Measurements of WDS Objects Found in Images Taken for Detecting CPM Pairs in the LSPM Catalog - II

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Abstract: During our research for CPM objects in the LSPM catalog so far not included in the WDS catalog part IV (Knapp and Nanson 2018) we found again a surprisingly large number of WDS objects in the field of view of several images taken for this project. To use the existing image material in the best possible way we decided to take measurements of these objects and to look at other existing catalog data allowing a check for potential common proper motion. This report presents the findings of this research

1. Introduction

During evaluation of the images taken for our CPM/LSPM-project part IV, we found a large number of existing WDS objects included in these images so we decided to make a separate report on these objects with our own measurements, as well as using data from the GAIA DR1 catalog to check for potential common proper motion.

The CPM check was done similar to the LSPM project based on comparison of 2MASS to GAIA DR1 positions and if available UCAC5 proper motion data allowing a CPM rating according to Knapp/Nanson 2017 (with extensions).

The image processing followed our usual procedure: stacking with VPhot, plate solving and measuring positions and Vmags with Astrometrica using URAT1 as reference catalog, and calculating Sep and PA with the formulas provided by Buchheim 2008. The I-filter images were first plate solved with URAT1 as reference catalog for the astrometry results and then again plate solved with USNO B1 as reference catalog for Icmags for the I-band photometry results.

2. Results of Our Research

In Table 1 we present the WDS catalog data as of October 2017 in the header line, the GAIA DR1 data in the second line and in the two following lines our own measurements based on images taken with remote telescope iT24. Given below is a description of the table content per column:

- Name gives the discoverer ID of the selected object in the header line
- RA and Dec give the recent precise coordinates of the A component from the WDS catalog in the header line in the traditional HH:MM:SS DD:MM:SS format and in the data lines from the sources referred to in the Notes column in decimal degrees format as these values are directly usable for calculating Sep and PA
- Sep gives separation in arcseconds in the data lines calculated as

$$Sep = \sqrt{\left[\left(RA_1 - RA_2\right)\cos\left(Dec_1\right)\right]^2 + \left(Dec_2 - Dec_1\right)^2}$$

  in radians
- PA gives position angle in degrees in the data lines calculated as

$$PA = \arctan\left[\frac{\left(RA_1 - RA_2\right)\cos\left(Dec_1\right)}{Dec_2 - Dec_1}\right]$$

  in radians depending on quadrant
- M1 and M2 give WDS Vmags in the header line for

A and B and Gmags in the GAIA DR1 line, and the next two lines give the measured V- and Imags from our own images

- pmRA1 and pmDE1 with e_pm1 give the WDS proper motion data for A and pmRA2, pmDE2 and e_pm2 for B in the header line and in the GAIA DR1 line the values calculated by comparison with 2MASS positions
- Spc1 and Spc2 give in the header line the WDS spectral class range for A and B if given in the WDS catalog and in the iT24 I-filter image lines the spectral class range based on the V-I color index taking into consideration also the error range of the measured Imags using the table provided by the Space Telescope Science Institute (http://www.stsci.edu/~inr/intrins.html)
- Ap indicates in the data lines the aperture used for the observation listed and Me indicates the WDS code for the used observation method (for GAIA calculated equivalent circular surface diameter)
- Date is the Julian epoch of the (averaged) observation date given in the data lines
- CPM Rat gives the rating of the CPM assessment based on comparison of positions between 2MASS and GAIA DR1 (see Appendix A)
- And last, Source/Notes indicates the source used (images and catalogs) and additional explanations if considered necessary.

3. Summary

Of a total of 31 objects only one (SLW 207) can be considered as solid CPM candidate with the rest most probably optical pairs – if pair at all as the two TDS objects included seem to be bogus.

References

Buchheim, R., 2008, "CCD Double-Star Measurements at Altimira Observatory in 2007", *Journal of Double Star Observations*, **4** (1), 27-31.

Knapp W. and Nanson J., 2017, "A New Concept for Counter-Checking of Assumed CPM Pairs", *JDSO*, **13** (1), 31-51.

Knapp W. and Nanson J., 2018, "CPM Pairs from LSPM so far not WDS Listed – Part IV", *JDSO*, **13** (4), 553-567.

Acknowledgements

The following tools and resources have been used for this research:

- Washington Double Star catalog
- 2MASS All Sky catalog
- iTelescope: Images were taken with iT24: 610mm CDK with 3962mm focal length. CCD: FLI-PL09000. Resolution 0.62 arcsec/pixel. V-filter. Located in Auberry, California. Elevation 1405m
- GAIA DR1 catalog
- Aladin Sky Atlas v9.0
- SIMBAD, VizieR
- AstroPlanner V2.2
- NASA/ IPAC Infrared Science Archive
- Astrometrica 4.10.1.432

