POLAR CRTS J035758.7+102943 CANDIDATE ANALYSIS WITH MULTIPLE OBSERVATIONAL TECHNIQUES

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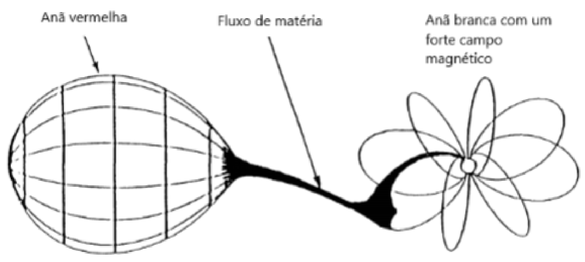
1 - INTRODUCTION

A polar-type magnetic cataclysmic variable (mCV), is a binary system formed by a white dwarf with an intense magnetic field (primary) and a red dwarf (secondary). The short distance between the components allows for mass transfer from the secondary to the primary, and the strong magnetic field present in the system diverts the flow of matter, forming an accretion column that collides with the primary in a small region close to its magnetic pole. The study of the polars is of great value for harboring processes that emit from radio waves to X-rays.



FONTE: Adaptado (Cropper, 1990)

Figure 1: Schematic representation of a polar. Evidencing the flow of matter following the magnetic field lines of the primary forming an accretion column

2 - OBJECTIVE

The main objective of this study is to confirm the classification of CSS0357+10 as polar-type mCV, and to characterize the system, based on photometry, spectroscopy, and polarimetry data.

3 - METHODOLOGY

Spectroscopy time series were obtained on the SOAR telescope, photometry and polarimetry on the Pico dos Dias Observatory, in addition to data from the TESS space telescope. These data were treated in the IRAF data reduction software, which allowed us to analyze the spectra, as well as a comparative study between the circular and light polarization curves. A search for periods was also performed using the Lomb-Scargle technique in python.

4 - RESULTS

4.1 - PHOTOMETRY

The periodograms of several sets of photometric data shown in figure 2, indicate an orbital period of 0.0791810(8) days, reducing by 20% the uncertainty of the period existing in the literature.

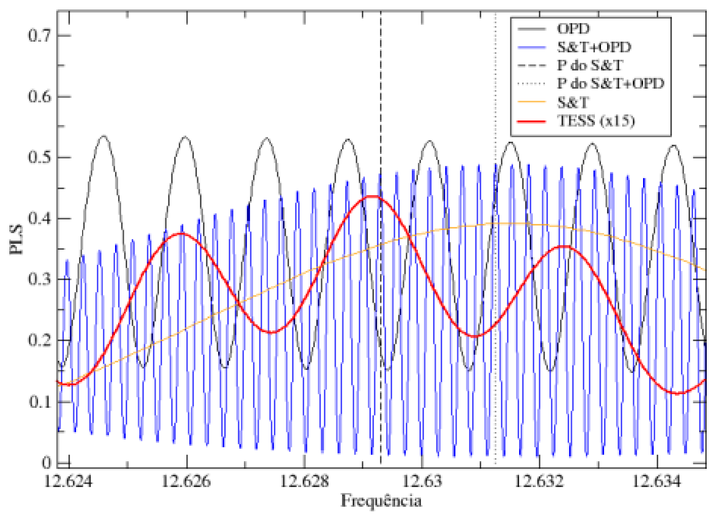


Figure 2. Periodograms from various datasets, where S&T are data kindly provided by Schowpe & Thinius (2012), which allowed us to have a wide temporal coverage. The vertical dashed line indicates the best orbital frequency.

Thanks

We thank Univap for the support and structure, and CAPES for the financial support, allowing the execution of this work.

4.2 - SPECTROSCOPY

The spectroscopy time series revealed emission lines with two components, one with a half-amplitude of 270 and another of 720 km/s. The average spectrum is dominated by emission lines, mainly Balmer's from Hydrogen and HeII.

