Spectroscopy and Component Masses of the Eclipsing Dwarf Nova HS 0907+1902

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ABSTRACT. HS 0907+1902 was recently discovered to be one of a handful of deeply eclipsing dwarf novae with periods longward of the 2–3 hr “gap.” This paper presents orbit-resolved spectra and time-series photometry of an eclipse. The apparent velocity amplitude of the M-dwarf secondary is \( K_2 = 297 \pm 15 \text{ km s}^{-1} \). The phase of the radial velocities of the H\( \alpha \) emission-line wings agrees accurately (for once) with the phase of the white dwarf motion deduced from the eclipse, and an estimate of the emission-line velocity amplitude yields \( K_1 = 115 \pm 7 \text{ km s}^{-1} \). The eclipse width is \( \Delta \phi = 0.060 \pm 0.005 \). At face value, these measurements yield mass estimates of \( M_1 = 0.99 \pm 0.12 \, M_\odot \) for the white dwarf and \( M_2 = 0.38 \pm 0.06 \, M_\odot \) for the secondary. The eclipse width and nominal mass ratio constrain the binary inclination \( i \) to be \( 77.3 \pm 0.9 \). The influence of systematic uncertainties on these values is discussed; the conclusion that the white dwarf is somewhat more massive than typical field white dwarfs appears to be robust.

The H\( \alpha \) emission-line profile out of eclipse is only slightly double-peaked, but the line shows a strong rotational disturbance in eclipse. Models of the line profile through eclipse using a flat, Keplerian disk do not give a good quantitative match to the observations.

1. INTRODUCTION

Cataclysmic variable stars (CVs) are close binaries in which a white dwarf accretes material from a late-type main-sequence companion. The average rate at which matter is transferred can vary widely, leading to a variety of interesting behaviors. The dwarf novae, a subset of the CVs, display bright outbursts generally separated by relatively quiescent intervals; the instability leading to the outburst is thought to occur when a critical amount of material is accumulated in an accretion disk about the white dwarf, the outburst itself being caused by a rapid increase in the mass-transfer rate through the disk. The orbital periods of dwarf novae range from \( \sim 80 \) minutes up to \( \sim 12 \) hr; there is a significant scarcity in the period range 2–3 hr, loosely referred to as the “gap.” Dwarf novae with periods shortward of the gap have distinct behaviors (dubbed superhumps and superoutbursts) which mark them as SU UMa stars; dwarf novae significantly longward of the gap generally do not show this suite of behaviors, and are called U Geminorum, SS Cygni, or Z Camelopardalis stars (the lattermost exhibiting frequent “standstills” intermediate between their quiescent and outburst brightnesses). Warner (1995) gives a comprehensive review of CVs.

Although a great deal of effort has been devoted to determining the masses of the component stars in CVs, systematic effects are very troublesome. The apparent motion of the disk’s emission lines can seriously misrepresent the white dwarf motion, mostly because the disk’s Keplerian rotation broadens the line to a width much greater than the small excursions caused by the white dwarf’s orbit. As the observer views the system from different angles, any slight azimuthal asymmetry in the emission-line surface brightness creates a velocity modulation which masquerades as orbital motion. These effects are especially egregious in the class of novalike variables known as SW Sextantis stars (Thorstensen et al. 1991; Dhillon et al. 1997). Many of these show eclipses which reveal the true phase of conjunction, yet the observed emission-line velocities can disagree with the known phase of the white dwarf motion by as much as \( \sim 0.2 \) cycle. Even in the dwarf novae, significant phase offsets and the presence of “S-waves” arising from the stream-disk collision often complicate the extraction of dynamical information from the emission lines (Marsh 1988). Absorption-line velocities of the secondary stars are more useful, since their interpretation is more straightforward and since CV mass ratios \( q = M_2/M_1 \) are generally less than 1, leading to greater velocity amplitude of the secondary. Even here, interpretation of the velocities can be problematical, since the lines arise in an externally illuminated, nonspherical star with nonuniform gravity over its surface. This leads to a “K-correction” which can be difficult to estimate (Wade & Horne 1988).

Even with these caveats, the discovery of a new eclipsing CV is cause for celebration. Eclipses constrain the problem...
sufficiently that careful interpretation of good data can potentially give reliable measurements of the system parameters.

