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DETECTION OF VARIABLE STARS AMONG BLUE STRAGGLERS IN M67

The open cluster M67 has six blue stragglers which are in the delta Scuti instability strip. Hereafter the stars are designated by their Fagerholm (1906) numbers. Danziger and Dickens (1967) observed No.131 for 81 minutes and assigned this star as a suspected variable. Photoelectric photometry of six blue stragglers in the instability strip and one comparison blue straggler outside the instability strip has been made. Observations were obtained on Feb. 11/12 1972, Jan. 11/12 1973, Jan. 11/12 1976 and Feb. 17/18, 18/19, 21/22 and 22/23, 1977. Observed blue stragglers are listed in Table I. Since about 30 per cent of the stars in the instability strip are delta Scuti variables, the probability of all stars to be variable is only 0.1 per cent, thus negligible. Therefore six stars have also been taken as the comparison stars for the first two nights (Figure 1). Two stars (No.185 and No.238) were omitted on the third night, (Figure 2), because we thought that these stars are not variables, according to the first and the second night observations. For the last four nights (Figures 3 and 4), the observations have also been made on one comparison blue straggler (No.136) outside the instability strip, which is nearby to No.131 in the M67 field. The reason to do so is to deny the possibility of the variation of No.131 owing to the position in the cluster field.

The observations have been made using the 91 cm reflector at the Okayama Astrophysical Observatory. The diaphragms used have been 1 mm and 1.5 mm. The 1 mm diaphragm has been used for No.190 only, because a fainter star by 2.7 mag than 190 lies at about 3" from the edge of the 1.5 mm diaphragm. The observed magnitudes have been V. The integration time has been 40 sec. All observations have been made at zenith distances less than 50°. The errors of the observations may be, on the average, 0.007 mag from the Figures. Special attention has been paid to the centering in the diaphragm. Otherwise, errors amount to 0.01 mag or more. Since our concern is the detection of the variability, no magnitude is given. The differential extinction by terrestrial atmosphere is negligible, because the diameter of M67 is 18' (Hogg 1958). The variations of the obtained results due to the dif-

Table 1

Fagerholm number	V	B-V	Spectral Type
55	11.32	0.30	A <sub>m</sub>
90	10.97	0.34	F3
131	11.22	0.415	F0IV:
136	11.31	0.63	
185	11.12	0.24	A4
190	10.96	0.245	A8IV-V:
238	10.96	0.24	A3

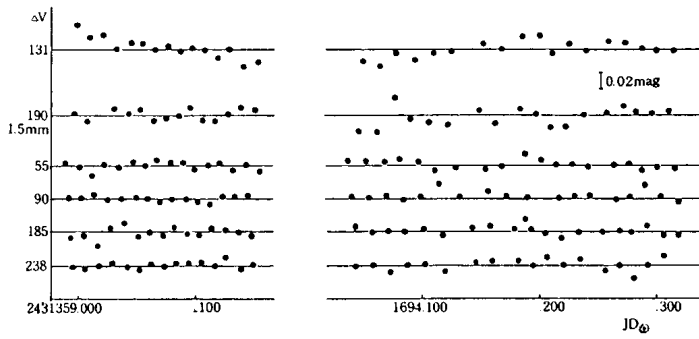


Figure 1

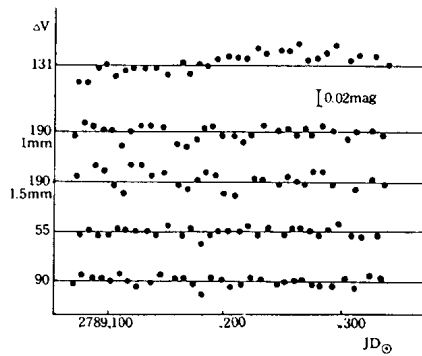


Figure 2

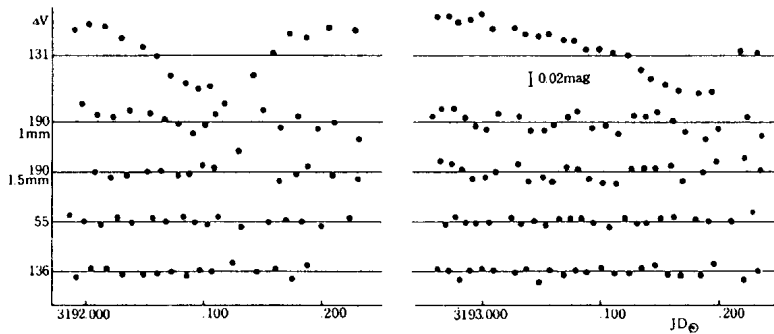


Figure 3

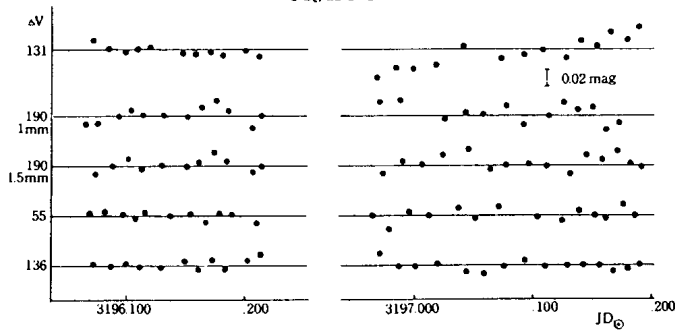


Figure 4

ferences in the color indices are insignificant as are shown in Table I and in the Figures.

The results are given in the Figures 1, 2, 3 and 4. As it is seen in these Figures, No.131 and No.190 are variables, and other four stars are not variables. The frequency of the variables is one-third, in agreement with the percentage of field variables. The period and the amplitude of No.131 are 6 hours or more and 0.00 - 0.05 mag, respectively. The period and the amplitude of No.190 are 1.5 - 2 hours and 0.00 - 0.02 mag, respectively. Thus for both stars, the periods and the amplitudes vary. The period of No.131 is unusually long for a delta Scuti variable. We suggest that pulsation of No.131 is non-radial.

More observations are necessary, in order to continue the monitoring of No.131 and No.190 and to confirm the non-variability of Nos.90, 185 and 238.

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Fagerholm, E.: 1906, inaugural dissertation, Uppsala.  
Hogg, H.S.: 1958, *Handbuch der Physik*, 51, 199.