UV SPECTRAL CLASSIFICATION AND STELLAR WINDS IN A SAMPLE OF Be AND STANDARD STARS

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Equivalent widths of 16 lines of CI, CII, CIII, CIV, SiII, SiIII, SiIV, AlII, AlIII, FeII, and FeIII, plus centroid and edge velocities of the SiIV and CIV lines, were measured in IUE spectra of 39 B1e–B8e and 18 B1–B8 standard stars. These suggest the following:

1. Certain line ratios of SiII/III, CII/III, AlII/III, and FeII/III are very sensitive to spectral type and represent excellent UV criteria for spectral classification.
2. UV line strengths and line ratios show that there are no significant differences between the photospheric line spectra of Be and normal, non-emission stars of corresponding type.
3. Despite the fact that the SiIV and CIV wind lines are variable in the Be stars, certain conclusions can be drawn from a statistical "snapshot" study such as this:
   a) The SiIV and CIV wind lines in the Be stars are correlated with both spectral type and luminosity class in the sense that the hottest stars have the strongest lines, and the giants and subgiants (at least for the B1–B3 stars) have stronger lines than the main-sequence stars. (see Fig. 1 and 2).
   b) The SiIV wind lines persist to spectral type B8 in both the Be stars and the standard stars but are stronger in the Be stars than in the standards for the earlier types (B1–B3). (See Fig. 1)
   c) The CIV wind lines persist to spectral type B8 in the Be stars but only to B3 in the standard stars. They are stronger in the Be stars than in the standards at all spectral types. (see Fig. 2).
   d) The equivalent widths of the SiIV and CIV wind lines are only very weakly correlated with $v\sin i$, if at all, but a threshold in $v\sin i$ near 150 km s^{-1} (as found earlier by Grady et al.) exists below which no large equivalent widths of SiIV or CIV may be seen. Assuming that the Be stars are all rapid rotators, such a correlation is essentially a correlation with i and suggests that the winds from Be stars arise preferentially from the equatorial regions. The aforementioned conclusion is supported by a plot of SiIV 1394 centroid velocities versus $v\sin i$, which shows that stars with large velocity shifts also have large $v\sin i$, while those with unshifted lines all have $v\sin i$ less

L. A. Balona et al. (eds.), Pulsation, Rotation and Mass Loss in Early-Type Stars, 277–279.

https://doi.org/10.1017/S0074180900215076 Published online by Cambridge University Press

than about 150 km s^{-1}. Again, it seems that strong stellar winds are more likely to arise from equatorial than polar regions.

e) Additional evidence that the winds are stronger for Be stars of early type comes from the SiIV and CIV centroid velocities, which are much larger for the hotter Be stars. The stars with the strongest lines also tend to have the largest velocity shifts, suggesting that winds with more mass are also faster moving.

f) The SiIV and CIV lines in the standard stars, while they may be asymmetric, never show displaced line centers.

g) The edge velocities for both the SiIV 1394 and the CIV 1548 lines increase with earlier spectral type in the Be stars (therefore, stronger winds in the hotter stars), and are considerably higher in the Be stars than in the standard stars, suggesting again that the winds are stronger in the Be stars.

h) Shell stars have weaker CIV absorption and smaller edge and centroid velocities than other Be stars, suggesting that they have weaker winds. Since there is considerable evidence that these are stars with cool, low-velocity disks which are being viewed edge-on or nearly edge-on, the winds may be inhibited and modified by the denser material in the equatorial regions.

4. Mg II emission is detected in about half of the program Be stars with long wavelength IUE spectra, and seems not to be correlated with spectral type, $v\sin i$, or strength of the SiIV wind lines. Since the MgII emission presumably originates in the cool, low velocity envelope and since MgII emission also correlates with hydrogen Balmer emission in the Be stars, this suggests that there is no strong physical relationship between the stellar winds and the cool disk.

