# Nota sobre el espectro de la estrella Wolf-Rayet HD 62910

# Note on the spectrum of the Wolf-Rayet Star HD 62910

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*Resumen:* Identificación de líneas en la parte azul-violeta del espectro de HD 62910 confirma su clasificación como objeto intermedio entre las secuencias WN y WC de las estrellas Wolf-Rayet. La variación de las velocidades radiales de distintas líneas espectrales parece indicar que podría tratarse de un sistema binario WN + WC.

*Abstract:* Line identifications on the blue-violet spectral region of HD 62910 confirm its classification as an intermediate object between the WN and WC sequences of the Wolf-Rayet stars. The variability of the radial velocities of different spectral features seems to suggest that we may be dealing with a WN + WC binary system.

## I. *Introduction*

There are only a few exceptions to the division into the WN and WC sequences among the Population I Wolf-Rayet stars. One of them is HD 62910, apparently located (Crampton 1971) in the nebula 247.26-3.88 of Lynds' (1965) catalogue. The spectrum of this star has been described by H. Smith (1955) as a WN6 object with some lines of C and O ions present. Hiltner and Schild (1966) used the spectrum of HD 62910 as a standard of their class WN7-B. L. Smith (1968) reclassified the spectrum as WN6-C7 on the basis of the published spectrograms of H. Smith (1955) and Hiltner and Schild (1966).

The aim of this paper is to present a more detailed description of the spectrum of HD 62910, which confirms its classification as an object with emission lines belonging both to the WN and WC sequences; and to study the radial velocities of different spectral features in order to test the suspicion (Niemela 1971) that we are dealing with a WN + WC binary system.

## II. *The observations*

The observations consist of 6 moderate dispersion spectra, on unbaked IIa-O Eastman Kodak emulsion, obtained during November-December, 1971, at the Cerro Tololo Interamerican Observatory, in Chile. The plates were taken with the Cassegrain spectrographs of the 90 cm (plates labelled A) and the 150 cm (plates labelled C) reflectors, with dispersions of 124 A/mm and 78 A/mm, respectively, and cover the wavelength range $\lambda\lambda$ 3380 - 4900 Å.

The radial velocities were measured, and the tracings recorded, with a Grant comparator-microdensitometer * at La Plata Observatory. The heliocentric radial velocities of various spectral features are recorded in Table 1. From the internal agreement of the radial velocities of the interstellar CaII-K line and the result of plates measured twice at different times, we estimate that the accidental errors of measurement are of the order of 15 km/sec for lines that are relatively sharp, and may amount to 20 km/sec for the broad ones. For this reason all velocities given in Table 1 have been rounded off to the nearest multiple of 5 km/sec.

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TABLE 1

*Heliocentric radial velocities of HD 62910*

| Plate Nº | Date 1971 (U.T.) | Radial Velocities (km.sec$^{-1}$) | | | | | |
|---|---|---|---|---|---|---|---|
| | | N IV 3482 | N IV 4058 | N III 4379 | O IV 3462 | C IV 4441 | K Ca II (int.) |
| A-2010 | Nov. 28.34 | + 305 | + 95 | + 110 | — 40 | + 130 | |
| A-2013 | 29.24 | + 260 | + 75 | + 30 | — 20 | — 45 | |
| A-2018 | 30.21 | + 235 | + 15 | — 105 | — 90 | + 105 | + 40 |
| A-2030 | Dec. 2.20 | + 235 | — 5 | — 235 | + 25 | — 65 | + 30 |
| C-2197 | 6.20 | + 195 | — 30 | — 235 | — 90 | + 140 | + 35 |
| C-2201 | 7.24 | + 240 | + 35 | — 95 | — 40 | + 10 | + 45 |

## III. *Results and discussion*

Figures 1 and 2 present microphotometric density tracings of the blue-violet spectral region of HD 62910, with identifications of the major contributors to the emission features made from the laboratory studies of Edlén (1956), Hallin (1966a, b), Bockasten (1955, 1956), Bockasten and Johansson (1969), Bromander (1969); and from the tables of Moore (1945, 1970) and Striganov and Sventitskii (1968). Each identification satisfies the requirement that strong lines

