

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4678

Konkoly Observatory
Budapest
4 March 1999

HU ISSN 0374 – 0676

IDENTIFICATIONS FOR THE HARO-CHAVIRA “INFRARED STARS”

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The first seven extremely-red Haro-Chavira stars were published by Johnson *et al.* (1965), which includes BVRIJHKLMN photometry for them. The positions listed for these stars are consistently nearly a full degree in error, as a consequence of which they seem to have been overlooked in later literature. The offsets are parallel to the direction of precession, and the error evidently arises from the application of 100 years of precession motion with the wrong sign. These stars were unambiguously identified using the published charts, which are copied from the POSS-I prints of the region.

In a follow-up work, Chavira (1967) published a more extensive list of stars based on far-red objective-prism and direct plates. The main difficulty in the identifications was the poor positions, some in error by 10'. The finder charts were thus indispensable for positive identification on the sky. Two stars (HC 56 and HC 62) defeated my attempts to locate them.

The table shows the HC numbers from the combined list followed by equinox 2000 coordinates. Note that HC 5 was omitted in Johnson *et al.* (1965). An asterisk by the star name indicates a note at the bottom of the table. Column 's' shows the source of the position, coded as follows: A = USNO-2.0, F = FASTT (Henden & Stone 1998), I = IRAS, S = SkyView. After the IRAS names come USNO-A2.0 blue magnitudes and 'b-r' colors (neither are on a standard system), and Johnson I magnitudes (from photoelectric measurements for HC 1-8, and Chavira's eye-estimates from plates for the remainder). The spectral types are mostly from Chavira, but others from the literature are given as available and specified in the Notes. Some new identifications based on the corrected positions are given in the Remarks. A few stars are known or suspected variables, but all certainly are to some degree.

This work was greatly facilitated by the use of SIMBAD, the VizieR catalogue-server from the CDS-Strasbourg, and (*sine qua non*) the Goddard SkyView utility. My thanks to their creators and maintainers for providing them to the astronomical community.