Table 1: Measurements for WDS objects found in the existing CPM LSPM IV images

Name	RA	Dec	Sep "	PA °	M1	M2	pmRA1	pmDec1	e_pm1	pmRA2	pmDec2	e_pm2	Spc1	Spc2	Ap	Me	Date	CPM Rat	Source/Notes
POU 1768 (AB)	06 39 16.66	+23 07 11.4	9.4	331	13.70	13.80	-3	4		-91	95						2013		WDS 06393+2307, WDS data as of beginning of Oct. 2017. POU 1769 is the AB pair of this triple star.
	99.819382	23.119833	9.427	331.589	14.06	14.41	-4.83	-1.27	5.25	-4.56	12.12	5.25			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.819321	23.119867	9.338	330.532	14.17	14.76									0.61	C	2017.084		iT24 1x180s V-filter
	99.819446	23.119800	10.076	332.167	13.21	13.35							K2-K5	K5-M0	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1769 (AC)	06 39 16.66	+23 07 11.4	16.0	63	13.70	14.50	-3	4		4	-6						2013		WDS 06393+2307, WDS data as of beginning of Oct. 2017. POU 1768 is the AC pair of this triple star.
	99.819382	23.119833	16.016	62.886	14.06	14.26	-4.83	-1.27	5.25	5.34	-3.36	5.25			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data. Vector length way outside range (113% and 110%)
	99.819321	23.119867	16.037	63.242	14.17	14.42									0.61	C	2017.084		iT24 1x180s V-filter
	99.819446	23.119800	16.033	62.835	13.21	13.32							K2-K5	K4-K5	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1710	06 38 05.02	+23 05 18.2	13.1	120	14.10	14.50	9	1									2016		WDS06381+2305, WDS data as of beginning of Oct. 2017.
	99.520911	23.088394	12.604	118.552	13.66	14.53	-1.15	-1.23	4.96	1.21	-7.84	4.96			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.520942	23.088444	12.816	117.612	13.93	14.77									0.61	C	2017.076		iT24 1x60s V-filter
	99.520892	23.088397	12.448	118.607	12.54	13.51							K5-M0	K4-K7	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1712	06 38 12.74	+22 55 13.5	12.1	79	14.80	14.90	-6	0		0	-11						2010		WDS06382+2256, WDS data as of beginning of Oct. 2017. Aladin image shows the secondary is obviously fainter when compared to the primary than the .4 of a magnitude shown in the WDS.
	99.553059	22.920427	11.745	79.370	14.37	16.05	-1.45	1.00	4.96	-1.98	-1.57	5.39			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.553088	22.920439	11.610	78.675	14.50	16.37									0.61	C	2017.084		iT24 1x180s V-filter
	99.553083	22.920372	11.999	78.803	13.51	15.30							K2-K5	K2-K5	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1713	06 38 07.08	+23 04 05.0	13.8	155	14.44	14.82	-11	5		4	15						2010		WDS06382+2304, WDS data as of beginning of Oct. 2017.
	99.529481	23.068095	13.732	154.662	14.39	14.85	-5.17	-3.33	4.96	0.32	-4.49	4.96			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.529450	23.068167	14.240	154.944	14.50	14.92									0.61	C	2017.076		iT24 1x60s V-filter
	99.529408	23.068019	13.397	153.509	13.51	13.96							K2-K5	K1-K5	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1714	06 38 08.32	+23 04 51.4	15.0	140	13.00	14.30	-6	-3		-1	1						2016		WDS06382+2305, WDS data as of beginning of Oct. 2017.
	99.534651	23.080929	15.329	139.030	12.66	13.86	-2.88	-2.64	4.96	1.74	-5.83	4.96			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.534696	23.080961	15.301	139.644	12.63	14.00									0.61	C	2017.076		iT24 1x60s V-filter
	99.534650	23.080925	15.520	138.312	11.93	13.03							G3-K3	K1-K5	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1719	06 38 38.15	+22 48 32.4	11.3	242	12.40	15.70	-16	-15									2000		WDS06384+2252, WDS data as of beginning of Oct. 2017.
	99.659024	22.808885	11.022	246.856	13.66	15.62	6.99	-29.35	5.70	1.65	0.86	5.70			0.96	Hg	2015.000	CCCB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.658921	22.809306	11.486	238.859	13.49	15.90									0.61	C	2017.084		iT24 1x180s V-filter
	99.658925	22.809108	11.203	241.940	12.44	14.71							K2-K5	K4-K7	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index

Table 1 continues on next page.

Table 1 (continued). Measurements for WDS objects found in the existing CPM LSPM IV images

