

Pisgah Astronomical Research Institute



2009

The HR Diagram: A Laboratory Exercise

The HR Diagram Lab gives students the opportunity to construct an HR Diagram based on their own classifications of 119 stars.

This lab has four documents:

A document with a list of 119 stars with spectral classifications

A document with a list of 119 stars without spectral classifications

A blank graph page to plot the HR Diagram

A document with spectral types and absolute magnitudes of standard stars

A document with complete catalog information on the 119 stars

I. THE SPECTRA OF STARS: TEACHER COPY

Table 1 lists over 100 stars that can be observed with SCOPE and classified. Log into SCOPE and select the plate listed in column 1 of the table. Then, pick one of the stars. Note the name of star, and locate it in Table 1, where you will record your classification of the star. Complete as many of the stars as you can.

Once you're done classifying as many stars as you can, let's find out how many stars of each spectral type you've classified. Fill in the table below.

Spectral Type	O	B	A	F	G	K	M
Number of Stars	0 (0%)	38 (33%)	29 (25%)	12 (10%)	15 (14%)	15 (13%)	6 (5%)

Question: What is going on? Are there equal numbers of each spectral type? To answer this question, let's build a Hertzsprung-Russell Diagram.

Table 1. Stars to Classify from Their Spectra as observed with SCOPE

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
Vela BC	HD72648	-1.54		B1/B2 I
	HD72919	-1.33		B8/B9V
	HD72876	2.43		K2
	HD73568	-7.42		B0.5III
	HD73153	0.14		B9V
	HD73010	-1.82		B5V
	HD72675	3.28		A3
	HD73477	2.48		G0
	HD73367			F0

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD73326	-0.20		B5
	HD72817	1.88		A0
	HD73739	-7.40		Ma
	HD72900	-2.56		K3III
	HD72752	-0.03		K2III
	V* T Vel	-3.36		G0II
	HD73461	1.49		A6V
	HD73244	0.49		K5
	HD72800	-7.51		B9I
	HD73478	-2.46		B3IV
	HD73220	1.41		F8
	HD72939			B5
	HD73608	6.80		A2
	HD72286			A0
	HD72975			F2
	HD72349	2.68		G0

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD72555	-1.22		B2.5V
Vela AL	HD72179	1.68		B8
	HD71470	0.48		B8III
	HD71787			B9IV
	CD-44 4392	4.79		B2IVe
	HD72232	-0.55		B7IV
	HD71743			B9
	HD71444	0.78		B5IV
	HD72351			A0
	HD72140	4.12		B8
	HD71984	-0.40		B8/B9V
	HD72017	2.08		G8/K0III
	HD71509	-4.07		B9
	HD72253	-0.15		B8V
	HD72090	-1.27		B6V
HD71587	1.87		F2V	

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD71218	3.62		B9
	HD71237			B9
	HD71125			A8/A9V
Vela MA	HD70872	0.39		B9V
	HD70781	5.70		G0V
	HD70506	-0.79		B6V
	HD69883	-0.06		B8IV
	HD70717	0.67		K1III
	HD70218	0.33		A5V
	HD69931	4.69		F5
	HD70850	4.11		B9
	HD70967	5.22		G0
	HD70507	0.28		Ap...
	HD70142			A7V
	V* IT Vel	-0.87		B7III
	HD70766			B9

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD70729	4.99		K1/K2III
	HD70238	-4.62		A0
	CD-48 3728			A2
	HD70799	1.46		G5
	HD69729	-1.01		G8III
	HD69781	4.95		G5
	HD69822	3.92		B9
	HD69762	2.50		K0
	HD69650	1.34		A4IV
Vela SK	HD68805			B8
	V* Al Vel	1.64		A3IV
	HD68322			B8
	HD68786	4.93		A0
	HD68604	1.55		G5
	HD69130a	5.92		F2
	HD69404	-1.55		B3V

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD69109	7.45		A3IV
	V* AH Vel	-2.28		F7p
	HD68555			B8
	V* BN Vel			M
	HD68966	4.20		K2
	HD68419	1.13		A2
	HD68187			M3III
	HD68157	4.74		B9
	HD68092	-1.00		B8
Hydra-2 BC	HD97663	1.01		K0III
	HD97877	5.12		F0
	HD97864	2.08		A3V
	HD97717	5.04		F5
	HD98019	0.66		K0III
	HD97751	2.00		K0III
	HD97573	2.40		A6V

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD97342	4.30		G3/G5V
	HD97309	1.95		A1m...
	HD97444			K0
	HD97426	6.42		A0
	HD97505	1.13		M2III
Hydra-2 AL	HD96745			F0
	HD96838	-0.19		A0/A1V
	HD96800	0.93		G8III/IV
	HD96874	0.71		B9V
	HD96766	7.11		Ma
	HD96403	1.73		A1V
Hydra-2 MA	HD96030	2.47		F6V
	HD96276	4.31		G1V
	HD96050	2.31		F2/F3V
	HD95680	1.43		K0/K1III
	HD95425	6.84		K0

