# Counter-Check of Janes Double Stars for being Physical Pairs

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**Abstract:** This report counter-checks 93 objects reported by Kenneth A. Janes in Nov. 2016 as wide binaries in the Kepler field for the probability of being physical pairs using UCAC5 proper motion data. Additionally these objects are counter-checked against the WDS catalog for being newly detected or already listed as double stars. All objects are listed in a table format giving all parameters necessary for being included into the WDS catalog if newly detected. Finally a newly detected common proper motion pair was found by chance during the work on this report.

## Introduction

Brian Skiff made me aware of the Janes 2016 report with 93 objects found as wide binaries in the field of the Kepler mission using proper motion data from different catalogs (USNO-B, UCAC4, URAT1, Tycho-2 and PPXML) as well as from the Pan-STARRS 1 study and using also self-consistent photometric properties. The paper lists only a sample of these objects so I contacted the author to get the complete list (also available online on the Astrophysical Journal website as attachment to this paper). All listed doubles are identified with the KIC numbers of the components so I had to search the Kepler Input Catalog to get the corresponding RA and Dec coordinates. Next step was then to identify these objects in the 2MASS images, load the WDS catalog to see if the object is already listed as double star and then load the UCAC5 data to check the PM values for common proper motion using the CPM assessment model from Knapp and Nanson 2017 adapted for use with UCAC5. For several Janes doubles UCAC5 does not offer corresponding objects for both components – in such cases I had to resort to comparison of 2MASS to GAIA DR1 or URAT1.

## Results

The results for the counter-checked objects are given in Table 1 below.

## Summary

A surprisingly large number of JN object components is listed in the UCAC5 catalog with rather suspect proper motion data – mostly for very faint components as is according to the UCAC5 description more or less to expect (Zacharias et al. 2017). In these cases the counter-check pm values calculated from 2MASS to GAIA DR1 position comparisons are considered as more reliable (with the exception of JN 82 with an unusually large 2MASS position error for B).

A good part of the Janes objects (46 out of 93) is already included in the WDS catalog as known double stars - in many cases with V-code indicating a physical pair. A few of these WDS double stars are Kepler Objects of Interest (KOI) and with exception of KOI 623 not identical with the Janes objects, but only with components indicating thus multiples. Despite this overlap with existing WDS objects there remains a good number of 47 newly detected double stars.

