

Observatorio Astrofísico de Javalambre

Call for Proposals

Legacy Surveys with JAST80



Proposals are expected to be submitted to:

JAST80Surveys@cefca.es

by 15 May 2022 at 23:59 CEST.

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1 - ANNOUNCEMENT OF OPPORTUNITY

The *Centro de Estudios de Física del Cosmos de Aragón* (CEFCA, <http://www.cefca.es>) opens a **Call for Proposals** for Legacy Surveys with the Javalambre Auxiliary Survey Telescope (JAST80) at the *Observatorio Astrofísico de Javalambre* (OAJ, <http://oaj.cefca.es>). Observations are expected to start in 2023A.

3250 h	5 years	2023A
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2 - INTRODUCTION

CEFCA is a research center located in the city of Teruel (Spain). Its main goal is to build and operate the OAJ and to implement the Data Center “*Unidad de Procesado y Archivo de Datos*” (UPAD) with the necessary equipment to provide the community with processed data ready for its scientific exploitation.

The OAJ, located at the Sierra de Javalambre, in Teruel (Spain), at 1950 meter above sea level, is aimed to lead large-sky multi-filter surveys of the Northern hemisphere in the mid-term future. The OAJ consists of two main telescopes with a large field of view (FoV): the 2.55m *Javalambre Survey Telescope* (JST250) and the 83cm *Javalambre Auxiliary Survey Telescope* (JAST80), with polychromatic, seeing-limited images in their unvignetted FoVs of 7 and 3 deg², respectively. Both telescopes are equipped with panoramic instrumentation: JPCam, with 1.2 Gpix distributed in a mosaic of 14 large-format CCDs covering 4.7 deg², located at the JST250 focal plane, and T80Cam, located at the focal plane of the JAST80 telescope and providing a 2 deg² FoV.

Currently, JAST80 is mostly devoted to conducting the Javalambre Photometric Local Universe Survey (J-PLUS; <http://www.j-plus.es>) with a set of 12 narrow-, intermediate- and broad-band filters.

As a Spanish Unique Scientific and Technical Infrastructure (*Infraestructura Científico-Técnica Singular*, ICTS), the OAJ offers the scientific community competitive access to 20% of the observing time of the JAST80 through open time call for proposals, following a semester-based periodicity.

Following the survey spirit of the OAJ, and with the aim of maintaining the competitiveness of the facility in the next years, the access modality to JAST80 Open Time is changing to Survey Mode in Semester 2023A. In this context, this open call for proposals is released to define the next-generation Legacy Surveys with the JAST80 Telescope. Awarded surveys will coexist with J-PLUS and ToOs.

3 - JAST80 AND T80Cam

The JAST80 telescope is an 83cm Ritchey-Chrétien-like telescope, with a German equatorial mount and a corrector of three spherical lenses. The secondary mirror (M2) is held by an hexapod, which is used to correct for optical aberrations during operation. This is done by wavefront curvature sensing techniques developed at CEFCA, making use of intra- and extra- focal images. Because of the large FoV and fast optics (F#4.5) of the telescope, this process is required to keep the optimal image

quality all across the FoV over time. In normal operation, the position and tilt of M2 are fine-tuned according to an empirically calibrated control law for the hexapod, that takes into account the pointing coordinates and the temperature of the telescope.

A software limit is set at 26 deg elevation (air mass 2.3), below which observations cannot be performed. Non-sidereal tracking capabilities are also available. For operational reasons, the longest integration time offered for a single exposure is 600 s.

T80Cam is the panoramic camera on the JAST80. This is a wide field camera with a 9.2k×9.2k pixels CCD, which provides a 2 deg² (unvignetted) FoV. The pixel scale is 0.55 arcsec/pixel. Table 1 shows default T80Cam read mode main characteristics. Other read mode alternatives may be available and, if required, shall be evaluated on a case-by-case basis. Further details can be found on <http://www.cefca.es/observatory/t80cam>.