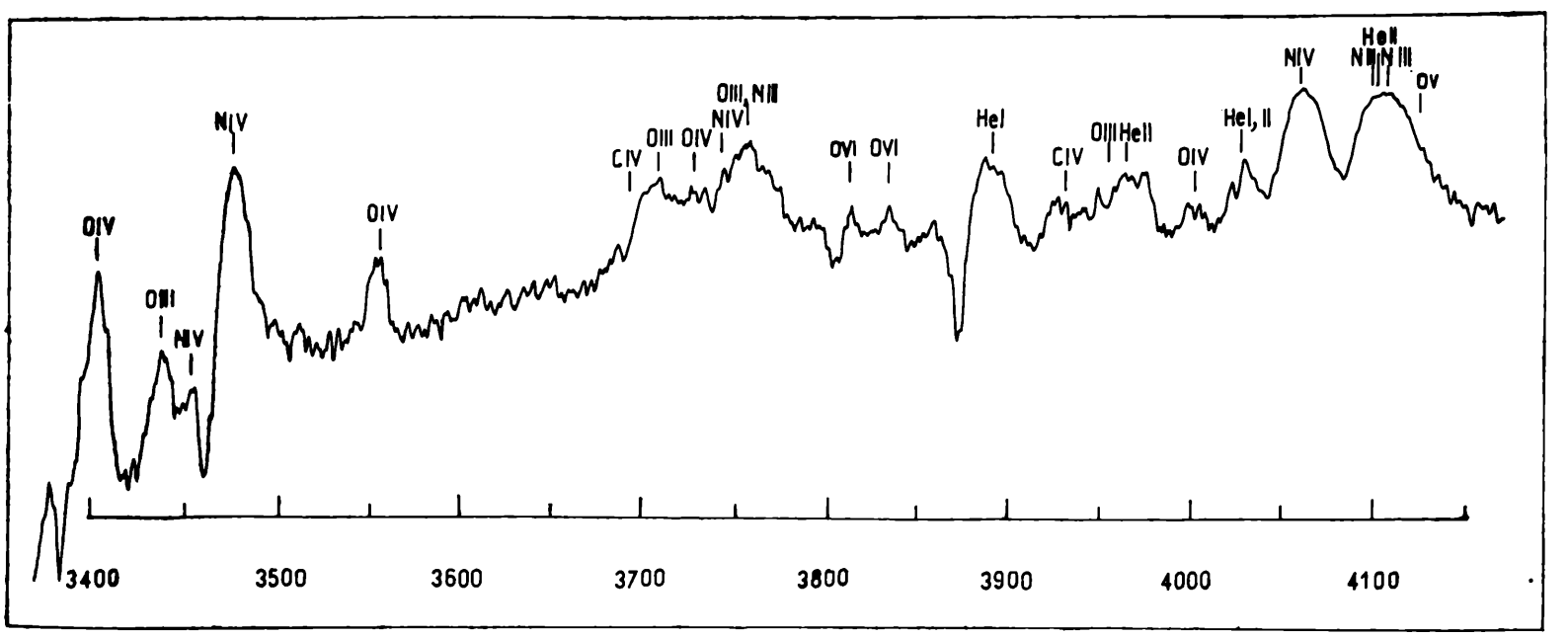


Fig. 1 — Microphotometric density tracing of the spectrum of HD 62910 with identifications of the major contributors to the emission lines.

