The Intriguing Accreting White Dwarf Pulsators

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With the discovery of nonradial g-mode pulsations in cataclysmic variables, a new venue of opportunity is now available to us to learn about the stellar parameters of accreting white dwarf pulsators using asteroseismic techniques. Constraining the population, mass distribution, and evolution of accreting white dwarfs is also important for studying supernovae Type Ia systematics. We will present some recent intriguing developments in this emerging sub-discipline of pulsations in cataclysmic variables.

Pulsations had ceased in the accreting white dwarf SDSS J074531.92+453829.6 subsequent to its October 2006 outburst. We recently acquired optical high-speed time-series photometry on this cataclysmic variable more than three years after its outburst to find that pulsations have now returned to the primary white dwarf. Moreover the observed pulsation spectrum is very similar to the pre-outburst data. This discovery is significant because the thermal timescale at the base of the convection zone governs which periods will be excited in this cool pulsating white dwarf, with a quiescent temperature of 11000 ± 2000 K. Observing similar pulsation periods now as the pre-outburst data allows us to constrain the depth of the heating during the outburst.

Our multi-site campaign on the accreting pulsator SDSS J161033.64-010223.3 (V386 Ser) conducted in May 2007 revealed the same photometric periods as observed previously in 2004, suggesting their underlying stability. Our data showed that this mono-periodic high-amplitude variable exhibits an evenly spaced triplet at 609 s. The even nature of the triplet is suggestive of rotational splitting, implying an enigmatic rotation period of about 4.8 days. There are two viable alternatives assuming the triplet is real: either the period of 4.8 days is representative of the rotation period of the entire star with implications for the angular momentum evolution of these systems, or it is perhaps an indication of differential rotation with a fast rotating exterior and slow rotation deeper in the star (Mukadam et al. 2010).

Szkody et al. (2002, 2007, 2010) are pioneering the effort to establish the pulsational instability strip for accretors empirically and testing the theoretical framework laid down by Arras et al. (2006). Our initial results constrain the broad empirical instability strip for accreting pulsators to be in the temperature range of 10500–15400 K, consistent with the theoretical expectations of Arras et al. (2006). We recently acquired HST UV time-series spectroscopy on the previous accreting pulsator GW Librae; this system had stopped pulsating after its outburst of April 2007, when it was heated to high temperatures well beyond the instability strip. Measuring the temperature of the white dwarf when pulsations are again visible should allow us to add another data point to the sparsely populated empirical instability strip that now comprises of just 6-8 other accreting pulsators.