The assessment of the newly detected pairs for

*(Text continues on page 425)*

*Table 1: CPM Rating for the objects in Janes 2016*

*Description of the table contents:*

- *JN# gives the number of the object according to Janes 2016 (note that there are a few gaps)*
- *WDS gives the corresponding WDS object if this object is already listed as double star*
- *RA and Dec give the GAIA DR1 coordinates in decimal degrees format as these values are directly usable for calculating Sep and PA*
- *Sep gives separation in arcseconds calculated from the coordinates of both components as SQRT(((RA2-RA1)*cos(Dec1))^2+(Dec2-Dec1)^2) in radians (Buchheim 2008)*
- *PA gives position angle in degrees calculated from the coordinates of both components as arctan((RA2-RA1)*cos(Dec1))/(Dec2-Dec1)) in radians depending on quadrant (Buchheim 2008)*
- *M1 and M2 give GAIA DR1 Gmags*
- *pmRA1 and pmDE1 with e_pm1 give the UCAC5 proper motion data for A and pmRA2, pmDE2 and e_pm2 for B if available, otherwise from comparing 2MASS to GAIA DR1 (or else URAT1) positions. If UCAC5 proper motion data seems suspect (indicated by e_pm values larger 6 mas) then values from comparison 2MASS to GAIA DR1 positions are given as counter-check*
- *Ap indicates the aperture of the observation (GAIA DR1 aperture calculated as corresponding circular surface diameter)*
- *Me indicates the WDS code for the used observation method*
- *Date is the Julian observation epoch*
- *CPM Rat gives the rating of the CPM assessment based on comparison of the given PM data (description see Appendix A)*
- *CPM % gives an estimated probability for being physical (beta version of a planned extension of the letter based CPM rating scheme – Knapp 2018, paper in preparation)*
- *Source/Notes indicate the used catalog and gives additional comments and explanations if considered necessary*
- *In case of unexpected large UCAC5 proper motion data errors a PM data counter-check based on 2MASS to GAIA DR1 is given in the second line*
- *In the next line the corresponding UCAC5 coordinates with calculated Sep and PA are given if available to provide an additional observation*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ES 478 | 280.90275110 | 42.6111178 | 9.33 | 184.33 | 9.84 | 11.33 | 15.30 | 11.30 | 1.98 | 14.80 | 10.10 | 2.05 | 0.96 | Hg | 2015.000 | ABCB | 62 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate, difference in PMVL might indicate an orbit |
| | | 280.90268420 | 42.6110814 | 9.32 | 184.30 | | | | | | | | | 0.20 | Eu | 2003.373 | | | UCAC5 |
| 2 | DEA 409 | 281.05412310 | 43.3651183 | 21.37 | 77.45 | 15.06 | 15.77 | 32.10 | 1.40 | 5.52 | 42.80 | 3.60 | 10.58 | 0.96 | Hg | 2015.000 | ACCB | 31 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Difference in PMVL too large to indicate an orbit, not such a good CPM candidate |
| | | | | | | | | 25.27 | 3.75 | 5.12 | 28.58 | 2.14 | 5.12 | | | | BCCC | 24 | Counter-check with PM data calculated from position comparison with 2MASS. Probably optical. UCAC5 pm data suspect |
| | | 281.05398060 | 43.3651136 | 21.25 | 77.45 | | | | | | | | | 0.20 | Eu | 2003.380 | | | UCAC5 |
| 3 | KOI 4419 | 281.11021780 | 43.2825325 | 15.88 | 92.71 | 12.44 | 14.97 | -27.10 | -28.80 | 1.84 | -29.00 | -28.90 | 4.95 | 0.96 | Hg | 2015.000 | AACB | 78 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Looks like a good CPM candidate. PM error a bit large. KOI 4419 is listed for B with a secondary not to be found in other catalogs consulted - suspect object |
| | | 281.11033810 | 43.2826256 | 15.90 | 92.71 | | | | | | | | | 0.20 | Eu | 2003.378 | | | UCAC5 |
| 4 | | 281.54843220 | 43.8914531 | 408.14 | 6.34 | 11.14 | 13.58 | 29.00 | 84.00 | 1.70 | 28.20 | 82.90 | 2.26 | 0.96 | Hg | 2015.000 | AAAC | 95 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Angular separation a bit large, else solid CPM candidate |
| | | 281.54830220 | 43.8911819 | 408.15 | 6.34 | | | | | | | | | 0.20 | Eu | 2003.384 | | | UCAC5 |
| 5 | DEA 188 | 282.13017920 | 42.6699775 | 8.86 | 67.80 | 15.38 | 15.40 | -15.50 | -30.40 | 6.58 | -10.60 | -34.50 | 8.49 | 0.96 | Hg | 2015.000 | CBCB | 12 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Difference in PMVD too large to be considered a good CPM candidate, rather optical despite V-coded in WDS |
| | | | | | | | | -13.25 | -37.68 | 5.12 | -11.65 | -37.08 | 5.12 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm values seem to be in error |
| | | 282.13024720 | 42.6700758 | 8.82 | 67.38 | | | | | | | | | 0.20 | Eu | 2003.372 | | | UCAC5 |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | | 282.31648530 | 41.2158236 | 14.47 | 78.27 | 14.00 | 15.31 | -1.20 | -21.40 | 2.55 | -0.10 | -33.10 | 6.93 | 0.96 | Hg | 2015.000 | BCCB | 25 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 282.31649070 | 41.2158928 | 14.48 | 77.73 | | | | | | | | | 0.20 | Eu | 2003.336 | | | UCAC5 |
| 7 | | 282.61271280 | 42.6694114 | 20.43 | 47.52 | 13.50 | 15.31 | -16.40 | -36.30 | 2.40 | -15.60 | -26.70 | 6.51 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | | | | | | | -20.79 | -35.55 | 5.12 | -19.22 | -35.73 | 5.12 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm values seem to be in error |
| | | 282.61278500 | 42.6695286 | 20.35 | 47.73 | | | | | | | | | 0.20 | Eu | 2003.371 | | | UCAC5 |
| 8 | | 282.84311913 | 47.3443398 | 12.72 | 185.61 | 14.41 | 15.94 | 22.89 | 46.11 | 5.58 | 23.44 | 50.34 | 5.58 | 0.96 | Hg | 2015.000 | ABCB | 62 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Good CPM candidate, difference in PMVL might indicate an orbit |
| | | 282.84296400 | 47.3441280 | 12.79 | 185.62 | 14.60 | 15.80 | | | | | | | 1.30 | E2 | 1998.466 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 9 | UC 3697 | 282.86391080 | 43.6747014 | 16.72 | 146.76 | 13.82 | 14.26 | 21.20 | 44.50 | 2.55 | 21.60 | 37.00 | 3.68 | 0.96 | Hg | 2015.000 | BCBB | 30 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 282.86381610 | 43.6745578 | 16.64 | 146.61 | | | | | | | | | 0.20 | Eu | 2003.382 | | | UCAC5 |