Name	RA	Dec	Sep "	PA °	M1	M2	pmRA1	pmDec1	e_pm1	pmRA2	pmDec2	e_pm2	Spc1	Spc2	Ap	Me	Date	CPM Rat	Source/Notes
POU 1721	06 38 23.97	+23 02 16.1	9.0	82	11.49	13.00	-1	-4		9	11						2001		WDS06384+2302 WDS data as of beginning of Oct. 2017.
	99.599909	23.037798	8.938	81.748	11.42	14.03	-0.59	-4.77	4.96	0.20	-2.80	4.96			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.599938	23.037797	8.824	80.805	11.59	13.45									0.61	C	2017.076		iT24 1x60s V-filter
	99.599904	23.037761	9.661	80.347	10.38	13.46							K4-K7	B8-F0	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1723	06 38 26.05	+23 05 41.6	13.1	340	14.00	14.60	17	8		7	-1						2001		WDS06385+2306, WDS data as of beginning of Oct. 2017. Secondary in Aladin image appears to be fainter when compared to the primary than the .6 magnitude shown in the WDS.
	99.608556	23.094905	13.068	339.751	13.90	15.11	4.67	1.56	4.96	0.07	-0.22	4.96			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.608583	23.094853	13.100	341.325	14.04	15.04									0.61	C	2017.084		iT24 1x180s V-filter
	99.608500	23.094939	12.499	343.914	12.98	14.46							K2-K5	F5-K2	0.61	C	2017.076		iT24 1x60s I-filter. SNR B<20. Spc based on V-I color index
POU 1727	06 38 30.84	+23 06 14.9	14.3	236	13.36	13.28	-4	-18		0	5						2010		WDS06386+2306, WDS data as of beginning of Oct. 2017. The WDS, 2MASS, and GAIA DR1 all show the secondary to be slightly brighter than the primary (2MASS numbers are 13.8 for A and 13.7 for B, which are visual magnitudes derived from the 2MASS J and K values).
	99.628531	23.104045	14.169	236.141	13.43	13.25	2.32	-21.94	4.96	-0.08	-1.71	4.96			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.628492	23.104111	14.163	236.097	13.62	13.63									0.61	C	2017.076		iT24 1x60s V-filter
	99.628575	23.104067	14.146	236.099	12.13	12.38							K5-M0	K4-K7	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1737	06 38 43.34	+23 00 39.9	6.5	224	13.80	13.90	14	-3		-18	-10						2013		WDS06388+2301, WDS data as of beginning of Oct. 2017. GAIA DR! And 2MASS show the secondary to be slightly brighter than the primary (2MASS numbers are 13.7 for A and 13.6 for B, which are visual magnitudes derived from the 2MASS J and K values). The secondary also appears to be slightly brighter than the primary in the Aladin image.
	99.680580	23.010972	6.845	223.660	13.50	13.34	-4.19	-21.83	5.70	-9.55	-10.60	5.70			0.96	Hg	2015.000	CCCB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.680629	23.010942	6.692	226.225	13.94	13.69									0.61	C	2017.076		iT24 1x60s V-filter
	99.680738	23.010814	6.884	230.914	12.53	12.55							K5-M0	K4-K5	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1740	06 38 47.76	+23 04 09.6	7.5	185	14.40	14.50	-3	79									2013		WDS06388+2304, WDS data as of beginning of Oct. 2017.
	99.699021	23.069306	7.633	185.390	15.01	15.27	0.39	-4.93	5.70	0.70	0.24	5.70			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.698983	23.069311	7.624	183.425	15.16	15.37									0.61	C	2017.076		iT24 1x60s V-filter
	99.699083	23.069269	7.591	183.126	14.12	14.58							K2-K5	G8-K4	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1765	06 39 11.30	+23 06 29.7	8.0	293	14.60	15.40	40	-8		-31	25						2013		WDS06392+2307, WDS data as of beginning of Oct. 2017.
	99.797056	23.108281	7.988	293.727	15.05	15.60	-2.79	5.71	5.25	-0.42	8.56	5.25			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.797008	23.108281	7.817	292.886	15.17	15.85									0.61	C	2017.084		iT24 1x180s V-filter
	99.797133	23.108183	8.416	295.627	14.25	14.63							K0-K5	K4-K7	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index

Table 1 continues on next page.

Table 1 (continued). Measurements for WDS objects found in the existing CPM LSPM IV images

Name	RA	Dec	Sep "	PA °	M1	M2	pmRA1	pmDec1	e_pm1	pmRA2	pmDec2	e_pm2	Spc1	Spc2	Ap	Me	Date	CPM Rat	Source/Notes
POU 1786	06 39 38.06	+23 05 03.6	8.1	355	14.90	15.30	3	-57		-7	45						2013		WDS06397+2305, WDS data as of beginning of Oct. 2017.
	99.908514	23.084249	8.064	354.804	15.11	15.35	-11.26	-20.45	5.25	-2.15	-1.58	5.25			0.96	Hg	2015.000	CCCB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.908446	23.084231	8.191	357.006	15.39	15.56									0.61	C	2017.084		iT24 1x180s V-filter
	99.908583	23.084244	8.209	354.405	14.19	14.56							K0-K5	K4-K7	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 1791	06 39 44.52	+22 58 10.9	8.1	141	13.70	15.10	0	0									2013		WDS06398+2259, WDS data as of beginning of Oct. 2017.
	99.935487	22.969700	8.158	141.253	13.16	14.72	-3.54	0.40	5.25	-3.26	-1.89	5.25			0.96	Hg	2015.000	CBCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	99.935442	22.969683	8.034	140.505	13.57	14.88									0.61	C	2017.084		iT24 1x180s V-filter
	99.935563	22.969642	8.099	140.504	12.13	13.85							K5-M0	K2-K5	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
POU 3062	09 54 13.37	+24 18 01.9	10.6	339	13.40	14.55	7	0									2006		WDS09543+2418, WDS data as of beginning of Oct. 2017.
	148.555693	24.300516	10.725	338.940	13.42	14.71	1.16	-17.96	6.22	-2.44	-14.77	6.22			0.96	Hg	2015.000	CCCB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	148.555679	24.300531	10.645	339.790	13.71	14.84									0.61	C	2017.081		iT24 1x60s V-filter
	148.555642	24.300508	10.779	337.794	12.13	13.60							K7-M1	K4-K7	0.61	C	2017.081		iT24 1x60s I-filter. Spc based on V-I color index
SLW 207	07 50 46.59	+40 17 47.8	138.8	353	15.60	16.60	38	-15		38	-13		M2.6	M3.3			2010		WDS07508+4018, WDS data as of beginning of Oct.2017.
	117.694362	40.296567	138.746	353.319	14.96	15.79	38.47	-17.02	6.97	37.11	-17.51	6.97			0.96	Hg	2015.000	AACC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	117.694354	40.296556	138.613	353.312	16.23	17.25									0.61	C	2017.209		iT24 1x300s V-filter
	117.694329	40.296475	139.047	353.238	13.87	14.62							M3->M4	>M4	0.61	C	2017.075		iT24 1x60s I-filter. SNR B <20. Spc based on V-I color index
STF 1139	07 49 11.68	+37 06 21.1	17.1	33	10.37	11.04	-6	-15		60	-31		F8				2010		WDS07492+3706, WDS data as of beginning of Oct. 2017.
	117.298634	37.105818	17.220	33.659	10.15	11.20	-12.63	-12.60	6.35	51.45	-26.70	6.35			0.96	Hg	2015.000	CCCB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	117.298634	37.105818	17.220	33.659	10.15	11.20	-6.46	-14.45	1.92	59.48	-30.40	0.00			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data direct from GAIA. Parallax data listed for both components in GAIA DR1: A is 4.13, B is 6.461.
	117.298454	37.105781	17.829	34.633	10.18	11.24									0.61	C	2017.075		iT24 1x60s V-filter
	117.298579	37.105792	17.520	33.438	9.41	10.42							0	0	0.61	C	2017.075		iT24 1x60s I-filter. Spc based on V-I color index
STI 1271	07 00 11.51	+56 28 33.9	3.9	331	11.10	11.40	-14	-12		-22	5						2006		WDS07002+5629, WDS data as of beginning of Oct. 2017.
	105.047720	56.476113	3.882	330.322	10.94	11.78	-21.17	7.84	5.77	-21.00	4.86	5.77			0.96	Hg	2015.000	CACB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	105.047771	56.476136	3.288	328.055	11.07	11.62									0.61	C	2017.076		iT24 1x60s V-filter. Touching star disks
	105.047788	56.476106	3.318	327.873	10.59	11.13							F2-K0	F2-K0	0.61	C	2017.076		iT24 1x60s I-filter. Touching/ overlapping star disks. Spc based on V-I color index
TDS 4001	06 39 03.64	+22 57 32.7	0.5	91	9.92	10.33	-70	-70		-70	-70						1991		WDS06391+2258, WDS data as of beginning of Oct. 2017.
																			Neither component identified in GaiA DR1. Primary identified in URAT1 and 2MASS, but not secondary.
	99.764958	22.958722			9.25	0.00									0.61	C	2017.076		iT24 1x60s V-filter. No resolution of B, star disk quite round, no hint of elongation. Might be bogus
	99.764938	22.958667			8.22	0.00							K2-K5		0.61	C	2017.076		iT24 1x60s I-filter. No resolution of B, star disk quite round, no hint of elongation. Spc based on V-I color index. Might be bogus

