

A SEARCH FOR HIGH EXCITATION NEBULAE AROUND WOLF-RAYET STARS IN THE MAGELLANIC CLOUDS

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We have serendipitously discovered that the WN+O binary Br 40a in the LMC is surrounded by a remarkable high excitation nebula, showing extended, narrow emission lines of HeII. This prompted us to make a systematic search for similar high excitation nebulae around other WR stars in the Magellanic Clouds. This survey revealed a second even more extreme example surrounding the WN+O binary AB-7 in the SMC, and one other marginal detection AB-5 (SMC). The detection of nebular HeII emission implies that these WN stars emit a much harder UV spectrum than is traditionally expected. For each of these nebulae we have taken narrow band CCD images at the CTIO 0.9-m telescope, and have obtained spectrophotometry with the 2D-Fruiti photon counting detector on the CTIO 1.0-m telescope.

The WN3+O6 star Br 40a (Sk -71° 34) is located in the outskirts of the bright HII region N206 in the LMC. Nebular HeII 4686Å line emission is detected in our two dimensional spectra over a region with an extent of 70 seconds of arc (18 pc). This high excitation zone coincides with a partial ring shaped feature seen in a narrow band [OIII]5007Å image. Figure 1 shows a one dimensional spectrum formed by averaging over the entire extent of the He⁺⁺ region.

The WN3+O6 star AB-7 (AzV 336a) is located near the centre of N76, the second brightest HII region in the SMC. A narrow band HeII 4686Å image shows an approximately circular high excitation zone 144 seconds of arc (37pc) in diameter, centred on the WR star. This He⁺⁺ region fills in a central hole in the annular nebula seen in a narrow band HeI 5876Å image. Figure 2 shows the average spectrum of the high excitation zone.

In our survey we found no evidence for nebular HeII emission in the vicinity of the 27 other WR stars, and 2 hot O3 stars, which are listed in the table. This suggests that either only a small fraction of all WR stars reach such high temperatures, or that the high temperature phase is of extremely short duration, or that most WR stars modify their environment in such a way that a high excitation zone is undetectable.

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Stars included in the survey for which nebular HeII 4686Å emission was not detected

Stars in the SMC		Stars in the LMC					
AB 1	WN3+OB	Br 5	Of/WN6+O7	Br 37	WN3+OB	Br 85	WN4
AB 2	Of/WN4.5	Br 10a	Of/WN6	Br 44	WC4+OB	Br 93a	WN3
AB 3	WN3+O4	Br 16	WN3	Br 46	WN4	Br 95	WN4+OB
AB 4	WN4.5	Br 23	WN3	Br 48	WN4+OB	Br 99	WN4
AB 6	WN3+O7	Br 25	WN3	Br 49	WN3+OB	Br 100	WN3
AB 8	WO4+O4	Br 26	WN7	Br 53	WN4+OB?	Sk-71*51	O3III(f*)
		Br 29	WN3	Br 66	WN3	Sk-67211	O3III(f*)
		Br 31	WC4+O9	Br 72	B1I+WN3		

AB: numbers from Azzopardi and Breysacher (1979, *Astron. Astrophys.* 75, 120)

Br: numbers from Breysacher (1988, *Astron. Astrophys.* 160, 185)

Sk: numbers from Sandulek (1970, *CTIO contributions* N°89)

Fig 1. Br 40a

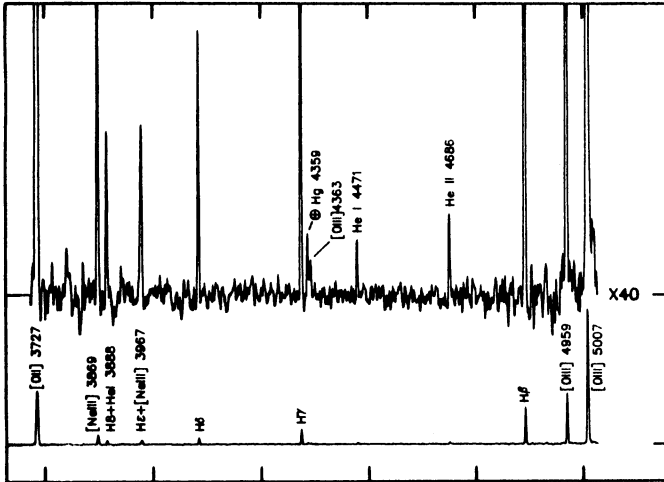


Fig 2. AB-7

