

The *Gran Telescopio Canarias OSIRIS* Broad Band First Data Release

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We present the first release of GTC OSIRIS Broad Band data archive. This is an effort conducted in the framework of the Spanish Virtual Observatory to help optimize science from the Gran Telescopio Canarias Archive.

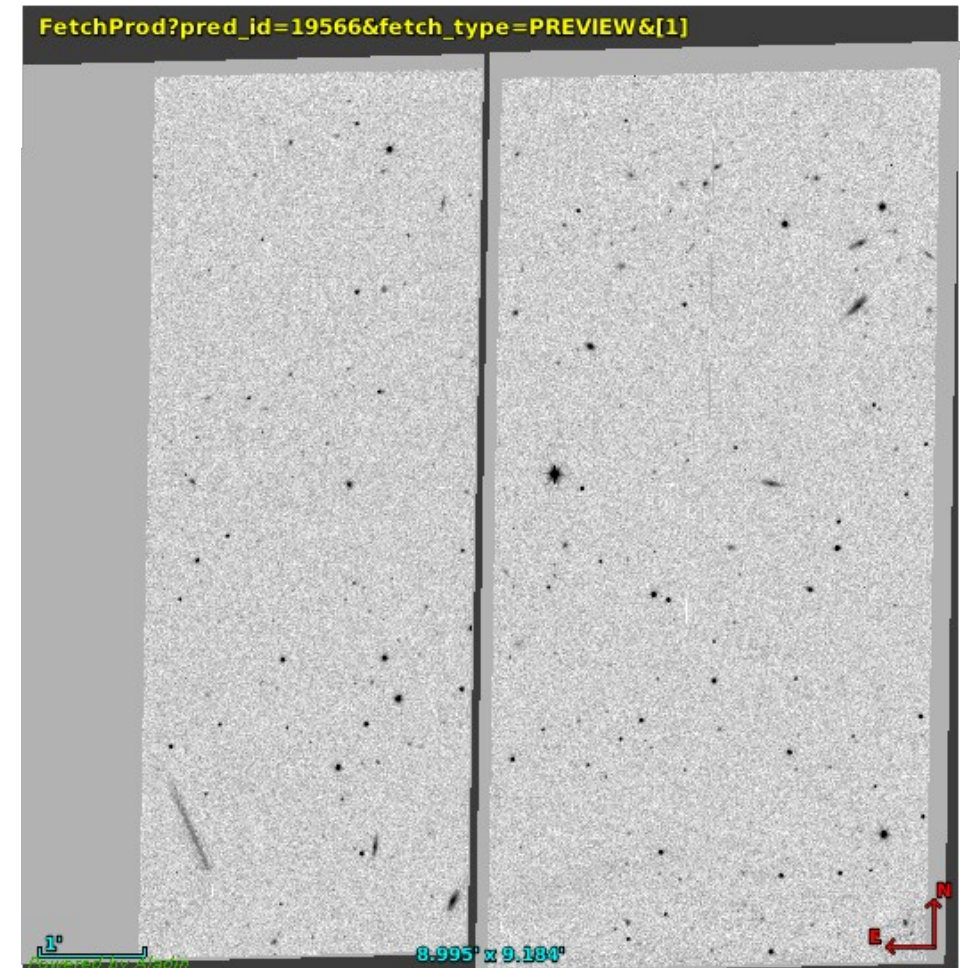
- Data Release 1 includes **6788 broad-band images** in the Sloan griz filters obtained between April 2009 and January 2014.
- The associated catalogue contains roughly **6.23 million detections of more than 630 000 unique sources**.
- The catalogue contains standard PSF and Kron aperture photometry.

In this paper we describe the **procedure followed** to build the image archive and the associated catalogue, as well as the **quality tests** carried out for validation. To illustrate some of the scientific potential of the catalogue, we also provide two examples of its scientific exploitation: **discovery and identification of asteroids and cool dwarfs**.