I. THE SPECTRA OF STARS: TEACHER COPY

Plate	HD	M_v	Spectral Type	Catalog Spectral Type
	HD95562	1.51		A2 / A6-A9
Hydra-2 SK	HD95282	1.96		A2/A3 II/III
	HD95190**	2.07		A5V
	HD94838	4.80		G3V
	HD95384	-4.94		M7/8III
	HD95194			A0
	HD95145	0.94		K0III
	HD95580	2.72		G0V
	HD95315			G5
	HD95158			A5
	HD94839	1.53		A5V

** *HD95190 is actually HD95180*

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Vela BC	HD72648	-1.54	
	HD72919	-1.33	
	HD72876	2.43	
	HD73568	-7.42	
	HD73153	0.14	
	HD73010	-1.82	
	HD72675	3.28	
	HD73477	2.48	
	HD73367		

I. THE SPECTRA OF STARS

Plate	HD	M_v	Spectral Type
	HD73326	-0.20	
	HD72817	1.88	
	HD73739	-7.40	
	HD72900	-2.56	
	HD72752	-0.03	
	V* T Vel	-3.36	
	HD73461	1.49	
	HD73244	0.49	
	HD72800	-7.51	
	HD73478	-2.46	
	HD73220	1.41	
	HD72939		
	HD73608	6.80	
	HD72286		
	HD72975		
	HD72349	2.68	

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Plate	HD	M_v	Spectral Type
	HD72555	-1.22	
Vela AL	HD72179	1.68	
	HD71470	0.48	
	HD71787		
	CD-44 4392	4.79	
	HD72232	-0.55	
	HD71743		
	HD71444	0.78	
	HD72351		
	HD72140	4.12	
	HD71984	-0.40	
	HD72017	2.08	
	HD71509	-4.07	
	HD72253	-0.15	
	HD72090	-1.27	
	HD71587	1.87	

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Plate	HD	M_v	Spectral Type
	HD71218	3.62	
	HD71237		
	HD71125		
Vela MA	HD70872	0.39	
	HD70781	5.70	
	HD70506	-0.79	
	HD69883	-0.06	
	HD70717	0.67	
	HD70218	0.33	
	HD69931	4.69	
	HD70850	4.11	
	HD70967	5.22	
	HD70507	0.28	
	HD70142		
	V* IT Vel	-0.87	
	HD70766		

I. THE SPECTRA OF STARS

Plate	HD	M_v	Spectral Type
	HD70729	4.99	
	HD70238	-4.62	
	CD-48 3728		
	HD70799	1.46	
	HD69729	-1.01	
	HD69781	4.95	
	HD69822	3.92	
	HD69762	2.50	
	HD69650	1.34	
Vela SK	HD68805		
	V* Al Vel	1.64	
	HD68322		
	HD68786	4.93	
	HD68604	1.55	
	HD69130a	5.92	
	HD69404	-1.55	

I. THE SPECTRA OF STARS

Plate	HD	M_V	Spectral Type
	HD69109	7.45	
	V* AH Vel	-2.28	
	HD68555		
	V* BN Vel		
	HD68966	4.20	
	HD68419	1.13	
	HD68187		
	HD68157	4.74	
	HD68092	-1.00	
Hydra-2 BC	HD97663	1.01	
	HD97877	5.12	
	HD97864	2.08	
	HD97717	5.04	
	HD98019	0.66	
	HD97751	2.00	
	HD97573	2.40	

I. THE SPECTRA OF STARS

Plate	HD	M_v	Spectral Type
	HD97342	4.30	
	HD97309	1.95	
	HD97444		
	HD97426	6.42	
	HD97505	1.13	
Hydra-2 AL	HD96745		
	HD96838	-0.19	
	HD96800	0.93	
	HD96874	0.71	
	HD96766	7.11	
	HD96403	1.73	
Hydra-2 MA	HD96030	2.47	
	HD96276	4.31	
	HD96050	2.31	
	HD95680	1.43	
	HD95425	6.84	

