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Observations of Southern Sky UGSU Cataclysmic Variables

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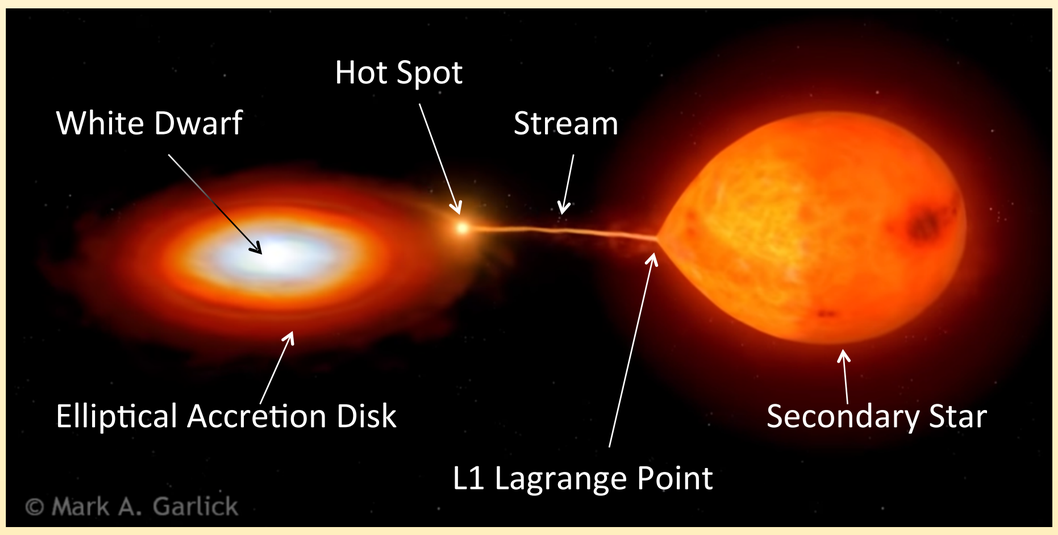
Type 1a supernovae are key 'standard candles' used to underpin the cosmological distance scale. Sources of variation in these events need to be understood to improve our agreed distance ladder, and a key input may be the configuration of the precursor systems, the dwarf nova cataclysmic variables.

We report observations of 7 UGSU dwarf nova systems in the southern skies over the period 16 Sept to 7 Nov 2019. Observations were made with 500mm PlaneWave optical telescopes in Perth (WA), Siding Spring (NSW), and New Mexico (USA).

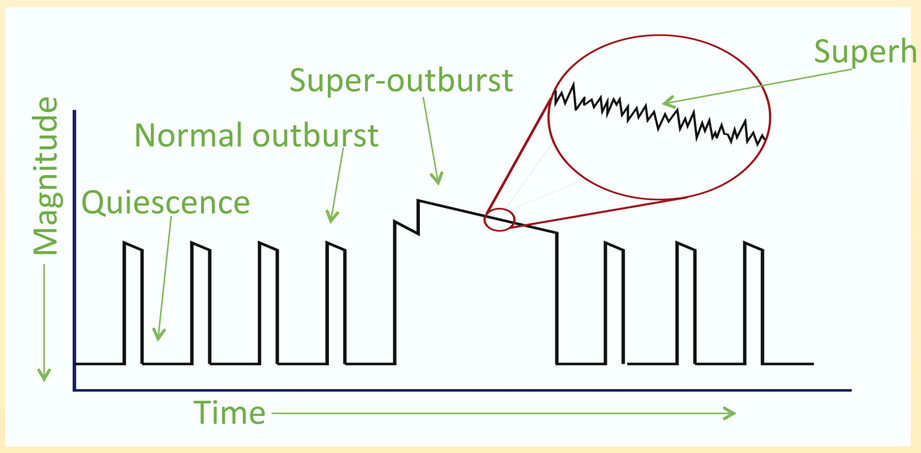
UGSU dwarf novae are characterised by the display of two types of outburst (rapid brightening) – normal outbursts and super-outbursts. We observed super-outbursts in two systems, VW Hyi and WX Hyi, and recorded periodic variations in the light curve of VW Hyi. We observed 'superhumps' with a period 112 minutes, slightly greater than the orbital period. This appears to indicate a continued slight increase in the superhump period from 109.5 minutes observed in 2004.

We also observed shorter period variations of 35 and 15 minutes. These variations have not been noted earlier in the literature although similar behaviour has been seen in at least one other system (Patterson et al. 2000). The cause of these variations is not known and should be the subject of future study.

