WHITE DWARF CANDIDATES IN THE GLOBULAR CLUSTER NGC 6752

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Recently (Richer 1978, hereafter Paper I), the results of a search for faint blue objects in and around the globular cluster NGC 6752 were reported. The aim of the program was to isolate a sample of white dwarf candidates in this cluster which could then be studied in further detail. The statistics of this survey are as follows: (1) 68 objects found with $B \leqslant 22.7$ and $(U-B) \leqslant -0.4$ within 20 arcmin of the cluster center; (2) of the 68, 36 also had a measurable V magnitude; (3) of these 36, only 11 lay in the area of the color-color diagram occupied by white dwarfs, while the remaining 25 were generally well above the black body line and are probably QSOs or peculiar blue stellar objects; (4) of these 11, 7 are within 14 arcmin of the cluster center and hence have a probability of greater than 50% of being cluster members (King *et al.* 1968); (5) CTIO 4-m SIT vidicon spectra were obtained of 5 of these 7 candidates, 4 of which appear to be white dwarfs and 1 of which is a QSO with $Z = 2$. Table 1 lists the derived properties of the 4 white dwarfs assuming that they belong to NGC 6752. The star names are from Paper 1.

James E. Hesser (ed.), Star Clusters, 471–475.

Table 1

Observations of White Dwarf Candidates
In NGC 6752

Star	B	U-B	B-V	Sp. Type	M_V	log ($R/R_\odot$)
1	20.36	-1.23	-0.22	DC	7.4	-1.57
2	20.70	-0.72	-0.08	DA	7.6	-1.33
12	21.49	-0.75	0.0:	DA	8.3	-1.44
18	21.67	-0.98	-0.1:	DA	8.6	-1.63
21	21.71	-0.67	+0.21	QSO	-	-

Stars 1 and 18 have properties typical of the very hot white dwarfs discussed by Greenstein and Sargent (1974) and are likely cluster members, particularly as they are so close to the cluster center (4.7 and 7.8 arcmin, respectively), while 2 and 12 are most probably foreground objects. Further details of these observations can be found in Richer (1979).

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DISCUSSION

VAN DEN BERGH: Did you calculate how many foreground field stars one might expect?

RICHER: To do that properly, I think, one clearly needs blank fields at about the same galactic latitude but a couple of degrees away from the cluster. And to answer your question directly, no I do not have plates in blank fields close to the cluster. But certainly that's part of the plan of the program and at some time in the future will be done. Ivan has some numbers - I don't know if you want to mention them or not?

KING: I don't mind mentioning them, since they're in a thesis that is submitted and therefore a matter of public record. I'm afraid I'll misquote them, though. I know that there are three fields totalling 0.3 square degrees in which George Chiu found of the order of a total of half a dozen objects down to a 20th or 21st magnitude where his colours and proper motions convinced him that they were very likely to be white dwarfs.

RICHER: I think that what has to be done is that one just has to get the blank fields and do them close to the cluster and see what the numbers are down to 22nd mag.

VAN DEN BERGH: I tried playing the same game some years ago on NGC 6397, which is the globular cluster with the smallest known distance modulus, on a 4-m CTIO limiting plate pair. I found about two dozen blue objects, but the blue objects had no concentration on the cluster.

RICHER: I think one has to do this with *U* plates. I presume that those were *B* and *V* plates?

VAN DEN BERGH: They were IIIaJ and IIIaF.

FEAST: Can you put us out of our misery about the fifth object?

RICHER: Yes, it was a quasar.

FEAST: Oh, it was a quasar - sorry.

RICHER: I assume that's not a cluster member. (Laughter).

STRAIZYS: In your earlier paper you mention that you find a complete sequence of white dwarves in this cluster?

RICHER: Of blue stellar objects, yes.

STRAIZYS: But they are all non members, I suspect?

RICHER: All that I know at the moment are the numbers I gave you. At that time I didn't have a good B-plate and one didn't have information in a colour-colour diagram. Now I have that information, and there's no doubt that the overwhelming number of objects, by something like 5:1, definitely lie above the blackbody line in the two-colour diagram. So, presumably the overwhelming number of objects again are quasars or other things.

STRAIZYS: And are they over-luminous or not?

RICHER: These objects here - the two which I'm talking about?

STRAIZYS: Yes, they are not all white dwarfs?

RICHER: Presumably, but they are at the bright end of the luminosity sequence of white dwarfs. But then again, one would not find them if they weren't.

RENZINI: The mass you have assumed, $\sim 0.7M_{\odot}$, it's a bit too large to be consistent with other data on globular clusters. It would imply an asymptotic giant branch extension two magnitudes above the red giant tip. Quite a number of red asymptotic giant branch stars should have arisen in globular clusters, which is not the case. Anyway, I think that if you reduce this number to $0.53 \pm 0.01\ M_{\odot}$, you don't change much in your conclusions.

RICHER: No, that was just to get an idea of what log g would be if the mass were what Greenstein likes to use $0.66M_{\odot}$, so I chose $0.70M_{\odot}$. If you make it $0.5M_{\odot}$, you're going to change the log g down by 0.2.

RENZINI: Well, let me add another point, emphasizing the potential importance of the observations of white dwarves in globular clusters. From a theoretical point of view we can pick out quite precisely what the mass of white dwarves being formed now in globular clusters has to be with an uncertainty of only 0.01 or $0.02M_{\odot}$. This means that we know quite precisely which cooling line to use for white dwarves in globular clusters to within a few hundredths of a magnitude. This provides, potentially, the standard candle for the determination of the distance of globular clusters. (Laughter). This is something, perhaps, the space telescope could do.

RICHER: Yes; it's remarkable that one wants to have the standard candle at $M_V \sim +10$, but Ken Freeman told me something yesterday which I thought was even more dramatic than that. He wanted to know which ones were definitely the quasars in and around the field because he could use these as the standards for proper motion studies, which is a great idea, but they're a little faint.

ALCAINO: This is a question to van den Bergh. How deep was your visual search in NGC 6397 and how many blue objects did you encounter?

VAN DEN BERGH: The limiting magnitudes were, I guess, 23½ and 22½; two plates; and the number of objects was about two dozen.

WALLERSTEIN: What's the story on M67 where Baade reported white dwarfs some 20 years ago?

RICHER: I think the answer to that was clear in Rene Racine's paper half a dozen years ago or so, namely that it was an error. I think Rene found two objects in a 10 armin diameter field bluer than $B\text{-}V \sim 0$.

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RACINE: Yes, *UBV* photographic photometry showed no excess of blue objects down to $V \sim 22$. There has been some grism spectra of the area taken by Art Hoag at Kitt Peak, who also fails to find any white dwarfs down to about magnitude 19.

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