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SPECTRAL TYPES IN THE ZETA SCULPTORIS OPEN CLUSTER

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RESUMEN

Se estudió espectroscópicamente el cúmulo abierto Blanco 1(ζ Scl). La clasificación espectral en el sistema MK muestra la presencia de una Am clásica y dos estrellas peculiares. La estrella ζ Scl misma parece no pertenecer al cúmulo.

ABSTRACT

We derived MK types for stars in the field of the open cluster Blanco 1 (ζ Scl). There are one Am and two peculiar stars among cluster members. The star ζ Scl itself seems to be a nonmember.

Key words: **CLUSTERS, OPEN — STARS, SPECTRAL CLASSIFICATION.**

I. INTRODUCTION

The open cluster Blanco 1 (ζ Scl) was discovered by Blanco (1949). It is located at an unusual high galactic latitude (b = 79°) but the motions are those of young disk stars (Eggen 1970). According to Eggen (1970) the F-type members have an ultraviolet excess with respect to the Hyades stars. This fact was recently challenged by Perry, Walter, and Crawford (1978) (PWC), who did not find any evidence of it.

Photometry in the region of the cluster was made by Westerlund (1963), Epstein (1968) and Eggen (1970, 1972). The most complete photometric investigation of Blanco 1 was recently made by PWC. They provided new *UBV* and *ubvyβ* photometry for 23 stars in the region. They obtained a distance modulus of 6.9 magnitudes and a mean color excess of 0.00 mag. The age was found 5×10^7 yrs. and only 16 of the 23 stars observed were considered cluster members by PWC.

II. OBSERVATIONS AND RESULTS

We observed 20 stars, 18 of them in common with PWC. The observations were made with the 0.9 m telescope and the Cassegrain spectrograph at Cerro Tololo. The spectra have a dispersion of 125 Å/mm and were in general widened 0.6-0.9 mm. They are suitable for spectral classification in the MK system. The classification was done with a modified Hilger and Watts spectra-comparator. Table 1 lists the MK types. The authors classified independently and their types differed in average 0.02 spectral subclasses and 0.2 luminosity classes. The final types differ from those derived by Wayman (1961) by 0.01

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TABLE 1

SPECTRAL CLASSIFICATION

HD or CD	Epstein N°	V	Spectral Type
50	4	9.73	A8 V
91	37	9.92	F0 V
104	2	8.01	G5 III
141	...	7.92	A0 V
235	1	8.67	A1 V
224820	17	8.43	A1 V
224948	15	9.96	F0 V
224964	22	8.98	A3 V
224976	14	9.89	F5 IV
224990	18	5.05	B5 V
225047	13	8.43	A0 V
225077	...	8.84	Am (K/H/M= A2/A5/A8:)
225187	8	7.10	B8 V
225200	21	6.39	A0 V + A:
225206	20	7.77	B9.5 Vp (K-line weak)
225264	19	8.29	A0 Vp: (Si II slightly strong)
225282	7	8.32	A1 V
-31°19554	24	10.50	F8 V
....	26	9.85	G6 IV
....	3	...	F4 V

spectral subclasses (6 stars in common) and are 0.04 spectral subclasses earlier than those determined by Bond, Perry, and Bidelman (1971).

The HR diagram is shown in Figure 1. The absolute magnitude scale was computed using the distance modulus derived by PWC. The ZAMS relation was obtained from Johnson (1963). The results of interest are as follows:

a) The star ζ Scl is a main sequence object, so it is probably a foreground star.

b) There is one classical Am star among the cluster members.

c) There are one peculiar star with the K-line weak and one Ap star with a marginal enhancement of the Si II lines.

PWC made a thorough discussion of photometry and the available proper motions and radial velocities, so we adopted their results on membership. In general our types are compatible with PWC results and we agree with them that stars HD 104, HD 224976, HD 224990 and HD 225200 are probably nonmembers of the cluster. The Am star is a member of the cluster according to PWC results. Besides star No. 6 in Epstein's list (not observed by PWC) is also a probable nonmember because it is located almost 2 magnitudes above the ZAMS. Star CD-31°19554 (also not observed by PWC) is not rejected as probable member because it is just in the 0.75 mag. limit above the ZAMS and its proper motion as discussed by Eggen (1970) does not permit to reject it as probable member. There is no radial velocity available.

Of particular interest is the case of HD 224990 (ζ Scl), the brightest star in the field. If it is not a member, as the observations suggest, it may be a runaway star from the same cluster, but as the star has been reported as variable in radial velocity (Buscombe and Morris 1961), it is necessary to compute first the possible orbit and the baricentric velocity. Only after this has been done it will be possible to study the kinematics of ζ Scl and its relation to the cluster. A program is underway to

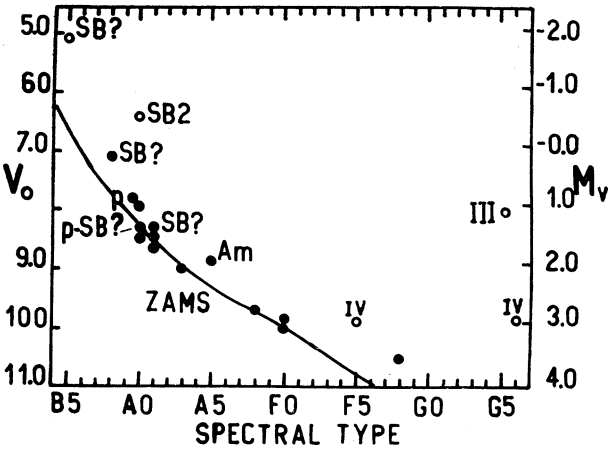

FIG. 1. HR Diagram of the open cluster Blanco 1. Filled symbols are probable members. Open symbols are probable nonmembers. Peculiar stars, evolved stars and stars reported as spectroscopic binaries are indicated.

determine the radial velocity variation and the possible orbital elements. Obviously nothing is known about the probable companion of ζ Scl. So no corrections to the magnitude can be applied due to the incidence of the secondary. However there are no double lines in the spectrum of ζ Scl, and there is no evidence of secondary spectrum so the correction, if it exists, to the visual magnitude must be surely small.

It is necessary to mention that the luminosity classification is crucial for the membership decision and it is well known that in the middle B-type stars the luminosity classification is difficult. We obtained a spectrum 2.5 mm wide of ζ Scl and also standards of the same kind to get the best luminosity classification as possible. Other authors classify this star as B5 V, for example Hiltner, Garrison, and Schild

(1969) but Bond, Perry, and Bidelman (1971) classified it as B5 III. As our observations show a main sequence object we have to agree with PWC results. The lines of ζ Scl are narrow, the V sin i value estimated from a spectrum of 39 Å/mm is less than 40 km/sec.

The brightest member of the cluster would be HD 225187, a B8 V object which has also been reported as a spectroscopic binary. The cluster would be less than 10^8 yrs old in agreement with the age found by PWC.

Summarizing the spectroscopic observations of the ζ Scl open cluster indicate the presence of an Am star and two peculiar stars among the cluster members. The brightest star in the field ζ Scl itself seems to be a nonmember of the ζ Scl Cluster. In this sense it is convenient to designate the cluster as Blanco 1.

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