

A catalog of Galactic multiple systems with a red supergiant and a B star

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INTRODUCTION

Binary stars are useful to study many aspects of stellar structure and evolution and the systems where the two objects have very different spectral types are especially so, as (barring interactions between them or with third objects) they signal coeval evolutionary phases. In this context, Neugent et al. (2019), from now on N19, indicate that “until a year ago [2018], the total number of known Galactic binary RSGs was 11” (RSG = red supergiant) and then go on to wonder about where the missing binaries are and to point towards 87 new RSG+B binary systems in M31, M33, the SMC, and the LMC. In this work we examine that quoted text.

METHODS

We have searched the literature and Simbad to find Galactic RSG+B binary systems. More specifically, we define RSGs as objects with spectral type G, K, or M and luminosity classes II to Ia for consistency with N19, but we note that criterion includes some Cepheids, which can be of spectral type G-K0 in some phases. Results are listed in Table 1 along with some useful information. The separation column is populated if a visual component with Δm small enough to contribute to the spectral type at short wavelengths is listed in the Washington Double Star Catalog (Mason et al. 2001).

RESULTS

We have found 108 Galactic RSG+B binary systems in the literature, with 61% of the sample already present in two references alone (Ginestet & Carquillat 2002; Samus’ et al. 2017). A significant number of the objects have two entries in the HD catalog, a likely consequence of the composite nature of the spectra. The total number in the sample has to be taken with care, as literature spectral classifications can include gross errors (see e.g. Maíz Apellániz et al. 2016). Also, RSGs in the spectral classification sense we are using here should not be identified with RSGs in the stellar evolution sense: some in our list are Cepheids and others may be bright AGB stars or even more peculiar objects (e.g. β Cyg A, Bastian & Anton 2018, or V838 Mon, Munari et al. 2007). Nevertheless, the number of known Galactic RSG+B systems is much larger than the one claimed by N19 and indeed it is not that different from the value found by those authors for the other four large galaxies in the Local Group. Nine of the eleven stars in N19 are in our sample. AL Vel and Algol are missing because they do not satisfy the luminosity class requirement.

Obviously, there must be many more Galactic RSG+B systems to be discovered. Two biases are a sign of this. 71% of the sample is brighter than $V = 8$ and 67% is in the northern hemisphere (despite the southern hemisphere containing many more Galactic disk stars). Future studies are required to find them and improve our statistics on

these important systems. Interestingly, there are no known Galactic RSG+O binary systems. There are, however, known Galactic BSG+O systems (e.g. HD 115 071, Sota et al. 2014, BSG = B-type supergiant) and at least one ASG+O system (6 Cas, Bartaya et al. 1994, ASG = A-type supergiant). This is a likely manifestation of the H-D limit (Humphreys & Davidson 1979).

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Table 1. Objects, spectral classifications, Galactic coordinates, V magnitudes, separations, references, and comments, sorted by l .

