Identification of Triple Stars in the UCAC3 Catalog

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Abstract: Nine previously unknown components of cataloged double stars are reported based on data-mining the UCAC3 catalog.

Introduction

The aim of this research was to search for new common proper motion components of systems already listed in the Washington Visual Double Star Catalog (WDS) using the proper motion data contained in the Third U.S. Naval Observatory CCD Astrograph Catalog (UCAC3).

UCAC3 (Zacharias et al. 2010) contains 44 database fields including magnitudes in a band between V and R, positional information with typical errors between 15 to 20 mas and proper motion data based on results from up to 140 catalogs.

Methods and materials

The data-mining process was accomplished in six steps, as listed below.

Step 1 – Download details of all the double stars systems listed in WDS where the most recent reported separation is less than one arc sec.

Step 2 – Delete those systems having more than two components.

Step 3 – Input the positional data for the systems remaining after steps 1 and 2 into the UCAC3 catalog and download the proper motion data. Delete those systems where the proper motion in either the declination or right ascension is not greater than 20 mas/Yr or less than -20 mas/Yr.

Step 4 – Input the positional data for the systems remaining after the first three steps into the UCAC3 catalog and download the magnitude, proper motion and positional data for all stars within 30 arc seconds of each of the primary stars.

Step 4 – Delete all those systems where the difference in the proper motion in declination or right ascension between the primary and secondary components is greater than the sum of the quoted mean errors in these results.

Step 5 – Delete all those systems where the quoted mean error in either declination or right ascension is greater than 10 mas/Yr.

Step 6 – The remaining systems are strong candidates for being triple star systems with two components within one arc sec and a third component up to 30 arc seconds distant. Present the key data for these triple star systems in the standard format.

Results and Discussion

Key features of the new components of the triple stars are presented in Table 1. The proper motion of the components of the triples stars are presented in Table 2.

Nine systems have been identified where there is strong evidence of a third component situated some distance from the other two stars. Each one has been checked against the on-line version of the Washing-

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Table 1: Key features of the new components of the triple stars

WDS ID	NAME	COMP	COMPUTED RA + DEC ALLOWING FOR PM		UCAC MAG	PA DEG	SEP ARCSEC	EPOCH + EQUINOX	N
00228+5312	MLR 647	PRIMARY	00 22 48.903	+53 11 32.93	8.619	80.3	26.8	J2000.000	1
		TERTIARY	00 22 51.847	+53 11 37.45	10.81				
08105-0332	TDS5597	PRIMARY	08 10 28.735	-03 32 22.22	10.376	355.5	25.2	J2000.000	1
		TERTIARY	08 10 28.865	-03 32 47.30	10.275				
08107-7430	B 1981	PRIMARY	08 10 43.405	-74 29 57.02	9.097	215.2	26.2	J2000.000	1
		TERTIARY	08 10 39.637	-74 30 18.46	13.37				
08158-1027	RST3578	PRIMARY	08 15 45.120	-10 26 54.45	8.786	142.5	26.8	J2000.000	1
		TERTIARY	08 15 46.224	-10 27 15.68	15.363				
08215-5626	FIN 75	PRIMARY	08 21 30.159	-56 26 02.52	9.147	203.6	19.2	J2000.000	1
		TERTIARY	08 21 29.237	-56 26 20.08	10.404				
09118+3355	TDS6384	PRIMARY	09 11 48.525	+33 54 49.30	10.44	141.4	10.2	J2000.000	1
		TERTIARY	09 11 49.035	+33 54 41.33	11.775				
11421-1717	RST3752	PRIMARY	11 42 05.810	-17 17 04.44	9.828	318.2	9.9	J2000.000	1
		TERTIARY	11 42 05.347	-17 16 57.03	13.223				
18013-6921	TDT 638	PRIMARY	18 01 20.018	-69 21 09.63	11.355	234	8.4	J2000.000	1
		TERTIARY	18 01 18.726	-69 21 14.59	15.16				
20432-2049	CHR 222	PRIMARY	20 43 10.886	-20 48 38.38	8.768	306.8	13.6	J2000.000	1
		TERTIARY	20 43 10.110	-20 48 30.24	14.841				

Table 2: Proper motion of components of the triple stars

WDS ID	NAME	COMP	PROPER MOTION IN RA MAS/YR	PM RA ERROR	PROPER MOTION IN DEC MAS/YR	PM DEC ERROR
00228+5312	MLR 647	PRIMARY	79.6	0.7	20.8	0.7
		TERTIARY	79.6	0.9	20.1	0.7
08105-0332	TDS5597	PRIMARY	-2.5	1.1	23.6	1.1
		TERTIARY	-3	0.9	23.6	0.7
08107-7430	B 1981	PRIMARY	37.8	1.2	-28.7	1.1
		TERTIARY	34.6	2.8	-30.5	3.9
08158-1027	RST3578	PRIMARY	-61.8	1.5	-50.1	1.9
		TERTIARY	-64.6	2.9	-47.3	5.3
08215-5626	FIN 75	PRIMARY	-22.5	1.4	15.7	0.9
		TERTIARY	-22.3	1.3	14	1.3
09118+3355	TDS6384	PRIMARY	2.3	2.4	-42.3	1.4
		TERTIARY	2.6	1.4	-41.5	1.3
11421-1717	RST3752	PRIMARY	19	1.3	-22.1	0.9
		TERTIARY	21	1.9	-21.7	1.9
18013-6921	TDT 638	PRIMARY	-5.9	1.1	-24.7	1.2
		TERTIARY	-6.9	4.3	-24.9	4.3
20432-2049	CHR 222	PRIMARY	-36.2	1.7	-37.6	1.9
		TERTIARY	-37.5	2.8	-35.2	2.8

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ton Visual Double Star Catalog, articles published within the Journal of Double Star Observations and the archives of the Yahoo group Binary-Stars-Uncensored. Nothing was found to indicate that these systems had been reported prior to the submission of this article.

As a further check the UCAC3 results were also checked against those obtained from the PPMXL catalog and where reliable positional matches could be made the PPMXL results support the claim that these are triple star systems.

Further research will be carried out in the coming months in an attempt to locate additional components of other cataloged systems - such as those with a most recent listed separation of between one and five arcsec.

Acknowledgements

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References

Journal of Double Star Observations - http://www.jdso.org/

PPMXL catalogue - http://cdsarc.u-strasbg.fr/viz-bin/Cat?I/317

Third U.S. Naval Observatory CCD Astrograph Catalogue (UCAC3) - http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=I%2F315.

Washington Visual Double Star Catalog (WDS) - http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=B%2Fwds

Yahoo group Binary-Stars-Uncensored - http://tech.groups.yahoo.com/group/binary-stars-uncensored/

Zacharias N., Finch C., Girard T. et al. 2010, AJ., 139, 2184-2199