COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4193

Konkoly Observatory
Budapest
16 May 1995
HU ISSN 0374 – 0676

HS VIRGINIS – A DWARF NOVA WITH 8-DAY OUTBURST CYCLE LENGTH

HS Vir was discovered as an ultraviolet excess object PG 1341−079 and was subsequently confirmed by spectroscopy to be a cataclysmic variable by Green et al. (1982, 1986). They reported two magnitude variability, but its nature remained little revealed. Some authors have classified this object as a nova-like star, others as a dwarf nova with a small amplitude.

Photographic photometry was undertaken by Osminkin (1985), who showed existence of relatively frequent short, faint outbursts, and presence of a bright (∼12.8 mag) outburst. Unfortunately Osminkin's observations were so sparsely done that the materials were not enough to determine the outburst parameters or the dwarf nova subtype. Howell et al. (1990) tried to get the orbital period of this system by photometry made during quiescence, but the result remained inconclusive.

Another important observation was carried out by Ringwald (1993). He obtained a number of radial velocity mesurements, and derived the best estimate of the orbital period of 0.0836 day (with possible aliasing problems), which is just below the lower edge of the period gap. This suggests that HS Vir may be a candidate of SU UMa-type dwarf nova (for a review, see Warner 1985). One problem of this suggestion is that HS Vir has much smaller outburst amplitude (mostly 1 mag) which makes a clear contrast to usual SU UMa-type dwarf novae. However, recent discovery of a new subgroup of low outburst-amplitude SU UMa-type dwarf novae, named ER UMa stars or RZ LMi stars (Kato and Kunjaya 1995; Nogami et al., 1995; Robertson et al., 1995; Misselt and Shafter 1995; hereafter ER UMa stars) has called our attention to HS Vir with a similar outburst amplitude.

Observations were carried out using a CCD camera (Thomson TH 7882, 576 × 384 pixels) attached to the Cassegrain focus of the 60 cm reflector (focal length=4.8 m) at Ouda Station, Kyoto University (Ohtani et al., 1992). To reduce the readout noise and dead time, an on-chip summation of 2×2 pixels to one pixel was adopted. An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was between 30 and 120 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based automatic-aperture photometry package developed by one of the authors (T.K.). The differential magnitudes of the variable were determined using a local standard star [C_1: $13^h43^m24^s.84$ $-08°1'25''.2$ (J2000.0), V=12.2: The position and magnitude were taken from the Guide Star Catalog]. The constancy of this comparison was checked against several stars in the same field (C_2 and C_3; see Figure 1).

The resulting general light curve is given in Figure 2. The light curve first clearly established the dwarf-nova nature of HS Vir, with a very stable outburst cycle length of

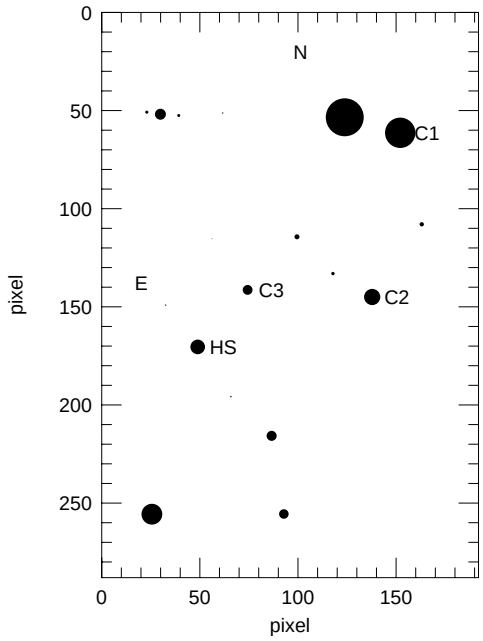

Figure 1. Field map of HS Vir. The field of view is about 6×9 arcmin. The variable (HS), comparison (C_1) and check stars (C_2 and C_3) are marked. The C_2 and C_3 were measured to be fainter than C_1 by 2.72±0.01 and 3.85±0.01 mag, respectively.

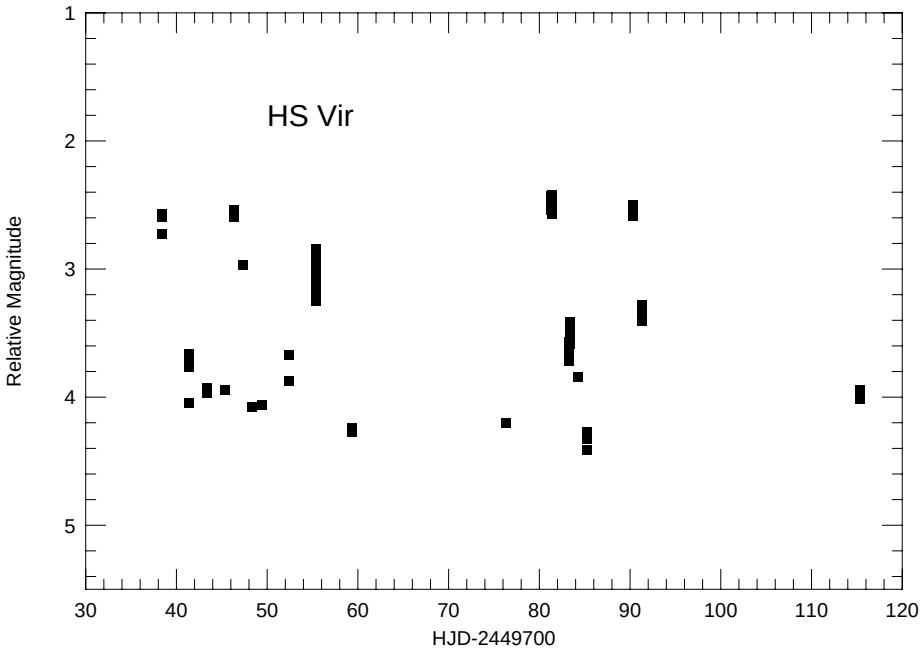

Figure 2. V-band light curve of HS Vir. The zero point of the relative magnitudes corresponds to V=12.2. Regular short outbursts spaced by 8 days are evident.

8 days. The observed amplitudes of outbursts were 1.1–1.8 mag, which are clearly smaller than those of usual dwarf novae. Other important points are the shortness of outbursts (one or two days), and the rapid decline up to 1.1 mag d^{-1} from the outburst peak. The shortness and the rapid decay of outbursts are very characteristic of normal outbursts of SU UMa-type dwarf novae. The shortest known recurrence time of normal outbursts in SU UMa stars had been 8 days in YZ Cnc, before the discovery of ER UMa stars. This value of HS Vir closely matches that of YZ Cnc, except outburst amplitudes, which are more similar to those of ER UMa stars. Although we have not yet detected superoutburst nor superhumps in this system, a search for these phenomena would surely bring the long confusing history of HS Vir to an end, and would prove the position of HS Vir among a group of low outburst-amplitude SU UMa-type dwarf novae, i.e. YZ Cnc, ER UMa stars and V503 Cyg (Harvey et al., 1995).

A record of the brightest outburst on JD 2443667 by Osminkin (1985), although severely undersampled, shows that this outburst lasted more than three days, and this outburst may be identified as a superoutburst. Confirmation of superoutbursts and superhumps, and determination of supercycle (recurrence time of superoutbursts) will be a next important step toward full understanding of this rather peculiar dwarf nova.

Part of this work is supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (T.K).

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