A dwarf nova system consists of a white dwarf (WD) with a K-M type secondary. The companion fills its Roche lobe and spills material onto the WD forming an accretion disk (AAVSOa) *Art is used with permission of the copyright owner; labels added*

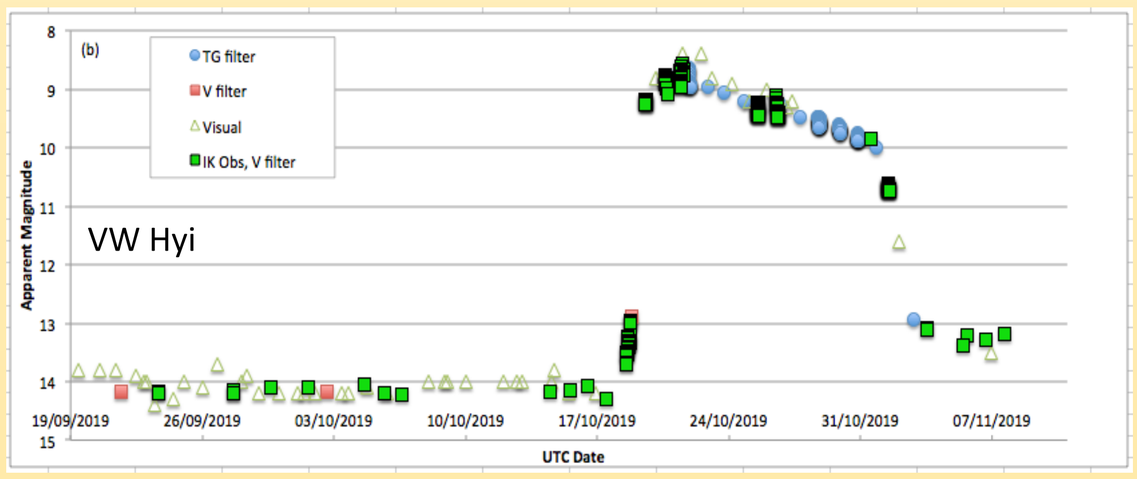


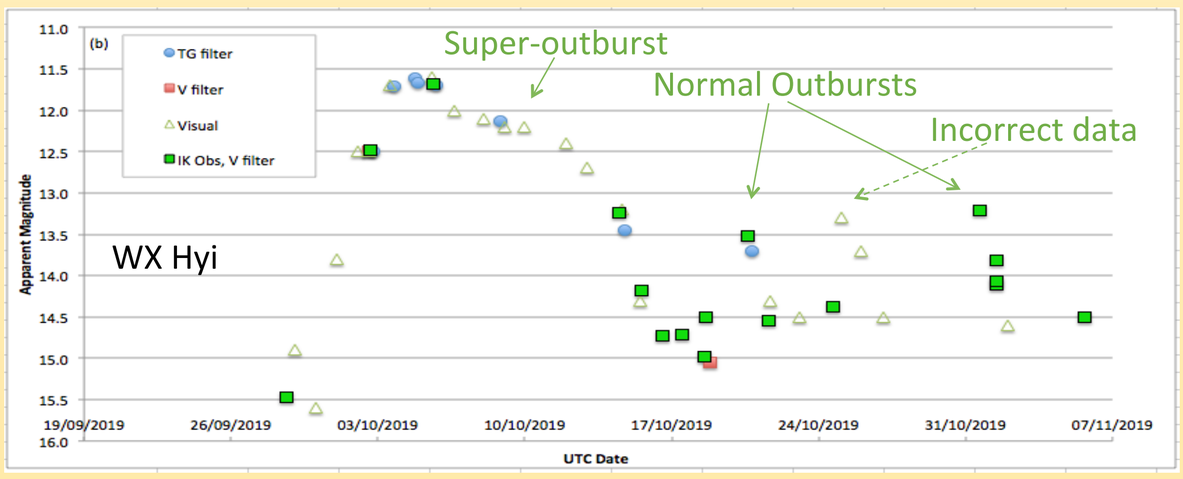
The accretion disk is unstable and displays two types of brightening − normal outbursts and super-outbursts. The super-outbursts are caused by gravitational instability. During a super-outburst we see 'superhumps', caused by the rotation of a pressure wave in the in the accretion disk as it collapses onto the WD (Osaki & Kato 2013)



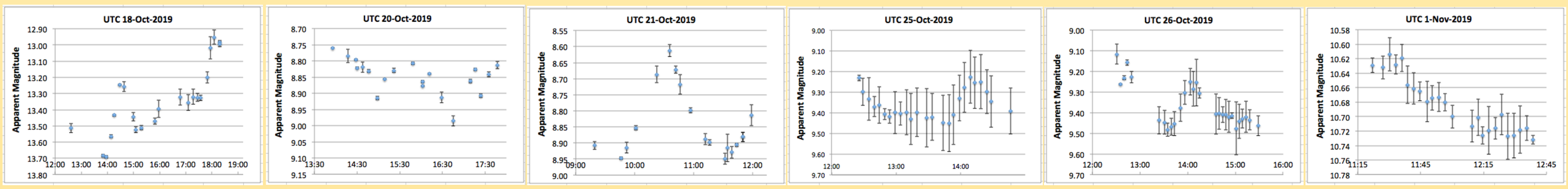
We observed a super-outburst in the system VW Hyi. Shown here in combination with observations from other members of AAVSO (AAVSOb). Our data are the solid green squares ■

We also observed a super-outburst and two normal outbursts in the system WX Hyi – again our data are the solid green squares.■ We noted some incorrect data in the AAVSO database – the timing does not fit the outburst.

