WOLF-RAYET NEBULAE - ENRICHMENT IN He AND N AND EFFECTIVE TEMPERATURES OF WOLF-RAYET STARS *)

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SUMMARY. Nebulae surrounding isolated Pop I WR stars provide observational constraints on as yet poorly determined chemical surface abundances and FUV energy distributions of their central stars. An integral of the mass loss history and the chemical evolution is stored in those parts of the nebulae that have suffered only very little mixing with the ISM (cf. Kwitter 1984). Effective temperatures in the Lyman continuum region are reflected in the ionization structure of oxygen and sulfur (cf. Mathis 1982). For intrinsic problems involved refer to the papers cited above.

Long slit spectrophotometry of the nebulae RCW 58, RCW 104 and MR 26 (cf. Chu et al. 1983) was obtained with a B & Ch. Cassegrain spectrograph and CCDs at the 2.2m telescope at ESO, La Silla. A total of 40 hours was spent on 6 positions in the 3 nebulae. The present data represent averages over 1.5 arcmin slits, reduced in a standard way.

The abundances in table 1 are based on N and S electron temperatures and on ionization correction factors determined from (O,S) diagrams calculated by Mathis (1982, 1985). All 3 nebulae are of low ionization, making a correction for unseen neutral helium difficult. Total He abun-

Object	RCW 58	RCW 104	MR 26	Orion
T(e;N,S)	8000	7500	8600	7800
n(e)	190	70	40	-
log(O/H)	8.55	8.52	8.52	8.54
log(He/H)	11.48	11.32	11.15	11.02
log(N/O)	-0.14	-0.30	-0.77	-1.15
log(S/O)	-1.5	-1.2	-1.6	-1.5
log(Ne/O)	-1.0		-1.2	-0.8
log(Ar/O)	-1.8	-1.7	-1.9	-1.9
log(Cl/O)	-3.4	-3.6	-3.6	-3.3

*) Based on observations collected at the European Southern Observatory, La Silla, Chile

I. Appenzeller and C. Jordan (eds.), Circumstellar Matter, 457–458.

dances quoted are likely lower limits. He and N are overabundant (relative to the Orion nebula values) by factors between 1 and 10. The heavy elements O,Ne,S,Ar,Cl are normal within the uncertainties. These results pertain to only a minute fraction of the nebulae and may not be representative for the global values, albeit significant differences between the various slit positions have not been found.

The most important new result is visualized in Figure 1. The ionic fractions (O+/O) and log(S+/S++) of the 3 nebulae are compared with the expected values for different line of sights in model nebulae, characterized by (T(eff), Kurucz or Mihalas), from Mathis (1982) and with observations of Orion and 30 Dor.

The WN 4 star in RCW 104 (≈ 40 000 K) is intrinsically hotter than the WN 6 star in RCW 58 (≈ 30 000 K). MR 26 occupies the degenerate part of the diagram were widely different atmospheres produce the similar low ionization values. Since MR 26 is a thin shell, other positions along its periphery will likely yield similar results. However, unless the conditions in this shell are exceptional an upper limit of 40 000 K may be appropriate. Very high values of T(eff), above say 50 000 K are not compatible with the present observations. It is particularly rewarding, that the NLTE models by Schmutz Hamann and Wessolowski presented at this conference indicate the same temperature domain.

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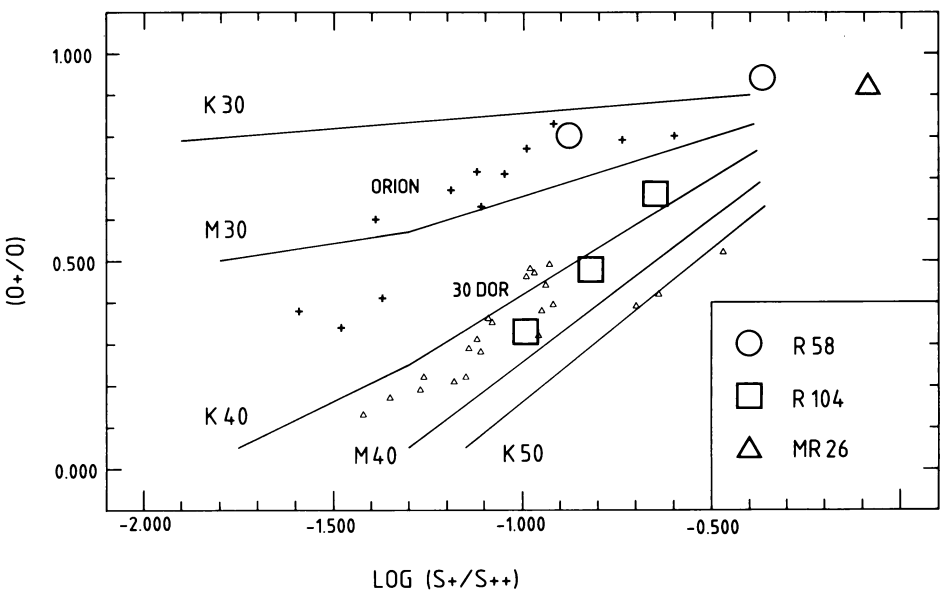

https://doi.org/10.1017/S0074180900157006 Published online by Cambridge University Press