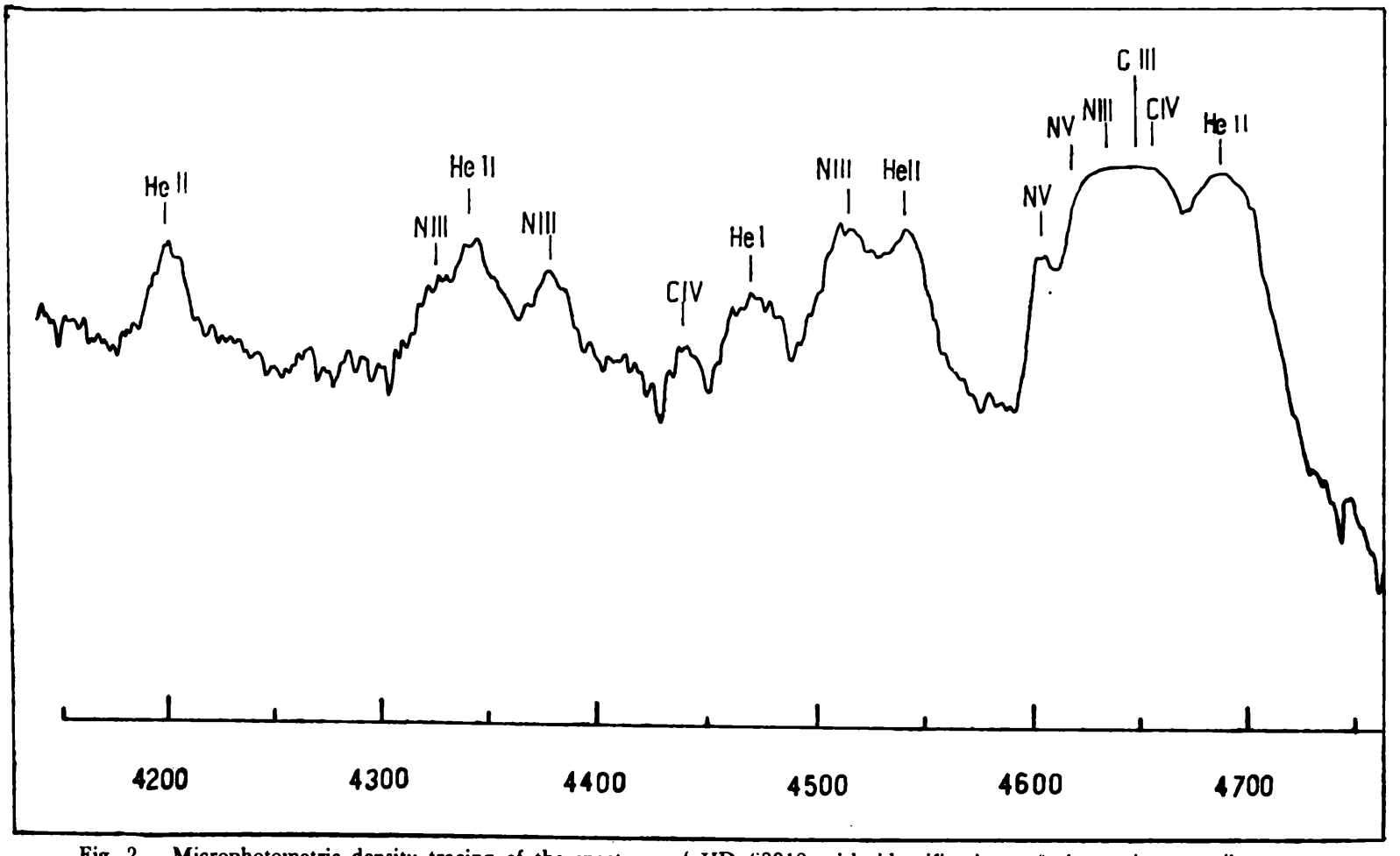


Fig. 2 — Microphotometric density tracing of the spectrum of HD 62910 with identifications of the major contributors to the emission lines.

of an ion spectrum should be present when weak ones are, though admittedly there may be particular selective excitation mechanisms operating, and the physical conditions of the laboratory spectra must be widely different from the stellar conditions. From these tracings it becomes clear that many emission lines of C IV, some of C III and many of O III, O IV, probably O V and the strongest lines of O VI are present, in addition to the normal spectral features of WN6 type. Thus the spectrum appears to be a composite one WN6 + WC7.

— Obviously to confirm this hypothesis it is necessary to find a period and to show that these distinct features really have opposite orbital motions. From the available 6 spectrograms it is not possible to infer a period, but the plots of the measured radial velocities (Fig. 3 and 4) crearly show variations suggesting binary motion.

