SPECTROPHOTOMETRY OF THE OPTICAL EMISSION FROM RCW103[1]

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ABSTRACT

Spectra for five different positions in RCW103 were obtained with the 1.5m and 4m telescopes of CTIO equiped with a SIT Vidicon detector.

From the observed Hα/Hβ ratio we found a variation of about 1.5 magnitudes in reddening for different filaments. The minimum value of Av found was 4.4 magnitudes implying a distance of 6.5 kpc.

Temperatures of about 10^5 K and densities of 70 cm^{-3} were found. Nitrogen is overabundant at least by a factor 3.

I INTRODUCTION

The discovery by Tuohy and Garmire (1980) of a compact X-ray source in the center of RCW103 gave special interest to the study of this object. Determination of its distance, age and possible interaction of the compact X-ray source with the gaseous filaments are very important.

Absorption measurements of HI and OH towards RCW103 give a lower limit to the distance of 3.3 kpc (Caswell et al. 1975). A distance of about 8 kpc is found from the Σ-D relation (Caswell et al. 1980). Westerlund (1969) finds a distance of 3.9 kpc assuming that the remnant is part of an OB association having 3 magnitudes of reddening. In 1982 Leibowitz and Danziger using the observed Hα/Hβ ratio for several filaments in RCW103 found a reddening of 4.5 magnitudes implying a distance of 6.6 kpc from the Sun.

II OBSERVATIONS

The spectra obtained with the 4m telescope of CTIO and the 40mm Vidicon tube covered the wavelength region between 5000 Å and

J. Danziger and P. Gorenstein (eds.), Supernova Remnants and their X-Ray Emission, 241–243.

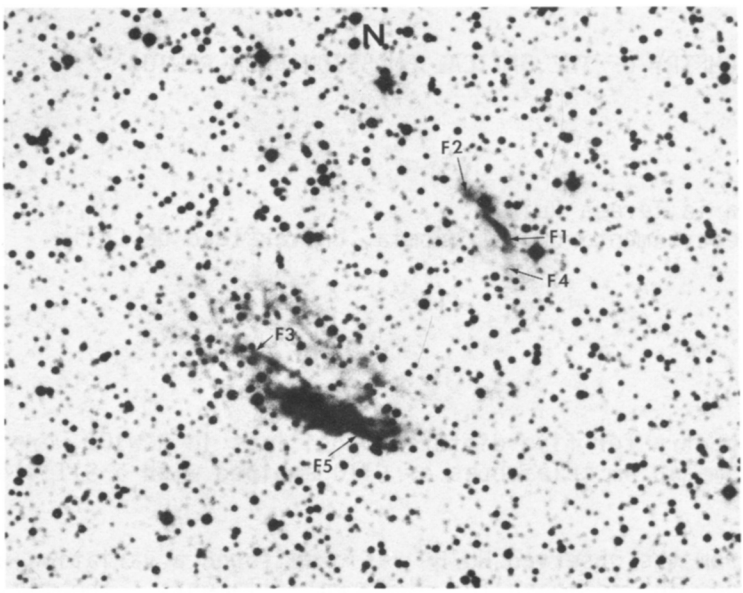

Figure 1. RCW103

6800 Å with 6 Å of resolution. At the 1.5m telescope the 16 mm Vidicon was used covering the region between 4363 Å to 6800 Å with about 15 Å of resolution and the regions between 3700 Å to 5100 Å and 6200 Å to 7300 Å with a resolution of about 10 Å.

The slit was always kept E-W; its width was 1.8". The length of the observed spectra was 13" for filaments F1, F3 and F4; 23" for F2 and 27" for F5. Figure 1 is a reproduction of RCW103 with the positions of the observed filaments indicated.

III RESULTS

Table 1 gives the line intensities corrected by reddening using a normal reddening law and assuming a theoretical Hα/Hβ ratio of 3. The accuracy of the line strengths are about 15% for lines stronger than Hβ and 30% for lines 1/2 Hβ. The values of Av for each filament are indicated in Table 1, the difference between the Av for filament 2 and 5 must be due to internal reddening. The minimum Av found was 4.4 magnitudes indicating a distance of about 6.5 kpc from the Sun and a galactocentric distance of about 4 kpc.

Comparison of the observed line intensities of Table 1 with models by Dopita (1977) and Shull and McKee (1979) indicates that the temperatures in the filaments of RCW103 are of the order of 10^5 K, the

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TABLE 1
Line Intensities in RCW103

Line	F1(Av=5.3)	F2(Av=4.4)	F3(Av=4.5)	F4(Av=5.0)	F5(Av=5.9)
[OII] 3726+3729	951				966
Hγ 4340	64				57
[OIII] 4363	73				
Hβ 4861	100	100	100		100
[OIII] 4959	87	38	185	118	136
[OIII] 5007	243	140	320	297	416
[NI] 5200	29		22		59
HeI 5876	7	21			
[OI] 6300	94	71	95	111	73
[OI] 6363	31	31	36	40	23
[NII] 6548	168	138	189	186	158
Hα 6563	300	300	300	300	300
[NII] 6584	492	394	534	555	520
[SII] 6717	115	181	158	157	136
[SII] 6730	157	197	192	204	176
HeI 7065	17	18			
[ArIII] 7135		45	31		26
[FeII] 7155	26	21			15
[CaII] 7293	43	39	12		
[OII] 7320+7330	62	105	112		74

densities about 70 cm^{-3} and there is an overabundance of N by a factor 3, S and O show smaller overabundance with respect to cosmic.

IV CONCLUSIONS

The observed minimum value of Av=4.4 magnitudes is in agreement with the Av=4.5 magnitudes found by Leibowitz and Danziger (1982) implying a distance to RCW103 of 6.5 kpc, thus the remnant is at a galactocentric distance of about 4 kpc. The observed overabundances could be explained as due to a galactic abundance gradient, although a small N abundance variation between filaments seems to be present.

(1) A more detailed discussion of this work has been sent for publication to the Astronomical Journal.

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