| 10 | | 282.96120640 | 48.9146631 | 260.20 | 333.75 | 9.74 | 9.90 | -11.40 | -41.70 | 2.26 | -16.60 | -45.40 | 2.26 | 0.96 | Hg | 2015.000 | BCBC | 29 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 282.9612622 | 48.9147967 | 260.21 | 333.77 | | | | | | | | | 0.20 | Eu | 2003.463 | | | UCAC5 |
| KPP n+1 | | 282.91256190 | 48.9794853 | 13.46 | 192.47 | 9.90 | 15.26 | -16.60 | -45.40 | 2.26 | -15.40 | -44.90 | 6.22 | 0.96 | Hg | 2015.000 | AACB | 78 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. PM error size B a bit large, else a solid CPM candidate. Curious coincidence - the secondary of rather wide Janes #10 has a much closer companion with obviously common proper motion |
| | | | | | | | | -13.73 | -45.49 | 5.14 | -16.24 | -43.89 | 5.14 | | | | BACB | 62 | Counter-check with PM data calculated from position comparison with 2MASS. Still good CPM candidate |
| | | 282.91264310 | 48.9796308 | 13.47 | 192.53 | | | | | | | | | 0.20 | Eu | 2003.467 | | | UCAC5 |
| 11 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 12 | | 283.28749030 | 48.6789358 | 24.01 | 113.11 | 11.89 | 12.76 | 5.40 | -42.10 | 1.98 | 7.50 | -42.80 | 1.70 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 283.28746410 | 48.6790708 | 23.98 | 113.12 | | | | | | | | | 0.20 | Eu | 2003.471 | | | UCAC5 |
| 13 | DEA 437 | 283.43970749 | 45.8379508 | 25.87 | 72.94 | 12.29 | 16.45 | 43.91 | -94.98 | 5.58 | 43.03 | -98.60 | 5.58 | 0.96 | Hg | 2015.000 | AABB | 92 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Solid CPM candidate |
| | | 283.43941800 | 45.8383870 | 25.90 | 72.83 | 12.69 | 15.79 | | | | | | | 1.30 | E2 | 1998.466 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 14 | DEA 460 | 283.73865610 | 47.5824956 | 36.60 | 286.82 | 14.94 | 15.27 | 40.00 | 3.90 | 9.48 | 27.00 | 4.40 | 9.40 | 0.96 | Hg | 2015.000 | BCCC | 24 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | | | | | | | 39.51 | 8.19 | 6.05 | 37.71 | 8.22 | 6.05 | | | | AACC | 76 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm data suspect |
| | | 283.73846580 | 47.5824831 | 36.45 | 286.88 | | | | | | | | | 0.20 | Eu | 2003.453 | | | UCAC5 |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | 47.7163733 | 27.60 | 155.06 | 10.23 | 14.15 | 12.70 | 38.40 | 1.84 | 10.30 | 37.80 | 2.40 | 0.96 | Hg | 2015.000 | BABB | 73 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate, difference in PMVD might be an indication for an orbit |
| | | 283.82378490 | 47.7162500 | 27.61 | 155.00 | | | | | | | | | 0.20 | Eu | 2003.454 | | | UCAC5 |
| 16 | | 284.08873420 | 45.5150331 | 550.04 | 341.84 | 9.11 | 11.30 | 24.20 | 57.40 | 2.69 | 26.40 | 67.80 | 1.98 | 0.96 | Hg | 2015.000 | ACAC | 38 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Difference PMVL too large to be considered being a good CPM candidate |
| | | 284.08862300 | 45.5148483 | 549.93 | 341.84 | | | | | | | | | 0.20 | Eu | 2003.430 | | | UCAC5 |
| 17 | HJ 1356 | 284.09234420 | 45.5072881 | 29.33 | 341.91 | 8.23 | 9.11 | 25.00 | 57.80 | 2.69 | 24.20 | 57.40 | 2.69 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate. Overlap Janes #16 B with Janes #17 A would indicate a CPM triple |
| | | 284.09222970 | 45.5071022 | 29.33 | 341.93 | | | | | | | | | 0.20 | Eu | 2003.424 | | | UCAC5 |
| 18 | | 284.18680470 | 42.5345142 | 102.81 | 357.82 | 8.85 | 10.95 | 14.50 | -42.80 | 2.12 | 13.30 | -45.40 | 1.70 | 0.96 | Hg | 2015.000 | AAAC | 95 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 284.18674110 | 42.5346522 | 102.84 | 357.83 | | | | | | | | | 0.20 | Eu | 2003.371 | | | UCAC5 |
| 19 | DEA 191 | 285.09521560 | 48.5836697 | 8.95 | 78.45 | 10.55 | 11.44 | -10.10 | -22.00 | 1.98 | -9.00 | -20.90 | 1.98 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate, potential orbit |
| | | 285.09526440 | 48.5837403 | 8.93 | 78.52 | | | | | | | | | 0.20 | Eu | 2003.470 | | | UCAC5 |
| 20 | | 285.51297220 | 44.3655581 | 89.80 | 98.69 | 12.59 | 12.59 | 3.40 | 39.10 | 1.98 | 5.60 | 37.80 | 1.98 | 0.96 | Hg | 2015.000 | BABC | 72 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Potential CPM cndidate |
| | | 285.51295670 | 44.3654319 | 89.77 | 98.68 | | | | | | | | | 0.20 | Eu | 2003.388 | | | UCAC5 |
| 21 | DEA 453 | 285.96818670 | 49.6937233 | 31.84 | 284.10 | 13.37 | 15.30 | -15.50 | -42.40 | 2.26 | -19.30 | -34.30 | 6.79 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Most probably optical despite being WDS V-coded |
| | | | | | | | | -16.89 | -45.55 | 5.78 | -16.60 | -44.51 | 5.78 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm data suspect |
| | | 285.96826310 | 49.6938589 | 31.78 | 283.96 | | | | | | | | | 0.20 | Eu | 2003.486 | | | UCAC5 |
| 22 | | 286.02291000 | 46.1075753 | 14.90 | 331.04 | 12.45 | 14.52 | -14.90 | -30.70 | 1.98 | -10.60 | -27.70 | 2.97 | 0.96 | Hg | 2015.000 | BCCB | 25 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Probably optical |
| | | 286.02297930 | 46.1076736 | 14.89 | 330.81 | | | | | | | | | 0.20 | Eu | 2003.442 | | | UCAC5 |
| 23 | | 286.04887560 | 39.6471325 | 32.04 | 268.07 | 10.94 | 14.25 | 10.60 | -39.00 | 1.56 | 10.50 | -41.60 | 2.40 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 286.04882860 | 39.6472661 | 32.04 | 268.13 | | | | | | | | | 0.20 | Eu | 2002.681 | | | UCAC5 |
| 24 | | 286.08339059 | 48.7527088 | 24.75 | 104.76 | 15.35 | 16.77 | -127.71 | 9.52 | 5.78 | -115.62 | 12.15 | 5.78 | 0.96 | Hg | 2015.000 | ABAB | 78 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Good CPM candidate, difference in PMVL might indicate an orbit |
