WHITE DWARF CANDIDATES FOR TRIGONOMETRICAL PARALLAX DETERMINATIONS

T. J. Moffett

Dept. of Physics, Purdue University

Thomas G. Barnes and David S. Evans

McDonald Obs. and Dept. of Astronomy, Univ. of Texas

ABSTRACT. The visual surface brightness relation is applied to the determination of parallaxes of white dwarfs on the assumption, borne out by previous studies of white dwarfs of known parallax, that these show only a small range of linear diameters.

In a previous paper (Moffett et al. 1978) the visual surface-brightness relation (Barnes et al. 1978) was shown to be applicable to white dwarfs by observation of white dwarfs of known parallax. It was also demonstrated that the photometric system of Eggen and Greenstein could be transformed reliably to that required for the application of the visual surface-brightness relation. In this way, values of the angular diameter ϕ'(in arc ms) can be deduced from the visual surface brightness using

$$\log \phi' = 8.4414 - 0.2V - 2F_v,$$

where $F_v = \log Te + 0.1\ C,$

C being the bolometric correction, tabulated in terms of (V-R) in Barnes et al. (1978).

These circumstances enable us to deduce angular diameter values for the white dwarfs in the lists of Eggen and Eggen and Greenstein. The stars are identified by their EG numbers in the comprehensive list given by Greenstein (1976) which gives other names and coordinates. The list is in order of right ascension, not EG numbers.

The paper of Moffett et al. strongly suggests that white dwarf radii do not scatter much about a mean lying between one and two hundredths of that of the Sun. Note how close the values are to those deduced from the theory of degenerate matter. The adoption of a particular linear radius for a star of given angular diameter determines its parallax. Table I gives the trigonometrical parallaxes deduced for a number of white dwarfs by this method, on a range of assumptions for their linear radii. It will be seen that the following may have parallaxes in excess of 0.1 arc seconds: -- EG Nos 21, 27, 309 and 320 (none of which may be white dwarfs) and EG Nos 111 and 188 (of which the latter

D. S. Hayes et al. (eds.), Calibration of Fundamental Stellar Quantities, 365–368.

may be composite) and 382, 388. On firmer ground the following can be expected to have parallaxes in excess of 0.03 arc seconds: —— EG Nos: 76, 91, 103, 178, 184, 248, 302, 307, 312, 319, 321 (possibly not a white dwarf), 322, 323, 327, 329, 335, 336, 342, 344, 349, 350, 353, 359, 364, 368, 370, 374, 380, 381, 391, or a total of four very close candidates and 30 within some 30 parsecs of the Sun.

REFERENCES

Barnes, T. G., Evans, D. S. and Moffett, T. J. 1978, Mon. Not. R. Astron. Soc., 183, 285.
Greenstein, J. L. 1976, Astron. J., 81, 323.
Moffett, T. J., Barnes, T. G. and Evans, D. S. 1978, Astron. J., 83, 820.

TABLE I

PREDICTED PARALLAXES FOR WHITE DWARFS

EG	Sp	F_v	log ϕ'	p R=.011$R_\odot$ (0".001)	p R=.013$R_\odot$ (0".001)	p R=.015$R_\odot$ (0".001)	Notes
3	DB	4.071	-2.764	17	14	12	
21	sdM	(3.417)	-1.478	325	275	238	3
27	sdM	(3.471)	-1.604	243	206	178	3
31	DA	4.129	-2.632	23	19	17	
63	DB	4.060	-2.810	15	13	11	
72	DA	3.802	-2.544	28	24	20	
76	DA	4.098	-2.362	42	36	31	1
77	DB	3.971	-2.688	20	17	15	
80	DA	4.145	-2.842	14	12	10	
86	DO	(4.295)	-3.074	8	7	6	
91	DB	4.015	-2.420	37	31	27	4
103	DA	4.060	-2.356	43	36	31	
128	DA	3.916	-2.510	30	25	22	
133	DB	4.060	-2.592	25	21	18	
136	DAe	3.920	-2.472	33	28	24	4
154	DA-F	3.905	-2.608	24	20	18	
178	DA-F	(3.781)	-2.424	37	31	27	
184	DA	4.129	-2.310	48	40	35	1
185	DA	4.098	-2.544	28	24	20	
193	DB	4.084	-2.662	21	18	16	
198	DA	3.994	-2.722	19	16	13	2
248	DC2p	3.802	-2.068	83	71	61	
267	DC	(4.377)	-3.218	6	5	4	
272	DB	3.912	-2.572	26	22	19	
297	DA	4.071	-2.750	17	15	13	
302	DA-F	3.836	-2.374	41	35	30	
303	DA	4.198	-2.896	12	11	9	
304	DAwk	(4.216)	-2.908	12	10	9	

https://doi.org/10.1017/S0074180900078979 Published online by Cambridge University Press