Name	Alternate name	RSG		B star		l (deg.)	b (deg.)	V (")	sep. (")	Ref.	Comments
		ST	LC	Q.	ST							LC	Q.
HD 161 387	V777 Sgr	K5	Ib	...	B6:	...	2.43	1.27	7.5	...	P98
HD 173 297	V350 Sgr	F5/G2	Ib	...	B9	V	13.76	-7.96	7.5	...	S17 Cepheid
HD 168 701	V4390 Sgr	K3	II	...	B3/5?	...	15.08	-1.04	7.7	...	G02
FR Sct	HIP 90 115	M2.5	Iab	ep	B	...	18.47	0.34	11.6	...	S17
β^1 Cap	Dabih Major	G9	II:	...	B8	...	p:Si: 29.15	-26.37	3.1	0.1	G02 Visual and spectroscopic binary
HD 169 689	V2291 Oph	G9	II	...	B9	V	37.21	9.36	5.7	...	G02
η Aql	55 Aql	F6-G2	Ib	...	B9.8	V	40.93	-13.08	3.8	0.7	E13 Cepheid
χ Aql	47 Aql	G2	Ib	...	B5.5	...	49.34	-5.70	5.3	0.4	G02
δ Sge	7 Sge	M2.5	II-III	...	B9	V	55.77	-3.38	3.8	0.1	S17 Visual and spectroscopic binary
HD 187 321	BD +18 4252	G5	Ib-II:	...	B7	IV	56.21	-3.49	7.1	0.4	G02
HD 190 361	BD +20 4406	K4	Ib	...	B4	IV-V	59.93	-5.41	7.3	...	G02
HD 187 299	BD +24 3889	G8	Ib	...	B6/9	V	61.48	-0.31	7.3	...	S14
HD 199 378	BD +14 4478	K1.5	II	...	B7:	...	61.83	-19.25	7.3	...	G02
β Cyg A	Albireo A	K3	II	...	B9	V	62.11	4.57	3.1	0.3	B18 Red star has low mass?
HD 186 518	PS Vul	K3	II	...	B6	...	62.82	1.61	6.4	0.3	G02 Visual and eclipsing binary
22 Vul	HD 192 713	G4	Ib	...	B7/9?	...	63.47	-6.36	5.2	...	G02 In Neugent et al. (2019)
BD +27 3542	Tyc 2148-00114-1	K3	Iab	...	B3	II	64.02	0.18	8.7	...	N20
HD 186 688	SU Cyg	F2-G0	I-II	...	B7	V	64.76	2.51	6.4	...	S17 Cepheid
HD 186 097	BD +30 3692	G1:	Ib-II	...	B8	III	65.65	3.90	7.3	0.8	G02
HD 196 753	BD +23 4085	K1	II	...	B7	...	66.65	-10.61	5.9	...	G02
V2028 Cyg	ALS 10651	K2	Ib/II	...	B4	III	67.63	1.26	10.9	...	Z01
V2417 Cyg	AS 381	K:	I:	...	B1	...	70.58	0.57	14.4	...	M02
47 Cyg	HD 196 093	K6:	Ib	...	B2.5:	...	75.43	-2.93	4.6	0.3	G02 Visual and spectroscopic binary
HD 193 469	BD +38 4003	K4.5	Ib	...	B8	V	76.76	1.68	6.3	3.5	G02
σ^1 Cyg	31 Cyg	K4	Iab	...	B4	IV-V	82.68	6.78	3.8	...	S17 In Neugent et al. (2019)
σ^2 Cyg	32 Cyg	K5	Iab	...	B4	IV-V	83.67	7.05	4.0	...	S17 In Neugent et al. (2019)
V1068 Cyg	BD +41 4100	G8	II-III	...	B9	...	86.69	-5.28	10.3	...	S17

Table 1 continued on next page

Table 1 (continued)