Context:

- **Reduced** (photometrically and astrometrically corrected images, spectra ready for immediate scientific exploitation,...) and **high-level** (catalogues, mosaics, stacked images,...) **data products** are of fundamental importance for archives as they enhance their use by the community.
- By using these resources, astronomers are able to **conduct research projects** that would otherwise be very time consuming or completely unaffordable.
- **OSIRIS** (Optical System for Imaging and low-Intermediate-Resolution Integrated Spectroscopy) is an **imager and spectrograph** for the optical wavelength range. OSIRIS allows broadband imaging over a field of view of 7.8×7.8 arcmin unvignetted.

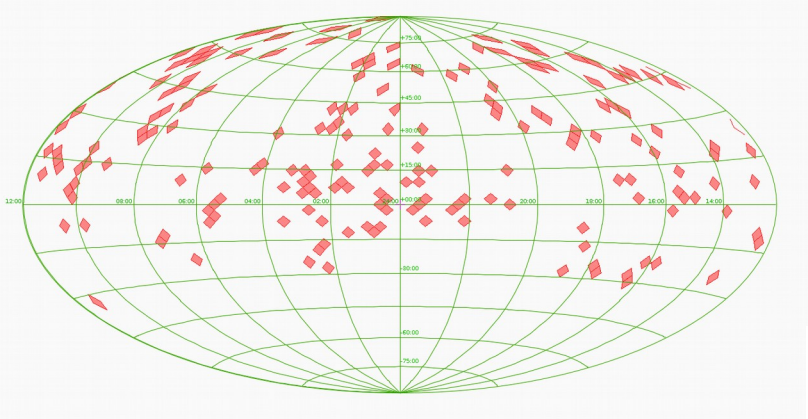


Methodology:

- I. **Data curation and preparation:** selection of science images
- II. **Data processing:** standard processing procedures using *Alambic* (Vandame 2002)
- III. **Source extraction:** SEXTRACTOR (Bertin & Arnouts 1996) and PSFEX (Bertin 2013)
- IV. **Astrometric calibration:** SCAMP (Bertin 2006) using 2MASS, SDSS DR10 or USNO-B1
- V. **Flux calibration:** PSF and Kron (AUTO) photometry using Pan-STARRS DR1
- VI. **Construction of catalogue sources and quality assessment:**
 - ◆ Removal of saturated and spurious detections
 - ◆ Morphological classification
- VII. **Scientific exploitation:**
 - ◆ Looking for cool dwarfs
 - ◆ Identification of asteroids
- VIII. **Data access:**
 - ◆ Astrometrically and photometrically corrected images: <http://gtc.sdc.cab.inta-csic.es/gtc/>
 - ◆ Detection and source catalogues: <http://svo2.cab.inta-csic.es/vocats/v2/gtc-osiris/>

Results:

- Catalogue coverage: 8.05 deg²



- The absolute astrometric uncertainty of the catalogue is of 0.12 arcsec.

Photometric properties:

- Mean photometric accuracy of the whole catalogue is better than 0.09 mag (PSF) and 0.15 mag (AUTO).
- Additional tests did not reveal any colour term in the photometric calibration nor dependence with the binning mode of observations nor the pixel position in the CCD.

Table 1. Summary of the photometric properties of the calibrated subimages.

	PSF				AUTO			
	<i>g</i>	<i>r</i>	<i>i</i>	<i>z</i>	<i>g</i>	<i>r</i>	<i>i</i>	<i>z</i>
Contribution to the photometric error (mag)	0.06	0.07	0.05	0.05	0.12	0.012	0.09	0.10
Exposure times (s)	1-900	1-360	0.5-360	0.5-300	1-900	1-542	0.5-360	0.5-30
Mean limiting magnitudes at SNR=5 (mag)	24.4	23.9	23.3	22.1				
Mean limiting magnitudes at SNR=10 (mag)	23.6	23.1	22.6	21.4				
Limiting magnitudes for the longest exposures and SNR=5 (mag)	25.8	24.1	23.6	22.4				
	Photometric quality							
Magnitude interval (mag)	18.5-22.0	18.5-22.0	18.5-22.0	18.0-21.5	18.5-22.0	18.5-22.0	18.5-22.0	18.0-21.5
Median of the std. dev. σ (mag)	0.034	0.026	0.038	0.034	0.043	0.038	0.053	0.056

