A SEARCH FOR DELTA SCUTI STARS†

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Introduction. The δ Scuti stars are variable stars of spectral type A and F with short periods (0.5 to 5 hours) and small ranges in light and radial velocity. In 1968, the author began a photometric search, among a sample of nearby A and F stars, for more such stars. The purpose was not simply to discover large numbers of δ Scuti stars but to discover δ Scuti stars which were "interesting" in the sense that their distance or mass was known. The sample of stars observed was consequently not a complete or homogeneous sample. It contained about 70 stars which had as many as possible of the following properties: (i) known trigonometric parallax; (ii) known visual or spectroscopic binary orbit; (iii) suspected variability; (iv) spectral type A or F; (v) suitable comparison stars.

Shortly after the observing list was compiled, I became aware of similar searches conducted by Breger (1969a) and Millis (1967). I then dropped from my list 19 stars which were being observed by Breger or Millis. Of these stars dropped, 14 were found by Breger or Millis to be constant, 3 were probably constant and 2 were δ Scuti stars. The final list of 51 stars is given in Table I.

Observations. The photometric observations were made either at Kitt Peak National Observatory using a 41-cm telescope or at the David Dunlap Observatory using a 48-cm telescope. The instrumentation and observing procedure have been described elsewhere (Percy 1969, 1970). A standard *B* filter was used, and observations were corrected for differential atmospheric extinction.

Results. The results of the search are presented in Table I, which gives the comparison stars used, the spectral type (Hoffleit 1964), the observed light range (Δm) or upper limit thereof, the number of observations (N), the time interval (Δt) over which the observations were made, and any remarks (Hoffleit 1964). Stars marked with an asterisk were suspected of variability and are described further in Table II. These stars should not be considered variable stars until their behaviour has been confirmed by independent ob-

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TABLE I

RESULTS OF A SEARCH FOR DELTA SCUTI STARS

Star HR	Comparison HR		Spectral Type	Δm	N	Δt hr	Remarks
0647	0673	0679	F5V	≦0.016	10	4.5	π,vb
1077	1033	1094	dF4	≦0.015	10	4.5	vb
1210	1160	1207	F5IV	≦0.010	10	4.7	π, sb
1218	1185	1221	dF3	≦0.012	12	4.5	π
1279	1284	1319	dF2	≦0.013	12	4.5	var?
1309	1254	1381	F3V	≦0.012	12	4.5	π, vb
1782	1781	1800	dF7	≦0.016	12	4.6	vb
1967	1918	1933	dF6	≦0.018	9	2.8	vb, sb?
2264	2172	2402	F5III	≦0.008	14	2.5	π, sb
2485/6	2172	2402	dF6/5	≦0.011	14	2.5	π
2711	2605	2669	dF6	≦0.013	11	2.7	vb
2846	2837		F5IV–V	≦0.009	10	2.7	π, sb
3098	2989*	3059	dF6	≦0.010	10	6.0	vb
3312/3*	3268	3329*	dF1/6	≦0.02	16	4.0	vb, var?
3616	3771		F7IV–V	≦0.009	12	2.2	π, vb, var?
3697	3725	3778	dF3	≦0.015	13	3.0	π
3701	3586	3727	dF3/2	≦0.012	10	2.2	vb
3754	3689	3755	dF8	≦0.015	10	2.5	π, vb
3775	3662*	3799	F6IV	≦0.014	7	2.8	π, vb
4039	4012	4030	dF3	≦0.012	10	2.5	π
4437	4341	4456	dF7	≦0.018	12	3.5	π
4439	4286	4421	F6V	≦0.015	18	3.8	π, vb
4825	4540	5107	F0V	≦0.008	5	4.0	π, vb, var?
4931	4760	5062	F2V	≦0.015	13	4.5	π, vb, var?
4968	5072	5144	F5V	≦0.015	13	3.9	π, vb, var?
5127	5025	5110	A7III	≦0.015	18	4.0	π, vb
5138	5129	5220	A6n	≦0.017	18	4.0	vb, var?
5304	5255	5387*	F8IV	≦0.014	18	4.0	π
5492*	5437	5608*	F2IV	0.029	13	5.0	π, var?
5933	5842	5867	F6IV–V	≦0.018	14	3.5	π
5977/8	5780	6031	F5IV	≦0.016	14	3.5	π, vb, sb?
5986	5886	6237	F8IV–V	≦0.016	12	2.5	π
6063/4	5968	5983	dF6/G1	≦0.011	14	3.5	π, vb, sb, var?
6369/0	6395	6618	dF6/dF6	≦0.006	12	2.2	π, vb
6701	6636	6637	F6IV–V	≦0.014	8	5.0	π
6636	6637	6701	F5IV–V	≦0.014	8	5.0	π
6733/4	6601	6755	F2/F2	≦0.010	8	3.5	π, vb, var?
6775	6707	6917	F7V	≦0.020	9	3.0	π, vb
6795*	6797	6873	F2	≦0.015	23	7.0	π, vb
7172	7167	7173	F8IV	≦0.017	14	3.0	π, var?
7377	7167	7173	F0IV	≦0.011	12	3.9	π, sb, var?
7389	7331*	7332	F6III	≦0.01:	6	3.0	π
7550	7512	7529	F5	≦0.010	20	3.2	vb
7882	7871		F5IV	≦0.011	5	2.4	π
8034	8038		F5IV	≦0.010	15	3.5	π, vb
8123	8012		F7V	≦0.008	15	3.5	π, vb, sb
8309/0	8315		F6V/dF3	≦0.010	11	2.5	π, vb
8548	8513	8514	dF5	≦0.011	13	2.5	π, vb
8697	8665	8717	F7IV	≦0.010	15	3.0	π
8825	8768		F5IV	≦0.009	6	2.0	π
8880*	8905	8915	A5IV	0.020	8	2.0	π

