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Wide-Field Variability Surveys: A 21st Century Perspective

A new search for R Coronae Borealis stars in the SMC

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Abstract. R Coronae Borealis (RCB) stars are rare, and their evolutionary origin is not well understood. Since they are obscured due to formation of carbon dust around the star during their mass loss events, RCB stars can be classified as *self-eclipsing variable stars*. The purpose of this work is to present a new search for RCB stars in the Small Magellanic Cloud (SMC), by analysing *VI* data from the OGLE project.

1 Introduction

R Coronae Borealis (RCB) stars are red supergiant carbon stars presenting dramatic dimming episodes at irregular intervals. The dimming episodes are caused by self-obscuration by dust, occurring as a consequence of mass loss events (e.g., [1–3, 6] and references therein). A subclass of RCB stars called DY Persei also exists. The DY Per stars tend to be cooler and have more symmetrical drops in comparison to RCBs (e.g., [1, 12], and references therein). Our goal was to search for new RCB stars in the Small Magellanic Cloud (SMC), using *VI* data from the OGLE project ([10]). The *VI* light curves of all SMC red variable stars were visually inspected, and compared against templates from the literature. New detected RCB and DY Per candidates were presented in Nikzat & Catelan (2016, [7]), which had previously been classified as semi-regular or Mira variables. If confirmed, these detections would lead to a significant increase in the number of known RCB + DY Per stars in the SMC.

2 Data

Observations were made with the 1.3 m Warsaw telescope at Las Campanas Observatory, northern Chile, in the course of the OGLE-III campaigns ([10]). The catalog data for red variable stars in the SMC are available online from the OGLE project.[1] All constructed *VI* light curves were examined, in a search for deep, non-periodic declines that might be indicative of RCB-like behavior.

3 Results

We found three new RCB and 63 new DY Per candidates ([7]). An additional spectroscopic RCB candidate, MSX-SMC-014 ([5]), three confirmed DY Per stars and three DY Per candidates from the

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[1] ftp://ftp.astrouw.edu.pl/ogle/ogle3/OIII-CVS/smc/lpv/

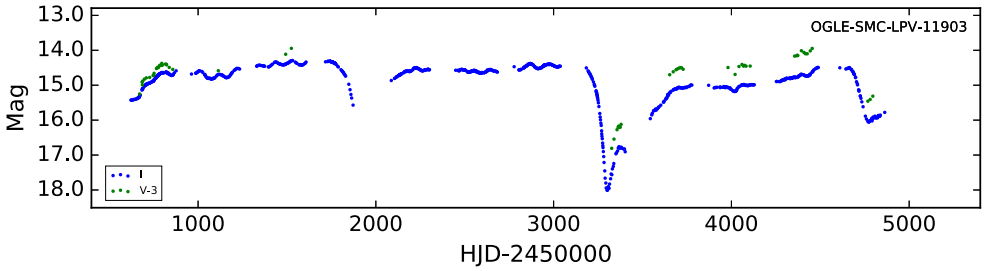

Figure 1. Light curves in *I* (*blue*) and *V* (*green*) of a known DY Per star in the SMC ([11]), identified using OGLE data ([7]), strongly reminiscent of an RCB star, and which we accordingly classify as a "transitional" DY Per/RCB star (see [7] for more details).

EROS2 project ([11]) were also analyzed. Their names, coordinates and light curves can be found in [7]. In addition, we noted the possible existence of a "borderline" DY Per-like star and a "transitional" DY Per/RCB star (Fig. 1). The latter might be consistent with the presence of an evolutionary sequence among H-deficient carbon stars, as suggested by [8] and supported by [4] and [9]. We point out that we have only used light curve morphology as indicative of potential RCB/DY Per status. Follow-up observations are required to conclusively confirm the nature of our candidates.

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