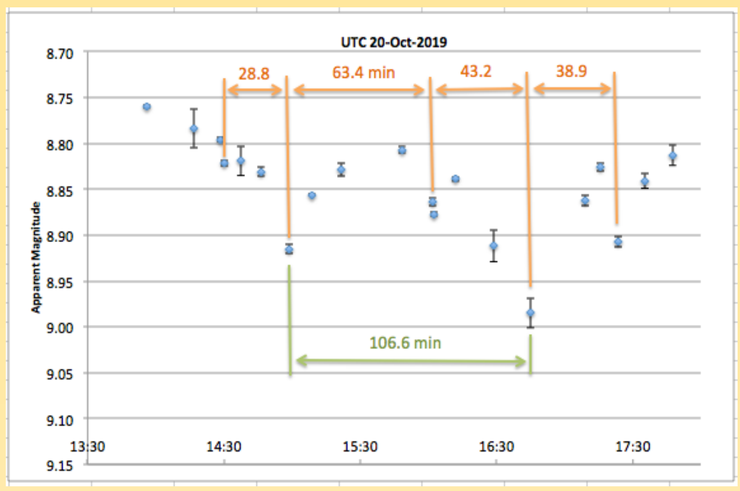


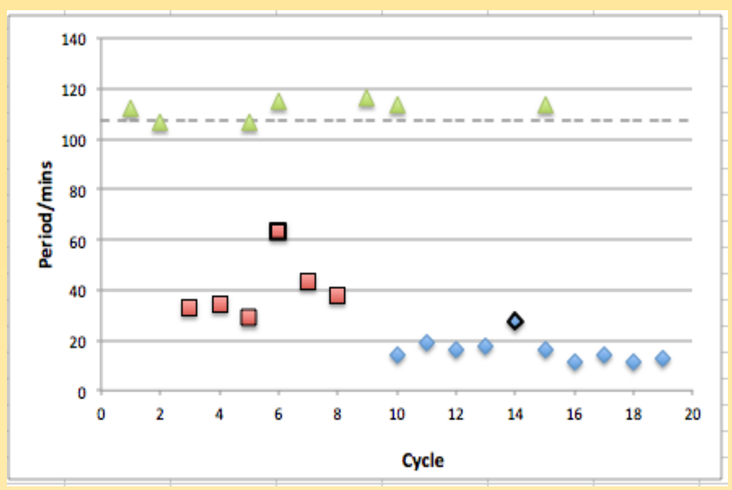


The super-outburst in VW Hyi was bright enough that we could observe superhumps over several nights – down to 3 minutes per measurement



Periodicities were extracted by finding the minima in the light curves (left hand chart) – there was clearly more than one periodic variation (right hand chart). The fundamental superhump averaging 112 minutes was accompanied by two short period features at 35 mins and 15 mins. These are much longer than the WD rotational period (2.2 mins), and longer than another documented 2.8 min 'wiggle' in the light curve (Woudt & Warner 2002).





The short period variations are a new phenomenon which needs to be investigated in future work. Also the fundamental superhump period seems to be increasing based on data from the last 15 years

Publication	Date of observation	VW Hyi avg. superhump period
Long et al. 2009	2004	109.5
Kato et al. 2014	2011	110.4
Present work	2019	112.1

Conclusions: We observed 7 dwarf nova systems in the southern sky. Two displayed super-outbursts during our observing period. Observations of VW Hyi showed a continued slowing in the superhump period, and the presence of a low-period oscillation which is currently not explained and should be further investigated. WX Hyi is continuing its historical pattern but some of the data in the AAVSO database is incorrect. The other 5 systems were in quiescence and observations were contributed to the AAVSO database for future study.

References

AAVSOa: web https://www.aavso.org/vsx/index.php?view=about.vartypes
AAVSOb: web https://filtergraph.com/aavso/
Osaki, Y. & Kato, T., PASJ, 2013, 65, 50
Long, K. S., Gänsicke, B. T., Knige, C., Froning, C. S. & Mondard, B., 2009, ApJ, 697, 1512
Kato, T. et al., 2014, PASJ, 66, 90
Patterson, J., Kemp, J., Jensen, L. et al., 2000, PASP, 112, 1567
Woudt, P. A. & Warner, B., 2002, MNRAS, 333, 411

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