

Multicolor photometry of the stars GM Cep and V1180 Cas

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Introduction

- The PMS star **GM Cep**
 - ❖ member of the cluster Trumpler 37
 - ❖ distance of 870 pc
 - ❖ $M \sim 2.1 M_{\odot}$ solar mass
 - ❖ G7V-K0V spectral type
 - ❖ radius between 3 and 6 R_{\odot}

- The PMS star **V1180 Cas**
 - ❖ associated with the dark cloud Lynds 1340
 - ❖ distance of 600 pc in the star forming region in Cassiopeia.
 - ❖ H α emitter (Kun+, 1994).

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Observations

The CCD observation of GM Cep and V1180 Cas was performed in two observatories with four telescopes and nine different types of CCD cameras:

- Rozhen National Astronomical Observatory (Bulgaria)
 - ❖ the 2-m Ritchey-Chretien-Coude
 - ✓ Photometrics AT200
 - ✓ Vers Array 1300B
 - ✓ ANDOR iKon-L
 - ❖ the 50/70-cm Schmidt
 - ✓ SBIG ST8
 - ✓ SBIG STL-11000M
 - ✓ FLI PL16803
 - ❖ the 60-cm Cassagrain telescopes
 - ✓ FLI PL9000

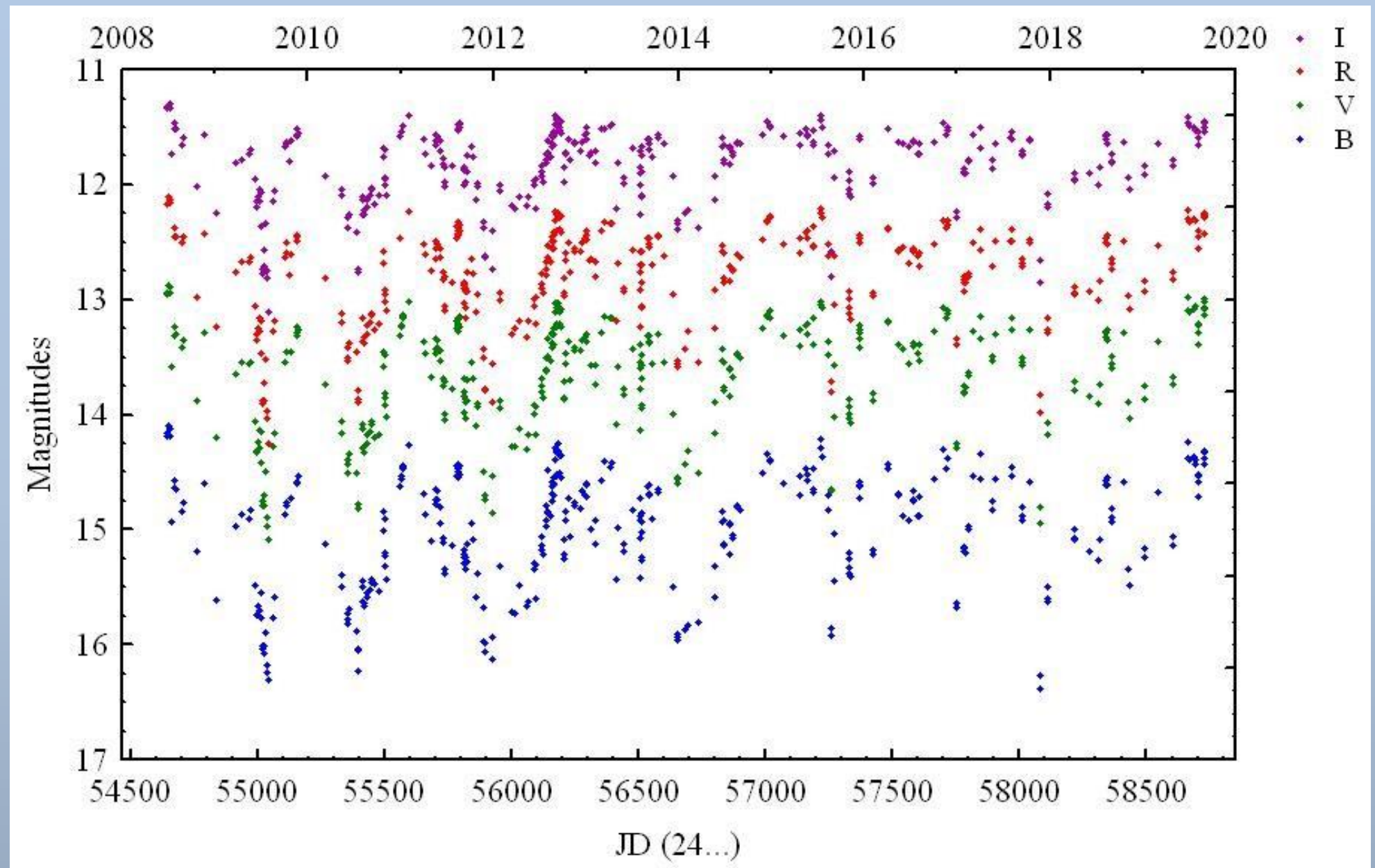
- Skinakas Observatory of the University of Crete (Greece)
 - ❖ the 1.3-m Ritchey-Chretien telescope
 - ✓ Photometrics CH360
 - ✓ ANDOR DZ436-BV

