

A SEARCH FOR MAIN-SEQUENCE BINARIES IN GLOBULAR CLUSTERS

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It is becoming increasingly clear that no (or only one or two) binaries occur among the evolved stars in globular clusters. Therefore, if binaries exist at all in these systems, they must be found on or near the main sequence. I have chosen 6 clusters to search for faint eclipsing binaries by the following criteria:

- (1) the apparent visual distance modulus (Harris 1976)
 $(m-M)_V \leq 14.5$ mag;
- (2) the Peterson and King (1975) concentration class $c \leq 1.5$, so that the search can be conducted near or at the cluster center where binaries would most likely be found; and
- (3) the galactic latitude is sufficiently large to avoid problems of extreme contamination by field stars.

The clusters thus chosen are NGC3201, 5139 (Omega Cen), 6121 (M4), 6218 (M12), 6254 (M10), and 6809 (M55). The plate material obtained on three nights with the 4-m telescope at CTIO in 1979, consists of seven to nine plates of each cluster on IIIa-F emulsion with an RG610 filter; the search is being conducted with a blink microscope.

Because M55 is the least concentrated, this was the first cluster to be searched in this program. Blinking of four independent plate pairs (out of a total of eight pairs to be blinked) has revealed only two definite variables, one at the tidal limit of the cluster, and one about half way from the cluster center to the tidal limit. The latter is of the RR Lyrae type with a probable period of 0.53 days and a mean magnitude of the order of 4 mag below the horizontal branch of M55. Such a faint RR Lyrae variable in the direction of M55 would lie at a distance of roughly 36 kpc from the Sun, putting it very close to the edge of the galactic halo.

During the next year I plan to blink the remaining plates. I am pessimistic about finding any eclipsing binaries, but there will undoubtedly be several other serendipitous discoveries such

as the distant RR Lyrae star described above. The final results will be published elsewhere.

REFERENCES

- Harris, W.E.: 1976, *Astron. J.* 81, 1095.
 Peterson, C.J. and King, I.R.: 1975, *ibid.*, 80, 427.

DISCUSSION

KRAFT: Do you provide poor old Northern hemisphere observers with a chart of that RR Lyrae star?

LILLER: Yes, I certainly will do that. I'll be glad to send you one along with the data.

KRAFT: What is the declination of M55?

HARRIS, W.: -31° .

KRAFT: Ah, so you can reach it from the north. (Laughter).

LILLER: Anyone else who wants one just slip me their name and address - I'm sorry I just don't have it with me at the moment. It's on the north side of the cluster, though, so that will help you. (Laughter).

HARWARDEN: Would you be in a position yet to comment on the degree of deficiency of main sequence binaries?

LILLER: I have blinked about a quarter of one pair of deep IIIaJ plates taken by W. Liller of Omega Centaurus, on which I estimate I have looked at a (few) $\times 10^4$ stars, and have found nothing definitely variable. In a normal population you would expect 1 in every 500 to be an eclipsing binary, and if there's a 10% duty cycle, you can expect 1 in every 5,000 stars to show something and I found nothing that I was convinced was really a variable star on these. I went all the way up to the tidal limit, which presumably shouldn't produce anything, since it is really the core you want to look at; but as long as I'm doing it, I'll do the whole business. I may prove the theory wrong anyway.

KING: Three quick comments. One is that the RR Lyrae is not unexpected, because there ought to be about one per square degree per unit magnitude interval and you found one.

LILLER: That will keep me going on another cluster. (Laughter).

KING: Second comment. I once did a calculation on the back of an envelope, which I can't produce because I threw away the envelope, but it indicated that there ought to be several dozen W Ursa Majoris stars in NGC 6809 and there ought to be half a dozen that you catch with eclipses, so it begins already to sound significant. Third. It's encouraging that you found a variable star

because it means that you're blinking significantly. (Laughter).

LILLER: I worry if I sit there wondering whether my mind is wandering or what, and then suddenly you see one and you figure, "well, probably you haven't missed many, if you catch one every now and then." It's very rewarding to find one.

KING: When Virginia Trimble blinked NGC 6809 she marked all known R R Lyrae stars as suspect variables, which was encouraging but it wasn't fair because they're 4 mag brighter than what she was looking for.

LILLER: I don't think I'd pick up anything that bright, because those are really getting blasted out on the plates.

ALCAINO: In regard to your plan for faint photoelectric sequences, I have calibrated sequences down to 20.5 in NGC3201 with the Racine wedge used at the 3.6 m at ESO. With the Racine wedge used with the 1-m Yale at Tololo I have down to 19th in M4 (NGC6121).

LILLER: I would appreciate being sent them just to help me establish where I'm at.

ANON: A main-sequence color-magnitude diagram for M12 is reported in one of the most recent *Soviet Astronomical Circulars*.

LILLER: Oh, good. Does it have numbers, or just say that it was done?

ANON: No - it has a colour magnitude diagram, but no details of the photography are reported.