HS 0907+1902, the subject of this paper, was discovered in the Hamburg Schmidt objective-prism survey (Hagen et al. 1995) and flagged as a CV candidate based on its spectrum and a cross-identification with a ROSAT X-ray source (Bade et al. 1998). It underwent a dwarf nova outburst early in 2000. Gaussieck et al. (2000) show eclipses which reveal a binary period of 4.2 hr and a minimum-light spectrum with a noticeable contribution from an M-dwarf secondary. Because only a handful of eclipsing dwarf novae are known longward of the gap, I studied the object further in 2000 April, during quiescence.

2. OBSERVATIONS

The data were all obtained at the MDM Observatory 2.4 m Hiltner telescope, on Kitt Peak.

2.1. Photometry

I observed an eclipse on 2000 April 5 UT ($E = 330$ in the ephemeris of Gaussieck et al. 2000) using a SITe 2048\(^2\) CCD and a $V$ filter. To expedite readout the data were binned on chip to 2 \times 2 pixels and a region of 512 \times 512 (binned) pixels was read. Each binned pixel subtended 0'550. All exposures were 30 s; with readout and chip preparation, the cycle time averaged 58 s. Standardization was not attempted. I measured four stars in each image using the IRAF `apphot` task and took the measurements differentially with respect to a brighter star east and slightly south of HS 0909+1902. For this star the USNO A2.0 catalog (Monet et al. 1996) gives $a = 9^\circ09^\prime57^\prime.793$, $\delta = +18^\circ49^\prime03^\prime.07$ (ICRS $\approx$ J2000) and magnitudes $r = 13.3$ and $b = 14.3$. Provisionally adopting $V = 13.8$ for this comparison star yields the differential light curve shown in Figure 1. The differential magnitudes of a check star similar in brightness to the target have a standard deviation of 0.01 mag. The adopted magnitude scale yields $V \approx 17.6$ in mid-eclipse, in very good agreement with that measured by Gaussieck et al. (2000) with respect to a Tycho-2 star (which lies outside the present field of view).

The eclipse center occurred at HJD 2,451,639.7228(5), slightly earlier than the Gaussieck et al. (2000) ephemeris predicts, so the period can be refined slightly to 0.175444(2) days. The eclipse width, measured halfway down the steep sides of the profile, is $\Delta \phi = 0.060(5)$. At the points measured the brightest part of the disk is being covered and uncovered, so $\Delta \phi$ should apply to the disk center's eclipse.

The object is brighter before eclipse than after, an effect usually attributed to emission from the stream-disk collision at the "bright spot."

The direct images used for the photometry can also be compared to the USNO A2.0 catalog (Monet et al. 1996) to constrain the proper motion. The first-epoch Palomar Observatory Sky Survey plates of this region, on which the USNO is based, were obtained 1950 March 21. For several pictures, linear fits were derived between the CCD image centers of six to 10 stars (excluding HS 0907+1902) and the corresponding USNO A2.0 coordinates (excluding HS 0907+1902). These yielded transformations with rms errors of $\sim 0.3$, with excellent reproducibility from frame to frame, implying that the USNO centers dominate the uncertainties as expected. Applying these transformations to the modern images of HS 0907+1902 gave a position 326 mas west and 438 mas south of the USNO position. The implied proper motion is $11 \pm 6$ mas yr\(^{-1}\), which is formally insignificant but suggestive.

2.2. Spectroscopy

On 2000 April 5 UT I obtained spectra covering a single orbit, and on 2000 April 10 I obtained additional exposures of another eclipse. The MDM modular spectrograph and SITe 2048\(^2\) CCD gave $\sim 3.5$ \AA\ resolution from 4200 to 7500 \AA, with severe vignetting toward the ends of the range. Exposures away from eclipse were generally 240 s, with shorter exposures when eclipses were predicted. I took wavelength calibration exposures about once per hour, and the measured standard deviation of the $\lambda 5577$ night-sky feature's apparent radial velocity was 7 km s\(^{-1}\) over the...
entire run. Flux calibration stars were observed, but the spectrograph suffers from a mysterious problem which leads to spurious variations in the continuum shapes. With the amount of data obtained these should largely average out. Occasional cirrus and seeing variations at the 1" entrance slit further degraded the absolute flux.

The average spectrum appears nearly identical similar to that shown by G"ansicke et al. (2000). The strong, broad emission lines typical of dwarf novae at minimum light (detailed in Table 1) are accompanied by the absorption features of an M-type secondary. The emission lines are only slightly double-peaked, in contrast to the strongly double-peaked profiles in the 3.8 hr eclipsing dwarf nova IP Peg (Marsh 1988). In the averaged spectrum the central parts of Hα are well fit by a single Gaussian with an FWHM equivalent to 1325 km s^{-1}.

