PHOTOMETRY OF EARLY TYPE STARS IN OPEN CLUSTERS (NGC 1444, NGC 1662, NGC 2129, NGC 2169 AND NGC 7209)

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This is part of a series which has the purpose of examining the nature of the stars belonging to open clusters. The aim of this series is, among others things, to study short period pulsating stars, mainly of the Delta Scuti type, by first establishing the membership of each star to the cluster, to determine the abundance of the Be and Ap phenomena and blue stragglers in open clusters for clusters of different ages and metalicities and, eventually, to study the chemical enrichment of the galaxy when age, dynamics and metalicity are known for a fair number of clusters.

In the present study, an analysis of the open clusters NGC 1444, NGC 1662, NGC 2129, NGC 2169 and NGC 7209 is presented. These clusters were selected because they seem to have a relatively large number of early type stars. The observations were carried out at the National Astronomical Observatory of the UNAM. The 1.5 m telescope with a multichannel uvby-β spectrophotometer was utilized for the acquisition of the data. A compilation of the observations and results are presented in Table 1.

Since the aim of the present paper is to establish physical and geometric characteristics of the cluster stars, the first step was to determine membership of the observed stars to each of the clusters. Then we defined which stars were Main Sequence stars and the broad spectral regions to which they belonged by constructing a $[m_1]-[c_1]$ diagram. It defines three main spectral regions: early type stars of class B and early A; A and F stars, and late type stars. The distance for each group has been calculated separately.

The calibration of the B and early A type stars follows a method proposed by Shobbrook in 1984, and by Balona and Shobbrook (1984) and for the A and F stars a procedure proposed by Nissen in 1988 was employed. The membership probability has been defined by adjusting a gaussian distribution to the histogram of the distances in parsecs.

In order to estimate the age of the cluster the following procedures were undertaken: An estimation of the turn-off point was carried out by means of the grids of Relyea and Kurucz (1978). Then a direct comparison was

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made with the theoretical models of VandenBerg (1985) or, for early type stars, with those of Maeder (1991) or Meynet et al. (1991) which consider overshooting.

The determination of the Ap abundance was carried out through uvby-β photometry since it is well-known that the Ap stars lie in a specifically defined zone in the $[m_1]-[c_1]$ diagram. From a compilation of several articles on Ap stars in open clusters, a ratio of 0.051 for the frequency of Ap stars in the clusters and of 0.070 for field stars was determined. From the results obtained in the present paper, a higher value is determined, see Table 1.

Two new blue stragglers that belong to the clusters have been found in the present study, see Table 1.

TABLE I
Compilation of Results.

cluster	obs	stars	Ap		dist	E(b-y)	age binaries blue				Ap/BAF
NGC	all	mbr	all	mbr	(pc)		$\times 10^6$	all	mbr	strg	
1662	42	28	7	7	390	0.231	490	4	2	0	0.24
1444	25	6	1	0	920	0.568	170	0	0	1	0.00
2169	20	8	2	0	860	0.147	50	0	0	1	0.00
2129	37	-	1	-	—	—	–	-	-	-	-
7209a	54	16	7	1	760	0.108	500	1	0	0	0.06
7209b	54	17	7	2	1190	0.145	710	1	1	0	0.12

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