OBSERVATIONS OF NEW WOLF-RAYET BINARIES

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At present we know that the Wolf-Rayet stars do not form a homogeneous group of objects with similar masses,but that their masses span a considerable range.Whether or not there is a correlation between the masses and the different subtypes of WR stars,can only be answered by more observations of WR stars in binarysystems yielding estimates of the masses of their components.

I will report here preliminary results of spectrographic observations for three southern WR stars,whose binary nature had not been previously verified.

The observations have been carried out at the Cerro Tololo Inter-American Observatory,Chile,mostly with the Cassegrain spectrograph with IT attached to the 1-m reflector.These spectrograms were secured on Kodak IIIaJ emulsion,and have a dispersion of 45 A/mm.

HDE 320102:This is one of the two stars classified as WN3 + abs in the sixth catalogue of galactic WR stars (van der Hucht et.al 1981).Nineteen blue spectrograms of HDE 320102 were obtained between May 1980 and June 1981.The earlier classification of this star as OB + WN (Smith 1968) denotes that the OB spectrum dominates at blue optical wavelength region.This is confirmed by the present observations.The absorption line spectrum corresponds to an O5-7 type star.

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A radial velocity study of the absorption and emission lines shows clearly that they move in opposite phase,and thus HDE 320102 must be a double-lined O5-7 + WN3 spectroscopic binary.

A period search routine was applied to the radial velocity variations.The best period found is 8.83 days,but due to the limited amount of available data,several other periods are possible.A preliminary set of orbital elements are listed in Table 1,and Figure 1 shows the observed radial velocity variations plotted in the period of 8.83 days.

Table 1. Preliminary orbital elements for HDE 320102.

	O5-7 star (mean abs.)	WN3 star (HeII 4686 em.)
Period (days)	8.83	
e	0 (assumed)	
V_o (km/s)	-60	0
K (km/s)	50	150
a sin i ($R_\odot$)	8.7	26
m $\sin^3$i ($m_\odot$)	5.5	1.8

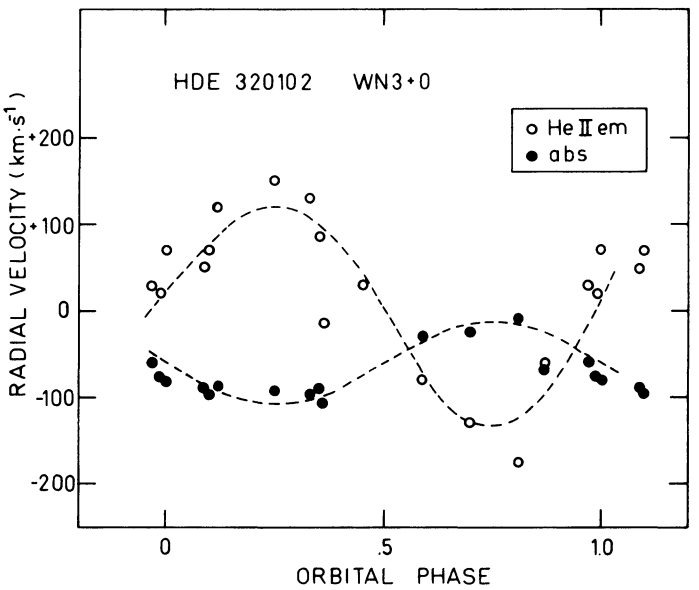

Figure 1. Radial velocities for HDE 302102 as a function of orbital phase.Dashed curves represent theoretical velocities defined by the orbital elements in Table 1.

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CD -45°4482:Twenty-nine blue spectrograms of this WN7 type star were secured between January 1980 and June 1981. A radial velocity study of these spectra shows a large amplitude variation,similar for all the emission lines.No lines corresponding to a companion star were detected,hence CD -45° 4482 appears to be a single-lined spectroscopic binary.

A period search routine applied to the radial velocity variations yielded as the most probable period that of 23.9 days. Figure 2 shows the observed velocity variations of various emission lines plotted in this period;and Table 2 lists the preliminary orbital elements as obtained from a sine fit to the radial velocities of the NIV λ4058 emission line.

Table 2. Preliminary orbital elements for CD-45°4482.