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Observations

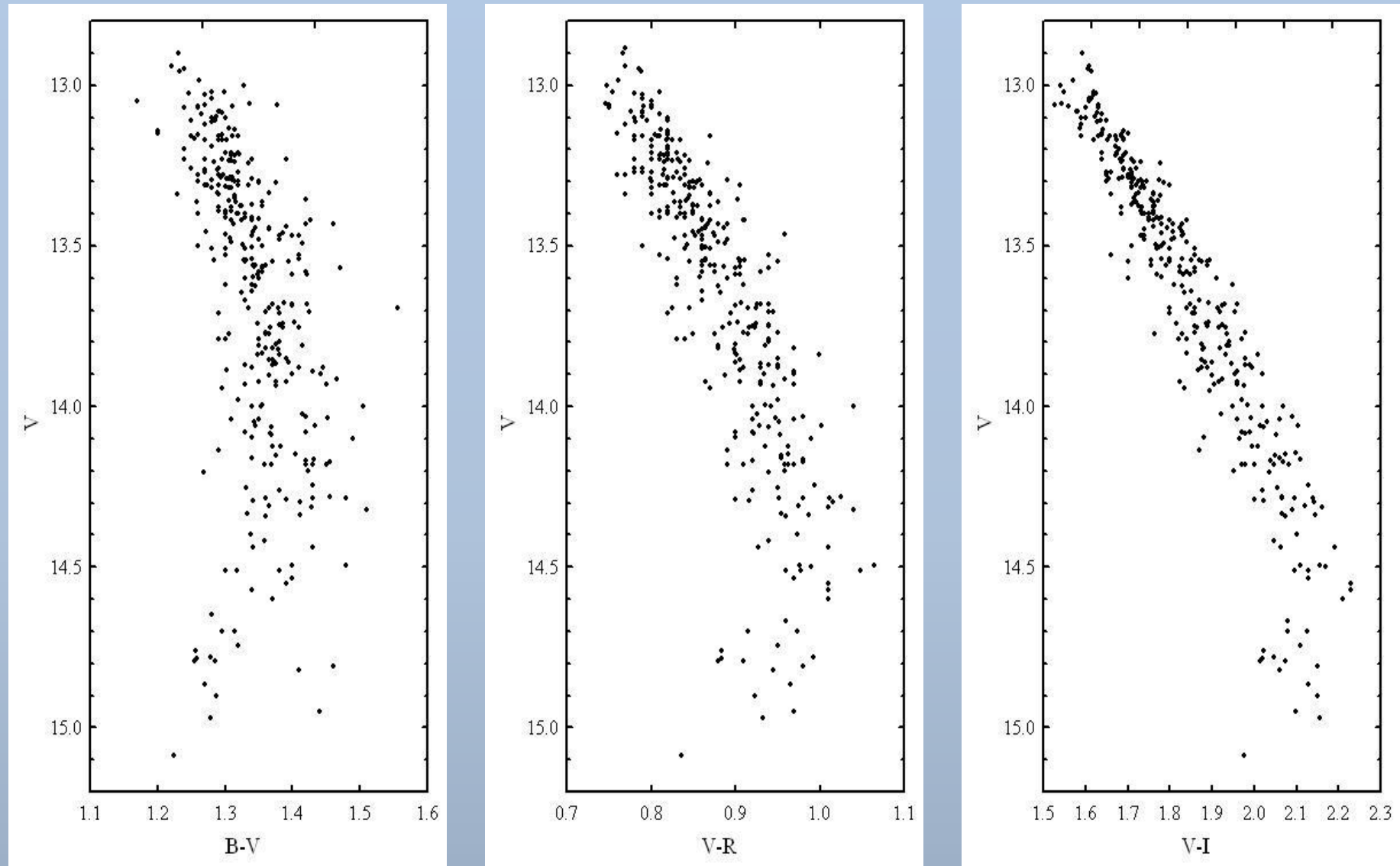
- All frames were taken through a standard Johnson-Cousins set of filters
- Our data was analyzed using fixed apertures:
 - ❖ for GM Cep it was chosen to be 6" radius (while the background annulus was taken from 11" to 17")
 - ❖ for V1180 Cas it was chosen to be 4" radius (while the background annulus was taken from 13" to 17")