Name	Alternate name		RSG		B star		l (deg.)	b (deg.)	V (")	sep. Ref.	Comments
	ST	LC	ST	LC	Q.	Q.					
HD 205 114	G2	Ib	...	B7/8	IV:	...	95.22	0.86	6.2	...	G02
HD 203 338	M1	Ib	ep	B2	...	ep	98.18	6.36	5.8	0.1	M69
5 Lac	K6-M0	I	...	B7/8?	IV:	...	99.66	-8.65	4.4	...	G02
HDE 235 749	M2	Ib	...	B	...	...	101.47	-0.80	8.9	...	D18
ALS 12 387	K3	Ib	...	B	...	...	104.52	0.75	10.7	6.3	D18
HD 208 816	M2	Ia-Iab	ep	B8:	V	e	104.92	7.05	4.9	...	S17
δ Cep	F5-G2	Ib	...	B7-8	...	...	105.19	0.53	3.8	...	E13
U Lac	M4	Iab	ep	B	...	...	105.82	-3.55	9.4	...	S17
HD 214 369	K0-M2	Ia	ep	B0/B1	...	...	106.02	0.06	7.6	...	S17
HD 218 393	G8	II	...	B3	...	pe	106.36	-9.29	6.9	...	P04
HD 217 476	F8-K	Ia-0	e	B1	V	...	108.16	-2.70	5.1	...	S17
HD 213 503	K2	II:	...	B8	IV:	...	110.36	8.88	7.9	...	G02
ψ And	G5	Ib	...	B9/A0	IV:	...	111.34	-14.97	5.0	0.3	G02
KN Cas	M1	Ib	ep	B3	V	...	118.15	0.19	9.5	0.2	S17
V641 Cas	M3	Iab	e	B2.5	...	...	118.34	1.46	8.3	...	S17
HDE 236 429	F5-G2	Ib	...	B9	V	...	120.27	-2.55	8.6	...	S17
HD 3210	K4	II-III	...	B2	...	...	120.30	-6.63	7.0	0.3	G02
V554 Cas	M2	I	...	B	...	e	125.11	-0.28	9.5	...	S17
BD +59 224	K4.5	Ib	...	B3	V	...	126.13	-2.33	9.5	...	G04
HD 9352	K3	Ib-II	...	B7/8:	...	...	128.44	-4.09	5.7	...	G02
AZ Cas	M0	Ib	e	B0-B1	V	...	128.97	-0.85	9.2	...	S17
55 Cas	G0	II-III	...	B9	V	...	131.08	4.98	6.1	0.1	M69
HD 12 401	M4	Ib	...	B	...	...	133.10	-6.22	8.2	...	S17
γ And	K3	II	...	B9.5	V	...	136.96	-18.56	2.1	9.4	A95
				A0	V	...				9.4	A95
HDE 237 006	M1	Ib	e	B:	...	...	138.02	-1.37	9.3	...	H69
HD 16 082	K0	II	...	B6	...	...	138.94	-7.60	7.3	...	G02
HD 17 306	K3	Iab	...	B:	...	...	139.65	-4.85	7.9	...	B57
HD 19 278	K2	II	...	B7/8	...	...	140.97	-1.34	8.2	1.7	G02
HD 23 089	G2	Ib/II	...	B7	III/IV	...	141.10	6.81	4.8	...	G06

Table 1 continued on next page

Table 1 (continued)

Name	Alternate name		RSG		B star		l (deg.)	b (deg.)	V (")	sep.	Ref.	Comments
	ST	LC	Q.	ST	LC	Q.						
HD 24480	K3	II	...	B8/9	...	...	143.54	5.90	5.1	1.7	G02	
HD 17245	G8	II-III	...	B8:	...	...	143.89	-13.82	6.5	...	G02	
HDE 237190	F5-G1	Ib	...	B8	III	...	144.85	3.80	8.7	0.3	S17	Cepheid
HD 21771	K3	II	...	B8	...	...	150.56	-9.23	7.3	...	G02	
HD 27395	G9	II	...	B	...	...	153.60	0.12	7.2	2.0	C05	Visual and spectroscopic binary
μ Per	G0	Ib	...	B9.5	...	...	153.94	-1.82	4.2	...	G02	
f Per	G9	II:	...	B9.5/A0:	IV:	...	159.45	-7.54	4.7	...	G02	
BD +43 1041	G5/K0	II/III	...	B8:	V	...	160.29	-1.48	8.7	...	S14	
58 Per	G7	Ib	...	B8/9.5:	...	...	161.76	-4.03	4.3	...	G02	
ζ Aur	K5	Ib-II	...	B6.5	IV-V	...	165.02	-0.43	3.8	...	S17	In Neugent et al. (2019)
HD 36947	G7	Ib:	...	B7	III:	...	166.22	6.54	7.3	0.1	G02	
HD 33203	K4	II:	...	B2	II:	...	168.95	-1.49	6.1	1.6	P98	
36 Tau	K1	II	...	B7.5	IV:	...	169.67	-20.79	5.5	<0.1	G02	Visual and spectroscopic binary
HD 27639	K5:	II	...	B7/8	...	...	175.26	-19.98	6.0	1.9	G02	
HDE 246901	G5:	Ib:	...	B1:	...	...	176.00	2.26	8.1	...	M55	
HD 42474	M2	Iab	ep	B2-B3	V	...	187.91	2.26	7.4	...	S17	
HD 39286	K0	IIb	...	B8	IV	...	188.57	-3.34	6.0	...	G00	
HD 47086	G:	I	...	B/A	...	...	190.31	7.72	6.7	0.1	B83	
HD 44990	G8	Iab-Ib	...	B9.8	V	...	203.63	-2.56	6.0	...	E94	Cepheid
HD 39118	K0	II	...	B7/8	...	...	204.02	-12.57	6.0	...	G02	
HD 45910	K1	II-III	...	B1	IV	eq	205.33	-1.95	6.9	...	S17	
HD 50820	K2	II	...	B3	IV	e	214.87	-0.08	6.2	...	H82	
HD 52690	M2	Ib	...	B7/9?	IV:	...	217.49	0.66	6.6	...	G02	
V838 Mon	M	I	...	B3	V	...	217.80	1.05	var	...	M07	In Neugent et al. (2019)
HD 55684	K3	II	...	B7.5	III:	...	220.07	2.59	7.3	...	G02	
μ CMa	K3	II	...	B8.5	...	...	225.99	-5.34	4.9	2.8	G02	
BD -12 1805	K3:	II	...	B	...	...	226.57	-2.29	9.9	...	M74	
HD 59067	G4:	Ib	...	B2	...	...	227.37	2.67	5.9	0.7	G02	
HD 60415	M2	Iab	ep	B2	V	...	230.67	2.52	5.0	...	S17	
F Hya	G1	Ib	...	B9.5/A0	...	...	233.29	20.97	4.6	...	G02	