| | | 286.08418000 | 48.7526700 | 24.58 | 104.95 | 14.80 | 16.16 | | | | | | | 1.30 | E2 | 2000.328 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 25 | DEA 435 | 286.48605190 | 40.1015331 | 24.93 | 40.05 | 11.18 | 15.49 | 24.60 | 36.30 | 1.84 | 41.40 | 25.80 | 8.20 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical |
| | | 286.48594220 | 40.1014092 | 24.89 | 39.49 | | | | | | | | | 0.20 | Eu | 2002.707 | | | UCAC5 |
| 26 | | 286.51762600 | 49.6455833 | 113.01 | 84.20 | 12.51 | 11.78 | -26.81 | -35.61 | 6.42 | -21.32 | -31.95 | 7.46 | 0.20 | Eu | 2013.553 | BCCC | 24 | URAT1. PM data calculated from position comparison with 2MASS. Rather optical |
| | | 286.51777800 | 49.6457140 | 112.93 | 84.22 | 12.43 | 11.78 | | | | | | | 1.30 | E2 | 2000.309 | | | 2MASS. M1 and M2 estimated from J - and K-band |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | | 287.09674360 | 50.2045786 | 91.86 | 198.45 | 10.66 | 13.17 | -23.30 | -28.00 | 1.70 | -22.80 | -34.20 | 1.98 | 0.96 | Hg | 2015.000 | CCAC | 8 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical |
| | | 287.09685970 | 50.2046683 | 91.80 | 198.46 | | | | | | | | | 0.20 | Eu | 2003.491 | | | UCAC5 |
| 28 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 29 | FMR 144 | 287.32925940 | 39.2002481 | 162.58 | 116.41 | 10.27 | 11.20 | -112.40 | -182.10 | 1.84 | -109.00 | -181.60 | 1.84 | 0.96 | Hg | 2015.000 | BAAB | 78 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate, potential orbit |
| | | 287.32975640 | 39.2008719 | 162.55 | 116.42 | | | | | | | | | 0.20 | Eu | 2002.666 | | | UCAC5 |
| 30 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 31 | DEA 364 | 287.60466110 | 42.1665178 | 16.96 | 307.91 | 12.49 | 13.96 | 4.40 | -51.70 | 1.84 | 1.90 | -52.40 | 2.26 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly physical |
| | | 287.60464220 | 42.1666847 | 16.95 | 307.99 | | | | | | | | | 0.20 | Eu | 2003.371 | | | UCAC5 |
| 32 | DEA 398 | 287.63748780 | 46.2044417 | 20.30 | 225.70 | 10.29 | 12.03 | -11.60 | 9.20 | 1.84 | -11.20 | 8.80 | 1.98 | 0.96 | Hg | 2015.000 | AACC | 76 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate but PM values rather small |
| | | 287.63754140 | 46.2044122 | 20.30 | 225.72 | | | | | | | | | 0.20 | Eu | 2003.444 | | | UCAC5 |
| 33 | DEA 313 | 287.74959082 | 44.2497632 | 13.20 | 190.03 | 15.68 | 16.35 | 9.00 | 24.81 | 5.12 | 8.76 | 29.21 | 5.12 | 0.96 | Hg | 2015.000 | BCCB | 25 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Rather optical |
| | | 287.74953300 | 44.2496490 | 13.28 | 189.96 | 15.81 | 16.35 | | | | | | | 1.30 | E2 | 1998.433 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 34 | | 287.75252220 | 43.0526894 | 7.43 | 341.35 | 14.25 | 15.42 | 12.30 | 44.40 | 2.55 | 3.00 | 51.90 | 8.44 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical |
| | | | | | | | | 4.33 | 45.74 | 5.12 | 4.04 | 45.67 | 5.12 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm data suspect |
| | | 287.75246810 | 43.0525461 | 7.32 | 341.93 | | | | | | | | | 0.20 | Eu | 2003.383 | | | UCAC5 |
| 35 | KOI 7228 and KOI 7227 | 287.94144470 | 46.5824950 | 18.08 | 246.83 | 13.61 | 15.42 | 8.30 | 27.80 | 2.40 | 16.10 | 33.30 | 7.35 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical. Both KOI objects seem rather suspect - no corresponding objects for B to be found in other catalogs |
| | | | | | | | | 9.37 | 22.80 | 5.98 | 10.21 | 21.99 | 5.98 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm data suspect |
| | | 287.94140580 | 46.5824056 | 18.18 | 246.76 | | | | | | | | | 0.20 | Eu | 2003.450 | | | UCAC5 |
| 36 | | 288.05844000 | 43.2426969 | 14.34 | 274.79 | 12.55 | 14.57 | -17.90 | -41.30 | 1.84 | -16.70 | -41.80 | 2.62 | 0.96 | Hg | 2015.000 | AABB | 92 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly ohysical |
| | | 288.05851920 | 43.2428303 | 14.35 | 274.81 | | | | | | | | | 0.20 | Eu | 2003.383 | | | UCAC5 |
| 37 | | 288.12074110 | 41.8253203 | 20.74 | 245.94 | 11.32 | 13.67 | -21.20 | 1.50 | 1.70 | -19.90 | -0.30 | 2.12 | 0.96 | Hg | 2015.000 | BBCC | 49 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Weak CPM candidate |
| | | 288.12083320 | 41.8253156 | 20.74 | 246.00 | | | | | | | | | 0.20 | Eu | 2003.355 | | | UCAC5 |
| 38 | | 288.57413860 | 46.8652569 | 41.33 | 27.75 | 11.12 | 11.33 | -29.30 | -29.30 | 1.84 | -29.40 | -30.10 | 1.84 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly physical |
| | | 288.57427610 | 46.8653508 | 41.34 | 27.74 | | | | | | | | | 0.20 | Eu | 2003.450 | | | UCAC5 |
| 39 | UC 3864 | 288.70694750 | 49.8369822 | 13.34 | 154.60 | 13.33 | 15.96 | 11.50 | 45.40 | 1.98 | 19.10 | 46.20 | 14.00 | 0.96 | Hg | 2015.000 | CBCB | 12 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | | | | | | | 20.96 | 43.98 | 5.78 | 20.97 | 45.27 | 5.78 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm data suspect |
| | | 288.70689030 | 49.8368372 | 13.31 | 154.96 | | | | | | | | | 0.20 | Eu | 2003.492 | | | UCAC5 |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | | 288.81033780 | 47.5810517 | 16.86 | 343.87 | 16.11 | 16.35 | -13.90 | -29.00 | 10.00 | -17.70 | -23.10 | 28.71 | 0.96 | Hg | 2015.000 | CBCB | 12 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | | | | | | | -6.19 | -28.77 | 5.57 | -6.41 | -30.72 | 5.57 | | | | ABCB | 62 | Counter-check with PM data calculated from position comparison with 2MASS. Good CPM candidate. UCAC5 pm data suspect |
| | | 288.81040360 | 47.5811447 | 16.79 | 343.95 | | | | | | | | | 0.20 | Eu | 2003.457 | | | UCAC5 |
| 41 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 42 | | 289.39432170 | 51.3808531 | 48.71 | 301.21 | 12.49 | 12.54 | -1.70 | -23.50 | 1.98 | 2.70 | -25.80 | 1.98 | 0.96 | Hg | 2015.000 | CBBC | 14 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 289.39433000 | 51.3809281 | 48.77 | 301.21 | | | | | | | | | 0.20 | Eu | 2003.498 | | | UCAC5 |