To refine the spectral type of the secondary I subtracted a grid of scaled spectra of M dwarfs (classified by Boeshaar 1976) from the average spectrum and examined the results; the best cancellation of the M-dwarf features (shown in Fig. 2) occurred at M3, in agreement with G"ansicke et al.'s estimate of M3.0 ± 1.5. M2- and M4-type spectra did not give satisfactory results, so the present estimate is slightly more discriminating than theirs.

Figure 3 shows a single-trailed representation of a portion of the spectrum, prepared using the phase-averaging procedure described by Taylor, Thorstensen, & Patterson (1998). Because the flux scale varied somewhat erratically from spectrum to spectrum, the data were rectified before averaging, which suppresses the eclipse. The emission lines appear brighter in eclipse, which in this representation shows that they are eclipsed less deeply than the continuum. Hα shows a strong rotational disturbance, in contrast to the lines in some eclipsing novalike variables (e.g., Dhillon et al. 1997). Outside of eclipse, there is a conspicuous absence of strong double peaks or S-waves; the variations near the line core as a function of phase appear rather disorganized. The M-dwarf absorption features are also visible, most dramatically the molecular band head near 6160 Å and the atomic lines just shortward of this. As expected, their contrast increases during the eclipse. The M-dwarf features can be traced through the entire orbital cycle, though they may be less pronounced around phase 0.5 (superior conjunction of the M dwarf). They show easily discernible orbital motion.

To measure the M-dwarf motion, I first co-added the target spectra into 16 phase bins. Then, using the RVSAO package (Kurtz & Mink 1998) I prepared a velocity-compensated template by summing the spectra of four M dwarfs with known radial velocities (Marcy et al. 1987). A cross-correlation of the region 5900 Å yielded usable radial velocities for 13 of the phase bins. The missing points are near M-dwarf superior conjunction where the features appear weakest. The cross-correlation routine gave typical uncertainties of 20 km s^{-1} for the usable velocities.

To measure the Hα emission radial velocities I used convolution methods outlined by Schneider & Young (1980) and elaborated by Shafter (1983); briefly, an antisymmetric function consisting of positive and negative Gaussians of adjustable separation is convolved with the observed line, and the zero of the convolution (when the contributions of the two sides is equal) is taken as the line center. The phase-binned spectra (excluding eclipse) were used for these measurements; velocities measured from the original spectra gave very similar results. A preliminary sine fit to the velocity variation showed that the phase accurately tracked

| Table 1: Emission-Line Measures |
|---------------------------------|
| Line   | Equivalent Width (Å) | Flux (10^{-14} ergs cm^{-2} s^{-1}) |
|--------|----------------------|-----------------------------------|
| Hγ     | 51                   | 6.6                               |
| Hδ     | 15                   | 1.6                               |
| Hβ     | 7                    | 0.6                               |
| Hγ     | 110                  | 8.8                               |
| Hα     | 12                   | 1.0                               |
| Hβ     | 16                   | 1.3                               |
| Fe I   | 11                   | 0.9                               |
| Hα     | 38                   | 2.9                               |
| Hβ     | 161                  | 12.3                              |
| Hα     | 17                   | 1.3                               |
| Hβ     | 16                   | 1.1                               |

*a Equivalent width measured after subtraction of secondary star contribution.*
the phase of the white dwarf motion as deduced from the eclipse. Encouraged by this I systematically varied the separation of the Gaussians in the convolution function in the procedure outlined by Shafter (1983), which yielded the diagnostic diagram shown in Figure 4. The aim of this procedure is to find the maximum separation for which the signal-to-noise ratio is adequate, the rationale being that the wings of the line originate toward the center of the disk,

**TABLE 2**

**Sinusoidal Fits**

| Data Set                  | $\Delta \phi^a$ | $K^b$ (km s$^{-1}$) | $\gamma$ (km s$^{-1}$) | $\sigma^c$ (km s$^{-1}$) | $N$ |
|---------------------------|------------------|----------------------|------------------------|--------------------------|-----|
| Hz emission ................| +0.013 ± 0.008   | 116 ± 5              | −18 ± 4                |                          | 19  |
| Hz emission (binned) ......| +0.008 ± 0.011   | 115 ± 7              | −7 ± 6                 |                          | 16  |
| Absorption (binned) ......| −0.001 ± 0.003   | 297 ± 15             | 38 ± 11                | 33                       | 13  |

$^a$ Phase offset based on the local eclipse ephemeris, HJD 2,451,639.7228 + 0.175444$E$, where $E$ is an integer. The values here are offsets from the phases expected for the white dwarf (emission) and red dwarf (absorption) motions; $\Delta \phi$ is positive for events which occur late.