Table 1 continued on next page

Table 1 (continued)

Name	Alternate name	RSG		B star		l (deg.)	b (deg.)	V (")	sep.	Ref.	Comments
		ST	LC	Q.	ST							LC	Q.
π Pup	HD 56 855	K3	Ib	...	B5	...	249.01	-11.28	2.7	...	S14
V624 Pup	CD -32 4694	M2	Iab	...	B1	V	249.58	-1.42	10.9	...	S17
HD 31 244	CPD -51 600	K3	II-III	...	B5	...	259.03	-39.32	6.6	...	J60
HD 81 137	WY Vel	M3	Ib:	ep	B	...	274.14	-1.82	8.8	...	S17
NGC 3105-24	[AMN2018] 348	K3	Ib	...	B2	V:	279.91	0.28	13.0	...	A18
HDE 300 933	CPD -56 3586	M2	Iab/Ib	...	B	...	285.42	1.45	8.3	...	H72
HDE 303 344	CPD -57 3805	M2	Ib	...	B	...	287.08	1.09	9.3	...	D79
HD 93 281	V730 Car	M1	Iab	...	B	...	287.70	-0.86	7.8	...	S17
HD 101 007	CPD -60 3178	M3	Ib	...	B	...	294.08	0.40	7.0	...	K89
HD 101 947	V810 Cen	F5-G0	Ia-0	...	B1	Iab	295.18	-0.64	5.0	...	S17
HD 101 712	V772 Cen	M2	Ib	ep	B	...	295.24	-1.59	7.9	...	S17
CD -61 3575	Tyc 8992-00314-1	M2	Ia	ep	B	...	302.09	0.92	9.9	...	S14
KN Cen	HIP 66 383	G8	Iab	...	B6	V	307.76	-2.11	9.9	0.3	S17 Cepheid
HD 119 796	V766 Cen	G8	Ia-0	...	B0	Ib	309.30	-0.41	6.8	0.1	S17 In Neugent et al. (2019)
26 Cnr	HD 130 702	F2-G2	II	...	B4	...	315.83	-4.01	6.0	0.3	S17 Cepheid
HD 134 270	CPD -54 6367	G2/5	Ib	...	B8	V	321.96	2.27	5.4	...	N85
CPD -58 6053	ALS 3371	M2	Ia	...	B	...	322.79	-2.28	9.9	...	D79
HD 146 323	S Nor	F8/G0	Ib	...	B9.5	V	327.75	-5.40	6.5	...	E13 Cepheid
HD 135 345	CPD -41 7104	G5	Ia	...	B	...	329.98	13.66	5.2	0.2	J60
HD 145 415	CPD -53 7442	K2	Ib	...	B	...	329.85	-2.18	8.9	...	A17
α Sco	Antares	M0.5	Iab	...	B3	V:	351.95	15.06	0.9	3.2	C84
HD 172 991	CPD -39 8163	K3	II	...	B7	...	356.00	-15.77	5.4	...	J60

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