COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4646

Konkoly Observatory
Budapest
2 November 1998

HU ISSN 0374 – 0676

IL HYDRAE: NEW ORBITAL SOLUTIONS AND BV PHOTOMETRY

RAVEENDRAN A.V., MEKKADEN M.V.

Indian Institute of Astrophysics, Bangalore 560034, India, e-mail: avr@iiap.ernet.in, mvm@iiap.ernet.in

IL Hya (=HD 81410) is an active RS Canum Venaticorum binary, which shows drastic changes in the light curve within a few orbital cycles (Mekkaden & Raveendran 1998, and the references therein). Though it was suspected to be double-lined, earlier attempts to detect the spectrum of the secondary component did not succeed (Raveendran et al. 1982; Fekel et al. 1986). Recently, Donati et al. (1997) detected the secondary component on two high dispersion, high S/N ratio spectra and measured its radial velocities. Subsequently, using high resolution spectra Weber & Strassmeier (1998) measured 12 radial velocities and determined the amplitude.

The orbital parameters of the primary of IL Hya were first derived by Raveendran et al. (1982) from the eight radial velocity measurements listed by Eggen (1973), which were supplied by Wayman and Jones. Jones & Fisher (1984) have since revised three of the measurements listed by Eggen (1973). By combining his own radial velocity measurements with those of Collier Cameron (1987), Balona (1987) obtained an orbital period of 12.908 days, which is slightly longer than that obtained by Raveendran et al. (1982). Balona (1987) also derived an eccentricity of 0.05 for the orbit. Recently, Weber & Strassmeier (1998) presented the orbital parameters based on 21 new radial velocities obtained by them and the 34 velocity measurements made by Balona (1987); they assumed a circular orbit.

A total of 85 radial velocity measurements are available for IL Hya dating from 1959 till 1995, and Weber & Strassmeier (1998) used only 55 of them covering a time span of only 15 years. We have obtained fresh orbital solutions combining all the radial velocity measurements available. The solutions for both circular and elliptical orbits were obtained and these are given in Table 1. The measurements obtained by Donati et al. (1997) and Weber & Strassmeier (1998) were given weights of two while all the other observations were given unit weights.

The standard deviation reduces only marginally to 2.440 km s^{-1} from 2.444 km s^{-1} for an elliptical orbit instead of circular. Though small, the eccentricity is significantly larger than its probable error.

The observed velocities are plotted along with the computed curve corresponding to the circular orbit in Fig. 1. We have excluded 6 measurements, which show residuals larger than 5 km s^{-1}, from the solutions; these are indicated in the figure by arrows.

IL Hya was observed in BV bands on 9 nights during January–March 1993 with the 0.34-m telescope at Vainu Bappu Observatory, Kavalur. HD 81904 and HD 80991 were observed as comparison stars. All observations were made differentially with respect to

Table 1: Spectroscopic orbital elements of IL Hya.

Orbital elements	Circular	Elliptical
P	12.90522±0.00005 $(days)$	12.90521±0.00005 $(days)$
e	0.0 $(assumed)$	0.013±0.005
ω	–	23°±3°
K	41.5±0.2 $km\ s^{-1}$	41.5±0.2 $km\ s^{-1}$
γ	−7.2±0.2 $km\ s^{-1}$	−7.3±0.2 $km\ s^{-1}$
$T_0(JD)$	2449390.607±0.016	2449390.603±0.016
$T_\omega(JD)$	–	2449391.428±0.07
$a \sin i$	7.37±0.04×10^6 km	7.37±0.10×10^6 km
$f(m)$	0.096±0.002 $M_\odot$	0.096±0.004 $M_\odot$
σ $(unit\ weight)$	2.44 $km\ s^{-1}$	2.44 $km\ s^{-1}$

HD 81904, and the differential magnitudes and colours were converted to V and $B-V$ using $V = 8.020$ and $B-V = 0.975$ for the comparison star (Mekkaden & Raveendran 1998). The Julian days of observation were converted to photometric phases using the ephemeris,

$$\text{Zero Phase} = \text{JD2449400.286} + 12^{\text{d}}.90522 \times E,$$

where the initial epoch is the time of conjunction with the primary in front and the period is the orbital period given in Table 1. Both the initial epoch and period correspond to the case of circular orbit for the system. Along with the present V values the y magnitudes obtained by Sterken et al. (1995) during JD 2448957–9025 are also plotted in Fig. 2.