| 43 | | 289.38309940 | 47.7032853 | 40.15 | 81.63 | 12.32 | 11.39 | 12.77 | 16.32 | 6.12 | 12.51 | 15.00 | 6.09 | 0.20 | Eu | 2013.535 | ABCC | 61 | URAT1. PM data calculated from position comparison with 2MASS. Good CPM candidate with the caveat of rather small PM values |
| | | 289.38302000 | 47.7032170 | 40.15 | 81.61 | 12.23 | 11.23 | | | | | | | 1.30 | E2 | 1998.434 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 44 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 45 | DEA 408 | 289.38309940 | 47.7032853 | 40.15 | 81.63 | 12.32 | 11.39 | 12.77 | 16.32 | 6.12 | 12.51 | 15.00 | 6.09 | 0.20 | Eu | 2013.535 | ABCC | 61 | URAT1. PM data calculated from position comparison with 2MASS. Good CPM candidate with the caveat of rather small PM values |
| | | 289.38302000 | 47.7032170 | 40.15 | 81.61 | 12.23 | 11.23 | | | | | | | 1.30 | E2 | 1998.434 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 46 | | 289.60290190 | 44.2823214 | 52.71 | 45.85 | 10.32 | 13.29 | 1.60 | -39.30 | 1.84 | 2.50 | -41.10 | 2.26 | 0.96 | Hg | 2015.000 | AABC | 90 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 289.60289470 | 44.2824481 | 52.72 | 45.83 | | | | | | | | | 0.20 | Eu | 2003.392 | | | UCAC5 |
| 47 | ES 1095 | 289.73567280 | 49.8596122 | 6.76 | 134.69 | 8.64 | 11.66 | 7.90 | -42.80 | 2.83 | 12.10 | -47.60 | 11.17 | 0.96 | Hg | 2015.000 | BCCB | 25 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | | | | | | | 23.70 | -37.22 | 6.81 | 15.10 | -46.50 | 6.81 | | | | CCCB | 6 | Counter-check with PM data calculated from position comparison with 2MASS. Almost certainly optical. UCAC5 pm data suspect |
| | | 289.73563360 | 49.8597492 | 6.68 | 134.64 | | | | | | | | | 0.20 | Eu | 2003.487 | | | UCAC5 |
| 48 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 49 | DEA 476 | 289.82403967 | 43.3508480 | 48.63 | 91.59 | 13.11 | 16.04 | 56.04 | -83.88 | 5.12 | 57.51 | -85.07 | 5.12 | 0.96 | Hg | 2015.000 | AABC | 90 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Solid CPM candidate |
| | | 289.82368500 | 43.3512340 | 48.60 | 91.57 | 13.42 | 15.43 | | | | | | | 1.30 | E2 | 1998.434 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 50 | UC 3884 | 289.91032000 | 51.4231128 | 52.95 | 27.26 | 10.87 | 14.91 | 23.70 | 68.30 | 1.84 | 22.00 | 72.90 | 3.89 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate, potential orbit |
| | | 289.91019890 | 51.4228947 | 52.91 | 27.30 | | | | | | | | | 0.20 | Eu | 2003.498 | | | UCAC5 |
| 51 | | 289.97381000 | 43.6539328 | 44.50 | 287.00 | 11.59 | 12.93 | 10.90 | 26.10 | 1.84 | 10.30 | 27.40 | 1.84 | 0.96 | Hg | 2015.000 | AABC | 90 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 289.97376140 | 43.6538483 | 44.49 | 286.99 | | | | | | | | | 0.20 | Eu | 2003.387 | | | UCAC5 |
| 52 | | 290.18185560 | 48.9453833 | 26.41 | 59.00 | 11.91 | 13.81 | -120.70 | 60.50 | 1.91 | -118.00 | 60.00 | 3.25 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 290.18244390 | 48.9451897 | 26.39 | 58.95 | | | | | | | | | 0.20 | Eu | 2003.481 | | | UCAC5 |
| 53 | | 290.43383220 | 50.1098864 | 26.80 | 353.77 | 14.02 | 15.01 | -14.90 | -31.50 | 2.26 | -12.00 | -38.30 | 3.25 | 0.96 | Hg | 2015.000 | CCBB | 7 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 290.43390640 | 50.1099869 | 26.89 | 353.72 | | | | | | | | | 0.20 | Eu | 2003.491 | | | UCAC5 |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54 | DEA 404 | 290.45823685 | 39.9927970 | 20.12 | 69.68 | 11.31 | 16.31 | 9.28 | 60.28 | 5.55 | 5.61 | 60.04 | 5.55 | 0.96 | Hg | 2015.000 | BABB | 74 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Good CPM candidate, difference in PMVD might indicate an orbit |
| | | 290.45818100 | 39.9925190 | 20.18 | 69.73 | 11.60 | 15.90 | | | | | | | 1.30 | E2 | 1998.398 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 55 | | 290.78212920 | 43.4343383 | 34.29 | 24.68 | 12.62 | 13.52 | -10.70 | -18.40 | 1.84 | -14.90 | -17.20 | 1.98 | 0.96 | Hg | 2015.000 | CBBC | 14 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 290.78217670 | 43.4343975 | 34.30 | 24.77 | | | | | | | | | 0.20 | Eu | 2003.387 | | | UCAC5 |
| 56 | | | | | | | | | | | | | | | | | | 0 | Missing Janes # |
| 57 | | 291.29986310 | 37.7782211 | 12.35 | 17.45 | 10.92 | 15.09 | 28.00 | 37.30 | 1.56 | 28.60 | 34.10 | 4.67 | 0.96 | Hg | 2015.000 | BACB | 62 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 291.29974170 | 37.7780931 | 12.38 | 17.36 | | | | | | | | | 0.20 | Eu | 2002.653 | | | UCAC5 |
| 58 | | 291.95200470 | 39.0240533 | 7.66 | 151.87 | 13.20 | 14.31 | -2.30 | 38.90 | 1.98 | -0.80 | 42.90 | 3.18 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 291.95201500 | 39.0239203 | 7.70 | 152.18 | | | | | | | | | 0.20 | Eu | 2002.667 | | | UCAC5 |
| 59 | | 291.98822030 | 42.6965792 | 37.12 | 110.30 | 13.35 | 12.67 | 7.75 | -31.62 | 5.61 | 3.48 | -28.77 | 5.61 | 0.20 | Eu | 2013.599 | CCCC | 6 | URAT1. PM data calculated from position comparison with 2MASS. Most probably optical |
| | | 291.98817600 | 42.6967120 | 37.20 | 110.33 | 13.16 | 12.56 | | | | | | | 1.30 | E2 | 1998.480 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 60 | | 292.01447860 | 43.9781933 | 4.93 | 242.14 | 12.70 | 15.81 | -25.40 | -27.40 | 1.70 | -40.40 | -45.70 | 38.29 | 0.96 | Hg | 2015.000 | ACCA | 32 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Probably optical |
| | | | | | | | | -27,99 | -21,26 | 5,14 | -32,48 | -18,34 | 5,14 | | | | CBCB | 12 | Counter-check with PM data calculated from position comparison with 2MASS. UCAC5 pm data suspect |
| | | 292.01459190 | 43.9782814 | 4.67 | 243.45 | | | | | | | | | 0.20 | Eu | 2003.405 | | | UCAC5 |
| 61 | SEI 604 | 292.15485000 | 38.1428722 | 16.89 | 170.44 | 10.23 | 10.52 | 15.00 | 49.30 | 1.70 | 14.00 | 49.40 | 1.70 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 292.15478440 | 38.1427031 | 16.89 | 170.40 | | | | | | | | | 0.20 | Eu | 2002.657 | | | UCAC5 |
