

Spectral Analyses of late-type [WC] Central Stars: Element Abundances of N, Ne and Si

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The optical spectra of [WC] central stars of the latest subtypes ([WC11], [WC12]) exhibit not only stellar emission lines of hydrogen (in some cases), helium, carbon and oxygen, but also features of nitrogen (N II, N III), neon (Ne I), magnesium (Mg II), aluminium (Al III), silicon (Si III, Si IV) and iron (Fe III). Some of these features are also visible in the peculiar [WC9]-type object SwSt 1 which has a lower final wind velocity and a smaller wind density than normal [WC9] stars.

Based on model atmospheres accounting for the elements hydrogen, helium, carbon and oxygen (Leuenhagen et al. 1996, A&A 312, 167; Leuenhagen 1997, this proceedings) first results of the analyses of nitrogen, neon and silicon lines are available. The trace elements are represented by the following model atoms: N I – N IV (63 NLTE plus 22 LTE levels), Ne I – Ne II (9 NLTE levels) and Si III – Si V (32 NLTE levels). The observed nitrogen and silicon lines appear as emission or P-Cygni shaped features, except for IRAS 21282 and V 348 Sgr whose wind densities are very small (\rightarrow absorption lines of N and Si). If present, the observed neon lines are P-Cygni shaped, indicating a formation region far out in the wind.

The element abundances (Table 1) are determined by fitting preferably unblended and distinct lines. In some cases only upper limits can be given (noisy spectrum or blended lines). A correlation can be found between the hydrogen and nitrogen abundances. Only in one of seven objects of the subtype [WC11] or [WC12], namely in CPD-56°8032, hydrogen is definitely absent. In the same object the nitrogen abundance can be restricted to a very sharp upper limit of 0.1%. Because of the simple model atom the abundances of neon should be taken as preliminary results.

Table 1: Element abundances (mass fractions) of nitrogen, neon and silicon in the atmospheres of [WC] central stars of latest subtypes.

	subtype	T_* [kK]	β_N [%]	β_{Ne} [%]	β_{Si} [%]
SwSt 1	[WC9]	37	<0.5	2...4	1...2
PM 1-188	[WC11]	35	1	2...4	2...3
CPD-56°8032	[WC11]	32	<0.1	- ^a	0.5...1
M 4-18	[WC11]	31	<0.5	- ^a	0.5...1
He 2-113	[WC11]	30	0.5	- ^a	0.5...1
K 2-16	[WC11]	30	1	>4	0.5...1
IRAS 21282+5050	[WC11]	28	<0.5	- ^b	<0.1
V 348 Sgr	[WC12]	20	0.5...1	2	<0.1

a: no spectra available; b: no neon lines detectable