

HD 166596: A SILICON STAR WITH H α EMISSION?

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The spectral type of HD 166596 (HR 6804) is given as B2.5III in The Bright Star Catalogue (Hoffleit and Jaschek 1982) and as B2III by Houk (1978). Its rotational velocity, $V \sin i$, is 255 km s⁻¹ (Uesugi and Fukuda 1982). Neubauer (1930) noted that its radial velocity is probably variable. Bidelman and MacConnell (1973) designated this star as a silicon star, and thereafter, Renson and Manfroid (1980) found its photometric period, $P = 1.67 \pm 0.01$ days (or 0.83 days) with the amplitudes of $0^m04 \sim 0^m05$ from their four-color photometry. To the best of our knowledge, there is no report on the presence of any emission line in the foregoing literature.

One of us (RH) obtained two IUE high dispersion spectra (SWP 18142 and SWP 18143) in the shorter wavelength region in 1982, 271 days. We found that the resonance lines of SiIII, SiIV, CIV, and NV have remarkably blue-shifted broad absorption features, indicating mass loss. Employing the synthesized photospheric spectra for the normal abundance, we tried to fit Castor and Lamers (1979) theoretical profiles to the observed ones except NV lines. All spectra can be fitted by the same parameters of $v_\infty = 1,070$ km s⁻¹, $\beta = 0.5$, and $\gamma = 2$ (see Castor and Lamers 1979 for the parameter definition). The resulting mass loss rate is 1.3×10^{-9} M \odot yr⁻¹ in Si, and 3.8×10^{-9} M \odot yr⁻¹ in CIV. Also, all lines have a narrow component at -700 km s⁻¹. There is no indication of overabundance in Si in the ultraviolet region.

One of us (GJ) continues the photometric observation in the Geneva system since 1983, by using the 70-cm telescope at Swiss station, ESO, La Silla. The total numbers of data obtained in each season are 19 (11 nights, 1983), 18 (15 nights, 1984), and 27 (25 nights, 1985) up to now. We confirmed the period of 1.67 days from our data, especially in the U-color, with the same order of amplitude as Renson and Manfroid (1980). The star becomes bluer when brightens. Following Cramer and Maeder (1979, 1980), we derived the following stellar parameters for the mean values in 1983 and 1984: $M_V = -3.16$, $M_{bol} = -5.29$, $T_{eff} = 21,000$ K, $R_* = 7.8R_\odot$, $\log g = 3.8$, $M = 14 M_\odot$, and the distance $r = 465$ pc.

Finally, we found a double-peaked emission profile at H α with moderate

intensity, from the high-dispersion spectra obtained on May, 16 and 17, 1986, at the Okayama Astrophysical Observatory. The observations were carried out, using a cooled reticon system with an image intensifier attached to the coude spectrograph of the 188-cm telescope (8 A mm⁻¹).

Thus, HD 166596 is a Be star which is also suspected to be a silicon star. The mass loss rate derived from the UV lines is normal for its luminosity. The photometric period of 1.67 days may be attributed either to its nonradial pulsation, or to the surface spot, or to its binarity. In the latter two cases, the inclination angle becomes 90°. Although the spectral type, B2.5III, is a little bit too early for the silicon star, and its ultraviolet spectrum does not show the overabundance in Si, these three possibilities cannot be eliminated unless one examines the radial velocity and line profile variations.

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DISCUSSION FOLLOWING HIRATA

van den Heuvel:

Is this star a member of a cluster or an association? I ask this because a rapidly rotating silicon star presumably must be very young, as such stars have magnetic fields and their rotation is rapidly braked in the course of time.

Hirata:

As far as I know, no.