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Thirty bright high velocity B, A, and F stars that may have late-type companions

Mudumba Parthasarathy

Indian Institute of Astrophysics, Koramangala 2nd Block, Bangalore 560034, India

Abstract

I found thirty high velocity stars that have large V-K values compared to standard stars of similar spectral types indicating the possible presence of late-type companion stars. All these thirty stars are relatively bright nearby stars with accurate Gaia DR3 parallaxes and radial velocities. There is hardly any relevant literature on these stars. There are 18 high galactic latitude stars in this sample. In order to further understand their chemical composition, evolutionary status, binary companions and how these stars acquired high radial velocities high resolution spectroscopy, radial velocity and photometric monitoring studies are very much needed.

Keywords : High velocity stars – Radial Velocities- Close- binaries

1. Introduction

While searching for high radial velocity post-AGB stars I came across thirty relatively bright and nearby high radial velocity stars that have accurate Gaia DR3 parallaxes and radial velocities (Gaia Collaboration 2020, 2022). These stars are not studied much and hardly there is any relevant literature on these stars. There may be more such stars in the Gaia DR3 and SIMBAD data. In this research note I discuss these stars, to bring them to the attention of observers for further study. These high velocity stars are selected from searching the SIMBAD and Gaia DR3 data (Strasbourg, France) that have V-K excess compared to normal stars of similar spectral types. The effective wavelength of V magnitude is 5448 Angstroms and K magnitude effective wavelength is 2.1 microns. The flux of normal O, B, A, and F stars at the wavelength of V filter is more than that at the wavelength of K filter and hence we do not expect large V-K values from these normal stars. However if they have a cool (late-type) companion stars then one can expect them to have brighter K magnitudes and V-K excess values. The search criteria includes stars V magnitudes 7.0 to 11.5 and radial velocities -80 km/sec to -250/sec and +80 km/sec to +250 km/sec. Hot (OB) stars and late (G and K) stars are excluded. Known binary stars and variable stars are not included. The main focus is on A and F stars.

Table 1. Selected high velocity stars with V-K excess

Star	l	b	Sp.	V	V-K	μ	RV	d	Teff	log g	[Fe/H]
	deg	deg				mas/yr	km/sec	pc	K		
HD 45075	246.0	-21.5	A7/9V	9.56	2.81	24.572	122	563			
HD 71756	258.2	-0.7	A0II	9.09	2.44	6.072	124	2825	6700	1.24	-1.74
HD 75529	231.5	24.0	F0V	7.0	2.24		148	204			
HD 143706	45.7	48.3	F8	11.0	3.08	16.919	-106	1409			
HD 159034	354.7	-0.4	B8V	9.86	1.0	2.353	87	1085	11893	3.55	-0.29
HD 233029	155.9	4.6	A	9.64	4.4	23.550	-93	681	5187	2.21	0.14
HD 234642	78.9	24.6	F5	9.35	2.17	28.005	-120	522	5845	2.98	-0.10
HD 239432	92.6	10.3	F	9.79	4.27	15.052	-205	1288	4805	1.63	0.14
HD 236166	110.9	-9.5	F8	9.97	3.2	55.884	-269	1039			
HD 284087	177.3	-9.6	A3	8.93	3.00	6.022	129	537			
HD 287282	187.4	-18.3	F5	10.28	4.1	32.774	171	1852			
HD 310348	292.4	-5.8	A	11.46	1.4	6.502	126	2547			
HD 314970	4.06	-1.5	A0	10.93	3.01	24.070	-124	767			
HD 316847	1.5	-2.7	A2	9.74	4.45	6.587	-87	1152			
HD 321615	359.4	-8.7	F8	9.86	3.6	4.629	-80	976	4380	1.84	-0.15
HD 330947	335.4	-1.2	F5	11.38	2.24	-	81	93			
HD 341978	48.5	16.5	F8	10.99	2.41	19.637	-116	959			
HD 341983	48.7	16.5	F5	10.68	3.31	1.477	-85	1359			
HD 348269	46.5	16.1	F0	10.92	3.1	6.354	-107	1438	4975	2.46	-0.14
BD+67 657	142.0	45.2	F0	10.30	2.11	40.105	-139	946			
CPD-27 5783	1.7	0.2	F8	10.6	3.05	52.545	-103	285	4409	2.77	-0.94
CD-30 5659	248.3	1.0	A2II	9.90	2.04	4.546	169	4112			
SAO 2836	114.7	30.2	F5	10.55	2.46	11.168	-117	2332			
SAO 13864	154.9	20.9	F8	9.40	3.77	2.078	-132	1464			
SAO 19163	99.5	10.27	F8	9.71	3.71	54.295	-243	505			
SAO 54172	122.5	-29.6	F8	9.08	2.03	98.687	-153	589			
SAO 8907	106.3	30.4	F8	10.07	3.87	15.791	-100	955			
SAO 70563	76.8	-6.1	A0	10.59	2.54	34.937	-153	570			
SAO 108071	81.9	-36.8	F5	8.70	2.30	21.201	-117	369	5374	2.86	-0.11
SAO 142514	30.7	1.5	B8Ia	9.22	3.99	5.232	175	4460			