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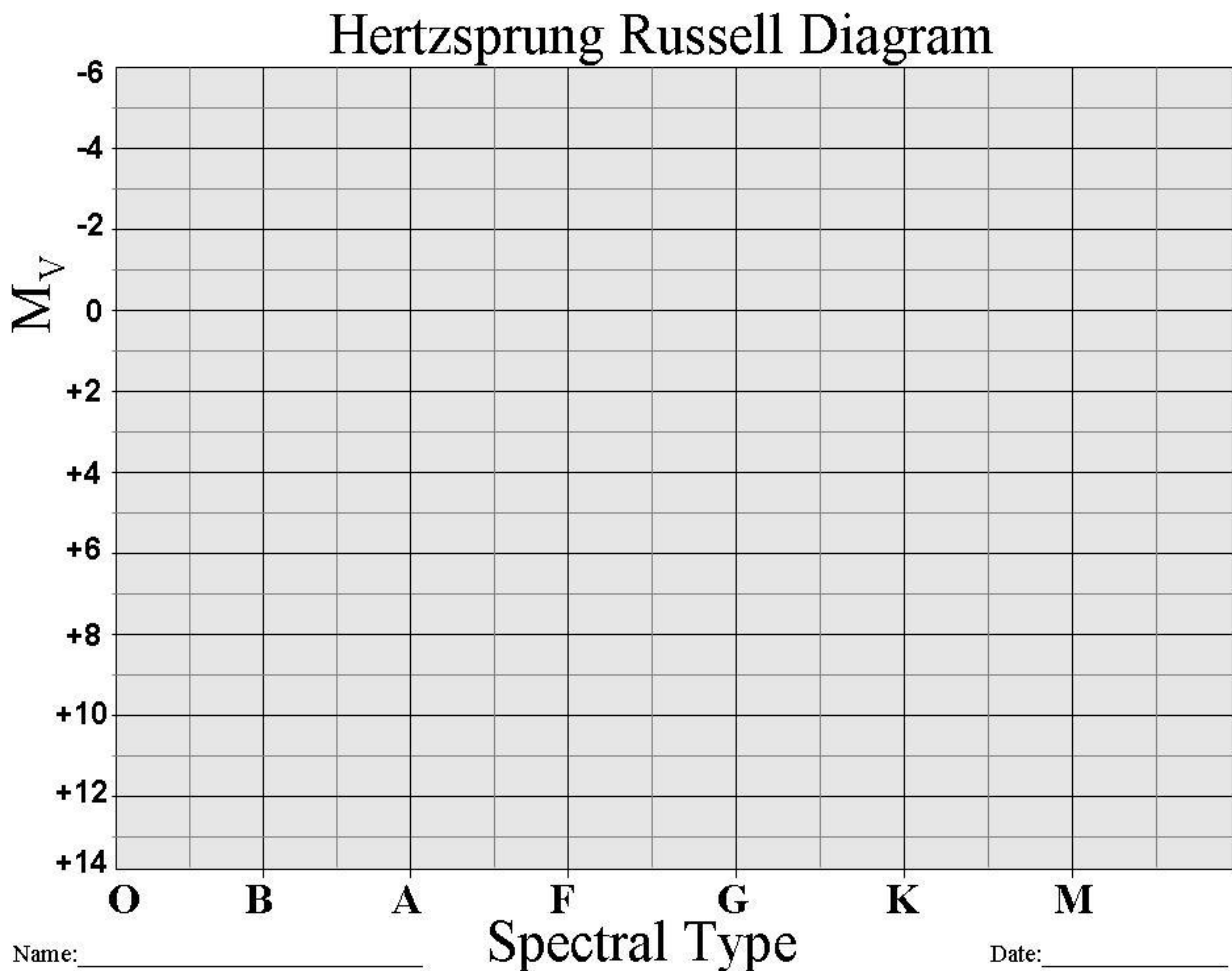
Plate	HD	M_V	Spectral Type
	HD95562	1.51	
Hydra-2 SK	HD95282	1.96	
	HD95190**	2.07	
	HD94838	4.80	
	HD95384	-4.94	
	HD95194		
	HD95145	0.94	
	HD95580	2.72	
	HD95315		
	HD95158		
	HD94839	1.53	

** *HD95190 is actually HD95180*

II. THE HERTZSPRUNG RUSSELL DIAGRAM

Once you have completed the classification of stars you observed with SCOPE, you can explore the natures of the stars by plotting the stars on the Hertzsprung Russell (HR) Diagram. You noticed that there is a larger number of G, K, and M stars, than O, B, and F.

Table 1 lists the Absolute Magnitudes (M_V) of the stars. Use those magnitudes and your classifications to plot on the graph below the Spectral Type versus the Absolute Magnitude. You will begin to notice the same thing astronomers notice – stars are not random, but are located in specific areas of the graph. What produces this trend? The answer gives us important clues to the masses, energies, and life cycles of stars.



III. The Nature of Stars.

Star	Spectral Type	Absolute Magnitude	Temperature (K)	Luminosity (x Sun)	Mass (x Sun)
Sun	G2V	4.8	6,000	1	1
Vega	A0V	0.6	9,600	79	2.1
Altair	A7V	2.3	8,000	6.3	2.0
Sirius	A1V	1.4	9,900	32	2.8
Arcturus	K2III	-0.2	4,100	100	4.5
Capella	G8	-0.6	5,200	0.6	0.8
Procyon	F5V	2.6	6,580	2.5	1.3
Aldeberan	K5III	-0.7	3,800	200	5.0
Spica	B1V	-3.2	25,000	1,000	15.8
Castor	A1	0.8	9,900	32	2.8
Antares	M1 I	-4.7	3,000	31,600	17.8

Plot the stars listed above on your HR Diagram. Look at the masses, temperatures, and luminosities. What trend do you notice in each of these stellar properties as a function of spectral type?

Now, go back to the stars you classified. How many are more massive than the Sun? How many are less massive? In the same way, compare the luminosities and temperatures of your stars to the Sun.

Summary: You can determine the basic properties of stars simply by looking at their spectra! Spectroscopy is an extremely powerful tool for astronomers.