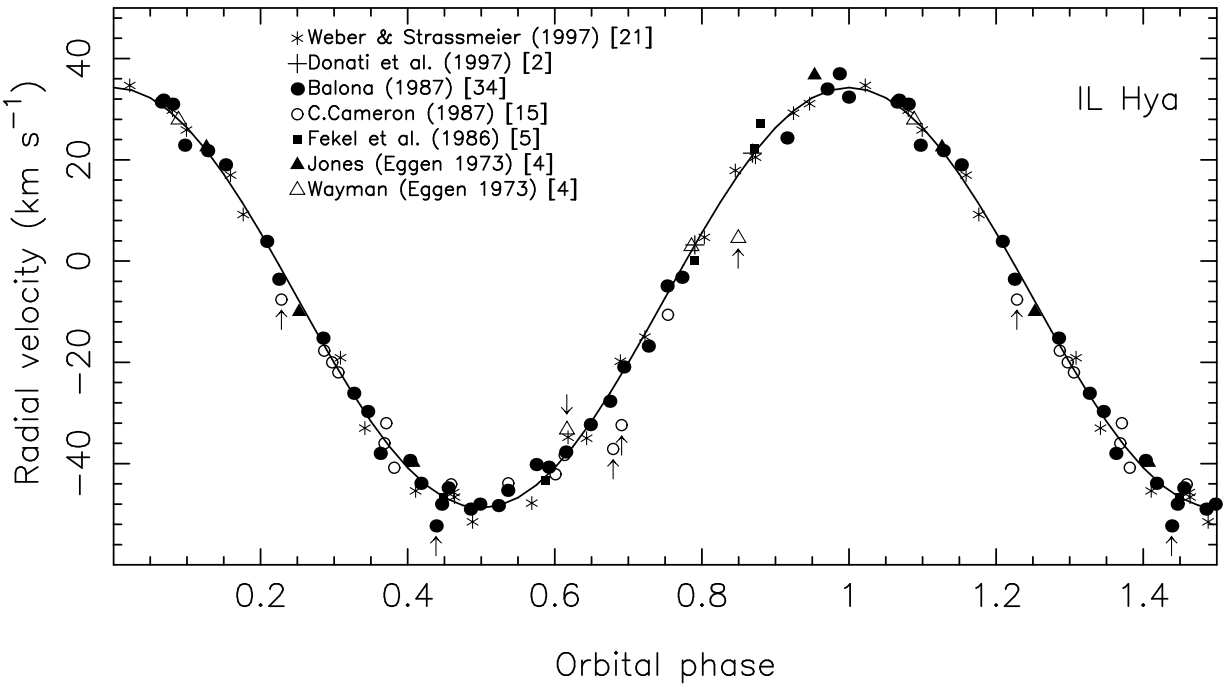

Figure 1. Radial velocity curve of IL Hya. The numbers inside the square brackets indicate the number of observations, and the arrows the observations excluded in the solutions

Table 2: BV photometry of IL Hya.