$^b$ $K$ and $\gamma$ are, respectively, the amplitude and mean of the fitted sinusoid.

$^c$ Uncertainty of a single point derived from the scatter around the best fit.
where the disk should approach azimuthal symmetry. A separation of 2300 km s\(^{-1}\) (full width) appeared to give the most reliable results; Figure 5 shows the average H\(_{\alpha}\) line profile with the adopted measurement function superposed. In Figure 6 the emission and absorption velocities are plotted together, with sine fits (Table 2) superposed.

Figure 7 shows H\(_{\alpha}\) radial velocities in the vicinity of the eclipse. There is a very large, regular velocity excursion, first toward the red and then toward the blue. This is the signature of a rotating object. The rotational disturbance is also evident in the single-trailed representation (Fig. 3). A detailed model of the rotational disturbance is described in § 3.2. A rotational disturbance is seen in the eclipsing dwarf nova IP Peg (Marsh & Horne 1990).
3. INTERPRETATION

3.1. Masses and Related Quantities

Let us begin by estimating the component masses, taking the observed parameters at face value. We have then

\[
q = \frac{M_2}{M_1} = \frac{K_1}{K_2} = 0.387 \pm 0.031.
\]

This can be combined with the geometry of the Roche lobe-filling secondary and the eclipse width \( \Delta \phi \) to yield a binary inclination of \( 77.3 \pm 0.9 \). With \( K_1 + K_2 = 412 \pm 16 \) km s\(^{-1}\), we have from Kepler’s third law

\[
M_1 + M_2 = 1.37 \pm 0.17 \, M_\odot.
\]

The mass ratio then gives

\[
M_1 = 0.99 \pm 0.12 \, M_\odot, \quad M_2 = 0.38 \pm 0.06 \, M_\odot.
\]

This simple calculation can be criticized on several grounds, and the rest of this section is devoted to refining these estimates and examining how robust they are under various assumptions.

First, the M-dwarf velocity amplitude probably requires adjustment because of uneven distribution of the absorption features over its surface. The lower contrast of the absorption features opposite primary eclipse, and the difficulty of obtaining velocities over that range of phases, suggests that this effect is operating here (though a secondary eclipse of the M dwarf by the disk may be contributing also). Unfortunately, the present data do not have sufficient photometric integrity to accurately estimate the absolute strength of the absorption around the orbit, precluding strategies such as those of Wade & Horne (1988) for estimating the correction. Also, the absorption velocities are not precise enough to show the deviations from a sinusoidal expected for nonuniform contributions from a Roche lobe (Martin et al. 1989). I therefore used a model calculation to crudely estimate the effect. I first created a model Roche lobe, with 500 segments in an icosahedral geodesic pattern similar to that implemented by Hendry & Mochnacki (1992). I then synthesized line profiles around the orbit; this calculation was purely kinematic and geometrical, the contribution of each surface element to the line profile being proportional only to the solid angle it subtended at Earth. Because the uncorrected data likely yield too large a \( K_2 \), and hence too small a \( q \), I chose \( M_1 = 0.85 \, M_\odot \) and \( M_2 = 0.37 \, M_\odot \) for the model and fixed \( i \) at 77.3. For these parameters, the line-of-sight velocity amplitude of the secondary’s center of mass is \( K_2 = 276 \) km s\(^{-1}\). When I assumed that the entire stellar surface contributed equally to the absorption, a sinusoidal fit to the synthetic velocity curve yielded \( K_2 = 276 \) km s\(^{-1}\), indistinguishable from the velocity of the secondary’s center of mass. With the extreme assumption that the absorption arises entirely from portions of the star not in view of the (pointlike) white dwarf, \( K_2 \) increased by 43 km s\(^{-1}\). As a frank guess, I take the actual correction to be \( \frac{1}{2} \pm \frac{1}{6} \) of the correction indicated by this simulation, or \(-14 \pm 7 \) km s\(^{-1}\). Applying this correction to the actual data changes \( K_2 \) to \( 283 \pm 17 \) km s\(^{-1}\). The correction derived by Wade & Horne (1988) for their velocities of the Z Chamaeleontis secondary is practically the same as that employed here. With the revised \( K_2 \), repeating the calculations above yields \( q = 0.41 \pm 0.04, \; i = 77.0 \pm 0.9, \; M_1 = 0.82 \pm 0.14 \, M_\odot, \) and \( M_2 = 0.33 \pm 0.07 \, M_\odot \).