COMPLETE STAR CATALOG

Star	_r arcsec	_RAJ2000 "h:m:s"	_DEJ2000 "d:m:s"	RAJ2000 deg	DEJ2000 deg	Plx mas	e_ mas	pmRA mas/yr	pmDE mas/yr	Bmag mag	Vmag mag	SpType	TYC1	TYC2	TYC3	(B-V)	Distance Parsecs	Mv	
HD72648	0.0650	08 32 18.99	-43 55 53.4	128.08	-43.93	1.45	0.66	-4.59	3.76	7.726	7.649	B1/B2Ib	7674	3286	1	0.077	690	-1.54	1
HD72919	0.0920	08 33 42.61	-44 56 45.8	128.43	-44.95	1.44	0.73	-6.18	7.59	7.825	7.874	B8/B9V	7674	1323	1	-0.049	694	-1.33	2
HD72876	0.0880	08 33 32.53	-45 00 10.0	128.39	-45.00	6.90	7.69	5.85	5.13	9.413	8.237	K2	8150	4795	1	1.176	145	2.43	3
HD73568	0.0008	08 37 19.48	-45 12 26.0	129.33	-45.21	0.07	0.76	-3.04	4.16	8.617	8.351	B0.5III	8150	363	1	0.266	14285.7	-7.42	4
HD73153	0.0013	08 35 07.42	-45 13 44.2	128.78	-45.23	1.50	1.77	-4.25	7.67	9.262	9.257	B9V	8150	942	1	0.005	667	0.14	5
HD73010	0.0020	08 34 11.12	-45 38 11.7	128.55	-45.64	1.35	0.63	-11.59	7.18	7.409	7.530	B5V	8150	4790	1	-0.121	741	-1.82	6
HD72675	0.0038	08 32 23.40	-45 47 06.6	128.10	-45.79	10.60	4.90	-20.03	10.17	8.387	8.156	A3	8150	4193	1	0.231	94	3.28	7
HD73477	0.0088	08 36 50.44	-46 19 21.4	129.21	-46.32	6.19	5.80	-20.16	56.18	9.068	8.523	G0	8150	457	1	0.545	162	2.48	8
HD73367	0.0029	08 36 15.42	-46 40 30.2	129.06	-46.68	-37.29	10.10	-13.62	15.06	9.728	9.39	F0	8150	181	1	0.338	0		9
HD73326	0.0011	08 36 02.24	-46 30 05.9	129.01	-46.50	3.20	3.20	-4.25	4.97	7.239	7.271	B5	8150	591	1	-0.032	313	-0.20	10
HD72817	0.0003	08 33 06.73	-46 27 18.2	128.28	-46.46	3.20	9.30	-4.86	7.03	9.441	9.356	A0	8150	3996	1	0.085	313	1.88	11
HD73739	0.0013	08 38 00.91	-46 54 15.4	129.50	-46.90	0.10	4.59	10.42	8.98	9.031	7.605	Ma	8155	343	1	1.426	10000	-7.40	12
HD72900	0.0008	08 33 30.27	-46 58 14.4	128.38	-46.97	1.74	0.55	-2.79	5.38	7.806	6.236	K3III	8154	947	1	1.570	575	-2.56	13
HD72752	0.1430	08 32 40.50	-47 02 31.6	128.17	-47.04	4.98	0.56	-13.33	9.36	7.811	6.483	K2III	8154	2315	1	1.328	201	-0.03	14
V* T Vel	0.0650	08 37 40.83	-47 21 43.1	129.42	-47.36	0.52	0.72	-5.88	3.18	8.949	8.063	G0II	8155	2477	1	0.886	1923	-3.36	15
HD73461	0.0510	08 36 41.01	-47 29 59.7	129.17	-47.50	5.95	1.13	0.93	-12.97	7.913	7.615	A6V	8154	70	1	0.298	168	1.49	16
HD73244	0.0018	08 35 26.46	-47 34 17.5	128.86	-47.57	4.90	3.5	0.62	11.05	8.447	7.043	K5	8154	2427	1	1.404	204	0.49	17
HD72800	0.0010	08 32 53.78	-47 36 19.9	128.22	-47.61	0.1500	0.55	-4.92	4.94	6.72	6.609	B9Iab:	8154	4904	1	0.111	6667	-7.51	18
HD73478	0.0019	08 36 42.75	-47 59 54.2	129.18	-48.00	1.08	0.61	-9.85	10.42	7.276	7.371	B3IV	8154	6179	1	-0.095	926	-2.46	19
HD73220	0.0128	08 35 14.38	-47 57 35.6	128.81	-47.96	4.40	4.8	-51.32	69.42	8.684	8.197	F8	8154	412	1	0.487	227	1.41	20