T80Cam is equipped with 2 filter wheels that can mount up to 6 filters each. The currently available configuration is: **the J-PLUS filter system** ([SVO](#)) composed of 4 SDSS-like broad bands (griz), the u_{Jara} , and seven medium band filters, as illustrated in Figure 1 and Table 2. The **GALANTE filter system**, composed of three narrow band filters, as shown in Figure 1 and Table 3. And the **J-PAS filter system** ([SVO](#)), composed of 54 narrow band filters of 14nm spaced by 10nm and two medium band filters in the blue and the red ends, as presented in Figure 2 and Table 4. The J-PAS filters are physically smaller than the J-PLUS and GALANTE fields, requiring a specially designed filter wheel. This translates to a smaller FoV of 1.5 deg².

CCD format	9216 × 9232 pix 10 μm pix ⁻¹
Pixel scale	0.55 arcsec pix ⁻¹
FoV coverage	2.0 deg ²
Read-out time	12 s
Read-out noise	3.4 e ⁻ pix ⁻¹
Full well	123 000 e ⁻
CTE	0.99995
Dark current	0.0008 e ⁻ pix ⁻¹ s ⁻¹
Number of filters	12

Table 1: T80Cam main characteristics (default read mode).

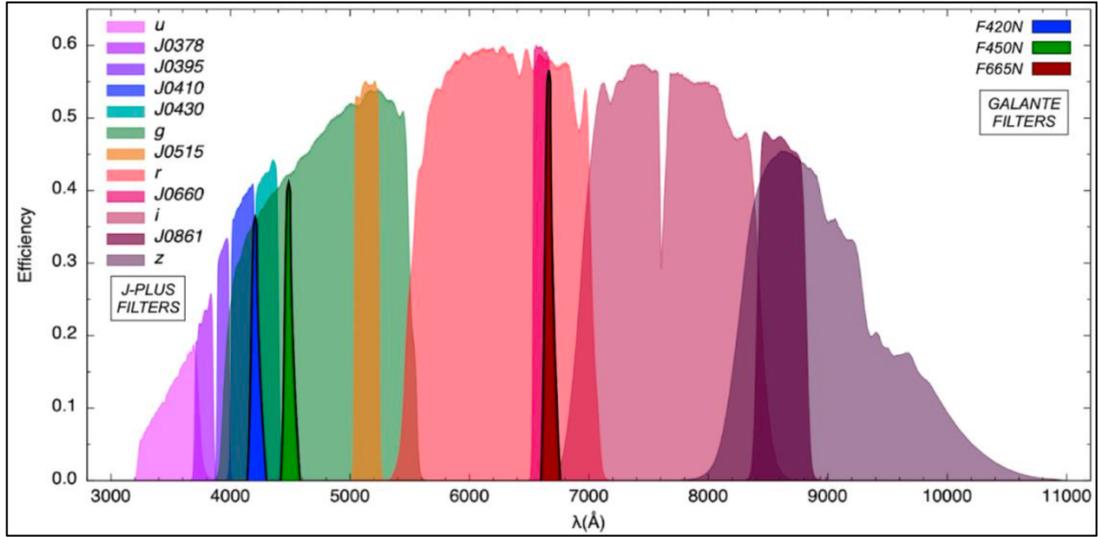


Figure 1: Transmission curves of the J-PLUS and GALANTE filter systems.

Filter	Central Wavelength [Å]	FWHM [Å]
<i>u</i>	3485	508
<i>J0378</i>	3785	168
<i>J0395</i>	3950	100
<i>J0410</i>	4100	200
<i>J0430</i>	4300	200
<i>g</i>	4803	1409
<i>J0515</i>	5150	200
<i>r</i>	6254	1388
<i>J0660</i>	6600	138
<i>i</i>	7668	1535
<i>J0861</i>	8610	400
<i>z</i>	9114	1409

Table 2: Main characteristics of the J-PLUS filter system.

Filter	Central Wavelength [Å]	FWHM [Å]
<i>F420N</i>	4200	100
<i>F450N</i>	4500	100
<i>F665N</i>	6650	50

Table 3: Main characteristics of the GALANTE filters.

