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## TOWARDS AN UNDERSTANDING OF THE Of?p STAR HD 191612: OPTICAL SPECTROSCOPY

Ian D. Howarth,<sup>1</sup> N. R. Walborn, D. J. Lennon, J. Puls, Y. Nazé, and the ‘Friends of HD 191612’

We have acquired extensive optical spectroscopy of the early-type magnetic star HD 191612 (O6.5f?p–O8fp). The Balmer and He I lines show strongly variable emission which is extremely reproducible on a well-determined 538-d period. Metal lines and He II absorptions (including many selective emission lines, but excluding He II  $\lambda 4686$  Å emission) are nearly constant in line strength, but are variable in velocity. The radial-velocity variations establish a double-lined binary orbit with  $P_{\text{orb}} = 1542\text{d}$ ,  $e = 0.44$ ; by elimination, rotational modulation of a magnetically constrained plasma is left as by far the most likely ‘clock’ underlying the 538-d changes. The implied rotation period shows that slow rotators can easily be hidden in the O-star population, with gaussian-like ‘turbulence’ dominating the line widths.

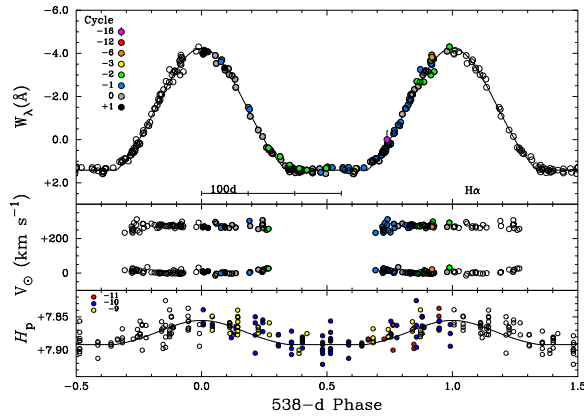


Fig. 1.  $H\alpha$  measurements folded according to the rotational ephemeris  $\phi_\alpha = (t - \text{JD } 2453415.2)/537.6$ , plotted over two cycles. Note the reproducibility of the behaviour over a quarter-century of observation, and the symmetry about phase zero. Upper panel: equivalent width (the solid line is an *ad hoc* functional fit). Middle panel: FWHM (upper groups of points) and central velocity (lower) of excess emission. The bottom panel shows *Hipparcos* photometry (with a scaled, shifted version of the  $H\alpha$  functional fit to guide the eye).

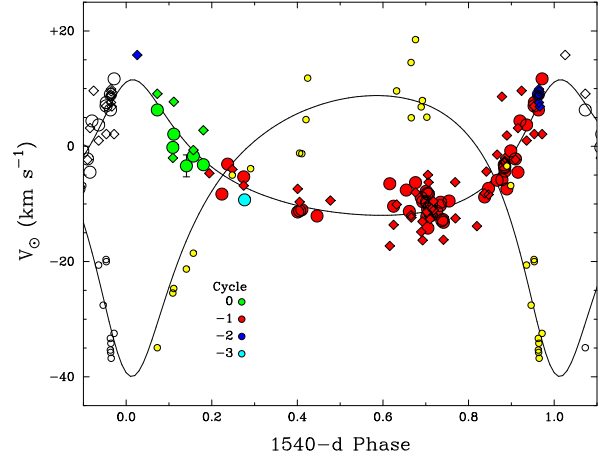


Fig. 2. Radial-velocity measurements for C IV 5801 Å (large circles), Si IV 6667 Å (diamonds), and O II lines (small circles), plotted with the orbital solution of Table 1. (For display purposes the O II velocities have been adjusted by  $-14.3 \text{ km s}^{-1}$  to bring them to the same  $\gamma$  velocity as the primary.)

TABLE 1  
ORBITAL SOLUTION

$\gamma_1$ ( $\text{km s}^{-1}$ )	$-5.19 \pm 0.36$	
$K_1$ ( $\text{km s}^{-1}$ )	$11.77$	$0.84$
$e$	$0.438$	$0.038$
$\omega$ ( $^\circ$ )	$344.7$	$6.5$
$P_{\text{orb}}$ (d)	$1542$	$14$
$T_0$ (JD)	$2453720$	$20$
$f(m)$ ( $M_\odot$ )	$0.190$	$0.042$
$a_1 \sin i$ ( $R_\odot$ )	$322$	$24$
rms: $2.2 \text{ km s}^{-1}$ (C IV, weight 1)		
$K_2$ ( $\text{km s}^{-1}$ )	$24.4$	$1.4$
$q = M_2/M_1$	$0.483$	$0.044$
rms: $5.1 \text{ km s}^{-1}$ (O II)		

The main orbital parameters are constrained by measurements of C IV 5801 Å, Si IV 6667 Å in the primary spectrum;  $K_2$  is established from O II lines in the secondary spectrum.

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