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On the Constancy of Some Stars in NGC 2287=Messier 41

The Pleiades-age open cluster NGC 2287 contains several luminous red bright-giants and spectroscopically interesting stars. Three of these stars have previously been suspected of low-level variability. In order to confirm this and ascertain the nature of the variations, differential photometry was obtained over two observing seasons.

The stars were observed with the Lowell Observatory 53cm photometric telescope. Two groups of stars were arranged in trios observed in the pattern: star 2-1-3-2..., switching filters at the completion of each cycle. A single nightly observation consisted of one cycle of measurement in each color, the measurements being the mean of six ten-second integrations on "star" compensated by the mean of two integrations on "sky." Diaphragms of 29 or 49 arcsec diameter were used depending on seeing. The data were reduced to instrumental magnitudes, accounting for differential extinction by the use of mean monthly extinction coefficients determined with this specific telescope/filters/detector system in an ongoing program initiated in 1972 (Lockwood and Thompson 1986).

The first group observed in the cluster consisted of three K-type bright-giants, identified by designations assigned by Cox (1954). Pertinent information about the stars is given in Table I.

Table I

Star	HD	V	B-V	MK	Membership probability	Remarks
Group 1						
1=Cox 21	49091	6.908	1.503	K3 IIb	0.81	=ADS 5437
2=Cox 97	49105	7.803	1.147	K0 IIab-IIb	0.89	
3=Cox 75	49068	7.436	1.254	K1.5 II-III	0.90	MK standard
Group 2						
1=Cox 102='a'	49126	7.275	0.592	F8 IV-V + B9.5 V	0.87	
2=Cox 21	49091	6.908	1.503	K3 IIb	0.81	=ADS 5437
3=Cox 107='f'	49212	7.781	1.136	K0 IIab	0.90	

BV photometry and cluster proper-motion membership probabilities are drawn from Ianna *et al* (1987); the MK classifications are by Levato and Malaroda (1979), except Cox 75, which is an MK standard in the 1985 list of Keenan and Yorke (1985). Of this group, Schmidt (1984) suspected variability in Cox 75 and 97 based on DDO photometry on two nights. The group was observed in the present program using Strömgren y and b filters on thirteen nights from 1985 March 31 to November 7 UT.

The second group included two bright-giants (Cox 21 carried over as a tie-in to group 1) and Cox 102, which has a composite spectrum of hotter stars. In the course of their photometric study of the cluster, Feinstein *et al* (1978) found Cox 102 to be variable with a V range of 0.09 mag from ten observations over a four-month interval. This trio was measured on twelve nights between 1985 November 20 and 1986 March 1 UT using Strömgren y , b , and v filters.

Table II

Pair	Δy σ	Δb σ	Δv σ
Group 1			
1-2	-0.909 6	-0.672 6	-
1-3	-0.539 5	-0.362 6	-
2-3	0.370 7	0.310 4	-
Group 2			
1-2	0.394 4	-0.094 5	-1.340 9
1-3	-0.495 4	-0.745 4	-1.445 6
2-3	-0.889 6	-0.651 6	-0.105 11

Table II summarizes the photometry, showing pairwise differential magnitudes and the standard deviation of these means on the second line of each entry. Because Messier 41 culminates at 1.8 airmasses from Flagstaff, the precision of the data ($\sigma \sim 5$ millimagnitudes in y and b) is roughly half what we expect for constant stars of similar brightness located north of the celestial

Equator (*cf.* Skiff and Lockwood 1986). Nevertheless the consistency of σ for each filter suggests it is reasonable to conclude that all five stars were constant to better than 1% over the interval covered by the observations. Indeed, for group 1, whose measures were split between two observing seasons, the interseasonal means differ on average by only 2.5 millimagnitudes. Sowell (1986) also reports differential UBV photometry of Cox 21, 97, and 107. A dozen measures were obtained over a four-day baseline in November 1985. These indicate short-term (less than several hours) constancy to within a few millimagnitudes.

These results exclude variations with time scales of hours to months, but longer-term changes are not ruled out.

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