

THE FAINTER THE BETTER: CATAclySMIC VARIABLES FROM SDSS

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The SDSS has identified a total of 212 cataclysmic variables, most of which are fainter than 18th magnitude. This is the deepest and most plentiful homogeneous sample of these systems to date, and we are undertaking a project to characterise the population. We find that the SDSS sample is dominated by a great “silent majority” of old and faint cataclysmic variables. We detect, for the first time, a population “spike” at the minimum period of 80 min which has been predicted by theoretical studies for over a decade.

Cataclysmic variables (CVs) are interacting binary stars containing a white dwarf accreting material from a low-mass main sequence star via an accretion disc. Theoretical studies have consistently predicted that the population of CVs is dominated by short-period systems, which pile up at a minimum period of 65-75 minutes (Kolb 1993; Politano 1996). Unfortunately, the known CV population (Ritter & Kolb 2003), nastily biased by observational selection effects, strongly disagrees with theory (Fig.1). We are therefore characterising the population of CVs found by the Sloan Digital Sky Survey (Szkody et al., 2002-6). This sample was identified spectroscopically and extends to faint magnitudes, so is much less biased than all previous samples. We have found the first CVs known to have a secondary star of brown dwarf mass (Littlefair et al., 2006; Southworth et al., 2006), and for the first time are demonstrating evidence of the long-predicted pile-up at minimum period (Gänsicke et al., 2008). Results for individual systems, based on data from the VLT, NTT, WHT, INT and NOT, can be found in Gänsicke et al. (2006), Southworth et al. (2006, 2007ab, 2008abc), Dillon et al. (2008ab) and Littlefair et al. (2006ab, 2007, 2008).

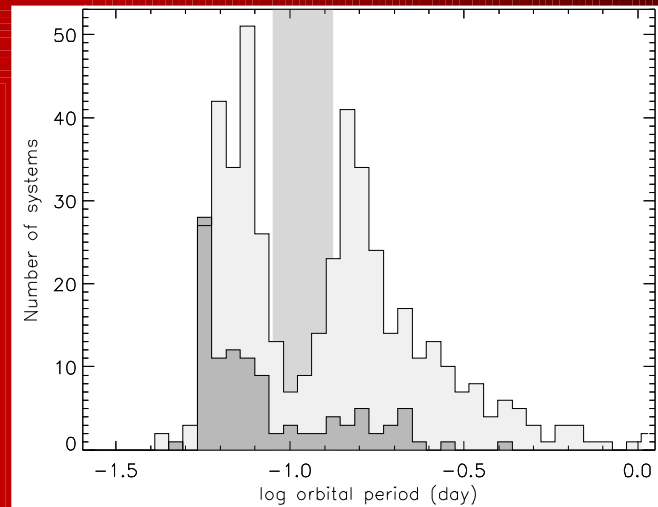


Fig. 1. Orbital period distribution of the SDSS CVs (grey histogram) compared to all other known CVs (white histogram). The 2-3 hour period gap in the known CV population is shown with light shading.

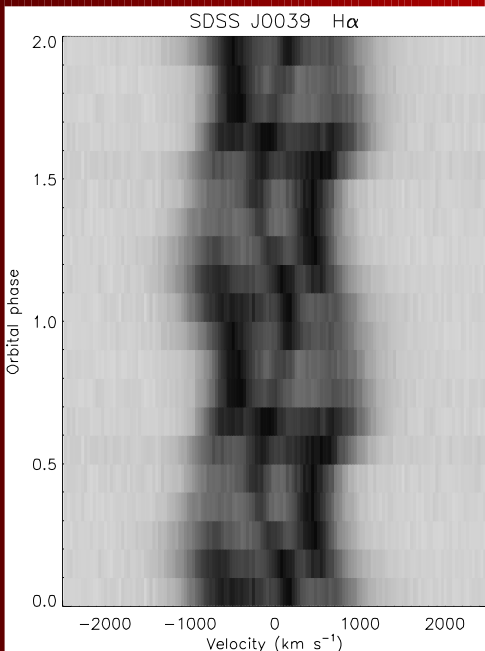


Fig. 2. Trailed spectra of the H α emission line of SDSS J0039, plotted versus orbital phase. The outer peaks are from an elliptical accretion disc. The inner peak is currently unexplained.

Triple-peaked H α emission from SDSS J003941.06+005427.5

We observed SDSS J0039 over two nights in 2007 August using the VLT UT1 and FORS2 spectrograph, finding an orbital period of 91.395 ± 0.093 min (Southworth et al., 2008c). The spectra of this system show a remarkable and unique triple emission peak at H α (Fig.2). Doppler maps (Marsh & Horne 1988) of the emission show that the inner peak moves with a velocity amplitude of 180 km/s, so cannot easily be assigned to either the white dwarf, secondary star, or accretion disc. Its existence remains a mystery. The H α Doppler maps also show that the accretion disc is strongly elliptical, which is unexpected for a system in a state of very low mass transfer. SDSS J0039 defies explanation in the standard picture of the properties and evolution of CVs.

SDSS J220553.98+115553.7: the pulsator which stopped

SDSS J2205 has twice been observed to vary in brightness (Szkody et al., 2007; Woudt & Warner 2004), with periods of 575, 475 and 330 s and amplitudes of 9-11 mmag, typical of ZZ Ceti-type non-radial pulsations. Over two nights in 2008 August we did not detect these pulsations, to a limit of 5 mmag, instead finding a previously unseen photometric period of 44.8 min (Southworth et al., 2008b). VLT spectroscopy yields an orbital period of 82.83 ± 0.09 min. The vanishing pulsation periods cannot be attributed to destructive interference or changes in accretion rate, but might be explained by changes in the white dwarf temperature or the surface visibility of the pulsation modes.

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