2. Discussion and conclusions

All the stars listed in Table 1 have very accurate Gaia DR3 parallaxes. Their RUWE values are less than 1.4. Their accurate distances given in Table 1 are from Gaia DR3, and Gaia EDR3 (Gaia Collaboration 2020, 2022). All the stars listed in Table 1 have accurate Gaia radial velocities and the errors in radial velocities are of the order of 2 km/sec. All the stars show V-K excess (Table 1). The astrophysical parameters Teff, log g and [Fe/H] values are from the Gaia DR3 data (Gaia Collaboration 2022). For most of the stars the Gaia DR3 spectra are available.

HD 75529

It is a high proper motion star (proper motion in RA : 73.025 mas/yr and proper motion in DEC : - 133.433 mas/yr). It is an IRAS sources (IRAS 08479-0400) (IRAS point source catalogue version 2.0 1986 (SIMBAD, Strasbourg, France online Catalogues). The 12-micron flux is 0.631 Jy and flux quality is 3. The 25, 60, and 100 micron fluxes have flux quality flags of 1. This star may have hot circumstellar dust shell. It is a nearby high galactic latitude high velocity star. Further detailed study of this star is important.

HD 159034

Its Gaia DR3 spectrum and light curves are available. It is a variable star. It may be Beta Cep type variable and or close binary with late type companion. It is located in the galactic plane and it is not expected to have such high radial velocity. Further radial velocity, and photometric monitoring and analysis of high resolution spectrum of this star is needed.

HD 233029

It is an IRAS source (IRAS 04485+5116). Its 12 micron flux is 0.389 Jy and flux quality flag is 3. The 25, 60, and 100 micron fluxes have a quality flag of 1. Its V-K value = 4.4 (Table 1) and 12-micron flux indicate that it may have hot circumstellar dust and a late type companion star. The astrophysical parameters from Gaia DR3 data (Table 1) indicate it is most likely a G type giant and may have dusty disk. It is not clear how it acquired high radial velocity. Further optical and IR observations of this star are needed.

HD 236166

It is a high proper motion star (Table 1). It is a high galactic latitude and high radial velocity star. The V-K value indicates that it may have a late-type companion star. Further detailed study of this star is needed to understand the chemical composition, binarity and evolutionary stage of this high velocity star.

HD 287282

It is a high galactic latitude and high velocity F5 star. Its V-K = 4.1 indicates that that it may have a late – type companion. There is no literature on this star. Further study of this star is important.

HD 310348

There is no literature on this high velocity star; the Gaia DR3 spectrum is available and the H-alpha line seems to be in emission.

HD 316847

It may be a in the galactic bulge field and in the Baade's Window . The V-K = 4.4 indicates that this high velocity A type star may have a very cool companion.

HD 330947

It is a high proper motion and high velocity star. Proper motion in R.A is -65.292 mas/yr and proper motion in DEC is -138.589 mas/yr. Its Gaia DR3 spectrum is available.. It is a nearby star. Its evolutionary stage is not clear.

CPD-27 5783, SAO 19163, and SAO 54172

The above mentioned stars are nearby high proper motion stars. No one has studied these stars. Their V-K values indicate they may have late type companions. SAO 54172 and SAO 19163 are high galactic latitude high velocity stars .

SAO 142514

It is an emission line high velocity B8/A0 Ia star. It is having large V-K value (Table 1) which is not expected for its spectral type.

There are 18 high galactic latitude stars in this sample (Table 1). Determination of C, N, O and s-process elements abundances is needed to understand if some of these stars have gone through mass transfer process and or if some of them have white dwarf companions.

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