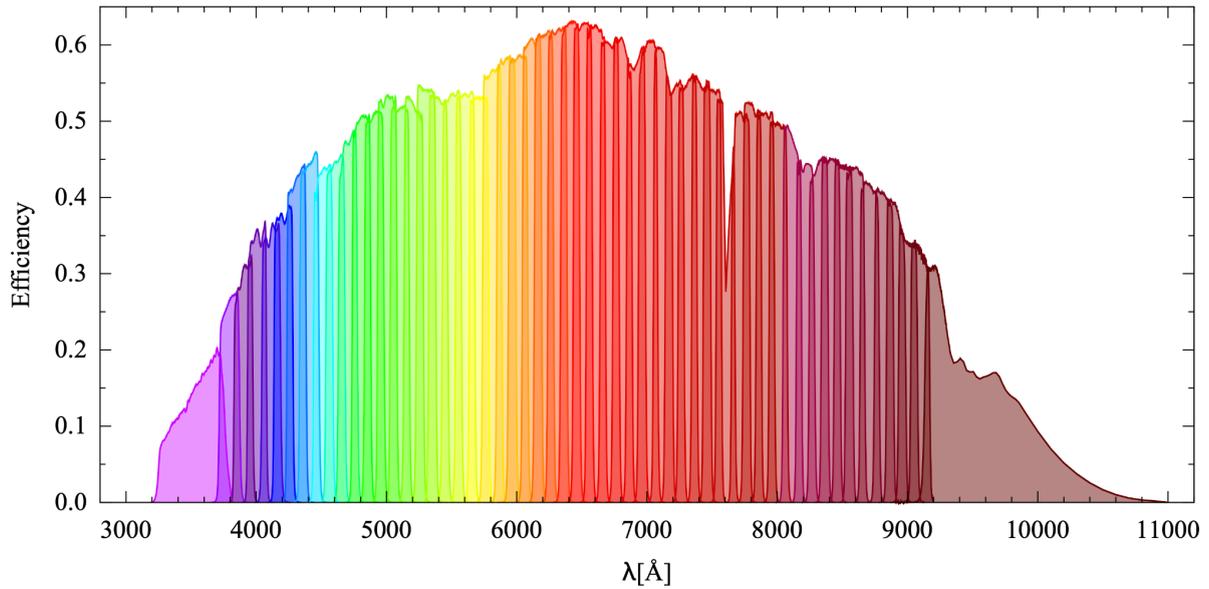


Figure 2: Transmission curves of the J-PAS filter system.

Filter #	Filter name	Central Wavelength [Å]	FWHM [Å]
1	<i>uJAVA</i>	3497	495
2	<i>J0378</i>	3782	155
3	<i>J0390</i>	3904	145
4	<i>J0400</i>	3996	145
5	<i>J0410</i>	4110	145
...
54	<i>J0900</i>	9000	145
55	<i>J0910</i>	9107	145
56	<i>J1007</i>	9316	<i>High-pass filter</i>

Table 4: Main characteristics of the J-PAS filter system.

4 - OFFERED OBSERVING TIME

CEECA opens a **Call for Proposals** for Legacy Surveys with the OAJ JAST80 Telescope. A maximum of 650 hours per year during a 5-year period are offered.

Eligible projects must fulfill the following requirements:

- Instrumentation:
 - Using the JAST80 telescope (<https://www.cefca.es/observatory/jast-t80>) and its large field of view imager T80Cam (<https://www.cefca.es/observatory/t80cam>).
 - Projects requiring the development of new instrumentation are also welcomed. In this case, the Proposal shall include additional, technical information of the proposed instrument design and characteristics.
- Filters:
 - Using the filters available at the OAJ: the J-PLUS (<http://www.j-plus.es>), GALANTE (<https://galante.cab.inta-csic.es>), and J-PAS filter systems.