Table 1 continues on next page.

Table 1 (continued). Measurements for WDS objects found in the existing CPM LSPM IV images

Name	RA	Dec	Sep "	PA °	M1	M2	pmRA1	pmDec1	e_pm1	pmRA2	pmDec2	e_pm2	Spc1	Spc2	Ap	Me	Date	CPM Rat	Source/Notes
TDS 4001	06 39 03.64	+22 57 32.7	0.5	91	9.92	10.33	-70	-70		-70	-70						1991		WDS06391+2258, WDS data as of beginning of Oct. 2017.
																			Neither component identified in GaiA DR1. Primary identified in URAT1 and 2MASS, but not secondary.
	99.764958	22.958722			9.25	0.00									0.61	C	2017.076		iT24 1x60s V-filter. No resolution of B, star disk quite round, no hint of elongation. Might be bogus
	99.764938	22.958667			8.22	0.00							K2-K5		0.61	C	2017.076		iT24 1x60s I-filter. No resolution of B, star disk quite round, no hint of elongation. Spc based on V-I color index. Might be bogus
TDS 4122	06 46 27.56	+52 13 32.3	1.7	123	10.59	11.77	-6	-4		-6	-4						1991		WDS06465+5214, WDS data as of beginning of Oct. 2017.
	101.614830	52.225584			10.31		-2.82	-10.55							0.96	Hg	2015.000		GAIA DR1. M1 is GAIA Gmag data, PMRA1 and PMDec1 are GAIA DR1 data. Secondary not identified in GAIA DR1, 2MASS, and URAT1.
TDS 4122	101.614842	52.225525			10.46										0.61	C	2017.076		iT24 1x60s V-filter. No resolution of B. Star disk perfectly round, no sign of elongation. Probably bogus
	101.614892	52.225547			9.94								F8-K0		0.61	C	2017.076		iT24 1x60s I-filter. No resolution of B, star disk perfectly round, no hint of elongation. Spc based on V-I color index. Probably bogus
UCI 1480	06 46 38.15	+52 12 19.6	32.2	62	14.50	16.60	-37	-71		-29	-67						2010		WDS06466+5212, WDS data as of beginning of Oct. 2017.
	101.658746	52.205135	32.178	61.932	14.06	15.79	-42.46	-73.61	6.15	-30.24	-69.56	6.60			0.96	Hg	2015.000	CCBB	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	101.658725	52.204994	32.325	61.971	14.98	17.08									0.61	C	2017.209		iT24 1x300s V-filter
	101.658758	52.205086	32.046	61.583	13.16	14.66							M0-M2	M3->M4	0.61	C	2017.076		iT24 1x60s I-filter. Spc based on V-I color index
BAL 2659	06 19 11.16	+04 29 03.0	18.5	327	11.87	12.80	-2	0		-8	-6						2010		WDS06192+0430, WDS data as of beginning of Oct. 2017.
	94.796560	4.484054	18.363	327.458	12.22	12.87	-3.70	-9.54	6.12	-2.79	-8.84	6.12			0.96	Hg	2015.000	BBCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	94.796592	4.484025	18.399	327.227	12.30	13.11									0.61	C	2017.081		iT24 1x60s V-filter
	94.796671	4.484081	18.374	327.232	12.08	12.54							0	0	0.61	C	2017.081		iT24 1x60s I-filter. Spc based on V-I color index
BAL 2678	07 29 12.67	+04 34 50.4	18.5	286	12.00	12.47	-4	-3		-4	-2						2010		WDS07292+0435, WDS data as of beginning of Oct. 2017.
	112.302804	4.580716	18.436	286.225	11.78	12.34	-5.69	-4.35	5.63	-3.79	-1.02	5.63			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	112.302800	4.580706	18.486	286.241	11.97	12.49									0.61	C	2017.081		iT24 1x60s V-filter
	112.302800	4.580750	18.509	286.155	11.12	11.74							K0-K4	G5-K4	0.61	C	2017.081		iT24 1x60s I-filter. Spc based on V-I color index
DAM 1221 AB	07 29 02.26	+04 40 49.7	4.3	153	12.90	13.60	-16	40		-26	-28						2010		WDS07290+0441, WDS data as of beginning of Oct. 2017.
	112.259431	4.680480	4.257	152.077	12.81	13.40	-1.69	-0.69	5.63	-2.75	-3.50	5.63			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	112.259408	4.680492	4.102	151.954	12.94	13.73									0.61	C	2017.081		iT24 1x60s V-filter
	112.259508	4.680392	3.890	150.028	12.36	12.62							F5-K1	K3-K5	0.61	C	2017.081		iT24 1x60s I-filter. Spc based on V-I color index

