

Spectral Analyses of the [WCL]–type CSPN He 2-459, M 2-43, SwSt 1, PM 1-188 and IRAS 21282+5050

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In this work recent results of spectral analyses of five late–type [WC] central stars are presented. We use spherically expanding model atmospheres to simulate non–LTE radiation transfer in mass–loosing envelopes. A detailed description of the model calculations and the stellar parameters of further eight [WCL]–CSPN can be found in Leuenhagen & Hamann 1994, A&A 283, 567, and Leuenhagen et al. 1996, A&A 312, 167.

The spectral fit of the observations provides the effective temperature T_* , the final velocity v_∞ , the element abundances β of H, He, C and O and the *transformed radius* R_t (see Table 1). The latter parameter is anticorrelated to the wind density. In the case of known reddening, visual brightness and distance, R_t can be disentangled into stellar radius R_* and mass–loss rate \dot{M} . Note, that all results for R_* , \dot{M} and L given in Table 2 depend on the distance ($R_* \sim d$, $\dot{M} \sim d^{3/2}$, $L \sim d^2$).

The most surprising result is the certain identification of hydrogen in PM 1-188 and IRAS 21282. The wind densities of SwSt 1 and IRAS 21282 are unusually small.

Table 1: Resulting stellar parameters. $T_{2/3}$ is related to $R(\tau_{\text{Ross}} = 2/3)$, R_t is defined as $R_*(v_\infty/\dot{M})^{2/3}$ and the element abundances are given in mass fractions.

	subtype	T_* [kK]	$T_{2/3}$ [kK]	v_∞ [km/s]	R_t [R_\odot]	β_{H} [%]	β_{He} [%]	β_{C} [%]	β_{O} [%]
He 2-459	[WC8]	77	52.6	1000	2.15	(< 2)	40	50	10
M 2-43	[WC8]	77	53.5	850	2.19	– ^a	40	50	10
SwSt 1	[WC9]	37	36.5	400	25.91	(<10)	43	52	5?
PM 1-188	[WC11]	35	31.7	360	7.07	1	42	50	7
IRAS 21282	[WC11]	28	27.4	180	51.95	10	43	46	1

(): affected by strong nebular lines; a: no spectra available; ?: uncertain

Table 2: Using photometry, extinction and distances from the literature the stellar radii R_* , the mass loss rates \dot{M} and the luminosities L can be determined.

	subtype	m_V [mag]	E_{B-V} [mag]	d [kpc]	R_* [R_\odot]	$\log \dot{M}$ [M_\odot/yr]	$\log L$ [L_\odot]
He 2-459	[WC8]	12.7	0.85	3.4	0.84	–5.01	4.37
M 2-43	[WC8]	15.7?	1.26?	1.4	0.22	–5.96	3.21
SwSt 1	[WC9]	11.9	0.40	1.4	1.03	–6.90	3.27
PM 1-188	[WC11]	14.6	0.83	–	1.88	–5.70	3.70
IRAS 21282	[WC11]	14.3	1.60	<2	<3.12	<–6.98	<3.75

?: uncertain; PM 1-188: L presumed (no distance estimation available)