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FAINT EARLY-TYPE STARS IN THE NEIGHBOURHOOD OF THE H II REGION RCW 99[1]

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RESUMEN

Se ha empleado fotometría fotográfica *UBV* para realizar una búsqueda de estrellas tempranas en un área de 600 minutos de arco cuadrados aproximadamente, alrededor de la región H II RCW 99. Los límites en magnitud de la búsqueda son: $V = 15.59$ mag, $B = 16.70$ mag y $U = 17.49$ mag. Se han encontrado veintisiete nuevas estrellas tempranas.

ABSTRACT

We used *UBV* photographic photometry to search for faint early-type stars in an area of about 600 square minutes of arc around the H II region RCW 99. The magnitude limits of the search are: $V = 15.59$ mag, $B = 16.70$ mag, and $U = 17.49$ mag. Twenty seven new early-type stars were found.

Key words: **PHOTOMETRY – STARS-EARLY TYPE**

I. INTRODUCTION

Le Marne and Lyngå (1968) identified some weak radio sources with minor H II regions one of which is RCW 99 (Rodgers, Campbell and Whiteoak 1960). The Hα photograph of Georgelin and Georgelin (1970*a*) of the field around $l = 328.^{\circ}4$, $b = -0.^{\circ}8$ shows an annulus of H II regions of 3° diameter that includes RCW 96, 97, 98 and 99; besides, the association of these nebulae was confirmed through their radial velocities by Georgelin and Georgelin (1976). This group is certainly a good spiral tracer and, therefore, it seems appropriate to search for faint early-type stars some of which might be the exciting stars of the nebulae. Muzzio and McCarthy (1973) and Muzzio (1974) searched for faint early-type stars in fields that enclosed RCW 98 and 97, respectively; the present work deals with the field around RCW 99.

II. METHOD AND RESULTS

We used two sets of *UBV* plates obtained by Muzzio with the Curtis Schmidt telescope at Cerro Tololo Inter-American Observatory. The *UBV* photographic photometry was obtained measuring the plates at La Plata Observatory with the Cuffey iris photometer of the Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, and calibrating the measurements with the Norma I and III sequences of Bok, Bok and Miller (1972) and with stars measured photoelectrically by Muzzio and Forte (1975); the limiting magnitudes are:

$$V = 15.59 \text{ mag } B = 16.70 \text{ mag and } U = 17.49 \text{ mag}$$

We measured all the stars within an area of $30' \times 20'$, shown in Figure 1, except for a few (indicated with letters in Figure 1), lying in regions of intense nebular background. We used the same color equations of Muzzio and Celotti de Frecha (1979), i.e.:

$$V_{pg} = V_{pe} - 0.1\,(B-V)_{pe} \qquad (1)$$

for the V magnitude, and no color terms for the B and U magnitudes. The root mean square error of a magnitude obtained as the average of the results of the two plates is about 0.07 magnitudes.

We derived the intrinsic colors of all the measured stars using the same method as Muzzio and Forte (1975) and we selected all the stars with $(U-B)_0$ bluer than −0.87 (i.e., a B2 V star in the calibration of Johnson 1958). These stars are shown in Figure 1 with numbers from 1 through 27; Table 1 gives for these the photographic *UBV* values, the intrinsic $U-B$ and the $B-V$ color excesses.

III. DISCUSSION

The purpose of the present paper is to provide a finding list of faint early-type stars in the region of RCW 99 which, through further photoelectric and spectroscopic studies, will help to understand the relation of the stars to the nebula and to derive its distance.