Table 1 concludes on next page.

Table 1 (conclusion). Measurements for WDS objects found in the existing CPM LSPM IV images

Name	RA	Dec	Sep "	PA °	M1	M2	pmRA1	pmDec1	e_pm1	pmRA2	pmDec2	e_pm2	Spc1	Spc2	Ap	Me	Date	CPM Rat	Source/Notes
DAM 1121 AC	07 29 02.26	+04 40 49.7	20.5	186	12.90	16.10	-16	40		-31	-32						2010		WDS09446+0845, WDS data as of beginning of Oct. 2017.
	112.259431	4.680480	20.863	186.465	12.81	15.94	-1.69	-0.69	5.63	2.19	-2.02	6.12			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	112.259408	4.680492	20.925	185.741	12.94	16.18									0.61	C	2017.081		iT24 1x60s V-filter
	112.259508	4.680392	20.598	186.627	12.36	15.21							F5-K1	K1-K5	0.61	C	2017.081		iT24 1x60s I-filter. Spc based on V-I color index
BKO 400	09 44 36.31	+08 45 18.9	17.3	348	11.10	13.10	3	14		-10	10						2010		WDS09446+0845, WDS data as of beginning of Oct. 2017.
	146.151291	8.755318	17.267	347.782	11.18	13.14	-5.71	13.73	10.23	-25.65	0.39	10.23			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	146.151346	8.755244	17.292	347.472	11.29	13.33									0.61	C	2017.305		iT24 1x60s V-filter
	146.151313	8.755317	17.301	347.479	10.72	12.60							F5-K1	G5-K3	0.61	C	2017.305		iT24 1x60s I-filter. Spc based on V-I color index
GRV 798	09 44 41.22	+08 40 19.2	81.1	130	12.15	12.49	16	-34		17	-32						2010		WDS09446+0840, WDS data as of beginning of Oct. 2017.
	146.171709	8.671949	81.096	130.285	11.87	12.23	8.71	-37.72	10.23	12.27	-32.49	8.03			0.96	Hg	2015.000	CCCC	GAIA DR1. PM data calculated from position comparison with 2MASS. M1 and M2 are GAIA Gmag data.
	146.171688	8.671903	81.169	130.328	12.09	12.43									0.61	C	2017.305		iT24 1x60s V-filter
	146.171746	8.671958	81.510	130.337	11.29	11.66							G8-K4	G8-K4	0.61	C	2017.305		iT24 1x60s I-filter. Spc based on V-I color index

Measurements of WDS Objects Found in Images Taken for Detecting CPM Pairs in the LSPM Catalog - II

Appendix A

Explanation of the CPM rating scheme according to Knapp and Nanson 2017:

- Four rating factors are used: Proper motion vector direction, proper motion vector length, size of position error in relation to proper motion vector length and relationship between angular separation and proper motion speed
- Proper motion vector direction ratings: “A” for within the error range of identical direction, “B” for similar direction within the double error range, and “C” for outside
- Proper motion vector length ratings: “A” for within the error range of identical length, “B” for similar length within the double error range, and C for outside
- Error size ratings: “A” for error size of less than 5% of the proper motion vector length, “B” for less than 10%, and “C” for a larger error size
- Angular separation rating: “A” for angular separation/proper motion speed less than 100, “B” for less than 1000 and “C” for above

To compensate for excessively large position errors resulting in an “A” rating despite rather high deviations an absolute upper limit is applied regardless of calculated error size:

- Proper motion vector direction: Max. 2.86° difference for an “A” and 5.72° for a “B”
- Proper motion vector length: Max. 5% difference for an “A” and 10% for a “B”

Appendix B

The following table gives the plate solving errors for the used iT24 images and error information derived from the measurements provided in Table 1 and also the measured positions for both components.