HD72939	0.0007	08 33 32.75	-47 53 39.2	128.39	-47.89	-15.10	10.3	-4.58	5.1	9.49	9.466	B5	8154	2782	1	0.024	0		21
HD73608	0.0018	08 37 14.45	-48 30 31.4	129.31	-48.51	24.29	12	-7.16	4.99	9.967	9.872	A2	8154	6533	1	0.095	41	6.80	22
HD72286	0.0019	08 30 13.02	-43 12 12.8	127.55	-43.20	-26.50	17.1	-8.57	11.56	10.14	9.976	A0	7674	76	1	0.165	0		23
HD72975	0.0042	08 33 47.40	-48 29 32.9	128.45	-48.49	-3.50	5.4	13.71	-27.05	8.736	8.25	F2	8154	6722	1	0.486	0		24
HD72349	0.0069	08 30 32.50	-43 56 23.9	127.64	-43.94	5.00	11	-39.56	23.16	9.72	9.186	G0	7674	2900	1	0.534	200	2.68	25
HD72555	0.0015	08 31 39.65	-47 14 27.7	127.92	-47.24	2.53	0.56	-5.63	7.04	6.634	6.769	B2.5V	8154	4334	1	-0.135	395	-1.22	26
HD72179	0.0017	08 29 37.74	-44 05 58.0	127.41	-44.10	5.00	4.69	-10.23	1.72	8.074	8.182	B8	7673	711	1	-0.108	200	1.68	27
HD71470	0.0014	08 25 58.95	-44 01 20.0	126.50	-44.02	2.68	0.81	-3.99	7.14	8.265	8.335	B8III	7673	1647	1	-0.070	373	0.48	28
HD71787	0.0007	08 27 30.03	-44 37 14.7	126.88	-44.62	-0.27	0.77	-4.81	2.07	8.281	8.233	B9IV	7673	2928	1	0.048	0		29
CD-44 439	0.0094	08 25 17.80	-45 09 45.5	126.32	-45.16	12.89	8.89	-2.5	2.36	9.409	9.238		8149	3059	1	0.171	78	4.79	30
HD72232	0.0042	08 29 45.63	-46 19 54.1	127.44	-46.33	4.95	0.52	-25.61	14.66	5.854	5.975	B7IV	8150	3065	1	-0.121	202	-0.55	31
HD71743	0.0007	08 27 05.36	-46 30 32.5	126.77	-46.51	-1.10	10.1	-4.32	7.2	9.502	9.476	B9	8150	4751	1	0.026	0		32
HD71444	0.0012	08 25 30.51	-46 38 03.3	126.38	-46.63	2.68	1.19	-6.01	3.99	8.579	8.636	B5IV	8149	2113	1	-0.057	373	0.78	33
HD72351	0.0007	08 30 24.69	-47 00 47.0	127.60	-47.01	-10.39	12.6	-4.68	3.99	9.805	9.691	A0	8154	1472	1	0.114	0		34
HD72140	0.0009	08 29 20.80	-46 53 36.9	127.34	-46.89	8.1	10.2	-7.11	6.67	9.574	9.582	B8	8154	833	1	-0.008	123	4.12	35
HD71984	0.0012	08 28 24.51	-46 57 18.6	127.10	-46.96	1.93	0.68	-5.31	6.51	8.139	8.169	B8/B9V	8154	6910	1	-0.030	518	-0.40	36
HD72017	0.0065	08 28 31.87	-47 26 20.9	127.13	-47.44	4.86	0.83	-23.36	35.49	9.674	8.642	G8/K0III	8154	3678	1	1.032	206	2.08	37
HD71509	0.0009	08 25 52.17	-47 45 44.3	126.47	-47.76	0.2	9.1	-7.45	4.07	9.459	9.424	B9	8153	2406	1	0.035	5000	-4.07	38
HD72253	0.0018	08 29 43.62	-48 01 34.6	127.43	-48.03	2.67	0.62	-9.51	7.38	7.679	7.722	B8V	8154	2374	1	-0.043	375	-0.15	39
HD72090	0.0014	08 28 52.24	-48 11 25.6	127.22	-48.19	1.5	1.25	-6.05	8.3	7.81	7.847	B6V	8154	4665	1	-0.037	667	-1.27	40
HD71587	0.0096	08 26 07.88	-48 25 54.9	126.53	-48.43	7.48	0.61	-28.47	60.09	7.854	7.504	F2V	8153	4394	1	0.350	134	1.87	41
HD71218	0.0012	08 24 24.19	-44 25 01.4	126.10	-44.42	7.3	10	-4.24	2.55	9.379	9.301	B9	7673	1771	1	0.078	137	3.62	42