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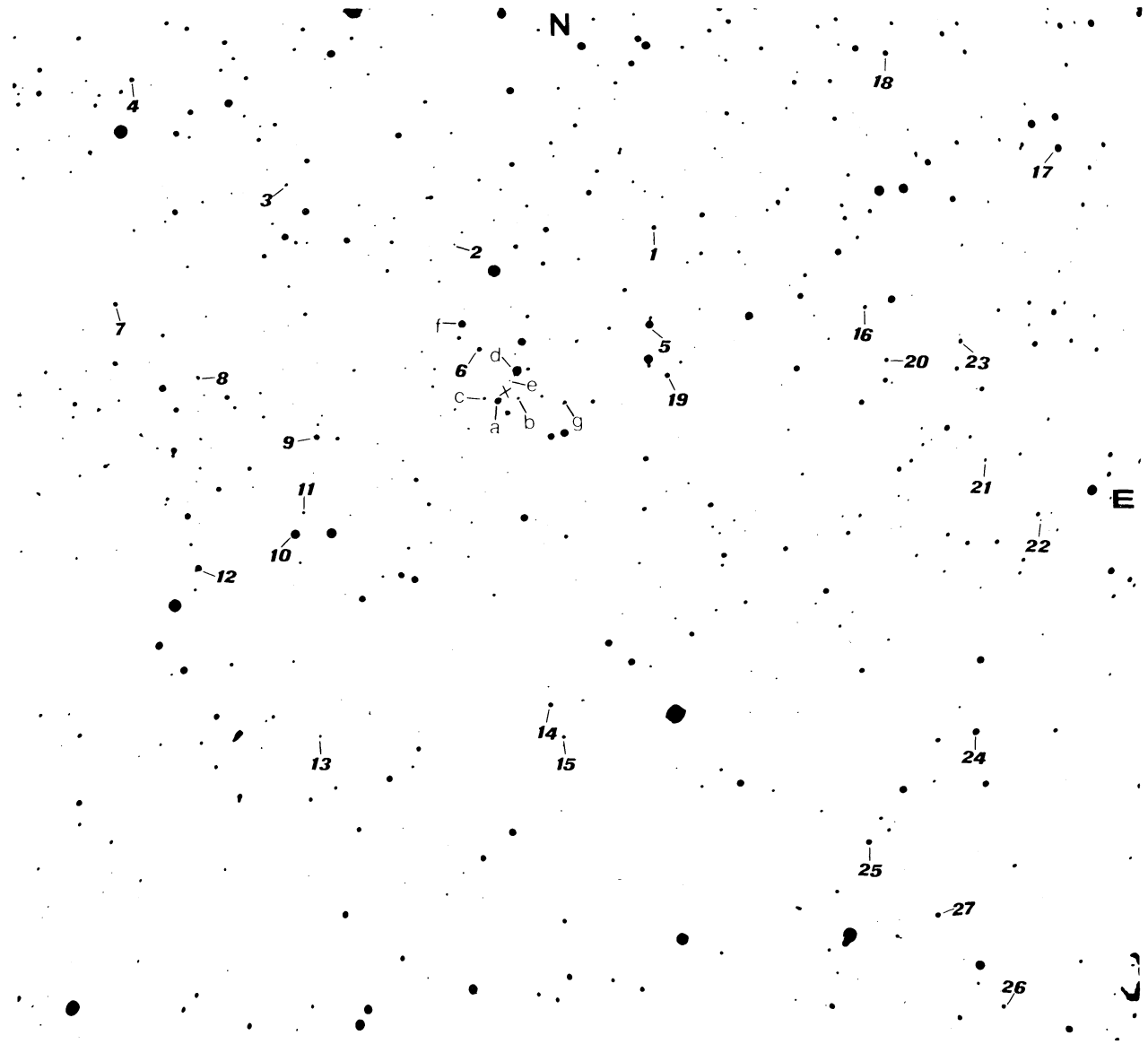

Fig. 1. Finding chart for the new early-type stars, obtained from one of our V plates. chart size is about $30' \times 20'$; north is up, east to the right. The cross shows the position of the radio source G328.6 – 0.5 (Day *et al.* 1969).

We note, however, that color excesses are very large, a characteristic of the Norma region of the Milky Way (see, e.g., Muzzio and Forte 1975).

The position of the radio source G328.6 –0.5 (Day, MacA. Thomas, and Goss 1969) is shown in Figure 1 with a cross. Close to it lie stars, a, b, c, d and e, which could not be measured, and seem to be good candidates for the exciting star of the main radio peak. Our star 6, on the other hand, may be not blue enough to be an exciting star.

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TABLE 1

PHOTOMETRY OF BLUE STARS

	V	$B-V$	$U-B$	$(U-B)_0$	$E(B-V)$	V_0
1	14.09	1.07	−0.41	−1.62	1.52	9.53
2	15.07	1.46	0.36	−1.06	1.75	9.82
3	14.66	0.95	−0.08	−1.05	1.24	10.94
4	14.13	1.91	0.85	−0.95	2.18	7.59
5	12.16	1.30	0.25	−1.02	1.58	7.42
6	13.89	0.93	−0.21:	−1.20:	1.26:	10.11:
7	14.07	1.36	0.10:	−1.28:	1.72:	8.91:
8	14.61	1.26	−0.04:	−1.35:	1.63:	9.72:
9	13.58	0.96	−0.3::	−1.4::	1.4::	9.5::
10[a]	11.81	0.91	−0.04	−0.96	1.18	8.27
11	14.88	0.94	−0.2::	−1.3::	1.3::	11.0::
12[b]	12.98:	0.98:	0.00:	−0.98:	1.25:	9.23:
13	15.04	0.92	−0.08	−1.02	1.20	11.44
14	14.06	1.25	0.15	−1.09	1.55	9.41
15	14.50	1.43	0.44	−0.92	1.69	9.43
16	14.74	1.56	0.53	−0.95	1.83	9.25
17	13.09	0.94	0.05	−0.87	1.18	9.55
18	14.03	1.17	0.21	−0.92	1.43	9.74
19	13.78	1.87	0.06	−1.97	2.41	6.55
20	14.28	1.29	0.06	−1.25	1.64	9.36
21	14.38	1.66	0.63	−0.94	1.92	8.62
22	14.63:	1.65:	0.61:	−0.95:	1.92:	8.87:
23	13.78:	2.35:	0.97:	−1.37:	2.73:	5.59:
24	13.19	1.44	0.19	−1.26	1.79	7.82
25	13.67	0.95	−0.11	−1.09	1.25	9.92
26	14.58	1.10	−0.04	−1.17	1.42	10.32
27	13.95	1.37	0.20	−1.16	1.69	8.88

a. Star 152 of Orsatti and Muzzio (1980).
b. Doubful *UBV* data because of nearby star.

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