canada —which has up to 25 % guaranteed observing time—, and is operated by CASLEO. The other two telescopes

are operated by their respective owners, and the Argentine community has access to 20 % of the available time on each of them.

3. Remote observing

CASLEO gives principal investigators (PIs) of successful proposals at the JS (2.15 m) and HSH (0.6 m) telescopes the possibility of observing in remote mode, accessing from anywhere with an Internet connection. The observer accesses a Linux server located at CASLEO headquarters in San Juan city, and uses a VNC client through a SSH tunnel to connect to the computers at the mountain: one controlling the telescope and its dome, and a second one controlling the instrument (and acquisition camera, in the case of spectrographs).

Figure 1 shows the graphic interface of TELESCO, the software that controls telescope and dome, at both telescopes. The observer has visual access to useful information (coordinates, Universal and sidereal times, pointing), and can use buttons to control both the telescope an dome (the latter can be set either in manual or automatic mode). Technical information is also displayed, allowing the staff to check critical parameters.

Each instrument has its dedicated control software, which is also remotely accessed by the observer. As an example, we show in Fig. 2 the control interface for the Roper imaging camera at the JS telescope. The observer is able to control all relevant parameters regarding data acquisition (integration time, filter, telescope focus, etc.) as well as visualization and a fast check of the displayed image.

The observer has also on-line access to meteorological and sky-quality information, which is updated every 12 min. A GUARD system has been set-up for the Burek telescopes, which automatically closes the domes in case of unfavorable meteorological conditions, and/or power or Internet failures.

The PI can download the data at the end of the observing night, while a quick on-line examination of the data is also possible.

Remote observing is the preferred option for about 70 % of the observers. Besides convenience for the observer, its advantages also include costs and time savings, and better flexibility for time scheduling. The technical staff is also able to check the telescope, dome, and instrument behaviors in real time, allowing for a rapid response in case of technical issues.

The smaller telescopes (Solaris-4 and ASH2) are also remotely operated by staff of their respective institutions (NCAC, IAA).

4. Solar and Geophysical instruments

The development of the Solar-Geophysical Mountain Laboratory (LHM) started in the mid '90s, through a collaboration between Brazilian institutions and CONICET (Argentina), with the installation at CASLEO of the Solar Sub-millimeter Telescope (SST). This instrument has a 1.5 m dish, and was used to observe the Sun at 212 and 405 GHz frequencies. The SST is presently operating remotely from Sao Paulo, Brasil.

The following instruments are also part of the LHM:

- SAVNET (ionospheric studies)
- EFM (atmospheric electric field measurements)
- CARPET (measurements of cosmic rays modulation)
- Solar Neutron Telescope (solar and atmospheric neutrons)
- Spectrometer for hard X-rays and γ-rays
- Meteorological station (installed in 2018).

Additional Geophysics and meteorological instruments are presently acquiring data at CASLEO, through different national and international collaborations:

- All-sky photometer (Boston Univ., USA)
- Fabri-Perot Interferometer (Boston Univ., USA)
- Airglow spectrometer (IAFE, Argentina)
- 1-D Seismograph (INPRES, Argentina)
- GPS (NASA)
- Flux Magnetometer (Instituto Geofísico del Perú - ICATE, Argentina)
- Burek peak meteorological station (CASLEO)
- Cloud sensor (IAA, Spain)
- Sky Quality Meter (SQM)
- Differential Image Motion Monitor (DIMM)
- TESS-W sky photometer (STARS4ALL).

These instruments are operated by their respective institutions; collected data may be available upon request.

5. Calls for proposals

Regular calls for proposals, to apply for observing time at the four optical telescopes, are open in September and March for semesters A (Feb/01-Jul/31) and B (Aug/01-Jan/31), respectively. Proposals for DD (Director's Discretionary) time can be submitted anytime during the current semester.

It is possible to ask for more than one instrument at the JS telescope, while different proposals should be submitted if more than one telescope is asked for.

On-line forms to ask for telescope time are available at CASLEO's web page (`https://www.casleo.conicet.gov.ar`). Detailed information on instruments, observing modes, visits to the observatory, etc., are found at the same site. For any other information, please contact CASLEO staff at direccion@casleo.gov.ar or turnos@casleo.gov.ar.

References

Fernández-Lajús E., et al., 2016, BAAA, 58, 190
Pintado O.I., Adelman S.J., 2003, A&A, 406, 987

Table 1: Three telescopes operating at CASLEO (Cerro Burek).

Name	D [m]	f-ratio	owner	FOV [arcmin^2]	plate scale [arcsec pix^{-1}]	filter set	obs. mode
HSH	0.6	f/15	Univ. Toronto	9.2×9.2	0.54	$UBVRI$ (Johnson-Cousins)	visitor – service
Solaris-4	0.5	f/15	NCAC	12.7×12.7	0.37	$UBVRI$ (Johnson-Cousins) $u'g'r'i'z'$ (Sloan)	service
ASH2	0.46	f/2.8	IAA	97.8×65.2	1.47	L (Luminance)	service