Star	_r arcsec	_RAJ2000 "h:m:s"	_DEJ2000 "d:m:s"	RAJ2000 deg	DEJ2000 deg	Plx mas	e_ mas	pmRA mas/yr	pmDE mas/yr	Bmag mag	Vmag mag	SpType	TYC1	TYC2	TYC3	(B-V)	Distance Parsecs	Mv
HD71237	0.0008	08 24 16.55	-46 59 10.1	126.07	-46.99	-3.29	9.39	-2.81	4.41	9.495	9.455	B9	8153	2855	1	0.040	0	
HD71125	0.0034	08 23 34.37	-48 13 56.3	125.89	-48.23	-1.1	15.3	-19.05	-4.7	10.22	9.836		8153	2204	1	0.382	0	
HD70872	0.0020	08 22 36.36	-44 11 09.6	125.65	-44.19	2.8	0.75	-8.89	10.12	8.134	8.159	B9V	7673	2273	1	-0.025	357	0.39
HD70781	0.3710	08 22 05.42	-44 18 56.1	125.52	-44.32	19.1	10.8	-39.31	9.65	9.927	9.292		7673	2359	1	0.635	52	5.70
HD70506	0.0022	08 20 34.56	-44 15 18.0	125.14	-44.26	2.49	0.62	-13.68	2.77	7.113	7.23	B6V	7673	2073	1	-0.117	402	-0.79
HD69883	0.0016	08 17 11.46	-44 40 00.4	124.30	-44.67	1.61	0.82	-8.15	8.93	8.865	8.908	B8IV	7672	3668	1	-0.043	621	-0.06
HD70717	0.0029	08 21 38.59	-45 00 10.4	125.41	-45.00	3.62	0.69	13.87	12.25	8.938	7.879	K1III	8149	184	1	1.059	276	0.67
HD70218	0.0015	08 18 54.03	-45 02 10.5	124.73	-45.04	2.44	1.4	-4.84	8.74	8.425	8.389	A5V+...	8149	5195	1	0.036	410	0.33
HD69931	0.0039	08 17 22.45	-45 11 17.4	124.34	-45.19	15.5	7	-22.76	8.58	9.221	8.741	F5	8149	3335	1	0.480	65	4.69
HD70850	0.0011	08 22 21.73	-45 47 55.7	125.59	-45.80	12.6	5.3	-4.22	1.96	8.575	8.609	B9	8149	963	1	-0.034	79	4.11
HD70967	0.0022	08 22 49.47	-47 05 42.5	125.71	-47.10	16.89	9	-7.41	-9.53	9.648	9.081	G0	8153	3383	1	0.567	59	5.22
HD70507	0.0020	08 20 23.45	-46 59 32.1	125.10	-46.99	3.12	0.68	-12.14	8.36	7.76	7.812	Ap...	8153	2159	1	-0.052	321	0.28
HD70142	1.8170	08 18 19.34	-47 08 05.7	124.58	-47.13	-7.8	14.4	-10.2	11.75	9.089	8.684		8153	2561	2	0.405	0	
V* IT Vel	0.1190	08 18 01.15	-47 05 30.7	124.50	-47.09	2.61	0.63	-9.04	9.94	6.905	7.045	B7III	8153	3245	1	-0.140	383	-0.87
HD70766	0.0013	08 21 43.64	-47 37 52.6	125.43	-47.63	-3.09	7.4	-7.24	8.4	8.864	8.86	B9	8153	4120	1	0.004	0	
HD70729	0.0012	08 21 29.28	-48 02 50.4	125.37	-48.05	15.3	14.9	-6.63	0.84	10.38	9.065		8153	2224	1	1.318	65	4.99
HD70238	0.0042	08 18 44.65	-47 45 26.7	124.69	-47.76	0.3	4.4	-19.39	21.33	8.093	7.998	A0	8153	1566	1	0.095	3333	-4.62
CD-48 372	0.0011	08 22 14.22	-48 29 58.1	125.56	-48.50	-9.1	17.8	-5.84	4.87	10.25	10.046		8153	4504	1	0.205	0	
HD70799	0.0085	08 21 48.91	-48 24 34.4	125.45	-48.41	4	6.9	-17.52	56.84	9.346	8.448	G5	8153	4477	1	0.898	250	1.46
HD69729	0.0023	08 16 21.45	-45 09 50.3	124.09	-45.16	1.03	0.89	-9.96	11.11	9.884	8.93	G8III	8149	1463	1	0.954	971	-1.01
HD69781	0.0036	08 16 41.10	-45 34 49.4	124.17	-45.58	21.1	6.19	-6.43	24.59	9.254	8.331	G5	8149	3734	1	0.923	47	4.95