| 62 | DEA 316 | 292.29461720 | 42.9830756 | 13.62 | 60.96 | 12.07 | 15.11 | -7.50 | -90.90 | 1.70 | -1.50 | -98.10 | 6.08 | 0.96 | Hg | 2015.000 | BBBB | 59 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 292.29465030 | 42.9833692 | 13.60 | 60.51 | | | | | | | | | 0.20 | Eu | 2003.377 | | | UCAC5 |
| 63 | | 292.40869920 | 47.3885822 | 15.00 | 47.11 | 11.89 | 12.97 | -7.80 | -63.00 | 2.12 | -9.00 | -63.60 | 2.26 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 292.40873610 | 47.3887844 | 15.02 | 47.12 | | | | | | | | | 0.20 | Eu | 2003.455 | | | UCAC5 |
| 64 | DEA 475 | 292.54467780 | 47.7212575 | 46.37 | 8.30 | 9.32 | 14.43 | 20.40 | 32.10 | 3.39 | 20.00 | 36.00 | 5.38 | 0.96 | Hg | 2015.000 | BBCC | 49 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Weak CPM candidate |
| | | 292.54458060 | 47.7211547 | 46.33 | 8.32 | | | | | | | | | 0.20 | Eu | 2003.456 | | | UCAC5 |
| 65 | BVD 267 | 292.93748110 | 45.1070425 | 24.58 | 112.88 | 13.58 | 13.93 | 78.30 | 58.40 | 2.97 | 77.90 | 60.80 | 3.82 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 292.93712470 | 45.1068547 | 24.59 | 112.93 | | | | | | | | | 0.20 | Eu | 2003.440 | | | UCAC5 |
| 66 | A 714 | 293.14600986 | 46.0486847 | 53.11 | 48.28 | 9.28 | 11.08 | -72.59 | -138.47 | 5.46 | -70.47 | -87.60 | 5.46 | 0.96 | Hg | 2015.000 | CCAB | 8 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Most certainly optical. WDS object A 714 only for primary |
| | | 293.14646100 | 46.0492820 | 52.56 | 48.90 | 8.83 | 11.47 | | | | | | | 1.30 | E2 | 1999.471 | | | 2MASS. M1 and M2 estimated from J - and K-band |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67 | | 293.90828854 | 40.0575146 | 5.62 | 270.20 | 9.13 | 13.39 | 4.24 | -25.48 | 5.12 | 5.53 | -29.30 | 5.12 | 0.96 | Hg | 2015.000 | ACCB | 31 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Rather optical |
| | | 293.90826300 | 40.0576320 | 5.64 | 270.84 | 9.33 | 13.80 | | | | | | | 1.30 | E2 | 1998.415 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 68 | | 294.09555810 | 44.6738081 | 22.60 | 187.82 | 13.37 | 13.66 | -7.00 | -22.50 | 1.98 | -8.10 | -23.60 | 2.19 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 294.09558980 | 44.6738803 | 22.59 | 187.79 | | | | | | | | | 0.20 | Eu | 2003.433 | | | UCAC5 |
| 69 | DEA 389 | 294.44033920 | 46.7611050 | 18.81 | 334.98 | 14.25 | 14.16 | -17.80 | -31.40 | 2.26 | -20.70 | -32.70 | 2.26 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 294.44042280 | 46.7612056 | 18.81 | 335.09 | | | | | | | | | 0.20 | Eu | 2003.454 | | | UCAC5 |
| 70 | DEA 421 | 294.53875610 | 44.1598133 | 22.21 | 188.93 | 9.59 | 9.80 | 38.50 | -21.80 | 3.11 | 36.70 | -21.90 | 2.26 | 0.96 | Hg | 2015.000 | AABB | 92 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 294.53858360 | 44.1598833 | 22.20 | 188.88 | | | | | | | | | 0.20 | Eu | 2003.412 | | | UCAC5 |
| 71 | DEA 392 | 294.73351970 | 50.8300031 | 19.31 | 310.49 | 13.68 | 14.41 | -4.60 | -40.50 | 2.26 | -5.10 | -36.70 | 3.11 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 294.73354280 | 50.8301322 | 19.27 | 310.40 | | | | | | | | | 0.20 | Eu | 2003.495 | | | UCAC5 |
| 72 | KOI 623 | 295.22647190 | 50.5592275 | 5.62 | 201.60 | 11.71 | 14.48 | 9.00 | 52.90 | 1.70 | 4.90 | 51.70 | 7.50 | 0.96 | Hg | 2015.000 | BACB | 62 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | | | | | | | 5.54 | 53.29 | 5.14 | 3.77 | 51.18 | 5.14 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS.Good CPM candidate. UCAC5 pm data a bit suspect |
| | | 295.22642700 | 50.5590583 | 5.59 | 201.21 | | | | | | | | | 0.20 | Eu | 2003.496 | | | UCAC5 |
| 73 | DEA 391 | 295.81577080 | 49.4923372 | 18.48 | 18.02 | 13.27 | 14.43 | -17.10 | 31.30 | 1.70 | -15.30 | 31.10 | 2.76 | 0.96 | Hg | 2015.000 | AABB | 92 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 295.81585500 | 49.4922369 | 18.48 | 17.95 | | | | | | | | | 0.20 | Eu | 2003.487 | | | UCAC5 |
| 74 | | 295.84086640 | 40.3459578 | 12.22 | 254.18 | 13.34 | 14.39 | 29.30 | 17.00 | 1.56 | 31.80 | 17.10 | 2.12 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 295.84073500 | 40.3458997 | 12.25 | 254.21 | | | | | | | | | 0.20 | Eu | 2002.709 | | | UCAC5 |
| 75 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 76 | | 296.20164390 | 50.1102914 | 485.16 | 19.25 | 9.07 | 9.66 | 29.00 | 36.10 | 3.25 | 36.60 | 38.80 | 3.25 | 0.96 | Hg | 2015.000 | BCBC | 29 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 296.20149920 | 50.1101761 | 485.10 | 19.24 | | | | | | | | | 0.20 | Eu | 2003.495 | | | UCAC5 |
| 77 | CBL 79 | 296.43270110 | 47.8123333 | 19.25 | 262.54 | 12.33 | 13.23 | 75.50 | 35.20 | 1.98 | 73.30 | 35.30 | 2.26 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 296.43234110 | 47.8122208 | 19.22 | 262.53 | | | | | | | | | 0.20 | Eu | 2003.470 | | | UCAC5 |
| 78 | ARN 117 | 296.43595000 | 39.5036461 | 28.74 | 161.61 | 8.46 | 9.75 | 26.10 | -1.40 | 2.83 | 24.90 | -5.20 | 1.84 | 0.96 | Hg | 2015.000 | CACC | 15 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 296.43583420 | 39.5036508 | 28.70 | 161.55 | | | | | | | | | 0.20 | Eu | 2002.669 | | | UCAC5 |
| 79 | | 296.65723890 | 51.0201883 | 470.16 | 166.39 | 8.63 | 11.30 | -3.10 | -57.70 | 2.26 | -2.10 | -61.60 | 1.70 | 0.96 | Hg | 2015.000 | ABAC | 76 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog, Good CPM candidate |
| | | 296.65725470 | 51.0203725 | 470.12 | 166.39 | | | | | | | | | 0.20 | Eu | 2003.499 | | | UCAC5 |
| 80 | | 296.77619640 | 50.3805244 | 42.97 | 179.86 | 8.31 | 11.62 | 9.80 | -16.80 | 2.55 | 10.70 | -16.00 | 1.70 | 0.96 | Hg | 2015.000 | BACC | 61 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 296.77614720 | 50.3805781 | 42.98 | 179.87 | | | | | | | | | 0.20 | Eu | 2003.495 | | | UCAC5 |