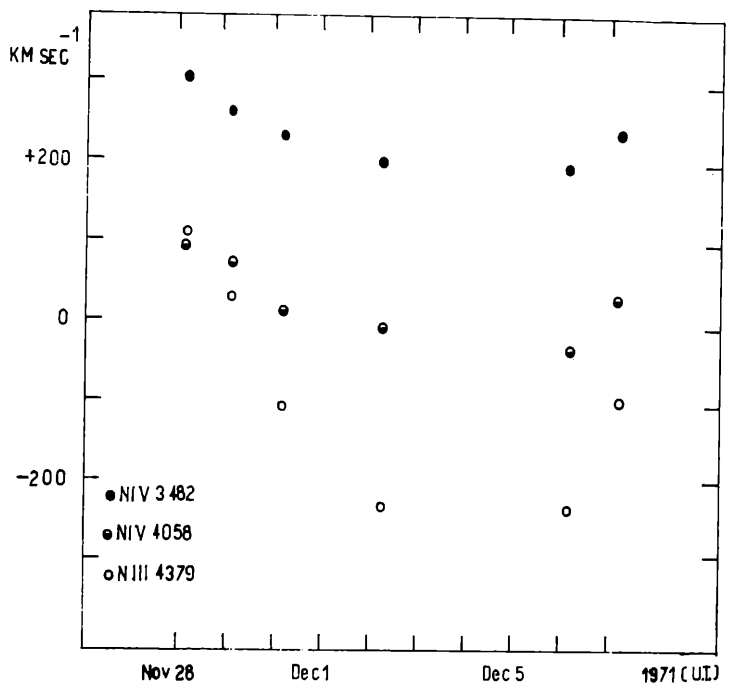


Fig. 3 — The radial velocity variations of the N IV 3482 (filled circles), N IV 4058 (half-filled circles) and N III 4379 (open circles) emission lines in the spectrum of HD 62910.

The velocity variations of three emission lines of N ions (Fig. 3) suggest similar trends; while the radial velocities of C IV 4441 and O IV 3462 emission lines (Fig. 4) show large scatter and no clear systematic tendency. In this connection it should be remembered that large scatter in the values of the radial velocities is common in binaries with WC type spectra (see eg. Ganesh and Bappu 1968, Cowley et al. 1971).

—The apparently differing values of γ-velocities and the amplitudes of the radial velocity variations suggested by Figure 3 is a commonly observed phenomenon in many WR binaries.

— In addition it is worth to note that many emission lines have to the violet displaced absorption components indicating expansion velocities of the order of –1100km sec$^{-1}$.

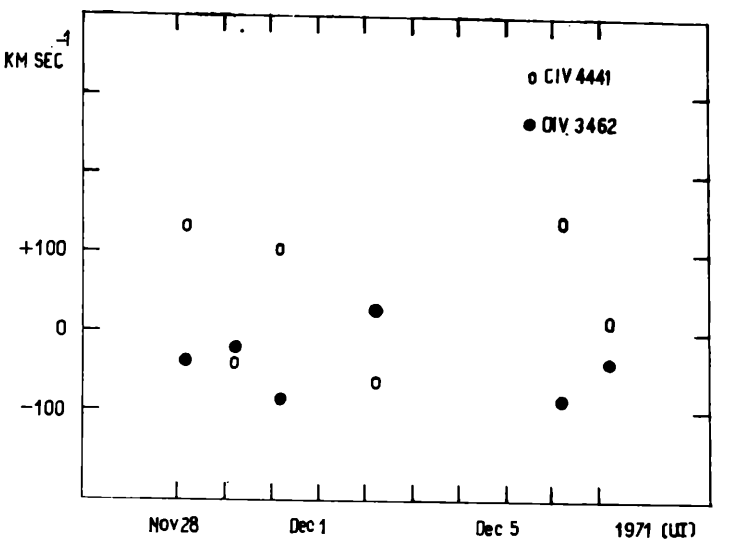


Fig. 4 — The radial velocity variations of the C IV 4441 (open circles) and O IV 3462 (filled circles) emission lines in the spectrum of HD 62910.

—The interstellar Ca II absorption lines appear extremely weak or absent in the spectrum, and their radial velocities agree closely with the radial velocity of the 21 cm line of neutral hydrogen corresponding to the local spiral arm (Goniadsky and Jech 1969).

— Further observations are planned.

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