HD69822	0.0002	08 16 50.46	-46 00 43.7	124.21	-46.01	9.19	8.5	1.19	1.47	9.182	9.101	B9	8149	4989	1	0.081	109	3.92
HD69762	0.0009	08 16 32.72	-46 03 32.7	124.14	-46.06	8.6	5.69	-1.05	-4.17	8.84	7.829	K0	8149	4794	1	1.011	116	2.50
HD69650	0.0078	08 15 52.84	-46 18 44.2	123.97	-46.31	8.69	0.56	-24.27	47.76	6.825	6.64	A4IV	8149	4927	1	0.185	115	1.34
HD68805	0.0018	08 12 17.37	-43 58 47.4	123.07	-43.98	-5.5	9.8	-4.6	8.22	9.624	9.684	B8	7672	786	1	-0.060	0	
V* AI Vel	0.0380	08 14 05.15	-44 34 32.9	123.52	-44.58	10.33	0.52	27.69	29.79	6.838	6.565	F2pvar	8154	4516	1	0.273	97	1.64
HD68322	0.1220	08 10 01.08	-44 20 45.1	122.50	-44.35	-0.1	4.4	-10.46	6.45	8.431	8.572	B8	7672	548	1	-0.141	0	
HD68786	0.0008	08 12 06.04	-45 23 10.8	123.03	-45.39	10.69	14.5	-5.03	3.66	9.912	9.786	A0	8136	1829	1	0.126	94	4.93
HD68604	0.0027	08 11 13.16	-45 09 50.2	122.80	-45.16	5	5.3	13.13	14.81	9.042	8.056	G5	8136	1355	1	0.986	200	1.55
HD69130a	0.5491	08 13 36.60	-45 57 32.4	123.40	-45.96	30.2	10.1	7.69	1.69	9.028	8.52		8136	5061	1	0.508	33	5.92
HD69404	0.0014	08 14 51.24	-46 29 09.2	123.71	-46.49	2.53	0.57	-4.44	7.22	6.284	6.436	B3Vnne	8136	5050	1	-0.152	395	-1.55
HD69109	0.0008	08 13 29.39	-46 37 56.9	123.37	-46.63	34.79	17.4	0.22	4.98	9.964	9.742		8136	2182	1	0.222	29	7.45
V* AH Vel	0.0012	08 11 59.97	-46 38 39.7	123.00	-46.64	2.5	0.55	-4.28	7.67	6.352	5.728	F7p	8136	1166	1	0.624	400	-2.28
HD68555	0.0028	08 10 52.60	-46 54 53.7	122.72	-46.91	-4.8	10.4	-17.97	4.04	9.179	9.186	B8	8140	4918	1	-0.007	0	
V* BN Vel	0.0128	08 13 05.53	-48 07 55.5	123.27	-48.13	-15.8	16.2	-4.53	-5.33	10.65	9.26	Mb	8140	108	1	1.387	0	
HD68966	0.0000	08 12 33.09	-48 18 43.3	123.14	-48.31	10.1	15.8	4.7	0.54	10.39	9.174	K2	8140	914	1	1.213	99	4.20
HD68419	0.0039	08 10 00.54	-48 20 05.4	122.50	-48.33	3.9	4.69	-15.45	19.67	8.284	8.175	A2	8140	1456	1	0.109	256	1.13
HD68187	0.0011	08 09 07.86	-48 16 09.5	122.28	-48.27	-15.3	11.2	-4.86	1.33	10.37	8.746		8140	1820	1	1.622	0	
HD68157	0.0900	08 09 11.08	-46 59 53.4	122.30	-47.00	16	7.5	-6.24	7.85	8.724	8.719	B9	8140	4936	1	0.005	63	4.74
HD68092	0.0013	08 08 51.24	-47 10 27.7	122.21	-47.17	2.29	3.79	-5.42	8.17	7.07	7.2	B8	8140	6532	1	-0.130	437	-1.00
HD97663	0.0079	11 14 10.55	-16 53 10.1	168.54	-16.89	6.09	0.95	-31.25	46.85	8.076	7.085	K0III	6084	421	1	0.991	164	1.01
HD97877	0.0051	11 15 26.03	-19 26 29.6	168.86	-19.44	13.89	18	-35.67	2.91	9.778	9.405	F0	6087	1361	1	0.373	72	5.12
HD97864	0.0078	11 15 17.59	-19 38 15.1	168.82	-19.64	10.94	0.87	-53.25	8.71	6.959	6.884	A3V	6087	1323	1	0.075	91	2.08
HD97717	0.0079	11 14 29.64	-19 31 59.9	168.62	-19.53	15.5	14.1	-57.28	-9.24	9.539	9.087	F5	6087	1728	1	0.452	65	5.04