JD 2440000+	V	$B-V$
9012.446	7.400	
9018.339	7.320	1.024
9019.323	7.357	1.045
9020.300	7.382	1.037
9021.294	7.400	1.045
9034.290	7.389	1.047
9035.274	7.399	1.057
9036.323	7.412	1.057
9050.272	7.377	1.045

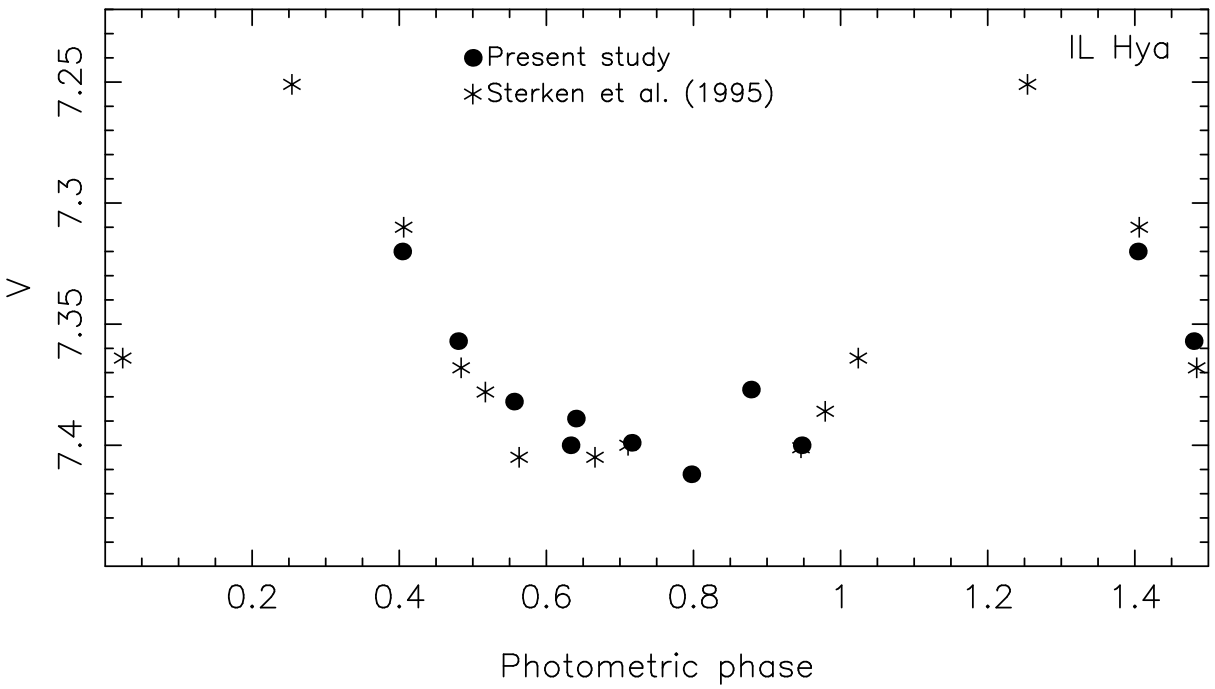

Figure 2. V light curve of IL Hya

The amplitude of variation in V is $\sim$0.20 mag. The light curve is highly asymmetric; it shows a broad minimum spread over $\sim$0$^{\rm p}$.4, implying that the starspots had a longitudinal extent significantly larger than 180°, and hence, the spots were not completely out of view during the phases of light maximum. The brightness at light maximum is $\sim$7.25 mag, indicating that the unspotted magnitude is appreciably brighter than 7.23 mag, the brightest so far observed (Mekkaden & Raveendran 1998).

References:

Balona L.A., 1987, *S. Afr. Astr. Obs. Circ.*, **11**, 1
Collier Cameron A., 1987, *S. Afr. Astr. Obs. Circ.*, **11**, 13
Donati et al., 1997, *MNRAS*, **291**, 658
Eggen O.J., 1973, *PASP*, **85**, 42
Fekel E.C., Moffett T.J., Henry G.W., 1986, *ApJS*, **60**, 551
Jones D.H.P, Fisher J.L., 1984, *A&AS*, **56**, 449
Mekkaden M.V., Raveendran A.V., 1998, *A&A*, **338**, 1031
Raveendran A.V., Mekkaden M.V., Mohin S., 1982, *MNRAS*, **199**, 707
Sterken C. et al., 1995, *A&AS*, **113**, 31
Weber M., Strassmeier K.G., 1998, *A&A*, **330**, 1029