An asterisk indicates that the star is a suspected variable and is described in Table II. Remarks: π (a reasonably accurate trigonometric parallax is known), vb (visual binary), sb (spectroscopic binary), var? (suspected variable according to Hoffleit (1964)).

TABLE II

SUSPECTED VARIABLE STARS

Star HR	Spectral Type	Remarks
2989	F0	Variable; δ Scuti star (Percy 1971)
3312/3	dF1/F6	One of these is a possible variable;
3329	A5	$\Delta m \sim 0^m.02$; period $\sim 2^h.5$
3662	A5	Possible variable; $\Delta m \sim 0^m.03$; period $\sim 3^h.0$
5387	F2	Considerable scatter. Found constant by Breger (1969a).
5492	F2IV	Probably variable; $\Delta m \sim 0^m.03$; period $\sim 3^h$ or 7^h
5608	A2	Considerable scatter.
6795	F2	Possibly variable; $\Delta m < 0^m.015$; period $\geqq 4^h$
7331	F0	Variable; δ Scuti star (Breger 1969a). Present search gives $\Delta m \sim 0^m.08$ and period $\sim 4^h$ confirming Breger's result.
8880	A5IV	Possible variable. Found constant by Breger (1969a).

servations; this is a rule which should be applied to *all* small-amplitude variable stars.

Discussion and Conclusions. Less than 10 per cent of the stars observed are variable or suspected variable stars. The rest are constant in light over a period of a few hours. Breger (1969b) has found that the δ Scuti stars are confined to a narrow region in the HR diagram between spectral types A3 and F3. Most of the stars in Table I have spectral types later than F3. This explains, to a large extent, the small proportion of variable stars found in the present search. All of the suspected variable stars in Table II have spectral types earlier than F3. Thus the results of this search strongly support the conclusion of Breger (1969b) that the δ Scuti instability strip terminates abruptly, at the cool side, at spectral type F3.

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