Table 2: Error estimations for the in table 1 provided measurements for the given objects:

- *dRA and dDec = average RA and Dec plate solving errors in arcseconds*
- *Err_Sep = separation error estimation in arcseconds calculated as SQRT(dRA^2+dDec^2)*
- *Err_PA = position angle error estimation in degrees calculated as arctan (Err_Sep/Sep) assuming the worst case that Err_Sep points perpendicular to the separation vector*
- *dmag as average mag plate solving error (Vmag for images with made V-filter and Imag for images made with I-filter)*
- *Err_Mag = magnitude error estimation calculated as SQRT(dVmag^2+(2.5*LOG10(1+1/SNR))^2)*
- *SNR as signal to noise ratio for the given object*

Name		RA	Dec	dRA	dDec	Err Sep	Err PA	Err Mag	SNR	dmag	Date	Notes
ALI 936	A	20 29 35.084	39 01 10.29	0.05	0.06	0.078	0.428	0.070	381.42	0.07	2016.658	iT24 1x60s V-filter
	B	20 29 35.958	39 01 12.69					0.070	302.23			
	A	20 29 35.080	39 01 10.32	0.05	0.06	0.078	0.427	0.130	286.98	0.13	2016.658	iT24 1x60s I-filter. Spc range according to V-I color index
	B	20 29 35.955	39 01 12.69					0.130	302.88			

Table 2 continues on next page.

Measurements of WDS Objects Found in Images Taken for Detecting CPM Pairs in the LSPM Catalog - II

Table 2 (continued). Error estimations for the in table 1 provided measurements for the given objects

Name		RA	Dec	dRA	dDec	Err Sep	Err PA	Err Mag	SNR	dmag	Date	Notes
POU 1768	A	06 39 16.637	23 07 11.52	0.13	0.13	0.184	1.128	0.062	62.16	0.06	2017.084	iT24 1x180s V-filter
	B	06 39 16.304	23 07 19.65					0.063	55.35			
	A	06 39 16.667	23 07 11.28	0.14	0.13	0.191	1.086	0.121	61.67	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 39 16.326	23 07 20.19					0.121	58.55			
POU 1769	A	06 39 16.637	23 07 11.52	0.13	0.13	0.184	0.657	0.062	62.16	0.06	2017.084	iT24 1x180s V-filter
	C	06 39 17.675	23 07 18.74					0.063	60.62			
	A	06 39 16.667	23 07 11.28	0.14	0.13	0.191	0.683	0.121	61.67	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	C	06 39 17.701	23 07 18.60					0.121	60.64			
POU 1710	A	06 38 05.026	23 05 18.40	0.14	0.13	0.191	0.854	0.053	66.22	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 05.849	23 05 12.46					0.057	38.58			
	A	06 38 05.014	23 05 18.23	0.14	0.13	0.191	0.879	0.121	76.07	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 05.806	23 05 12.27					0.121	60.11			
POU 1712	A	06 38 12.741	22 55 13.58	0.14	0.13	0.191	0.943	0.063	56.71	0.06	2017.084	iT24 1x180s V-filter
	B	06 38 13.565	22 55 15.86					0.068	32.41			
	A	06 38 12.740	22 55 13.34	0.14	0.13	0.191	0.912	0.122	49.72	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 13.592	22 55 15.67					0.127	25.50			
POU 1713	A	06 38 07.068	23 04 05.40	0.14	0.13	0.191	0.769	0.057	40.57	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 07.505	23 03 52.50					0.059	34.85			
	A	06 38 07.058	23 04 04.87	0.14	0.13	0.191	0.817	0.121	57.16	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 07.491	23 03 52.88					0.123	37.00			
POU 1714	A	06 38 08.327	23 04 51.46	0.14	0.13	0.191	0.715	0.053	63.88	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 09.045	23 04 39.80					0.054	53.03			
	A	06 38 08.316	23 04 51.33	0.14	0.13	0.191	0.705	0.121	81.48	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 09.064	23 04 39.74					0.121	60.26			
POU 1719	A	06 38 38.141	22 48 33.50	0.14	0.13	0.191	0.953	0.068	33.82	0.06	2017.084	iT24 1x180s V-filter
	B	06 38 37.430	22 48 27.56					0.074	24.28			
	A	06 38 38.142	22 48 32.79	0.14	0.13	0.191	0.977	0.123	43.11	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 37.427	22 48 27.52					0.128	24.17			
POU 1721	A	06 38 23.985	23 02 16.07	0.14	0.13	0.191	1.240	0.052	76.46	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 24.616	23 02 17.48					0.054	51.67			
	A	06 38 23.977	23 02 15.94	0.14	0.13	0.191	1.133	0.121	72.85	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 24.667	23 02 17.56					0.125	29.33			
POU 1723	A	06 38 26.060	23 05 41.47	0.14	0.13	0.191	0.836	0.063	53.99	0.06	2017.084	iT24 1x180s V-filter
	B	06 38 25.756	23 05 53.88					0.065	42.37			
	A	06 38 26.040	23 05 41.78	0.14	0.13	0.191	0.876	0.121	56.96	0.12	2017.076	iT24 1x60s I-filter. SNR B<20. Spc based on V-I color index
	B	06 38 25.789	23 05 53.79					0.133	18.27			
POU 1727	A	06 38 30.838	23 06 14.80	0.14	0.13	0.191	0.773	0.054	50.58	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 29.986	23 06 06.90					0.056	43.70			
	A	06 38 30.858	23 06 14.64	0.14	0.13	0.191	0.774	0.121	81.79	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 30.007	23 06 06.75					0.121	73.72			
POU 1737	A	06 38 43.351	23 00 39.39	0.14	0.13	0.120	1.027	0.060	32.09	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 43.001	23 00 34.76					0.057	38.67			
	A	06 38 43.377	23 00 38.93	0.14	0.13	0.191	1.590	0.122	49.06	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 42.990	23 00 34.59					0.123	42.64			
POU 1740	A	06 38 47.756	23 04 09.52	0.14	0.13	0.191	1.436	0.065	26.02	0.05	2017.076	iT24 1x60s V-filter
	B	06 38 47.723	23 04 01.91					0.068	23.39			
	A	06 38 47.780	23 04 09.37	0.14	0.13	0.191	1.442	0.124	34.77	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 38 47.750	23 04 01.79					0.124	35.10			
POU 1765	A	06 39 11.282	23 06 29.81	0.13	0.13	0.184	1.347	0.064	48.02	0.06	2017.084	iT24 1x180s V-filter
	B	06 39 10.760	23 06 32.85					0.066	39.84			
	A	06 39 11.312	23 06 29.46	0.14	0.13	0.191	1.300	0.124	36.38	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 39 10.762	23 06 33.10					0.123	36.78			