Table 1: Positions and identifications

Name	RA (2000)	Dec	s	IRAS	mb	b-r	I	spec	Remarks
HC 1*	20 34 01.5	+42 25 27	A	20322+4215	19.9	6.7	6.4	M4:	
HC 2*	20 33 01.1	+40 45 41	A	20312+4035	18.0	6.1	5.8	M0	
HC 3*	20 25 30.1	+40 44 37	A	20236+4034	19.4	4.2	8.4		
HC 4*	20 26 55.7	+39 51 04	S				9.0		
HC 6*	20 41 11.2	+41 06 26	S				8.5	M3:	IRC +40440
HC 7*	20 42 24.8	+40 24 48	S	20405+4013			9.3		
HC 8*	20 44 09.6	+40 56 20	A		18.9	6.0	8.2		
HC 9	17 56 34.8	-19 51 01	A	17536-1950	18.2	6.0	8.8	M8	
HC 10	18 03 43.1	-18 41 01	A		18.6	3.8	7.9	M8?	
HC 11	18 04 40.9	-19 17 43	A	18017-1917	18.8	4.6	7.5	M8:	
HC 12	18 05 37.2	-18 27 05	A	18026-1827	20.3	4.3	9.2	M8	
HC 13	18 06 10.4	-17 29 16	A	18032-1729	20.0	2.2	9.3	M8	
HC 14	18 11 24.1	-19 45 53	A	18084-1946	20.6	5.1	8.1		
HC 15*	18 29 32.3	-4 15 34	I	18268-0417			8.9	M7	
HC 16	18 30 46.3	-5 34 29	S	18281-0536			9.3	M7	
HC 17	18 33 57.0	-3 04 37	A		16.3	3.1	9.3		
HC 18*	18 34 37.4	-2 51 22	I	18320-0253			9	M6?	
HC 19	18 37 36.7	-5 54 27	S	18349-0557			9	M7	
HC 20	18 39 40.6	-0 01 25	S	18370-0004			9.4	M6	
HC 21	18 40 21.4	-0 06 52	S	18377-0009			8.9	M8	
HC 22	18 40 30.1	+0 46 09	A	18379+0043	19.7	4.1	9.5	M6	
HC 23	18 40 52.7	+0 45 45	S	18383+0042			9.4	M7	
HC 24	18 40 46.3	+1 09 58	S	18382+0107			9.5	M6	
HC 25	18 41 18.9	-0 31 12	S	18387-0034			8.9	M9	
HC 26	18 42 30.6	+0 07 07	S	18399+0004			8.9	M7	
HC 27*	18 42 34.1	-0 47 26	S				9.6		
HC 28	18 43 13.3	-0 13 38	S	18406-0016			9.4	M7	
HC 29	18 44 22.0	+2 07 41	A	18418+0204	19.8	5.0	9.4	M8	
HC 30*	18 45 19.4	+0 56 19	S				9.5	M7	
HC 31	18 45 56.1	-0 51 57	S	18433-0055			8.4		
HC 32	18 45 57.8	-1 14 17	S	18433-0117			9.5	M7	
HC 33	18 47 00.1	-1 22 39	S	18443-0126			9.5	M6	
HC 34	18 47 02.4	+0 46 52	S	18444+0043			9.5		
HC 35	18 49 25.4	+4 22 35	A	18469+0419	14.3	5.9	7.7	M7	
HC 36	18 49 42.8	+1 41 03	S	18471+0137			8.3		
HC 37	18 49 58.0	-0 24 53	A		18.9	3.6	9.3	M6	crowded
HC 38	18 51 15.3	+3 46 56	S	18487+0343			9.3		
HC 39*	18 50 36.1	-0 29 04	S				9.1		
HC 40	18 50 48.7	+1 25 58	S	18482+0122			8.8		
HC 41	18 51 43.8	+1 05 43	S				9.5	M6	
HC 42	18 52 39.7	+0 11 41	S				9.5	M	variable
HC 43	18 55 01.0	+4 52 34	S				9	M6?	
HC 44	18 54 47.4	+0 25 28	S	18522+0021			7.2	M7?	NSV 11511
HC 45	18 59 51.3	+8 16 48	S	18574+0812			9.4	M9:	EIC 728
HC 46*	19 01 16.3	+9 21 41	S	18588+0917			9.4		
HC 47	19 02 09.9	+4 53 22	S	18596+0448			9	M7	
HC 48	19 02 25.0	+4 49 59	S	18599+0445			8.2		EIC 734
HC 49	19 03 19.0	+5 35 23	S				9.1	M7	
HC 50	19 03 05.0	+8 44 21	S	19006+0839			8.6	M7	
HC 51	19 03 51.8	+8 25 48	S	19014+0821			9.4		
HC 52	19 04 55.8	+8 38 01	S	19025+0833			9.3		
HC 53	19 09 49.9	+7 45 13	S	19074+0740			8.6	M7:	
HC 54	19 11 36.1	+10 05 59	S	19092+1000			8.7	M6	
HC 55	19 12 41.1	+8 32 17	S	19102+0827			8.9		
HC 56*	19 12.7	+9 48					9.4		

Table 1: Positions and identifications (cont'd.)