TABLE I cont'd

EG	Sp	F_v	log ϕ'	p R=.011$R_\odot$ (0".001)	p R=.013$R_\odot$ (0".001)	p R=.015$R_\odot$ (0".001)	Notes
305	DB	4.060	-2.548	28	23	20	
307	DC	3.844	-2.244	56	47	40	
308	DA	4.198	-2.576	26	22	19	
309	sdB	3.916	-1.860	134	114	99	1,3
310	DA	4.198	-2.844	14	12	10	
311	DA	4.036	-2.616	24	20	17	
312	DA	3.900	-2.328	46	39	34	
314	DA	4.129	-2.572	26	22	19	
315	DB	4.036	-2.620	23	20	17	
317	DA	3.889	-2.536	28	24	21	
318	DA	3.961	-2.686	20	17	15	
319	DA	3.864	-2.224	58	49	43	
320	RSL	(3.664)	-1.774	164	139	121	3
321	DC-K	(3.639)	-2.112	75	64	55	3
322	DC	3.910	-2.400	39	33	29	
323	DA	3.840	-2.388	40	34	29	
325	DC	3.941	-2.636	23	19	17	2
326	DA	4.145	-3.140	7	6	5	
327	DC	3.818	-2.436	36	30	26	
328	DAs	3.886	-2.632	23	19	17	
329	DC	3.860	-2.298	49	42	36	
330	DC-F	(3.775)	-2.532	29	24	21	
331	DA	4.060	-2.712	19	16	14	
332	DA	4.129	-2.856	14	11	10	
333	DXp	4.071	-2.666	21	18	15	
335	DC	3.920	-2.426	37	31	27	
336	DA	3.924	-2.032	91	77	67	
341	DA	3.910	-2.514	30	25	22	
342	DA-F	(3.750)	-2.392	40	33	29	
343	DA	3.947	-2.586	25	21	19	2
344	DC	3.808	-2.316	47	40	35	
347	DA	4.162	-3.094	8	7	6	
348	DAp	4.060	-2.808	15	13	11	
349	DC	(3.611)	-2.186	64	54	47	
350	DA	3.823	-2.146	70	59	51	
351	DA	3.902	-2.752	17	15	13	
352	DA	4.015	-2.668	21	18	15	
353	DC-G	(3.652)	-2.148	69	59	51	
354	DA	4.005	-2.790	16	13	12	
355	DA	3.941	-2.659	21	18	16	
356	DC	(3.787)	-2.558	27	23	20	
357	DA	4.036	-2.932	11	10	8	
358	DF	(3.775)	-2.460	34	29	25	
359	DB+M	3.848	-2.058	85	72	63	4
361	DC	3.902	-2.762	17	14	12	

https://doi.org/10.1017/S0074180900078979 Published online by Cambridge University Press

TABLE I cont'd

EG	Sp	F_V	log ϕ'	p $R=.011R_\odot$ $(0''.001)^\odot$	p $R=.013R_\odot$ $(0''.001)^\odot$	p $R=.015R_\odot$ $(0''.001)^\odot$	Notes
362	DF-C	3.814	-2.596	25	21	18	
363	DA+K	3.961	-2.712	19	16	14	
364	DA	3.941	-2.392	40	33	29	
365	DA	3.875	-2.480	32	27	24	
366	DC	3.879	-2.682	20	17	15	
367	DC-F	3.910	-2.688	20	17	15	
368	DA	4.015	-2.030	91	77	67	1
370	DA	4.036	-2.294	50	42	36	
373	DA-F	3.836	-2.518	30	25	22	
374	DXp	3.802	-2.278	51	43	38	
376	DA	4.113	-3.036	9	8	7	
378	DA	4.275	-2.574	26	22	19	1
379	DC	3.947	-2.842	14	12	10	
380	DAwk	(3.698)	-2.368	42	35	31	2
381	DA-F	3.802	-2.064	84	71	62	
382	DK-G	(3.664)	-1.870	132	111	97	
383	DB	3.961	-2.718	19	16	14	
384	DB	4.010	-2.684	20	17	15	
386	DB	3.994	-2.470	33	28	24	
387	DB	3.924	-2.572	26	22	19	
388	DC+M	(3.475)	-1.644	222	188	163	4
389	DBe	3.889	-2.542	28	24	21	4
391	DG	3.814	-2.404	39	33	28	
392	DC	3.848	-2.544	28	24	20	
393	DB	4.024	-2.572	26	22	19	
394	DA	3.941	-2.476	33	28	24	
395	DA	3.977	-2.804	15	13	11	
396	DA	3.920	-2.578	26	22	19	
397	DA	(4.216)	-2.668	21	17	15	
398	DC	3.907	-2.524	29	25	21	
399	DO?	(4.234)	-2.648	22	19	16	
400	DA	4.071	-2.938	11	9	8	
401	DA	4.005	-2.628	23	19	17	
402	DA	4.113	-2.828	15	12	11	
403	DA	4.084	-2.908	12	10	9	
404	DA	3.941	-2.692	20	17	15	
405	DA	3.941	-2.668	21	18	15	

NOTES TO TABLE I

1 - Our photometry used.
2 - Greenstein's (1976) photometry uncertain.
3 - Possibly not a white dwarf.
4 - Composite.

https://doi.org/10.1017/S0074180900078979 Published online by Cambridge University Press