RevMexAA (Serie de Conferencias), **33**, 120–120 (2008)

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

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We have acquired extensive optical spectroscopy of the early-type magnetic star HD 191612 (O6.5f?pe–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 λ4686 Å emission) are nearly constant in line strength, but are variable in velocity. The radial-velocity variations establish a double-lined binary orbit with $P_{\rm orb} = 1542$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.

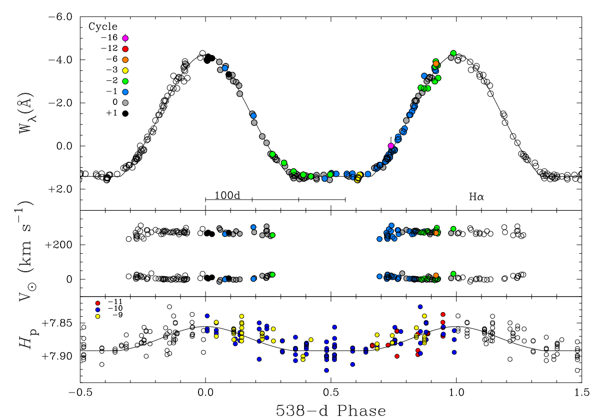

Fig. 1. Hα measurements folded according to the rotational ephemeris $\phi_\alpha = (t - \mathrm{JD}\ 2453415.2)/537.6$, plotted over two cycles. Note the reproducibility of the behaviour over a quarter-century of observation, and the symmetry about phase zero. Upper panel: equivalent width (the solid 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 Hα functional fit to guide the eye).

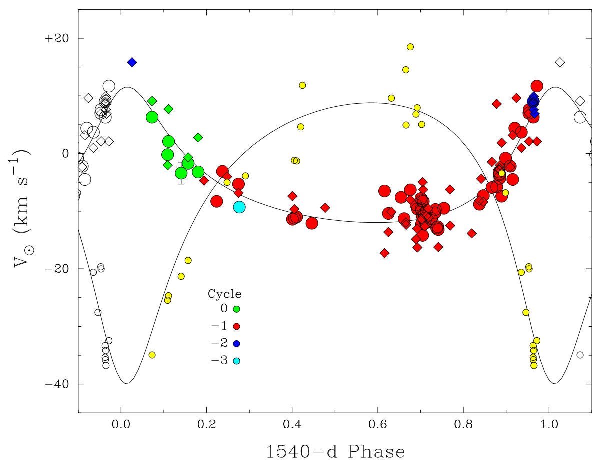

Fig. 2. Radial-velocity measurements for C IV 5801Å (large circles), Si IV 6667Å (diamonds), and O II lines (small circles), plotted with the orbital solution of Table 1. (For display purposes the O II velocities have been adjusted by -14.3 km s^{-1} to bring them to the same γ velocity as the primary.)

TABLE 1

ORBITAL SOLUTION

γ_1 (km s^{-1})	-5.19	±	0.36
K_1 (km s^{-1})	11.77		0.84
e	0.438		0.038
ω (°)	344.7		6.5
$P_{\rm orb}$ (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 km s^{-1} (C IV, weight 1)			
K_2 (km s^{-1})	24.4		1.4
$q = M_2/M_1$	0.483		0.044
rms: 5.1 km s^{-1} (O II)			

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

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