Period	= 23.9	days
e	= 0	assumed
V_o	=-34	km/s
K	=130	km/s
a sini	= 61	$R_\odot$
f(m)	= 5.5	$m_\odot$

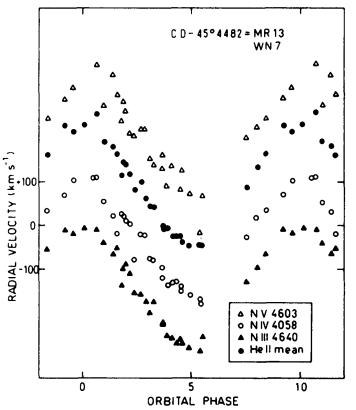

Figure 2. Radial velocities for CD-45°4482 as a function of orbital phase.

HD 62910:This star has a composite WN6 + WC spectrum,but other indications of its binary nature are not known.The WN6 type emission line spectrum is the dominant one in the blue optical wavelength region.The C lines are seen only faintly. I have observed HD 62910 for about 10 years,and will report here a radial velocity study based on 83 blue spectrograms.

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Striking changes in the radial velocities of the blue-shifted HeI absorptions are evident between spectra taken during different observing runs.A period search routine applied to the radial velocity variations of the HeI 3888 absorption reveals several periods,all longer than 40 days,with about the same probability.The best period (only slightly better than others),is 85.37 days.

Radial velocity variations of the emission lines in HD 62910 are detected only marginally.The faint CIV λ4441 emission seems to follow the radial velocity variations of the blueshifted HeI absorptions,but with smaller amplitude.The NIV λ4058 emission appears to have an opposite trend in velocity,with even smaller amplitude.Figure 3 shows the radial velocity variations plotted in the 85.37 day period.

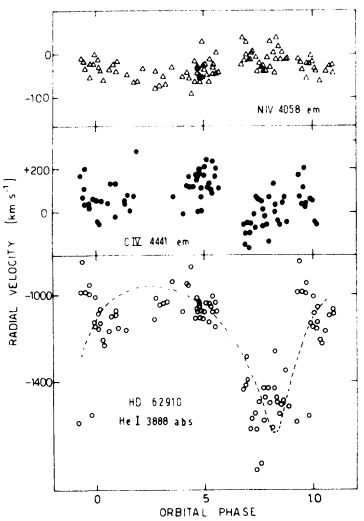

Figure 3.Radial velocities for HD 62910 as a function of orbital phase.The dashed curve represents an orbit with K=250 km/s and e=0.4.

The present study suggests that HD 62910 may be a binary, but for a conclusive answer more observations,especially red optical spectra where the WC type spectrum is seen more clearly,are necessary.

REFERENCES:

van der Hucht,K.A.,Conti,P.S.,Lundstrom,I.and Stenholm,B.:1981, Space Sc.Reviews,vol.28,No.3.
Smith,L.F.:1968,M.N.R.A.S.138,p.109.

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DISCUSSION

Turner: I have a brief comment to make about the last four objects you discussed. I notice that three of these objects are candidates for membership in clusters or associations. In view of this fact, it is important to have estimates of the differences in magnitudes for the components of these systems. I realize that this may be difficult to do for some of these objects, but it would be nice if it could be attempted wherever possible.

Garmany: Your velocity curve for HD 50896 seemed to show a phase shift between the data for the different times (1971, 1974 and 1979). Can you comment on this ?

Niemela: No phase shift is apparent in our data.

Lamontagne: Concerning HD 62910, maybe the scatter of the radial velocity could be reduced if the plates were measured with a PDS machine rather than a Grant comparator. This kind of analysis gives better results for wide lines like those found in WNE and WC stars.

Conti: This comment concerns HD 62910. You have amassed considerable spectroscopic data over a number of years. The lack of convincing radial velocity variations in the emission lines does suggest that the object is not a binary. The obvious radial velocity changes in the violet displaced HeI 3889 suggets, instead, random wind variability.

Niemela: I think it is a long period binary with a rather low inclination.

Abbott: You derived a minimum mass of $105M_{\odot}$ for the O star component of HD 63099. Do you know if this is consistent with the star's luminosity?

Niemela: The O star completely dominates the optical spectrum of HD 63099, so it is the brighter component of the system. I have not checked the absolute luminosity.

Underhill: In the case of HD 63099 it is possible that the large amplitude shown by the 4650 blend of CIII and CIV may be caused in part by phase-dependent absorption in CIII 4650 cutting away the shortward side of the emission feature. This multiplet of CIII often is unusually strong in low-density gas at a moderate electron temperature. I am thinking of absorption in an asymetric flow of gas in the system which need not cause an absorption feature dipping below the level of the continuum.

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Niemela: I did not see absorption components in my spectra.

Hiltner: A comment on the violet displaced HeI 3889 absorption line. One may ask whether this may be an extreme case of a WR star ejecting material, similar to that observed less frequently in other WR stars.

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