The power of OAJ telescopes for the discovery of Cataclysmic Variables

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Abstract

The Observatorio Astrofisico de Javalambre is equipped with two wide field telescopes with a combination of broad and narrow band filters. The filters of the Javalambre Auxiliary Survey Telescope (80cm diameter) have been designed for stellar classification while the filters of the Javalambre Survey Telescope (2.5m diameter) have been designed for high accuracy determination of photometric redshifts of galaxies. In this article, I explain how the same filter set can also be used to efficiently recover cataclysmic variables and separate them from other objects (like quasars) and even tell their type. The observations to be carried out at the Observatorio Astrofisico de Javalambre will provide the best magnitude limited complete saple of cataclysmic variables to date.

1 - Telescopes and instrumentation at OAJ

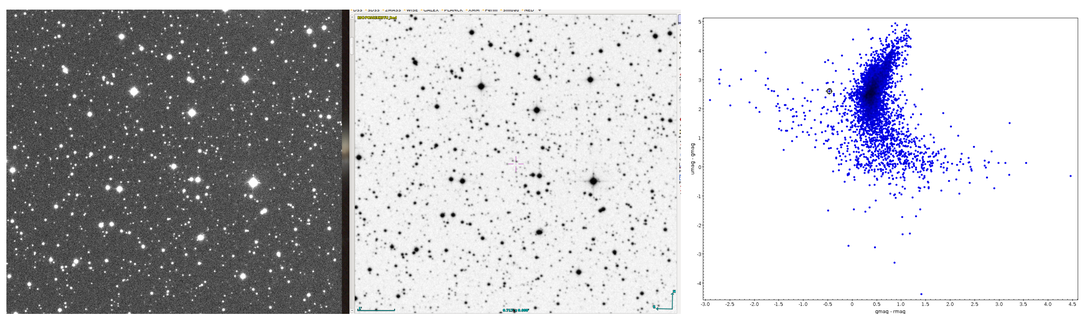
The Observatorio Astrofísico de Javalambre (OAJ)[1] will host:

- an 83cm telescope (JAST/T80) with a 9.2k×9.2k CCD[2], providing a $\sim 2^\circ$ diameter field of view.
- a 2.55m telescope (JST/T250) with a mosaic of 14 9.2k×9.2k CCDs[3] and a total field of view of $\sim 3^\circ$ diameter

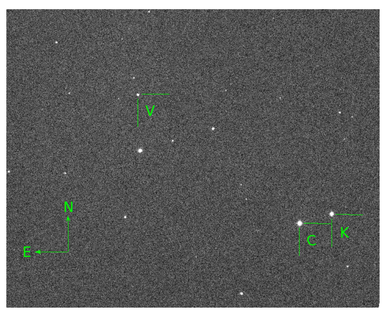
Each night, the observatory produces about 1.5TB of data, transferred to the CEFCA headquarters and processed in the "Unidad de Procesado y Archivo de Datos" (UPAD)[4]. Currently the JAST/T80 telescope is undergoing acceptance and it is equipped with a First Light Camera which mounts a FLI CCD 4k×4k providing a 30'×30' FoV in the SDSS bands.

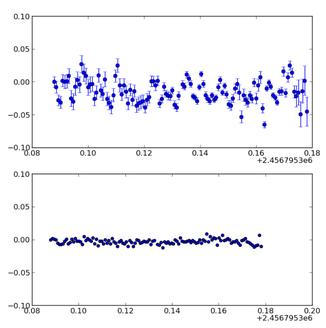
Nova Del 2013

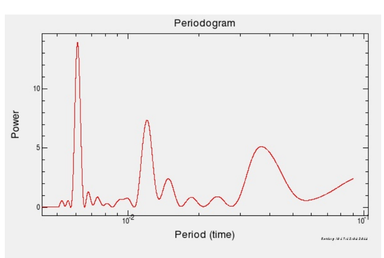
Discovered on 14 August 2013 [7], nova Del 2013 (V339 Del) reached maximum brightness two days later at $V \sim 4.43$ mag. It was observed with JAST/FLC on 27 July 2014. Here we report a comparison between the *r*-band observed with JAST/FLC in a 60 seconds exposure (left) and an image of the DSS (centre). The right panel shows the location of the star in a colour-colour diagram (note its displacement with the locus of the other "normal" stars).