Name	RA (2000)	Dec	s	IRAS	mb	b-r	I	spec	Remarks
HC 57	19 14 13.3	+11 09 26	S				9.4	M6?	NSV 11835
HC 58	19 14 30.4	+10 50 47	S	19121+1045			9.1	M8:	not PN
HC 59	19 20 04.7	+19 53 23	S	19178+1947			8	M8	OO Sge
HC 60	19 27 53.3	+24 06 27	S	19257+2400			7.5		
HC 61*	19 37 00.4	+21 43 42	S	19348+2136			7.9	M8	NSV 12208
HC 62*	17 56.9	-19 17					7.3	M7	
HC 63	17 58 26.6	-16 32 41	A	17555-1632	18.9	3.5	8.2	M6	
HC 64	18 01 02.5	-20 08 40	S				8		
HC 65	18 03 11.7	-20 05 11	A	18002-2005	17.2	4.5	7	M7:	
HC 66	18 03 36.3	-16 51 08	A	18007-1651	16.6	3.7	7	M7	
HC 67	18 05 27.6	-19 33 13	A	18024-1933	18.5	4.1	8.1	M7	
HC 68*	18 06 14.9	-18 58 55	A	18032-1859	16.8	1.3	8.0	M6	
HC 69*	18 11 56.9	-19 52 22	A	18089-1953	18.4	3.3	8.1	C/S:	CGCS 3964
HC 70	18 31 34.9	-4 44 11	A	18289-0446	19.2	5.3	7.9	M6.5e?	
HC 71	18 32 08.1	-3 58 41	A	18294-0400	19.7	5.3	8.5	M6.5	
HC 72	18 33 06.7	-4 12 41	A	18304-0415	19.7	4.3	9	M6	
HC 73	18 33 43.8	-6 01 30	A	18310-0603	19.3	5.3	8.3	M6?	
HC 74	18 33 45.0	-3 13 30	A	18311-0315	18.9	4.6	8.1	M7	
HC 75	18 36 34.6	-4 22 20	S	18339-0424			8		
HC 76	18 36 35.3	-5 44 49	A	18338-0547	18.3	4.0	7.9	M8	
HC 77	18 37 39.2	-3 53 03	A	18350-0355	18.3	4.3	8.7	M7:	
HC 78	18 42 07.8	-1 05 01	A	18395-0108	19.5	4.7	8.9	M7:	
HC 79	18 42 37.5	-1 23 33	A	18400-0126	19.1	4.5	9	M6	
HC 80	18 44 47.9	+0 22 31	F	18422+0019	19.3	5.7	7.5	M6	FASTT 1187
HC 81	18 45 04.3	-0 46 47	F		19.3	4.6	9	M7:	FASTT 1270
HC 82*	18 46 05.1	-0 03 12	A		19.4	4.8	8.6	M6	
HC 83	18 47 02.4	+1 14 17	A	18444+0110	19.7	4.9	8.7	M6	
HC 84	18 48 10.6	+1 46 39	A	18456+0143	18.7	5.4	7.9	M6	
HC 85	18 48 27.8	+0 21 56	S				8.6	M6	
HC 86	18 49 34.3	+5 57 19	A		17.9	4.6	7.2	M7	
HC 87*	18 49 47.8	+6 00 27	A		17.8	5.1	7	M7	
HC 88	18 50 26.0	+4 36 05	A	18479+0432	19.7	5.9	7	M8:	
HC 89	18 51 42.6	+3 46 37	S	18492+0342			9	M7:	
HC 90	18 51 10.2	+1 35 13	A	18486+0131	19.5	5.0	8	M6	
HC 91	18 52 10.6	+5 51 40	A	18497+0547	19.1	5.1	8.3	M7	
HC 92	18 52 27.4	+5 15 11	A	18499+0511	19.8	4.0	9.4		
HC 93	18 51 38.1	+2 22 28	A		19.2	4.4	8.6		
HC 94	18 52 24.5	+5 34 51	S				9.3	M6.5	
HC 95	18 54 09.1	+6 25 58	A	18517+0622	19.1	4.7	7.2	M7:	
HC 96*	18 54 41.8	+6 24 12	S	18522+0620			9.2	M7:	
HC 97	18 54 02.4	+0 15 35	F	18514+0011	17.7	4.4	7.9	M6	FASTT 1211
HC 98	18 56 23.8	+4 45 14	A		19.4	4.9	7.2	M8	
HC 99	19 00 18.0	+10 11 18	A	18579+1006	18.5	4.2	8	M7	
HC 100	19 00 50.3	+9 12 24	S	18584+0908			9.3		
HC 101	19 02 05.8	+9 23 14	A	18597+0918	19.2	3.9	8.6	M6	
HC 102	19 02 13.1	+9 11 28	A	18598+0907	19.5	4.3	8.5	M6	
HC 103	19 03 26.4	+3 43 06	A	19008+0338	17.0	3.1	9	M7:	
HC 104	19 08 28.3	+14 58 55	A	19061+1454	18.4	3.9	7.9		
HC 105	19 10 39.1	+10 13 06	S	19082+1008			8.8	M7:	
HC 106	19 11 15.0	+11 12 21	A	19088+1107	18.4	4.3	8.5	M6	
HC 107	19 13 10.0	+9 46 13	A	19107+0941	19.1	5.3	8.4	M6	
HC 108	19 13 53.0	+8 44 12	A		18.3	3.8	8.7	M6.5	
HC 109	19 14 14.5	+7 45 26	A	19118+0740	19.7	4.8	8.8	M6	
HC 110	19 16 13.1	+12 18 18	A	19138+1212	19.0	5.3	7.5	M7	