Results:

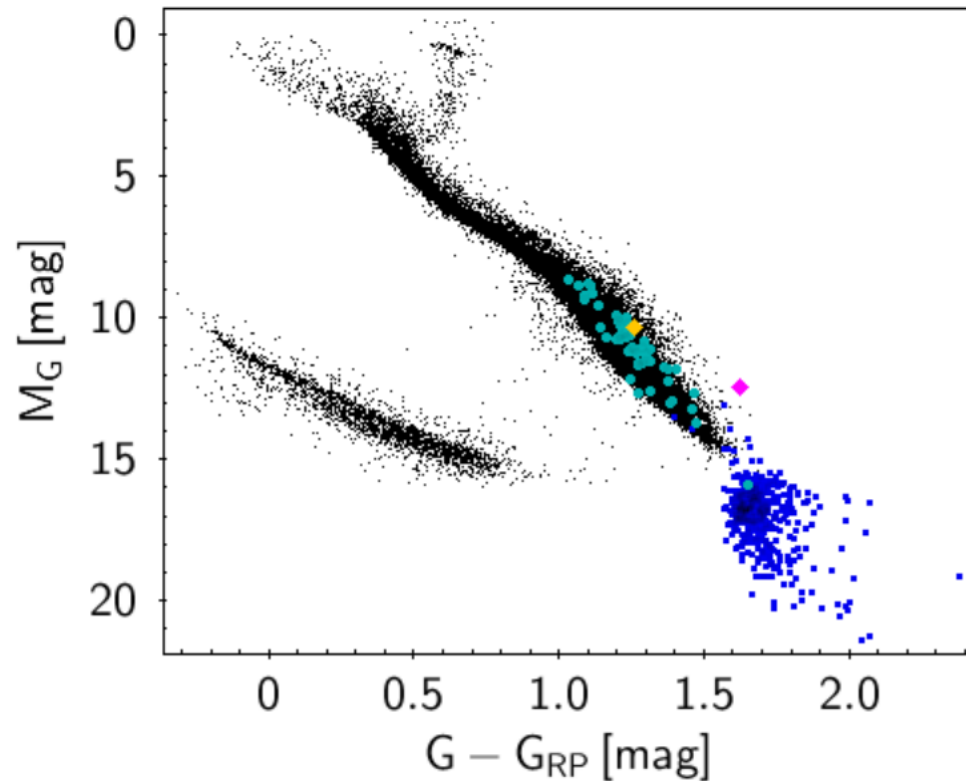


Figure 21. Colour-magnitude diagram using *Gaia* DR2 sources with parallaxes larger than 10 mas (black dots). Light blue filled circles represent our 48 single dwarf candidates later than M0, yellow filled diamond represents the M type secondary belonging to the K+M close binary and the magenta filled diamond stands for the M+L close binary system. L and T dwarfs with *Gaia* counterparts identified in [Smart et al. \(2017\)](#) are displayed with dark blue dots.

- ← Looking for cool dwarfs:
- 48 M dwarfs
 - K+M and M+L binaries

Identification of SSOs:

- 59 known asteroids
 - 4 known comets
 - 141 unknown objects
- } 2828 detections.

Table 4. Distribution of previously known SSOs detected in the DR1 images over SSO classes. The 4 comets were retrieved from targeted observations. MB stands for Main-Belt.

Comet	Inner MB	Middle MB	Outer MB	Trojan
4	21	17	20	1

Impact and prospects for the future:

- New releases of the catalogue including the new public broadband images will be delivered over the life of the instrument.
- We also plan to improve the absolute astrometry of the catalogue by linking it to the Gaia DR2 catalogue.
- New versions of the Pan-Starrs will also be used for the photometric calibration.
- The News section of the catalogue website will contain a list of Frequently Asked Questions as well as a description of caveats that may arise with the scientific exploitation of the catalogue.