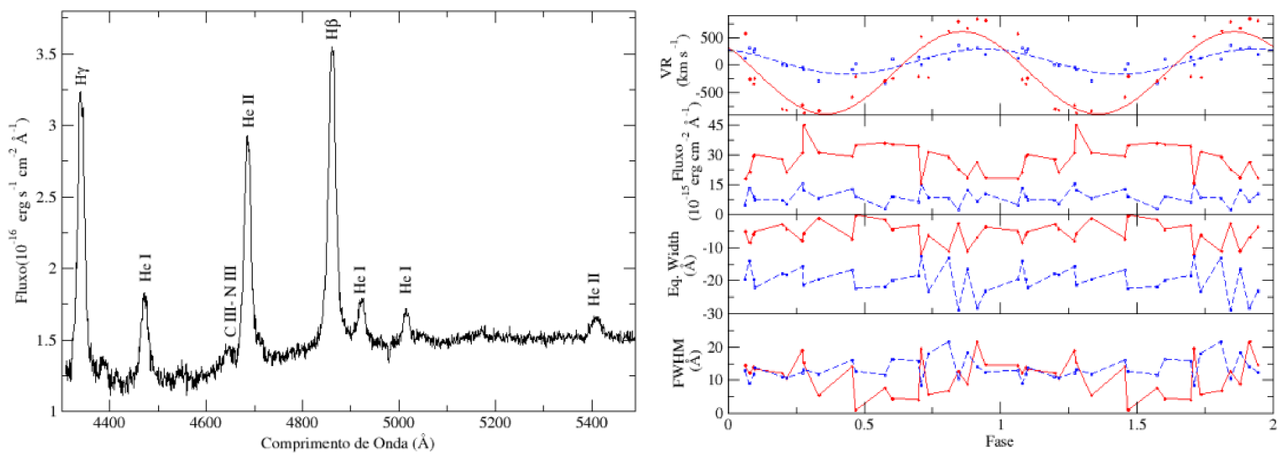


Figure 3 – Right: Average spectrum of J035758.7+102943, Left: Radial Velocity, Flux, Equivalent Width, and FWHM of the two emission line components.

4.3 - POLARIMETRY

The polarimetry data in phase with the ephemeris found, shows us modulations in orbital time scale and a circular polarization that reaches approximately 40%, depending on the filter.

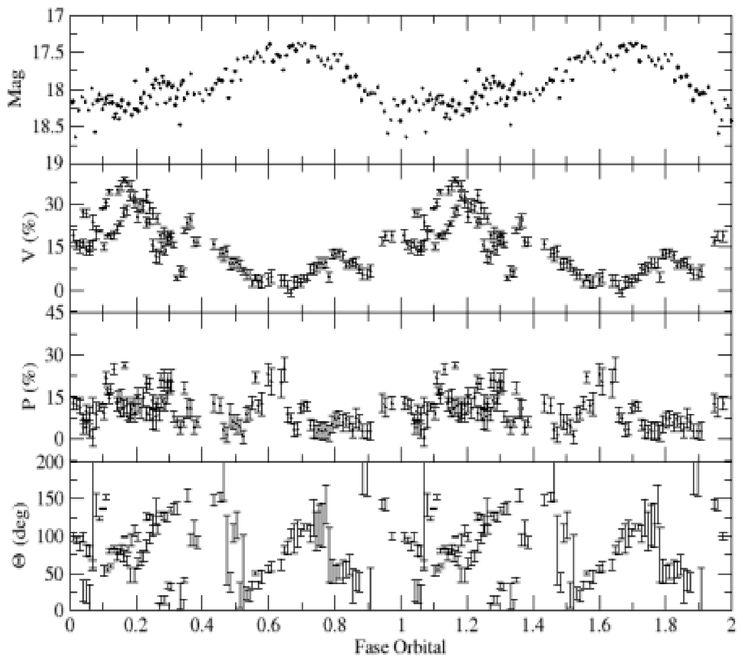


Figure 4 - From top to bottom: light curve, circular polarization curve, linear polarization, and linear polarization angle in the V filter.

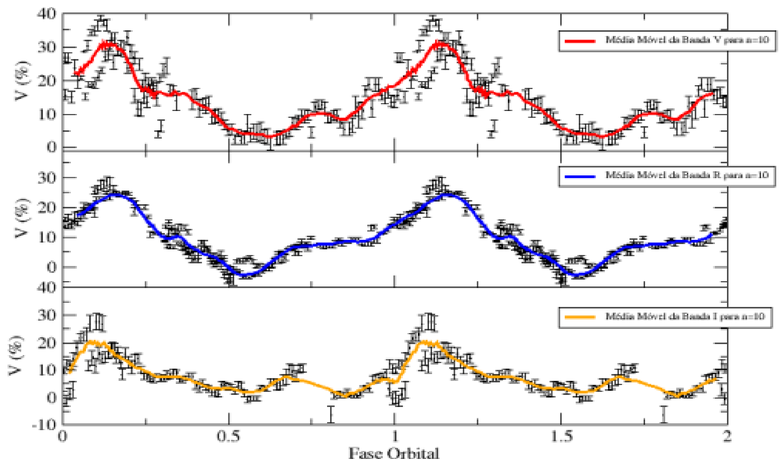


Figure 5 – Circular polarization curve of the V, R and I filters, in phase with the ephemeris found.

5 - CONCLUSIONS

It can be safely concluded that J035758.7+102943 is a polar-type mCV with an orbital period of 0.0791810(8) days, as it has all the typical characteristics of one, especially the high fraction of polarized light.

6 - REFERENCES

Hellier, C.:***Cataclysmic Variable Stars***.(2001).

Schwope, AD e B Thinius: **CSS091109: 035759+ 102943: A candidate polar**. Astronomische Nachrichten (2012)