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57 Tau = HD 27397 – A SPECTROSCOPIC BINARY

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In a recent paper, Paparó et al. (1999) suggest that the low-frequency variations observed in the bright F0 star 57 Tauri (= HD 27397 = HR 1351) may be due to either duplicity effects, g-mode pulsations (similar to those found in γ Doradus stars, see, e.g., Kaye et al. 1999), or a combination of the two. Their multi-site photometry, although sufficient for finding the frequencies associated with these phenomena, was not able to distinguish between them.

To this end, 139 high signal-to-noise ratio spectra were obtained over fourteen nights at the Kitt Peak National Observatory during December 1998. The signal-to-noise ratio (SNR) is estimated to be over 350. Each spectrum covers the wavelength region 5840 to 6160 ångströms and were obtained using grating A, camera 5, and the long collimator. An OG550 filter was used to block both higher and lower orders. Data were recorded on the F3KB CCD; these spectra have a reciprocal dispersion of 0.105 ångströms per pixel, resulting in a resolving power of approximately 35,400. The slit width was fixed at 250 μm, which corresponds to 1.81 seconds of arc. The projected slit image was 0.024 mm and covered 1.60 pixels.

Subsequent analysis based on the time series of first moments of the Fe I λ6122.226 photospheric line indicates that 57 Tauri is a spectroscopic binary. Table 1 presents the preliminary orbital elements of the system; the solution is plotted as a phased radial-velocity curve in Figure 1. The standard deviation of the orbital fit (noted as σ in Table 1) is higher than expected due to the ongoing pulsations present in 57 Tauri (see Paparó et al. 1999).

Additionally, since this binary has such a short period, at least some of the low-frequency variations observed by Paparó et al. (1999) are probably due to duplicity (i.e., geometric and proximity) effects.

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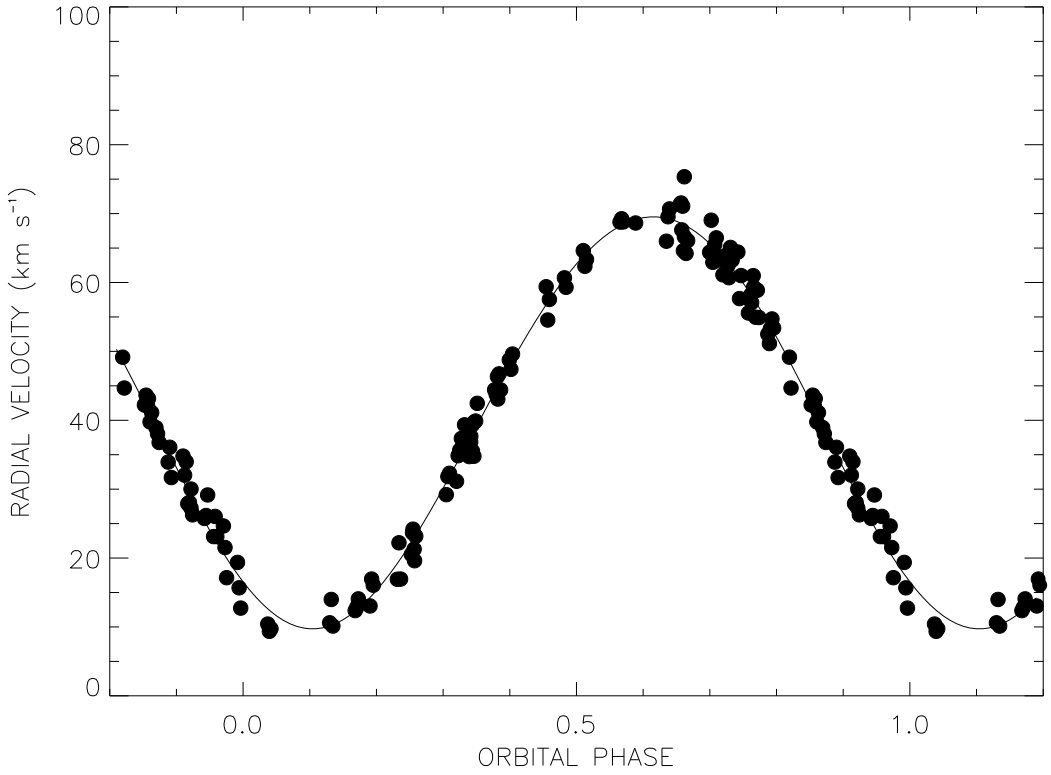

Figure 1. A phased radial-velocity curve of the primary star (57 Tauri) based on the first moments of the Fe I λ6122.226 line.

Table 1: Preliminary Orbital Elements of 57 Tauri = HD 27397

Orbital Element	Value
γ	40.268 ± 0.203 km s^{-1}
K_1	29.906 ± 0.316 km s^{-1}
e	0.028 ± 0.010
Ω	$140\overset{\circ}{.}5 \pm 20\overset{\circ}{.}4$
HJD of $T_{\rm periastron} - 2451100$	64.968 ± 0.144 days
P	2.4860 ± 0.0017 days
Mass Function	$0.0069 \pm 0.0002\ M_\odot$
$a \sin i$	6831.0 ± 72.4 AU
σ	2.12 km s^{-1}

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