- Projects requiring a different set of filters are also welcomed. In this case, the Proposal shall include a description of the proposed filters characteristics and a feasibility study of its design and manufacture.
- Observing Time:
 - Projects shall require a **minimum of 200 and a maximum of 650 hours per year**. The observation of a minimum of 75% of the TAC awarded time will be guaranteed by CEFCa.
 - The length of the project shall be up to 5 years.
- Observing conditions: Available observing time includes dark, gray and bright nights (in 1:2:1 ratio), both photometric and not photometric. Whenever possible, we encourage the users to consider less restrictive observing conditions for a higher success rate of their proposals.
- Starting date: Observations are expected to start in **2023A**. If the Survey requires new filters and/or new instrumentation, the starting date will be accommodated to adjust to the required filters and/or the instrumentation availability. In any case, the starting date for surveys requiring new instrumentation will be not earlier than **2028A**.

Awarded surveys will be executed in queue mode. The visitor mode can be considered upon request depending on the available resources and logistics at the OAJ.

5 - DATA PRODUCTS

CEFCa provides access to raw and/or reduced and calibrated (using the standard procedures developed for the J-PLUS project) OAJ data through the UPAD/TAC-Data web service (<https://tacdata.cefca.es/login>). Additional, non-standard developments in the reduction process and the calibration of the data shall be evaluated on a case-by-case basis.

A brief description of the standard data reduction pipeline and photometric calibration is provided in **Annex 1**.

Delivered data account for:

- The raw scientific data.
- Calibration frames (bias/overscan/darks/flatfields/icor/fringing).
- The scientific data reduced in a standard way with the most-recent version of the OAJ pipelines developed by the CEFCa team for the T80Cam instrument. These data include:
 - Astrometrized, processed images compressed with 'fpack' software.
 - Preliminary catalogues of the detected sources and their instrumental photometry.
 - Diagnostic plots regarding astrometry and PSF.
 - Configuration files and logs.
- Quick access to preliminary reduced individual images can be provided upon request which must be scientifically justified in the Proposal.
- Photometric calibration.
- Coadded images (if required).

OAJ guarantees the storage of these data during the duration of the project, which will be available to the Survey team once the raw images have been processed by the standard pipeline and validated at CEFCO.

CEFCO staff is continuously developing and implementing upgrades of the system to optimize the overall performances. Although we will try to notify important upgrades, take into account that the reduction pipeline may change and the offered processed data may be updated without prior notice. If you think this can be critical for your project, we encourage you to keep track of the data versions.

Additional support regarding the data could be provided by the OAJ staff on a best-effort basis. In case it is needed, please, contact oaj-upad@cefca.es.

6 - DATA MANAGEMENT PLAN

Given the expected Legacy Value of the awarded projects, the Research Groups of the Surveys are expected to release higher-level data products that have legacy value for the community. The data management plan (DMP) shall include a detailed list of expected science data products and timeline for their release.

In addition, it is advisable to provide an estimation of the overall data volume production (from raw to final processed data) that will also help the Survey Teams to estimate the required resources to store and process the data as well as to detect any possible overhead resulting from its transmission.

The Research Group must include a realistic plan for the Data Release (DR) of the Survey. The plan should justify the expected number, cadence, and content of the data releases. Default proprietary time is one year since the Research Team has access to the data products. If an extended period of proprietary time is required, it must be justified. Nonstandard proprietary time shall be approved by CEFCO/OAJ.

A publication plan, including the main expected articles from the Survey, is also desired.

The DMP should include the available resources to publish and share the data; for example database infrastructure, virtual observatory compliant tools, storage capabilities, web frontend, etc.

Upon request, CEFCO may offer support to develop the infrastructures needed for the publication of the data, including databases and web front-ends like those available in CEFCO's Catalogues Portal (<https://archive.cefca.es>).

7 - RESEARCH GROUP REQUIREMENTS

Scientific exploitation and data management of the awarded project/s shall be guaranteed. With this aim, the following requirements shall be fulfilled by the Research Group leading a project at the time of submitting the observing time proposal:

- The groups shall provide an estimation of the data production rate and the total data volume foreseen to be produced by the project.

- The groups shall have access to the required computing and storage facilities to handle the project data, including its final publication. This may include UPAD services upon discussion with CEFCa.
- The groups shall have access to the required scientific and technical human resources to process and analyze the project data.
- Periodic reports on survey progress.

