LCO Photometry of a newly-identified white dwarf-M dwarf binary

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Telescope/Instrument/Hemisphere: 1 m/Sinistro/North
Time Requested: 1–3 runs of 4.3 hours each (12.9 hours total)

Abstract: We have identified a post common-envelope binary (PCEB) consisting of a white dwarf and an M8 star in a 4.23 hour orbit. This is one of the lowest mass stellar companions in a PCEB known and provides an opportunity to study the survival of low-mass objects through the common-envelope phase and measure the stellar winds of the companion. Here we request photometry from LCO to search for phase variation from the illuminated day side of the companion and possible eclipses.

Target: Guo et al. (2015) detected emission lines from Ca II in the SDSS spectrum of the white dwarf SDSS J1144+0529. We obtained follow-up X-shooter spectroscopy showing that the lines undergo radial velocity shifts , demonstrating that this is a PCEB where the emission lines are produced by the illuminated dayside of a low-mass companion to the white dwarf. Radial velocity measurements of both components (Figure 1) found that the system has a period of 4.23 hours and, intriguingly, a companion mass of $0.08\pm0.01\,M_{\odot}$, or an M8 star. This is the joint-lowest mass stellar companion in a PCEB known (Badenes et al., 2013; Parsons et al., 2012), and bridges the gap between brown dwarfs companions with 4 hr periods and stellar companions at generally longer periods (Casewell et al., 2018).

Proposed Observations: The spectroscopic follow up of this discovery is complete, and the only remaining observations required before publication are time-series i-band photometry of the system. This will allow us to measure phase variation in the flux from the companion as the illuminated day side moves into and out of view and model the effects of illumination from the white dwarf on the emitted spectrum of the companion, as well as look for eclipses that can be used to measure the radius of the companion, contributing to ongoing studies of the M dwarf mass-radius relationship.

Technical details: We request to observed at least one and ideally three complete orbital cycles with the Sinistro cameras on the 1 m LCO telescopes in the i-band, using 30 s exposures to achieve S/N = 25 with each exposure. One orbit will be enough to identify or rule out eclipses and at least detect evidence of phase-modulation. Observations covering a further 1-2 orbits will allow precise measurement of eclipse depths and phase variation, with diminishing returns after three orbits.

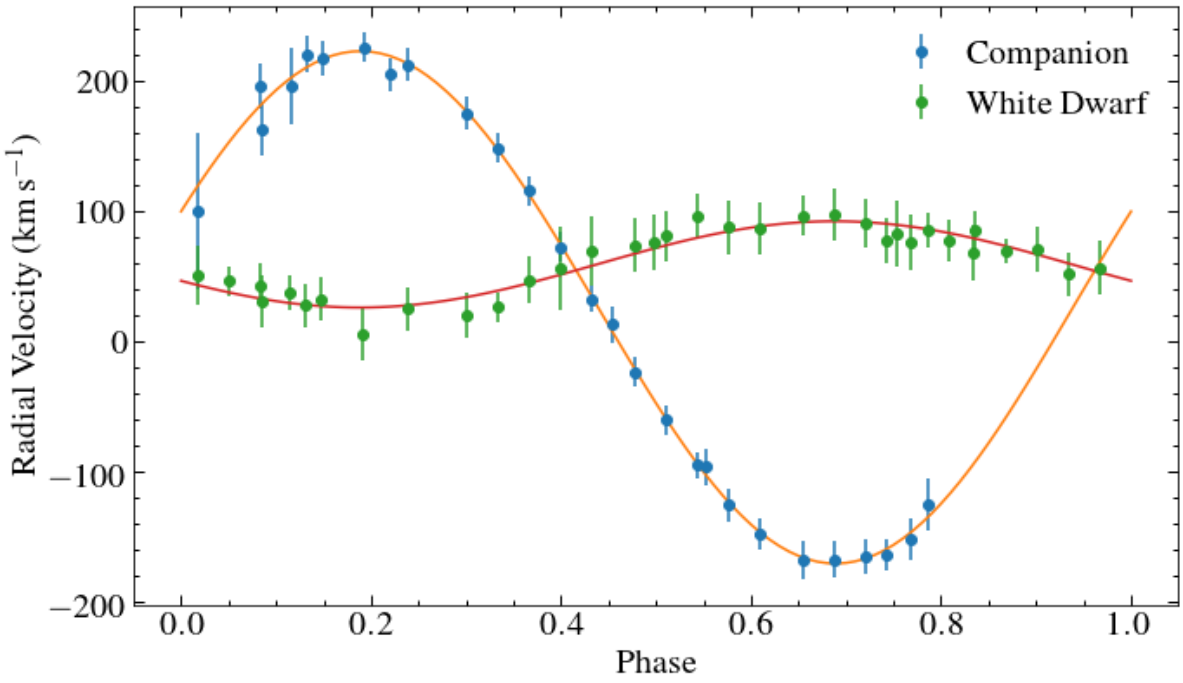

Figure 1: Radial velocity measurements of the SDSS J1144+0529 system, folded onto the 4.2 hour orbital period. Note the gap in RV measurements from the companion at phases 0.8–1 as the night side moves into view and the emission lines fade.

References

Badenes, C., van Kerkwijk, M. H., Kilic, M., et al. 2013, *MNRAS*, 429, 3596

Parsons, S. G., Marsh, T. R., Gänsicke, B. T., et al. 2012, *MNRAS*, 419, 304

Guo, J., Tziamtzis, A., Wang, Z., et al. 2015, *ApJ*, 810, L17

Casewell, S. L., Braker, I. P., Parsons, S. G., et al. 2018, *MNRAS*, 476, 1405