Table 2 continues on next page.

Measurements of WDS Objects Found in Images Taken for Detecting CPM Pairs in the LSPM Catalog - II

Table 2 (continued). Error estimations for the in table 1 provided measurements for the given objects

Name		RA	Dec	dRA	dDec	Err Sep	Err PA	Err Mag	SNR	dmag	Date	Notes
POU 1786	A	06 39 38.027	23 05 03.23	0.13	0.13	0.184	1.286	0.066	39.61	0.06	2017.084	iT24 1x180s V-filter
	B	06 39 37.996	23 05 11.41					0.065	44.10			
	A	06 39 38.060	23 05 03.28	0.14	0.13	0.191	1.333	0.123	40.20	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 39 38.002	23 05 11.45					0.123	38.24			
POU 1791	A	06 39 44.506	22 58 10.86	0.13	0.13	0.184	1.311	0.062	68.71	0.06	2017.084	iT24 1x180s V-filter
	B	06 39 44.876	22 58 04.66					0.067	37.19			
	A	06 39 44.535	22 58 10.71	0.14	0.13	0.191	1.351	0.122	50.73	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 39 44.908	22 58 04.46					0.123	39.20			
POU 3062	A	09 54 13.363	24 18 01.91	0.11	0.10	0.149	0.800	0.081	81.53	0.08	2017.081	iT24 1x60s V-filter
	B	09 54 13.094	24 18 11.90					0.082	67.80			
	A	09 54 13.354	24 18 01.83	0.11	0.10	0.149	0.790	0.131	80.14	0.13	2017.081	iT24 1x60s I-filter. Spc based on V-I color index
	B	09 54 13.056	24 18 11.81					0.131	67.19			
SLW 207	A	07 50 46.645	40 17 47.60	0.08	0.11	0.136	0.056	0.041	105.22	0.04	2017.209	iT24 1x300s V-filter
	B	07 50 45.234	40 20 05.27					0.044	59.74			
	A	07 50 46.639	40 17 47.31	0.12	0.11	0.163	0.067	0.133	39.13	0.13	2017.075	iT24 1x60s I-filter. SNR B <20. Spc based on V-I color index
	B	07 50 45.208	40 20 05.39					0.142	18.52			
STF 1139	A	07 49 11.629	37 06 20.81	0.10	0.11	0.149	0.478	0.104	35.53	0.10	2017.075	iT24 1x60s V-filter
	B	07 49 12.476	37 06 35.48					0.103	40.50			
	A	07 49 11.659	37 06 20.85	0.12	0.12	0.170	0.555	0.142	46.40	0.14	2017.075	iT24 1x60s I-filter. Spc based on V-I color index
	B	07 49 12.466	37 06 35.47					0.141	55.88			
STI 2171	A	07 00 11.465	56 28 34.09	0.12	0.12	0.170	2.955	0.056	40.87	0.05	2017.076	iT24 1x60s V-filter. Touching star disks
	B	07 00 11.255	56 28 36.88					0.066	25.06			
	A	07 00 11.469	56 28 33.98	0.13	0.11	0.170	2.938	0.112	57.21	0.11	2017.076	iT24 1x60s I-filter. Touching/overlapping star disks. Spc based on V-I color index
	B	07 00 11.256	56 28 36.79					0.112	46.75			
TDS 4001	A	06 39 03.590	22 57 31.40	0.14	0.13	0.191	#WERT!	0.053	62.04	0.05	2017.076	iT24 1x60s V-filter. No resolution of B, star disk quite round, no hint of elongation. Might be bogus
	B	0	0					-	-			
	A	06 39 03.585	22 57 31.20	0.14	0.13	0.191	#WERT!	0.121	59.46	0.12	2017.076	iT24 1x60s I-filter. No resolution of B, star disk quite round, no hint of elongation. Spc based on V-I color index. Might be bogus
	B	0	0					-	-			
TDS 4122	A	06 46 27.562	52 13 31.89	0.12	0.12	0.170	#WERT!	0.052	79.11	0.05	2017.076	iT24 1x60s V-filter. No resolution of B. Star disk perfectly round, no sign of elongation. Probably bogus
	B	0	0					-	-			
	A	06 46 27.574	52 13 31.97	0.13	0.13	0.184	#WERT!	0.121	82.40	0.12	2017.076	iT24 1x60s I-filter. No resolution of B, star disk perfectly round, no hint of elongation. Spc based on V-I color index. Probably bogus
	B	0	0					-	-			
UC 1480	A	06 46 38.094	52 12 17.98	0.12	0.11	0.163	0.289	0.110	112.23	0.11	2017.209	iT24 1x300s V-filter
	B	06 46 41.198	52 12 33.17					0.115	30.55			
	A	06 46 38.102	52 12 18.31	0.13	0.13	0.184	0.329	0.121	61.93	0.12	2017.076	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 46 41.168	52 12 33.56					0.124	34.32			
BAL 2659	A	06 19 11.182	04 29 02.49	0.12	0.11	0.163	0.507	0.080	131.04	0.08	2017.081	iT24 1x60s V-filter
	B	06 19 10.516	04 29 17.96					0.081	92.00			
	A	06 19 11.201	04 29 02.69	0.13	0.11	0.170	0.531	0.130	107.29	0.13	2017.081	iT24 1x60s I-filter. Spc based on V-I color index
	B	06 19 10.536	04 29 18.14					0.130	94.89			