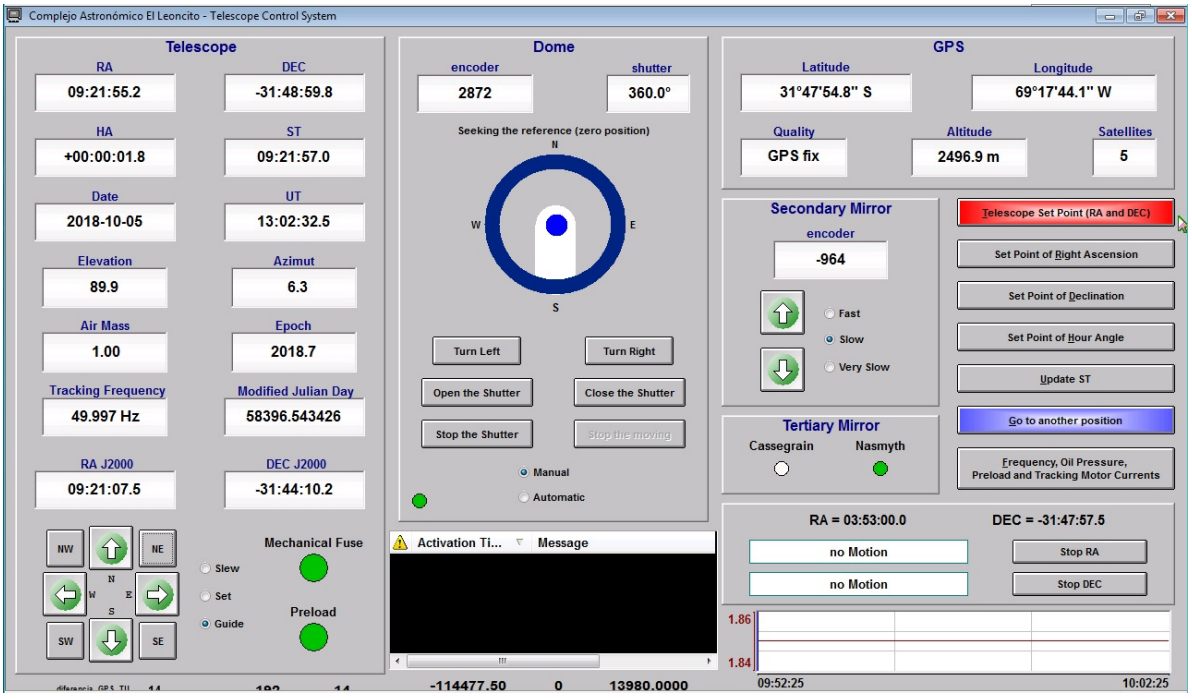

Figure 1: Graphic interface of TELESCO, the software used to control telescope and dome at the JS telescope. The same interface is used for the HSH telescope.

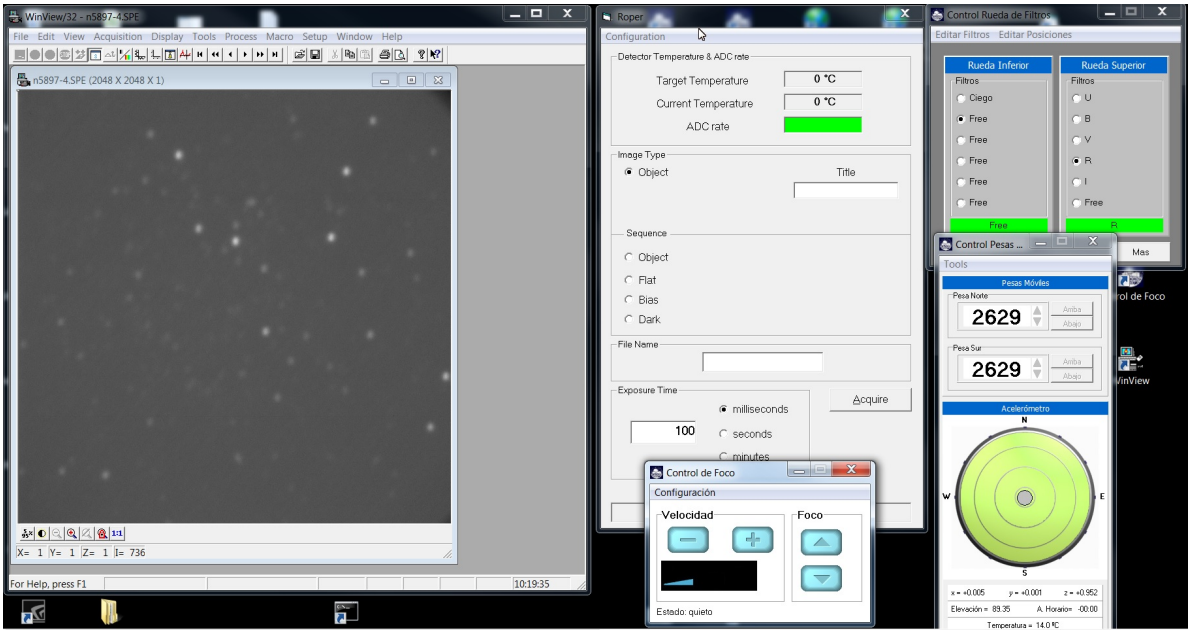

Figure 2: Graphic interface of the Roper imaging camera at the JS telescope. Similar interfaces are used for the HSH telescope and the remaining JS telescope instruments.