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In Fig. 1 The *B*, *V*, *R* light curves of GM Cep for the period of our CCD photometric monitoring (June 2008 – August 2019). During ongoing photometric monitoring nine deep minimums in brightness are observed.

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In Fig. 2 using data from our *BVRI* photometry of GM Cep in the period of observations June 2008 - August 2019 we constructed and displayed the three color-magnitude diagrams (*B-V/V*, *V-R/V* and *V-I/V*). The existence of a turning point of each of the diagrams is seen on the figure.

Results

- The new photometric data showed continued strong brightness variability of GM Cep as registered in the previous studies (Sicilia-Aguilar+, 2008; Xiao+, 2010; Semkov & Peneva 2012; Chen+, 2012, Semkov+, 2015).
- In the time scale of days and months outside the deep minimums GM Cep also shows significant brightness variations.
- The summarized results of over ten year period of observations show very strong photometric variability. We have registered nine deep minimums in brightness in the light curve of GM Cep.
- The collected multicolor photometric data shows the typical of UXor variables color reversal during the minimums in brightness.
- Our photometric results for the period June 2008 – August 2019 suggest that the variable extinction dominates the variability of GM Cep.

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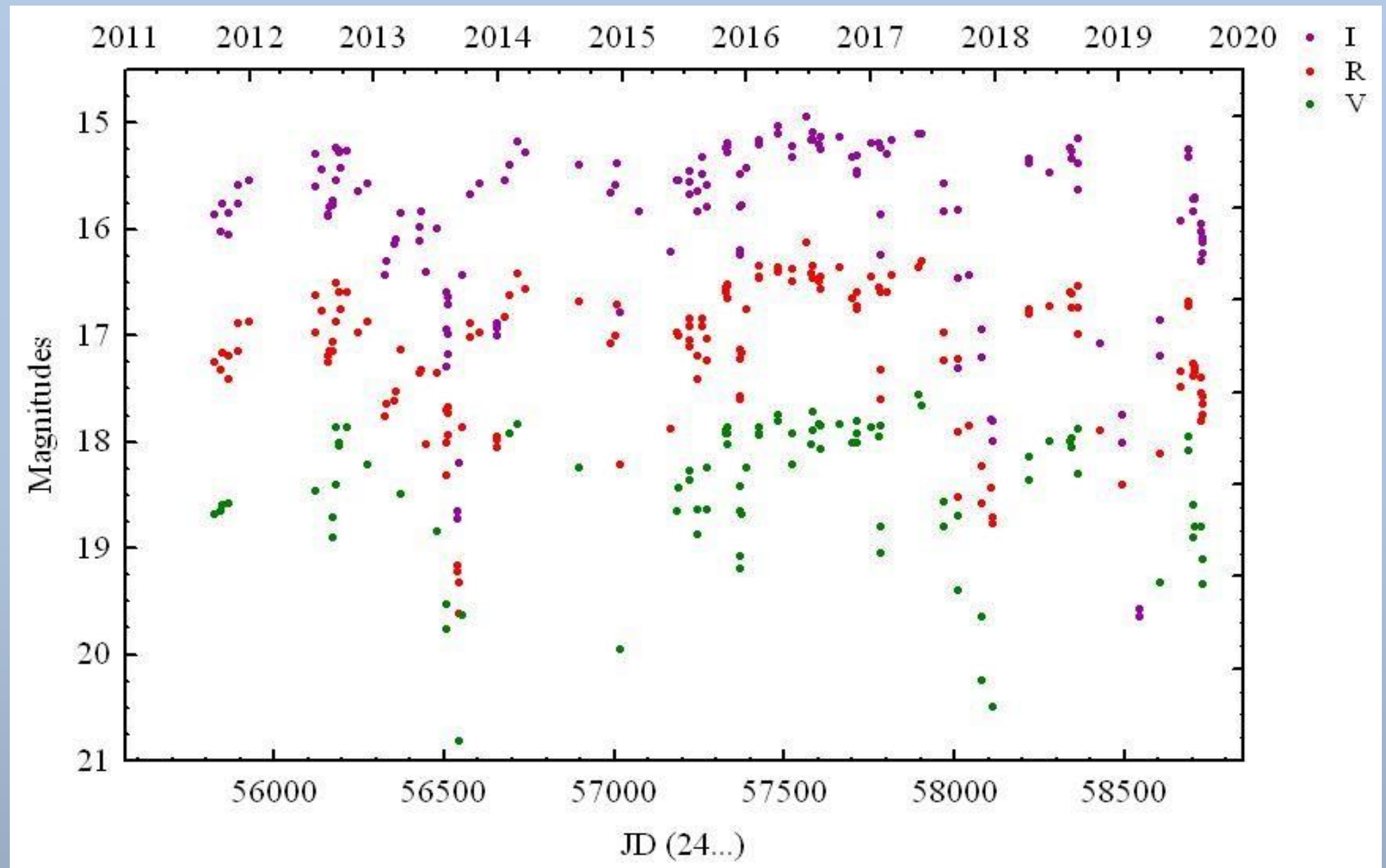


Fig. 3. Data from our *VRI* photometric monitoring of V1180 Cas in the period October 2011 – August 2019 are presented. The object exhibited large amplitude brightness variations $\Delta I_C \sim 4\text{--}5$ mag