Star	_r arcsec	_RAJ2000 "h:m:s"	_DEJ2000 "d:m:s"	RAJ2000 deg	DEJ2000 deg	Pix mas	e_ mas	pmRA mas/yr	pmDE mas/yr	Bmag mag	Vmag mag	SpType	TYC1	TYC2	TYC3	(B-V)	Distance Parsecs	Mv	
HD98019	0.0050	11 16 15.40	-20 41 24.2	169.06	-20.69	4.01	0.93	-33.73	-9.95	8.721	7.649	K0III	6090	744	1	1.072	249	0.66	90
HD97751	0.0036	11 14 42.35	-20 39 20.4	168.68	-20.66	4.62	1.16	-23.62	9.2	9.667	8.679	K0III	6090	356	1	0.988	216	2.00	91
HD97573	0.0046	11 13 36.76	-20 27 01.5	168.40	-20.45	5.21	1.3	-30.26	5.56	9.02	8.814	A6V	6090	602	1	0.206	192	2.40	92
HD97342	0.0216	11 12 03.03	-21 20 17.9	168.01	-21.34	15.88	1.12	31.07	-146.5	8.935	8.299	G3/G5V	6090	1438	1	0.636	63	4.30	93
HD97309	0.0083	11 11 53.70	-20 08 52.5	167.97	-20.15	6.21	1	-54.58	14.36	8.228	7.981	A1m...	6083	336	1	0.247	161	1.95	94
HD97444	0.0020	11 12 38.23	-18 40 33.5	168.16	-18.68	-2.79	9.69	-10.54	-14.47	9.137	8.085	K0	6087	1081	1	1.052	0		95
HD97426	0.0067	11 12 36.71	-17 53 42.7	168.15	-17.90	28.89	11.6	-41.87	8.29	9.245	9.112	A0	6087	376	1	0.133	35	6.42	96
HD97505	0.0049	11 13 06.63	-17 15 22.7	168.28	-17.26	4.08	1.12	-31.94	-11.94	9.633	8.08	M2III	6084	440	1	1.553	245	1.13	97
HD96745	0.0043	11 08 27.59	-18 06 49.3	167.12	-18.11	-3.4	12.8	-25.33	5.17	9.304	8.931	F0	6080	775	1	0.373	0		98
HD96838	0.0017	11 08 57.02	-19 24 59.3	167.24	-19.42	3.8	0.93	6.79	-6.56	6.942	6.91	A0/A1V	6080	1108	1	0.032	263	-0.19	99
HD96800	0.0063	11 08 44.24	-20 03 28.0	167.18	-20.06	3.63	1.13	-2.42	-41.22	9.081	8.133	G8III/IV	6083	158	1	0.948	275	0.93	100
HD96874	0.0045	11 09 05.22	-20 30 48.8	167.27	-20.51	3.98	0.98	-31.86	1.79	7.737	7.715	B9V	6083	1327	1	0.022	251	0.71	101
HD96766	0.0018	11 08 28.60	-20 47 11.4	167.12	-20.79	43.5	21.6	-9.05	-11.21	10.39	8.921	Ma	6083	945	1	1.472	23	7.11	102
HD96403	0.0056	11 06 32.87	-21 10 00.8	166.64	-21.17	7.61	1.12	-39.44	0.21	7.396	7.319	A1V	6083	792	1	0.077	131	1.73	103
HD96030	0.0044	11 04 27.57	-19 39 56.5	166.11	-19.67	3.59	3.54	-16.89	-26.37	10.14	9.69	F6V	6080	726	1	0.453	279	2.47	104
HD96276	0.0096	11 05 50.73	-20 24 32.7	166.46	-20.41	17.42	1.07	49.7	-41.72	8.692	8.106	G1V	6083	760	1	0.586	57	4.31	105
HD96050	0.0052	11 04 32.02	-21 07 35.7	166.13	-21.13	7.23	1.12	-3.06	-33.58	8.418	8.014	F2/F3V	6083	315	1	0.404	138	2.31	106
HD95680	0.0069	11 02 26.72	-21 24 40.2	165.61	-21.41	6.83	1.05	-42.98	3.26	8.266	7.258	K0/K1III	6083	1442	1	1.008	146	1.43	107
HD95425	0.0021	11 00 44.16	-20 18 58.7	165.18	-20.32	41.59	14.3	2.91	-18.39	9.963	8.743	K0	6082	1815	1	1.220	24	6.84	108
HD95562	0.0032	11 01 38.49	-17 21 04.0	165.41	-17.35	4.65	1	-20.59	-10.38	8.451	8.171	A2mA6-A	6077	411	1	0.280	215	1.51	109
HD95282	0.0066	10 59 54.52	-17 19 01.1	164.98	-17.32	5.21	1.02	-45.39	6.23	8.635	8.377	A2/A3II/III	6076	1756	1	0.258	192	1.96	110
HD95180	0.2530	10 59 16.18	-17 37 23.7	164.82	-17.62	7.81	0.99	-26.26	-10.84	7.8	7.604	A5V	6079	133	1	0.196	128	2.07	111
HD94838	0.0197	10 56 45.84	-17 27 07.9	164.19	-17.45	23.93	0.98	39.04	-128.5	8.547	7.902	G3V	6076	1811	1	0.645	42	4.80	112
HD95384	0.0040	11 00 33.85	-18 19 29.6	165.14	-18.32	0.17	1.77	-31.3	-2.04	10.2	8.908	M7/8III	6079	1902	1	1.290	5882	-4.94	113
HD95194	0.0041	10 59 15.96	-19 28 48.8	164.82	-19.48	-1.29	8.39	-31.03	-3.76	9.137	8.886	A0	6079	1560	1	0.251	0		114
HD95145	0.0121	10 58 56.72	-19 36 17.3	164.74	-19.60	6.6	0.81	42.3	-71.37	7.914	6.847	K0III	6079	1887	1	1.067	152	0.94	115
HD95580	0.0136	11 01 43.99	-20 03 33.8	165.43	-20.06	8.28	1.14	-87.1	-37.78	8.756	8.128	G0V	6083	381	1	0.628	121	2.72	116
HD95315	0.0037	11 00 08.87	-20 02 57.1	165.04	-20.05	-0.3	7.59	-21.73	8.82	9.263	8.381	G5	6082	368	1	0.882	0		117
HD95158	0.0030	10 59 01.59	-21 10 14.2	164.76	-21.17	-6.19	10.6	-19.17	0.83	9.548	9.286	A5	6082	1580	1	0.262	0		118
HD94839	0.0042	10 56 37.20	-21 16 31.2	164.16	-21.28	4.89	1.14	-26.86	12.06	8.348	8.086	A5V	6082	596	1	0.262	204	1.53	119