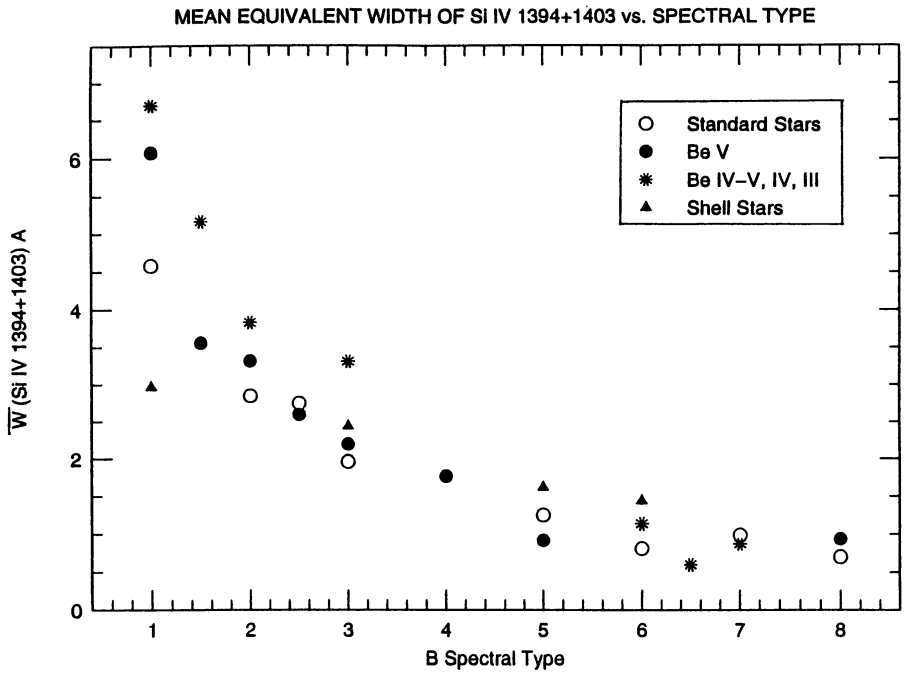

Fig. 1.

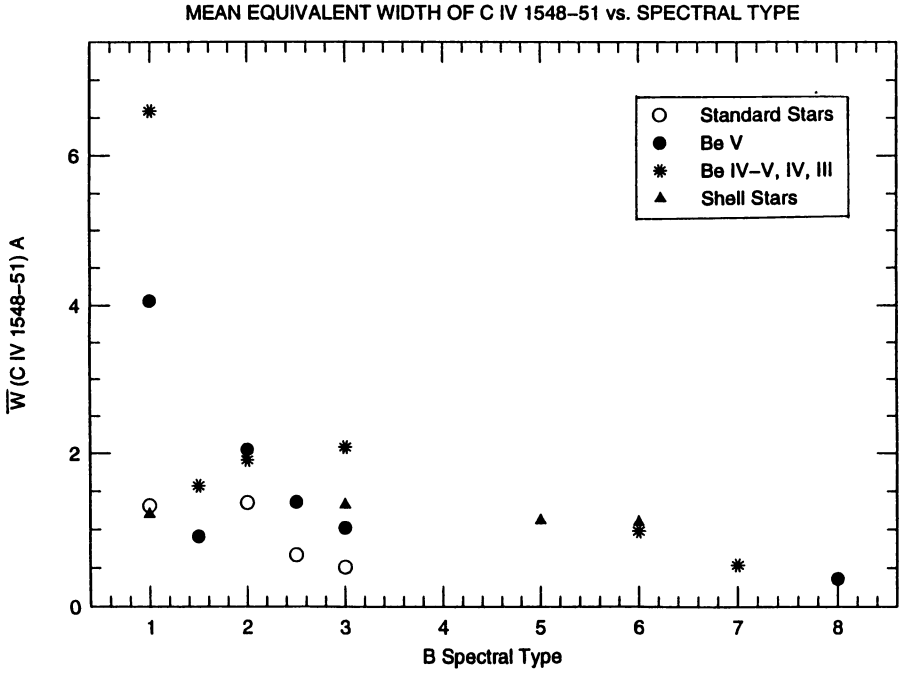

Fig. 2.

https://doi.org/10.1017/S0074180900215076 Published online by Cambridge University Press