Variability

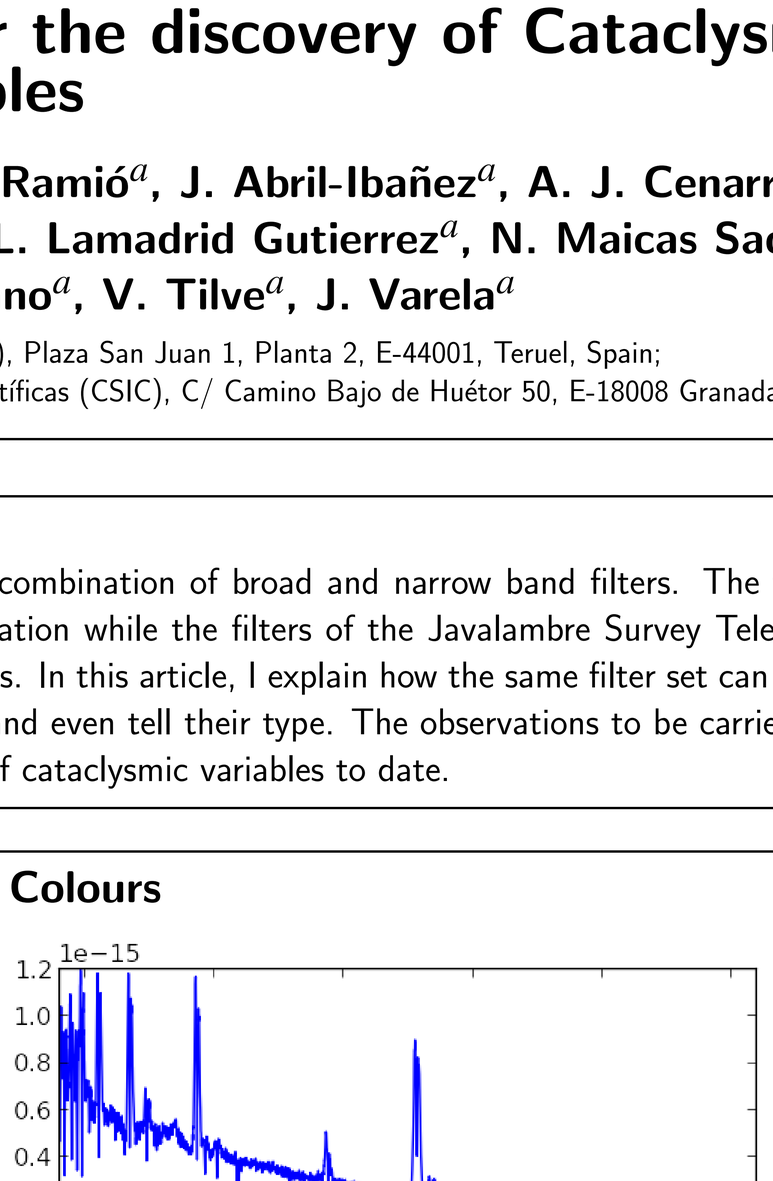




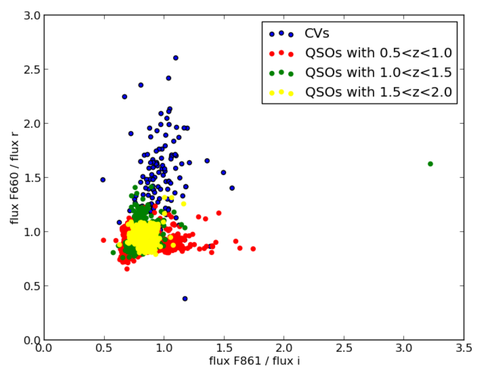


AM CVn is the prototype of a class of compact binary stars with no hydrogen lines. It has a $P_{\rm orb} \sim 17$ minutes and an amplitude of about 0.1 mag [8] which makes it an ideal target to test the ability of a telescope to detect variability. This star was observed during about 2 hours with JAST/FLC on the night of 17 May 2014. Here we show (from top to bottom) the finding chart, the obtained light curve (and the light curve of a check star) and a periodogram which shows that we are able to recover the orbital period of 17 minutes with a probability of 99.9% (using the Lomb-Scargle implementation available at `http://exoplanetarchive.ipac.caltech.edu/`).

2 - CVs Colours



Cataclysmic Variables (CVs) are binary stars made of a white dwarf which is accreting mass from a less evolved companion (see [5]). The spectral energy distribution of a CV is the result of the superposition of the spectrum of its three components (the two stars and the accretion disk). As an example, here we show the spectrum of J1052+3334, a CV with g=17.5 (upper panel), its SED in the J-PLUS filter system (mid-panel) and in the J-PAS filter system (lower panel).



Historically, the discovery of CVs has occurred either thanks to variability or colours. The experience has shown that CVs lie in the same region occupied by quasars (see [6]). Convolving CV and quasar spectra from SDSS and show that the J-PLUS filter system has a great potential to identify CVs by their colours.

References:

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