*Table 1 continues on next page.*

*Table 1 (continued). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | UC 246 | 296.86405420 | 44.1120522 | 47.29 | 252.62 | 10.98 | 12.78 | 50.20 | 20.90 | 1.98 | 51.10 | 20.80 | 2.12 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 296.86382930 | 44.1119850 | 47.31 | 252.62 | | | | | | | | | 0.20 | Eu | 2003.412 | | | UCAC5 |
| 82 | DEA 157 | 297.01122670 | 50.4857672 | 7.55 | 334.43 | 12.14 | 15.48 | 10.30 | 28.60 | 1.98 | 10.50 | 28.80 | 7.21 | 0.96 | Hg | 2015.000 | AACB | 78 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate despite rather large pm error for B |
| | | | | | | | | 11.88 | 31.63 | 5.14 | 15.26 | 32.93 | 9.46 | | | | BBCB | 50 | Counter-check with PM data calculated from position comparison with 2MASS.PM error larger than UCAC5 so PM data even less reliable |
| | | 297.01117470 | 50.4856758 | 7.54 | 334.41 | | | | | | | | | 0.20 | Eu | 2003.496 | | | UCAC5 |
| 83 | | | | | | | | | | | | | | | | | | | Missing Janes # |
| 84 | DEA 479 | 297.25958400 | 44.2316256 | 55.74 | 155.09 | 10.71 | 12.48 | 46.34 | -66.67 | 5.58 | 47.46 | -67.67 | 5.59 | 0.20 | Eu | 2013.629 | AABC | 90 | URAT1. PM data calculated from position comparison with 2MASS. Solid CPM candidate |
| | | 297.25931100 | 44.2319070 | 55.72 | 155.10 | 10.73 | 12.32 | | | | | | | 1.30 | E2 | 1998.447 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 85 | | 297.27950610 | 49.8134836 | 6.94 | 196.28 | 13.51 | 14.37 | -18.20 | -23.50 | 2.26 | -18.20 | -22.60 | 2.69 | 0.96 | Hg | 2015.000 | AABB | 92 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 297.27959640 | 49.8135589 | 6.95 | 196.25 | | | | | | | | | 0.20 | Eu | 2003.492 | | | UCAC5 |
| 86 | UC 247 | 297.32235360 | 40.0896269 | 40.57 | 30.83 | 10.27 | 13.23 | 61.50 | -91.10 | 1.84 | 63.40 | -92.60 | 2.05 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 297.32207920 | 40.0899383 | 40.58 | 30.79 | | | | | | | | | 0.20 | Eu | 2002.701 | | | UCAC5 |
| 87 | LEP 94 | 297.32616310 | 41.5817333 | 66.83 | 67.09 | 7.38 | 10.24 | 108.40 | -174.10 | 3.68 | 106.80 | -175.60 | 1.70 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 297.32566830 | 41.5823275 | 66.86 | 67.09 | | | | | | | | | 0.20 | Eu | 2002.729 | | | UCAC5 |
| 88 | | 297.45699000 | 50.1821908 | 5.72 | 42.82 | 15.02 | 15.44 | 7.80 | 34.30 | 5.66 | 14.20 | 18.50 | 13.72 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical |
| | | | | | | | | 5.74 | 41.83 | 5.14 | 7.20 | 39.85 | 5.14 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS.Good CPM candidate. UCAC5 pm data suspect |
| | | 297.45695110 | 50.1820814 | 5.81 | 41.07 | | | | | | | | | 0.20 | Eu | 2003.496 | | | UCAC5 |
| 89 | AG 240 | 297.52937140 | 47.8064050 | 14.54 | 255.42 | 9.54 | 9.62 | -3.60 | -17.10 | 2.26 | -6.50 | -17.50 | 2.26 | 0.96 | Hg | 2015.000 | CBCB | 12 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Rather optical |
| | | 297.52938830 | 47.8064597 | 14.50 | 255.40 | | | | | | | | | 0.20 | Eu | 2003.478 | | | UCAC5 |
| 90 | | 297.53642640 | 44.0195692 | 6.01 | 194.40 | 11.41 | 11.97 | 35.10 | -6.60 | 1.70 | 35.20 | -7.30 | 1.70 | 0.96 | Hg | 2015.000 | AAAB | 97 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 297.53626970 | 44.0195906 | 6.00 | 194.44 | | | | | | | | | 0.20 | Eu | 2003.434 | | | UCAC5 |
| 91 | | 297.55938030 | 47.4735181 | 31.72 | 296.53 | 9.09 | 12.91 | -15.30 | -34.60 | 3.39 | -16.20 | -33.50 | 2.26 | 0.96 | Hg | 2015.000 | AABB | 92 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Solid CPM candidate |
| | | 297.55945280 | 47.4736292 | 31.70 | 296.52 | | | | | | | | | 0.20 | Eu | 2003.456 | | | UCAC5 |
| 92 | | 297.62841000 | 40.3902175 | 13.71 | 191.94 | 14.94 | 15.21 | 4.00 | -35.20 | 4.31 | 5.10 | -39.60 | 5.31 | 0.96 | Hg | 2015.000 | ACCB | 31 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Weak CPM candidate |
| | | 297.62839190 | 40.3903378 | 13.66 | 192.04 | | | | | | | | | 0.20 | Eu | 2002.701 | | | UCAC5 |
| 93 | DEA 126 | 297.74720390 | 48.6941869 | 7.01 | 250.51 | 10.99 | 11.75 | -8.20 | -27.80 | 1.84 | -8.80 | -29.70 | 2.26 | 0.96 | Hg | 2015.000 | ABBB | 74 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 297.74724390 | 48.6942758 | 6.99 | 250.67 | | | | | | | | | 0.20 | Eu | 2003.486 | | | UCAC5 |