The emission-line \( K \)-velocity presents a more intractable issue, since it could misrepresent the white dwarf motion while mimicking the expected phase. The line profiles do not appear strongly double-peaked, as they do in IP Peg (Marsh & Horne 1990), so employing them in the solution puts us in the position of using something we do not entirely understand physically.\(^1\) On the other hand, the single-trailed spectrum does not show any obvious \( S \)-wave (generally the signature of emission from the stream-disk impact point); detection of such a component would create extra complications, at least.

Even if we disregard the emission-line amplitude entirely, we can still estimate the white dwarf mass, because the condition that the secondary fill its Roche critical lobe sets the mean density of the secondary as a function of orbital period (Faulkner, Flannery, & Warner 1972). The spectral type of the secondary in HS 0907+1902 is typical for its orbital period (Gänsicke et al. 2000; Beuermann et al. 1998), which does not prove anything but at least does not indicate trouble.

The density constraint is often implemented by assuming a main-sequence mass-radius relationship for the secondary. This approach was used by Patterson (1984) to derive a semiempirical relation between orbital period and \( M_2 \), which predicts 0.40 \( M_\odot \) in this case (Gänsicke et al. 2000); encouragingly, this is in reasonable agreement with the mass estimated earlier. Fixing \( i = 77^\circ \), the corrected \( K_2 \) then requires \( M_1 = 0.92 \, M_\odot \). If we allow a generous uncertainty of \( \pm 0.2 \, M_\odot \) for \( M_2 \), this propagates to \( \pm 0.2 \, M_\odot \) in \( M_1 \). The \( \pm 17 \) km s\(^{-1}\) uncertainty in \( K_2 \) propagates to \( \pm 0.1 \, M_\odot \), and even a rather wide \( 3^\circ \) uncertainty in \( i \) propagates to only \( \pm 0.02 \, M_\odot \) in \( M_1 \). Summed in quadrature, these yield

\[
M_1 = 0.92 \pm 0.22 \, M_\odot.
\]

This estimate is rather crude; a somewhat more sophisticated one recognizes that the main-sequence mass-radius relation is uncertain and that CV secondaries may not be

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\(^1\) Not that this usually stops astronomers!
main-sequence stars. Baraffe & Kolb (2000) model CV evolution and find that different (plausible) assumptions predict substantially different values of $M_2$ at a given orbital period. In addition, Wade (1990) gives a formalism for the uncertainty in $M_1$ when the Roche-filling constraint is employed and when various parameters have been measured; the present calculation is his case 3 (i measured, $K_2$ measured, $K_1$ presumed unknown). He parameterizes the uncertainty in when the Roche-filling constraint is satisfied; the present calculation is his case 3 ($i$ measured, $K_2$ measured, $K_1$ presumed unknown). He parameterizes the uncertain secondary star mass-radius relation as $R_2 = c_2 M_2$. The range of evolutionary models computed by Baraffe & Kolb (2000) (their Table 2) has $0.96 \leq c_2 \leq 1.88$ at this period, with $0.18 M_\odot \leq M_2 \leq 0.51 M_\odot$. If we take the spread of the model parameters as a guide to the plausible range, we can characterize this as $M_2 = 0.33 \pm 0.15 M_\odot$ and $c_2 = 1.4 \pm 0.4$. Taking the other parameters and their uncertainties as above, and using the Wade (1990) formalism for the error, gives

$$M_1 = 0.86 \pm 0.18 M_\odot.$$

Bergeron et al. (1992) find that field DA white dwarfs have masses strongly clustered near $0.56 M_\odot$; the white dwarf in HS 0907+1902 appears to be significantly more massive than this.