Proposals shall include the scientific rationale, emphasizing the *Legacy Value* of the data, and an overall description of the observing strategy and the filter system requested.

8 - SUBMISSION AND EVALUATION PROCESS

8.1 - SUBMISSION PROCESS:

Detailed submission instructions can be found in the following link:

https://oajweb.cefca.es/observingtime/cfp_legacy_surveys_jast80

Proposals shall be prepared using the available templates and submitted via email to JAST80Surveys@cefca.es by 15 May 2022 at 23:59 CEST.

8.2 - EVALUATION PROCESS

Proposals are being evaluated by the OAJ Time Allocation Committee (OAJ-TAC). The meeting of the OAJ-TAC will take place at CEFCa at least 5 months in advance to the beginning of the observations.

The OAJ-TAC will also evaluate the progress of the awarded surveys' execution on a yearly basis. To this aim, the research teams will be requested to provide periodic survey reports.

9 - SURVEY IMPLEMENTATION

Once the Proposals' evaluation is completed, an iterative process to complete the detailed definition of the awarded surveys will take place. In this process, the research team is expected to interact with CEFCa to optimize the survey definition and strategy taking into account technical, logistics and planning aspects. After the detailed definition of an awarded survey is completed, the Principal Investigator will have to define the correct way to carry out the observations.

10 - EXPECTED TIMELINE

- Call for Proposals OPEN: **1 March 2022**
- Call for Proposals CLOSED: **15 May 2022**
- Awarded Surveys announcement: **July 2022**
- Agreements and Survey implementation: **July - December 2022**
- Beginning of observations: **January 2023⁽¹⁾**

⁽¹⁾ *If the Survey requires new filters and/or new instrumentation the starting date will be programmed according to the technical requirements.*

Annex 1 - Standard data reduction pipeline and photometric calibration

Standard Data reduction pipeline:

Currently, the standard data processing consists on the following steps:

1. Construction of master frames of bias, overscan regions, sky flat fields, illumination correction, fringing.
 - a. IMPORTANT NOTE:
 - i. Master overscan images are computed combining, for each amplifier, the overscan regions of images with similar exposure times.
2. Construction of bad pixel masks from master bias and master flat fields.
3. Detrending of the scientific raw image, including:
 - a. Overscan subtraction.
 - i. IMPORTANT NOTES:
 1. It has been found that bias levels change between master bias and scientific images. For this reason, only overscan subtraction is performed.
 2. It has also been detected that overscan regions changed as a function of the exposure time.
 - b. Flat field correction.
 - c. Illumination correction (icor).
 - d. Fringing correction (currently only for zSDSS, although J0861 images can also show a faint fringing pattern).
 - e. Background image computation.
 - i. This background image is stored compressed in an additional HDU.
4. PSF analysis.
5. Astrometrization.
6. Generation of a final catalog of sources.
7. Generation of a mask identifying bad pixels and pixels assigned to objects (segmentation map).
 - a. This mask is also stored as an HDU in the final reduced image.

Photometric Calibration

The photometric calibration of the reduced images would be performed using the methodologies developed for the J-PLUS project, including: (i) Comparison with SDSS and Pan-STARRS photometry for broad passbands (Cenarro et al. 2019), and with J-PLUS photometry in the shared areas and filters. (ii) Comparison with synthetic photometry from SDSS spectra in those fields with enough spectroscopic data; unavailable for u and z passbands (Cenarro et al. 2019). (iii) Using the stellar and white dwarf loci methodology described in López-Sanjuan et al. (2019c, 2021). Future improvements and new developments from the J-PLUS project will be offered as well (i.e., the comparison with synthetic photometry from Gaia spectrophotometric data).

The calibration with the repeated observation of spectrophotometric standard stars (SSSs) is also implemented but deprecated due to the large investment in observational time and the poorer performance when compared with the methods above. The request of SSSs images for calibration is

possible but the time will be charged to the survey allocated time and not considered as part of the calibration frames of the observatory.

The use of other calibration methodologies will be assumed by the Survey Research Team.