*Table 1 concludes on next page.*

# Counter-Check of Janes Double Stars for being Physical Pairs

*Table 1 (conclusion). CPM Rating for the objects in Janes 2016*

| JN# | WDS | RA | Dec | Sep" | PA° | M1(G) | M2(G) | pmRA1 | pmDec1 | e_pm1 | pmRA2 | pmDec2 | e_pm2 | Ap | Me | Date | CPM Rat | CPM % | Source/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 94 | | 297.89498190 | 41.9118897 | 6.28 | 78.48 | 11.15 | 14.30 | 35.30 | 1.50 | 1.70 | 40.60 | -6.10 | 20.01 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog |
| | | | | | | | | 43.22 | -2.87 | 5.57 | 44.44 | -1.11 | 5.57 | | | | AACB | 78 | Counter-check with PM data calculated from position comparison with 2MASS.Good CPM candidate. UCAC5 pm data suspect |
| | | 297.89482000 | 41.9118847 | 6.23 | 77.53 | | | | | | | | | 0.20 | Eu | 2002.721 | | | UCAC5 |
| 95 | DEA 306 | 298.12185250 | 46.5519769 | 12.73 | 122.43 | 13.93 | 14.35 | 85.50 | 104.70 | 3.11 | 77.90 | 96.60 | 4.18 | 0.96 | Hg | 2015.000 | ACAA | 40 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Weak CPM candidate |
| | | 298.12145330 | 46.5516408 | 12.75 | 121.86 | | | | | | | | | 0.20 | Eu | 2003.449 | | | UCAC5 |
| 96 | DEA 455 | 298.33952934 | 41.3058646 | 34.03 | 301.48 | 12.42 | 16.13 | 39.46 | 13.78 | 5.11 | 39.99 | 17.07 | 5.11 | 0.96 | Hg | 2015.000 | BACB | 62 | GAIA DR1. M1 and M2 are G-band. PM data calculated from position comparison with 2MASS. Good CPM candidate |
| | | 298.33928700 | 41.3058010 | 34.01 | 301.40 | 12.70 | 16.00 | | | | | | | 1.30 | E2 | 1998.393 | | | 2MASS. M1 and M2 estimated from J - and K-band |
| 97 | | 298.61086110 | 39.9901631 | 16.65 | 313.40 | 14.19 | 15.25 | -8.50 | -5.90 | 2.69 | 17.80 | -2.90 | 4.24 | 0.96 | Hg | 2015.000 | CCCC | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical |
| | | 298.61089890 | 39.9901831 | 16.86 | 312.55 | | | | | | | | | 0.20 | Eu | 2002.686 | | | UCAC5 |
| 98 | | 299.14395690 | 47.2917497 | 49.52 | 312.74 | 10.75 | 14.91 | 43.40 | -17.80 | 2.26 | 45.50 | -33.80 | 8.72 | 0.96 | Hg | 2015.000 | CCCB | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical |
| | | | | | | | | 46.84 | -19.21 | 5.79 | 49.33 | -21.84 | 5.79 | | | | ABCC | 61 | Counter-check with PM data calculated from position comparison with 2MASS.Good CPM candidate. UCAC5 pm data suspect |
| | | 299.14375190 | 47.2918069 | 49.66 | 312.88 | | | | | | | | | 0.20 | Eu | 2003.472 | | | UCAC5 |
| 99 | DEA 481 | 299.31849110 | 47.8021133 | 64.80 | 175.12 | 13.35 | 15.18 | 31.90 | 54.70 | 2.12 | 30.70 | 22.30 | 13.08 | 0.96 | Hg | 2015.000 | CCCC | 6 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Almost certainly optical. Fainter B is DEA 481 primary |
| | | | | | | | | 27.74 | 61.04 | 6.29 | 44.08 | 40.15 | 6.29 | | | | CCCC | 6 | Counter-check with PM data calculated from position comparison with 2MASS.CPM rating ident despite suspect UCAC5 pm data |
| | | 299.31833860 | 47.8019381 | 64.43 | 175.08 | | | | | | | | | 0.20 | Eu | 2003.466 | | | UCAC5 |
| 100 | CBL 80 | 299.35530500 | 45.1243775 | 17.70 | 66.79 | 14.46 | 14.96 | 123.50 | 217.00 | 2.97 | 118.20 | 221.20 | 4.74 | 0.96 | Hg | 2015.000 | BAAA | 80 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 299.35474310 | 45.1236806 | 17.74 | 67.00 | | | | | | | | | 0.20 | Eu | 2003.441 | | | UCAC5 |
| 101 | DEA 366 | 299.41052250 | 47.1970206 | 17.08 | 279.00 | 10.68 | 10.99 | 14.30 | 8.10 | 1.98 | 10.60 | 7.20 | 1.98 | 0.96 | Hg | 2015.000 | BCCC | 24 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Probably optical |
| | | 299.41045480 | 47.1969947 | 17.04 | 279.06 | | | | | | | | | 0.20 | Eu | 2003.455 | | | UCAC5 |
| 102 | | 300.22222970 | 45.0160889 | 40.45 | 281.03 | 14.18 | 14.56 | 82.40 | 14.60 | 3.61 | 88.70 | 21.00 | 5.02 | 0.96 | Hg | 2015.000 | BBBB | 59 | GAIA DR1. M1 and M2 GAIA DR1 Gmag. PM data from UCAC5 catalog. Good CPM candidate |
| | | 300.22185560 | 45.0160419 | 40.51 | 280.90 | | | | | | | | | 0.20 | Eu | 2003.441 | | | UCAC5 |

**Counter-Check of Janes Double Stars for being Physical Pairs**

*(Continued from page 415)*

common proper motion resulted in a mixed bag: 12 are solid CPM candidates, another 19 are good CPM candidates, 4 are "might be" CPM pairs but 12 are to be considered as rather optical pairs. Interestingly this statistic is quite similar for the already existing WDS objects.

As the original list of Janes objects contains for each object a probability for being a CPM pair I used a beta version of an intended extension of the letter based CPM assessment scheme to "translate" the letter code into an estimated probability for being physical based on proper motion data (Knapp 2018). This number is given in table 1 in the "CPM %" column.

Very interesting seems to me also the fact that the given separation in the original list of Janes objects shows in most cases differences of several arcseconds to the values calculated from the GAIA DR1 coordinates – and this can certainly not be explained by proper motion even over decades.

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- UCAC5 catalog
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- VizieR
- AstroPlanner v2.2
- Space Telescope Science Institute website for searching coordinates of KIC objects (https://archive.stsci.edu/kepler/kic10/search.php)

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## Appendix A - Description of the CPM rating procedure

- Four rating factors are used: Proper motion vector direction, proper motion vector length, size of position error in relation to proper motion vector length according to Knapp and Nanson 2017 with extension for relation separation to proper motion speed.
- Proper motion vector direction ratings: “A” for identical direction within the error range (given by assuming the worst case of the position error pointing in right angle to the PM vector), “B” for similar direction within the double error range, and “C” for outside double but inside triple error range and “D” for outside triple.
- Proper motion vector length ratings: “A” for identical length within the error range (given by assuming the worst case of the position error pointing in the direction if the PM vector), “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.
- Relation separation to proper motion speed: "A" for less than 100 years, "B" for less than 1000 years 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”.