3.2. The Eclipse of Hα

The rotational disturbance in the Hα line presents an opportunity to probe the accretion disk’s structure. To explore this I constructed synthetic line profiles for a model eclipsed disk, and attempted to match them to the observations. The model disk had 600 segments, divided into 20 logarithmically spaced annuli and 30 azimuthal zones. Ingress and egress phases for each segment were calculated using a method similar to that employed by Horne (1985); the minimum potential along the ingress or egress line of sight generally matched the critical Roche potential to better than one part in $10^4$. The velocity of each segment was approximated as circular Keplerian motion around the white dwarf combined with the systemic orbital rotation, and the emissivity was taken to be a power law in distance from the white dwarf, $I \propto r^{-\beta}$. The line radiation from each segment was assumed to be broadened in wavelength using a Gaussian profile with an adjustable $\Delta \lambda$ (FWHM, or $\sim 2.35 \sigma$), constant among the different segments; even if there is no intrinsic broadening, $\Delta \lambda$ can account for the instrumental resolution. The inner and outer disk radii $r_{\text{min}}$ and $r_{\text{max}}$ were adjustable and expressed as a fraction of the distance from the white dwarf to L1. The system parameters were fixed at representative values ($M_1 = 0.90 M_\odot$, $M_2 = 0.4 M_\odot$, and $i = 77.3$). I ran models with $0.05 \leq r_{\text{min}} \leq 0.3$, $0.4 \leq r_{\text{max}} \leq 0.7$, $0 \leq \beta \leq 2$, and $5 \leq \Delta \lambda \leq 20$. The largest value of $\Delta \lambda$ corresponds to $390 \text{ km s}^{-1}$ of broadening at Hα. It was chosen in order to smear out the double peaks predicted by all simple disk models. Line profiles were computed for each set of parameters at binary phases 0.85 through 0.15, and at each simulated phase a radial velocity was computed using the same double-Gaussian convolution algorithm as for the real data.

As expected, the models qualitatively reproduced the observed behavior, but quantitative agreement was poor. The solid curve in Figure 7 is among the simulations which most closely resembled the data, and the fit is not particularly good. Comparison of the models with the data yielded the following conclusions. When the inner disk radius was set small ($0.05 \leq r_{\text{min}} \leq 0.2$), the peak-to-peak amplitude of the rotational disturbance was much larger than observed. Unless the outer disk radius was made quite large (0.6–0.7), the slope of the velocities across mid-eclipse was too steep. But when the outer disk radius was adjusted to match the slope at mid-eclipse, the maximum and minimum velocities occurred rather too far from eclipse, as in the example shown. Rather surprisingly, the broadening $\Delta \lambda$ and disk index $\beta$ did not affect these conclusions significantly, but avoiding strongly double-peaked profiles out of eclipse required $\Delta \lambda \geq 15 \text{ Å}$. All the models showed conspicuously double-peaked profiles in a small interval around mid-eclipse, a feature not seen in the data.

The poor match to the data suggests that the Hα emission in HS 0907+1902 does not entirely arise in a flat, Keplerian disk. A rotating, but sub-Keplerian, disk wind may contribute. It is also possible that the system parameters are off (particularly the inclination) or that the disk is significantly flared. The remedy adopted in the model for the lack of strong double peaks—a very large smoothing in $\lambda$—is quite ad hoc; a non-Keplerian component might fill in the line center in a more natural way.

4. Conclusion

HS 0909+1902 presents a splendid opportunity for determining the masses of the component stars in a dwarf nova. The secondary star’s radial velocities are easily measured, and the emission-line velocities appear to be unusually well-behaved. The particular masses found here will undoubtedly be superseded as better data are acquired. Spectra with finer velocity resolution and better spectro-photometric integrity should yield a very reliable value for the M dwarf’s center-of-mass motion, and detailed tomographic and eclipse studies of the emission lines should test the assumption that $K_1$ is a trustworthy measure of the white dwarf motion. Although the present work will not be the last word, it helps spread the good news. The conclusion that the white dwarf mass is larger than typical field white dwarf masses does appear fairly robust, as it is can be deduced using the absorption-line velocities alone, without reference to the more devious emission-line velocities.
The behavior of the Hα emission line through eclipse presents a puzzle. While the expected rotational disturbance is observed, simple models do not give a good quantitative match. At first this is somewhat disappointing, but it opens an avenue for further research. With improved system parameters, the region of space occulted by the secondary as a function of time will be even better constrained. Because a rotational disturbance does occur, we know that something is rotating in the occulted region. With physically motivated parameterizations of various possible effects (sub-Keplerian disk winds, Stark broadening, and flared disks to name some possibilities), it may be possible to assemble a physically based model of the velocity field in the emitting region. Spectra with improved signal-to-noise ratio, phase redundancy, time resolution, and (especially) photometric integrity will be key to this effort.

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