Table 1: Positions and identifications (cont'd.)

Name	RA (2000)	Dec	s	IRAS	mb	b-r	I	spec	Remarks
HC 111	19 16 55.9	+13 09 04	A	19146+1303	19.1	4.2	7.8	M6	
HC 112	19 18 10.7	+13 45 19	A	19158+1339	18.1	4.4	7.4	M7:	
HC 113	19 19 38.5	+14 05 57	S	19173+1400			7.8	M6.5	
HC 114	19 19 55.8	+12 54 36	S	19176+1248			6.6		
HC 115	19 21 55.7	+20 12 11	A	19197+2006	19.1	4.6	8.8	M8	
HC 116	19 22 01.3	+19 44 40	A	19198+1938	19.1	4.4	8.8	M7	
HC 117	19 23 27.3	+18 38 05	A		19.4	4.2	8.9	M7:	
HC 118	19 24 16.7	+17 23 51	A	19220+1717	20.2	4.9	9	M7	
HC 119	19 24 48.4	+19 48 18	A		19.8	4.4	8.6	M6	
HC 120	19 25 15.6	+18 55 26	A	19230+1849	19.6	4.9	8.9	M6?	
HC 121	19 26 19.1	+16 40 32	A	19240+1634	18.5	3.8	7.8	M8	NSV 12022
HC 122	19 26 17.0	+18 12 16	A	19240+1806	20.2	4.8	6.7	M9:	PV Sge
HC 123	19 28 04.9	+23 48 38	A	19259+2342	18.2	4.2	8.3	M7	
HC 124	19 28 57.8	+20 54 24	A	19267+2048	18.3	4.5	8.6	M7:	
HC 125	19 29 27.5	+18 39 40	A		19.3	4.9	8.9		
HC 126	19 29 41.2	+18 42 08	A	19274+1835	19.9	6.2	8	M8	

Notes:

- HC 1 SIMBAD position slightly in error, spectral type from Pesch (1967).
 HC 2 GSC 3157-0317; SIMBAD position somewhat in error, spectral type from Kwok *et al.* (1997).
 HC 3 eastern of two stars.
 HC 4 eastern star of merged pair.
 HC 6 also StRS 381, spectral type from Pesch (1967); M0I in Imanishi *et al.* (1996), and M3/4III in Goto *et al.* (1997).
 HC 7 western star of merged pair.
 HC 8 northwestern star of merged pair.
 HC 15 extremely faint on DSS, IRAS coordinates roughly confirmed.
 HC 18 not visible on DSS, IRAS coordinates roughly confirmed on POSS-II IIIa-F film.
 HC 27 northeastern star of pair; just outside error ellipse of IRAS 18399-0050.
 HC 30 if chart ID is correct, this is *not* IRAS 18427+0053 = FASTT 1171.
 HC 39 outside error ellipse of IRAS 18480-0032.
 HC 46 near edge of IRAS error ellipse.
 HC 56 not found; nominal Chavira coordinates shown.
 HC 61 just outside IRAS error ellipse.
 HC 62 not found; nominal Chavira coordinates shown.
 HC 68 very faint on DSS.
 HC 69 spectral type from Kwok *et al.* (1997).
 HC 82 eastern star of merged pair.
 HC 87 near but outside error ellipse of IRAS 18472+0556.
 HC 96 Chavira chart has south up, east right.

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