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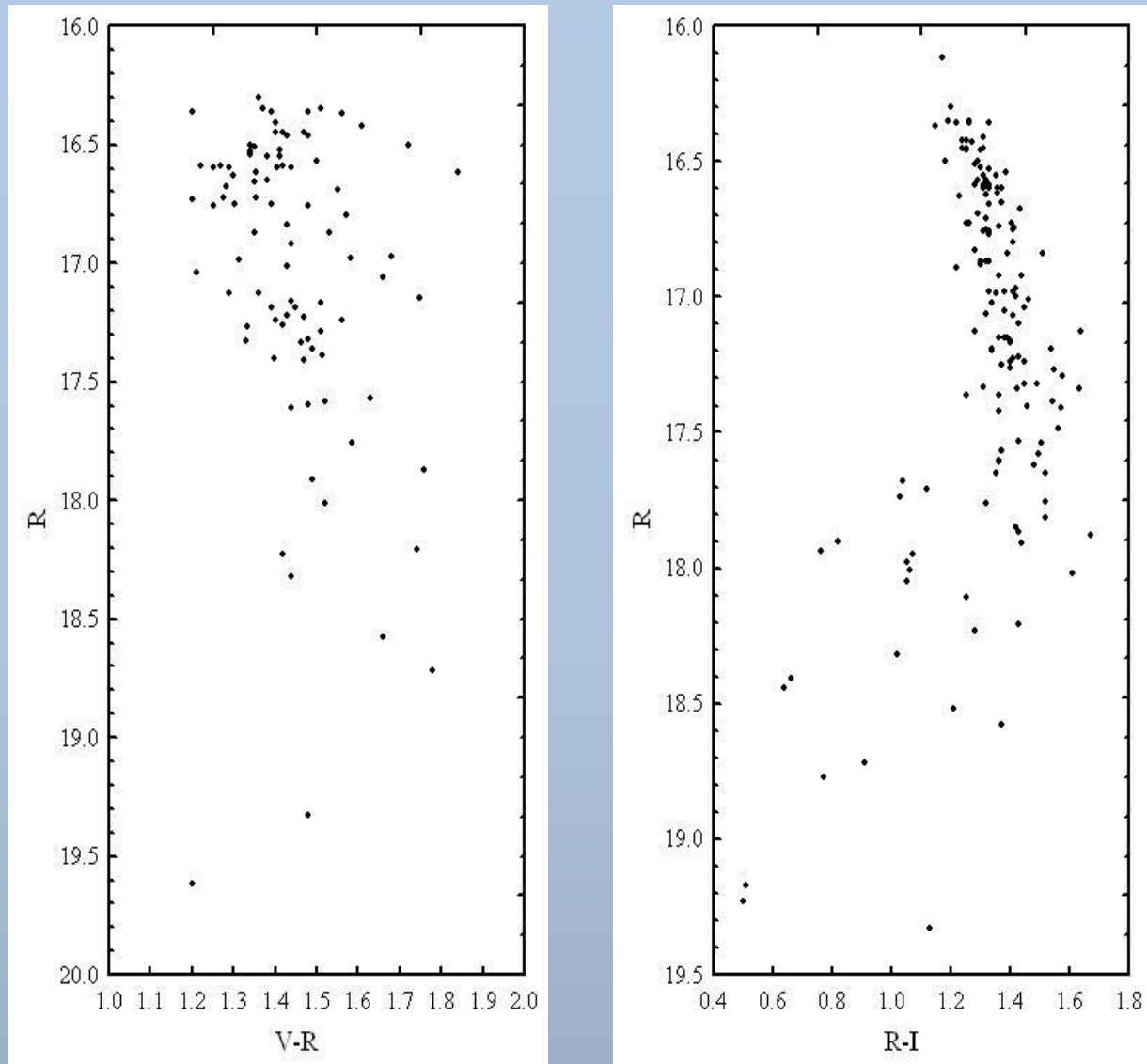


Fig. 4. The color-magnitude diagrams ($V-R/V$ and $V-I/V$) of V1180 Cas in the period of observations October 2011 - August 2019. The existence of a turning point of each of the diagrams is seen on the figure.

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Results

- During the 8 year period of observations the photometric data shows large amplitude variations ($\Delta I \sim 4.7$ mag)
- The first deep minimum is registered in September 2013, the second in December 2017 and the third one in February 2019.
- V1180 Cas shows significant brightness variations in the timescale of days and months when not in a deep minimum, too, similar to another UX Ori type variable star GM Cep (Semkov & Peneva 2012; Semkov+, 2015).
- V1180 Cas shows color reversal during its minimum of brightness similar to GM Cep (Fig.4).

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Acknowledgements

This work was partly supported by the Bulgarian Scientific Research Fund of the Ministry of Education and Science under the grants DN 08-1/2016, DN 08-20/2016 and DN 18-13/2017 as well as by the project RD-08-37/2019 of the University of Shumen..

THANK YOU