Table 2 concludes on next page.

Measurements of WDS Objects Found in Images Taken for Detecting CPM Pairs in the LSPM Catalog - II

Table 2 (conclusion). Error estimations for the in table 1 provided measurements for the given objects

Name		RA	Dec	dRA	dDec	Err Sep	Err PA	Err Mag	SNR	dmag	Date	Notes
BAL 2768	A	07 29 12.672	04 34 50.54	0.11	0.10	0.149	0.461	0.060	166.38	0.06	2017.081	iT24 1x60s V-filter
	B	07 29 11.485	04 34 55.71					0.060	143.06			
	A	07 29 12.672	04 34 50.70	0.12	0.10	0.156	0.484	0.110	110.13	0.11	2017.081	iT24 1x60s I-filter. Spc based on V-I color index
	B	07 29 11.483	04 34 55.85					0.110	104.19			
DAM 1221	A	07 29 02.258	04 40 49.77	0.11	0.10	0.149	2.076	0.062	78.79	0.06	2017.081	iT24 1x60s V-filter
	B	07 29 02.387	04 40 46.15					0.065	44.21			
	A	07 29 02.282	04 40 49.41	0.12	0.10	0.156	2.299	0.112	48.73	0.11	2017.081	iT24 1x60s I-filter. Spc based on V-I color index
	B	07 29 02.412	04 40 46.04					0.114	36.89			
DAM 1221	A	07 29 02.258	04 40 49.77	0.11	0.10	0.149	0.407	0.062	78.79	0.06	2017.081	iT24 1x60s V-filter
	C	07 29 02.118	04 40 28.95					0.067	35.69			
	A	07 29 02.282	04 40 49.41	0.12	0.10	0.156	0.435	0.112	48.73	0.11	2017.081	iT24 1x60s I-filter. Spc based on V-I color index
	C	07 29 02.123	04 40 28.95					0.115	30.56			
BKO 400	A	09 44 36.323	08 45 18.88	0.09	0.09	0.127	0.422	0.060	161.97	0.06	2017.305	iT24 1x60s V-filter
	B	09 44 36.070	08 45 35.76					0.061	94.77			
	A	09 44 36.315	08 45 19.14	0.10	0.09	0.135	0.446	0.100	157.06	0.10	2017.305	iT24 1x60s I-filter. Spc based on V-I color index
	B	09 44 36.062	08 45 36.03					0.100	108.08			
GRV 798	A	09 44 41.205	08 40 18.85	0.09	0.09	0.127	0.090	0.060	154.89	0.06	2017.305	iT24 1x60s V-filter
	B	09 44 45.378	08 39 26.32					0.060	150.91			
	A	09 44 41.219	08 40 19.05	0.10	0.09	0.135	0.095	0.100	133.37	0.10	2017.305	iT24 1x60s I-filter. Spc based on V-I color index
	B	09 44 45.409	08 39 26.29					0.100	130.18			
LEP 131	A	07 09 38.530	32 17 48.42	0.10	0.12	0.156	#WERT!	0.113	11.73	0.07	2017.209	iT24 1x300s V-filter. SNR A <20. No resolution of B, has to be fainter than 19.5Vmag
	B	0	0					-	-			
	A	07 09 38.558	32 17 48.28	0.13	0.11	0.170	0.599	0.139	21.38	0.13	2017.084	iT24 1x180s I-filter. SNR B <10. Spc based on V-I color index with Vmag B estimated 19.6
	B	07 09 38.974	32 18 03.70					0.186	7.69			
DAM 1222	A	07 29 07.344	04 46 25.44	0.11	0.11	0.156	#WERT!	0.071	106.46	0.07	2017.739	iT24 1x300s V-filter. No resolution of B, has to be fainter than 18.7 Vmag
	B	0	0					-	-			
	A	07 29 07.353	04 46 25.50	0.12	0.10	0.156	0.553	0.110	110.47	0.11	2017.081	iT24 1x60s I-filter. SNR B <20. Spc based on V-I color index. Vmag B estimated with 18.8Vmag
	B	07 29 07.751	04 46 40.55					0.133	13.99			
GOM 9	A	09 44 23.261	08 42 21.87	0.11	0.12	0.163	#WERT!	0.190	5.36	0.04	2017.324	iT24 1x300s V-filter. SNR A <10. No resolution of B, has to be fainter than 19.5 Vmag
	B	0	0					-	-			
	A	09 44 23.284	08 42 21.81	0.14	0.12	0.184	1.180	0.110	23.13	0.10	2017.324	iT24 1x300s I-filter. SNR B <10. Spc based on V-I color index with Vmag B estimated 19.6
	B	09 44 22.681	08 42 22.30					0.310	3.22			