ASAS-SN Identification of FY Sct as a Detached Eclipsing Binary System with a 2.6 Years Period

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Published 2018 September 28 •

Research Notes of the AAS, Volume 2, Number 3

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Received 2018 September 24
Accepted 2018 September 24
Published 2018 September 28

T. Jayasinghe *et al* 2018 *Res. Notes AAS* **2** 181

https://doi.org/10.3847/2515-5172/aae433

binaries: eclipsing; stars: variables: general; surveys

The All-Sky Automated Survey for SuperNovae (ASAS-SN, Shappee et al. 2014; Kochanek et al. 2017) has monitored the entire visible sky to a depth of ~17 mag in the V-band since 2014. ASAS-SN data is well suited for the discovery and study of variable stars (Jayasinghe et al. 2018a; Shields et al. 2018). In Jayasinghe et al. (2018b), we have uniformly analyzed the ASAS-SN light curves of ~412,000 known variables in the VSX catalog (Watson et al. 2006), providing homogeneously classified samples of variable groups for further study.

Here we report the identification of a long period detached eclipsing binary system. ASASSN-V J184258.61−105928.4 (FY Sct) was discovered by Harwood (1960) with a spectral type of M6, and is currently classified as a semi-regular (SRB) variable in the VSX catalog. FY Sct (l, b = 22.184, −3.135) was also classified as a variable source in the *INTEGRAL*-OMC catalog of variable sources (Alfonso-Garzón et al. 2012). The ASAS-SN data spanning 2014–2018 captures a single, deep (A ~ 1.5 mag) eclipse. The similarity of this light curve to the recently identified long period detached eclipsing binary ASASSN-V J192543.72 + 402619.0 (Jayasinghe et al. 2018c) piqued our interest. We supplemented the ASAS-SN light curve with V-band data from the All-Sky Automated Survey (ASAS; Pojmanski 2002), extending the light curve back to the year 2000 (Figure 1). We calculated periodograms and arrived at an orbital period of $P_{\rm orb}$ ~ 939 days. Based on this orbital period, we highlight the expected times of eclipse using the red dotted lines in the top panel of Figure 1. The ASAS data captures three eclipses. We see clear evidence for pulsational variability when the system is out-of-eclipse, with a period of $P_{\rm pulse}$ = 78 days. This pulsational variability resembles the variability of semi-regular variables, and likely explains the current VSX classification as a SRB variable.

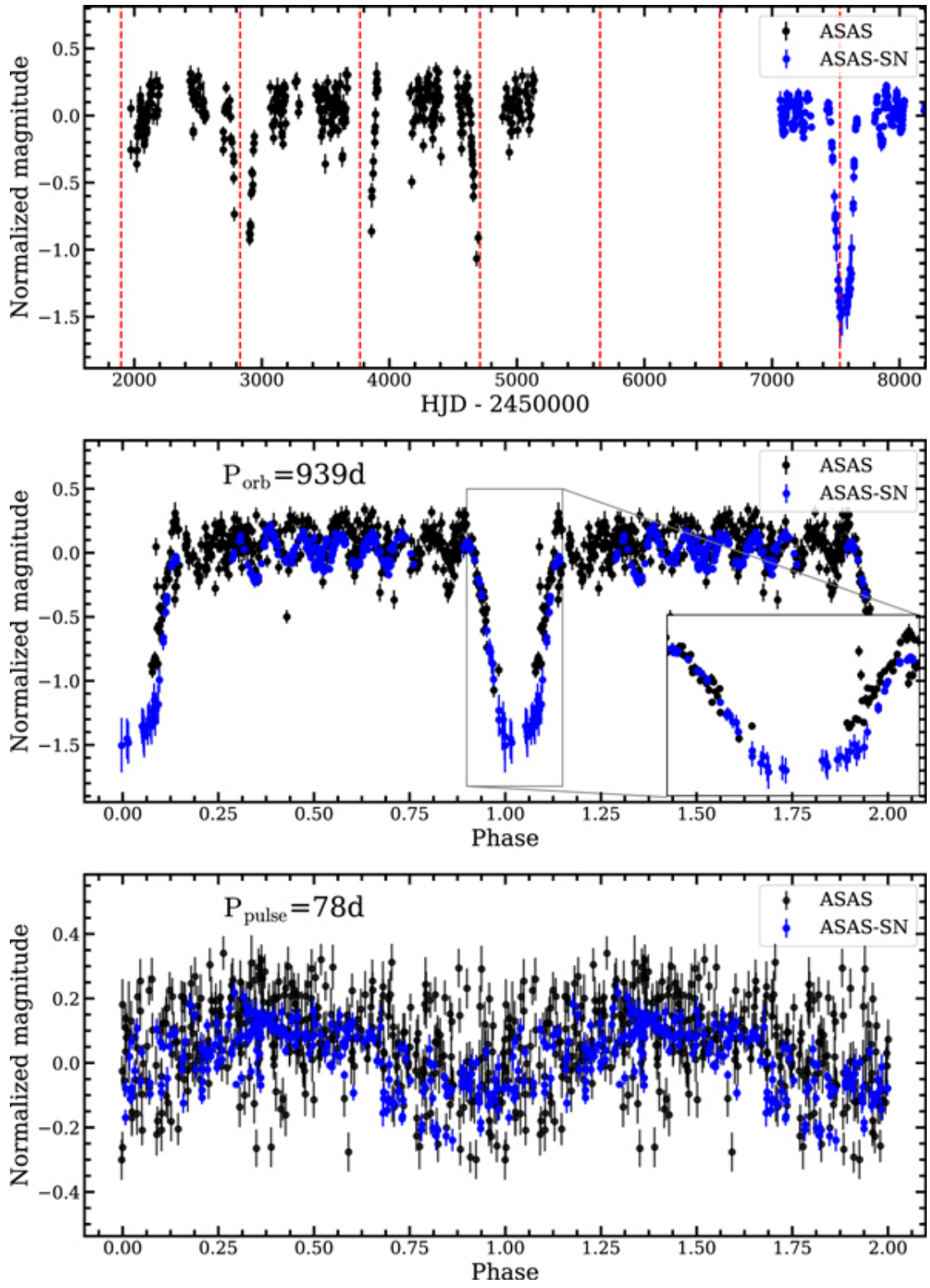

Figure 1. The top panel shows the combined ASAS-SN (blue) and ASAS (black) light curve for ASASSN-V J184258.61−105928.4. The middle panel shows the combined light curve phased with the orbital period of $P_{\rm orb}$ ~ 939 days, and the bottom panel shows the combined light curve excluding the eclipses and phased with the pulsational period of $P_{\rm pulse}$ = 78 days. The data used to create this figure are available.

Multi-band photometry from ALLWISE (Wright et al. 2010) and 2MASS (Skrutskie et al. 2006) provides colors of $W1 - W2 = -0.125$ and $J - K_s = 1.292$ typical of an M-giant (Zhong et al. 2014). The probabilistic *Gaia* DR2 distance of $d \sim 6$ kpc (Bailer-Jones et al. 2018; Gaia Collaboration et al. 2018) gives $M_{K_s} = -5.7$, which is also typical of a M-giant. The eclipse profile is suggestive of a disk eclipsing binary (Dong et al. 2014) rather than a stellar companion. The primary eclipse lasts ~73 days, and the next eclipse is expected to begin on ~2018 September 28. We encourage further photometric and spectroscopic observations, particularly during the eclipse, to further understand this peculiar binary system.

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