

New High Proper Motion Sources from the UKIDSS Galactic Plane and Large Area Surveys

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Proper motion surveys allow us to investigate the space motions of brown dwarfs, identify thick disk/halo objects, identify benchmark binaries and discover previously overlooked objects very close to the sun. The UKIDSS Large Area Survey (LAS) covered 1500 deg² at 2 epochs in J band, while the Galactic Plane Survey (GPS) has so far covered 1400 deg² at 2 epochs in K band. We have developed a proper motion pipeline that calculates motions for all sources in each WFCAM array using a unique set of reference stars for each source. We present a proper motion catalogue of approximately 140,000 stars from the LAS with motions above the 5 sigma level. This includes 15 new candidate ultracool benchmark binary systems and two candidate thick disc/halo T dwarfs. Furthermore, we present the discovery of ~160 new high proper motion sources in the GPS with proper motion greater than 200 mas/yr.

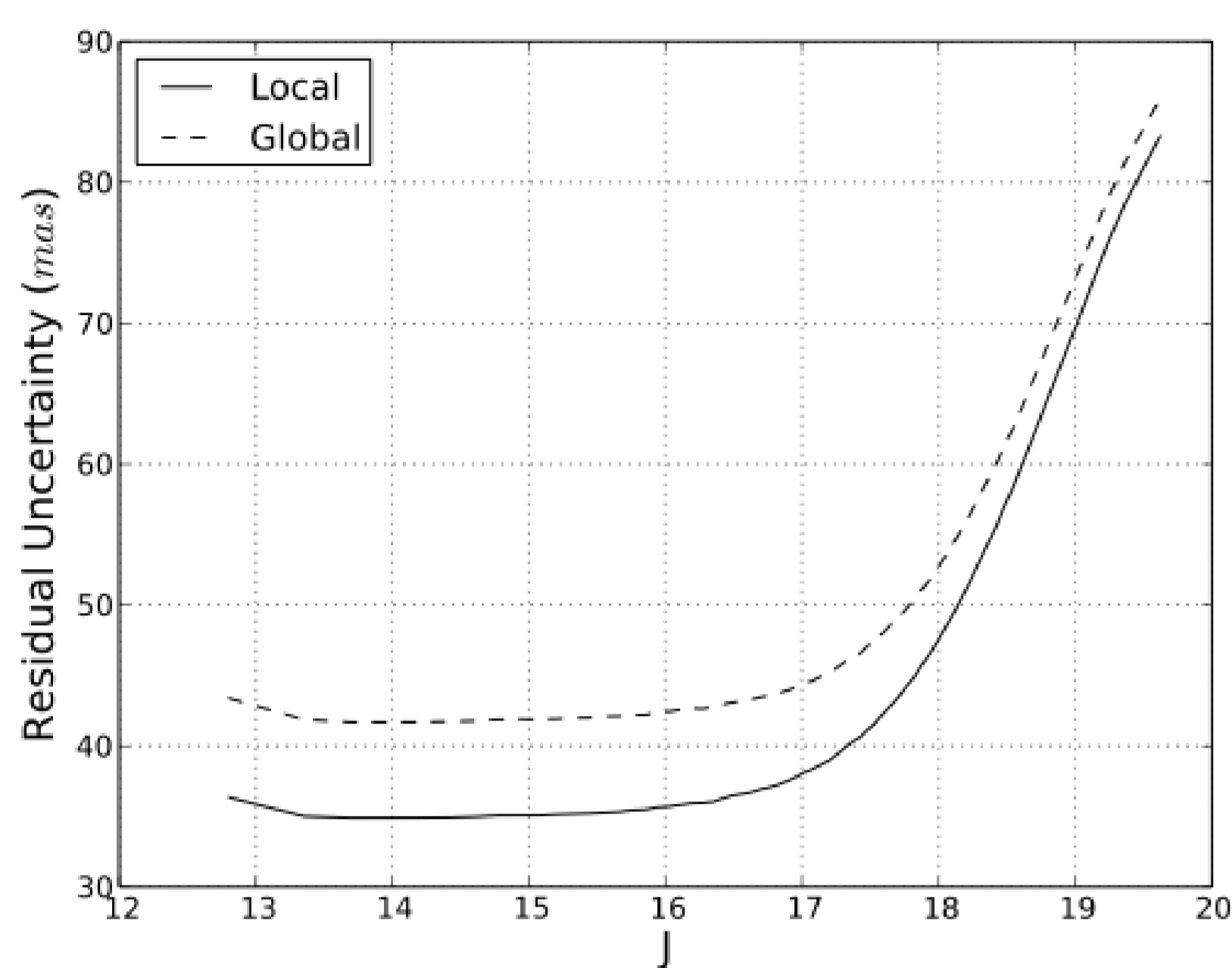


Figure 1: We select reference stars locally if the local star density and distribution is good, otherwise we use all reference stars on the array. Here we justify the preference of a local solution by comparing the uncertainties on the motions produced by the two methods. The local solution is consistently more accurate.

Figure 2: LSPM^[1] total proper motions (vertical axis) versus those calculated by our pipeline (horizontal axis) for the 381 matches within 300 deg² of our LAS catalogue. The data are well correlated; with Pearson product-moment correlation coefficient of 0.980.

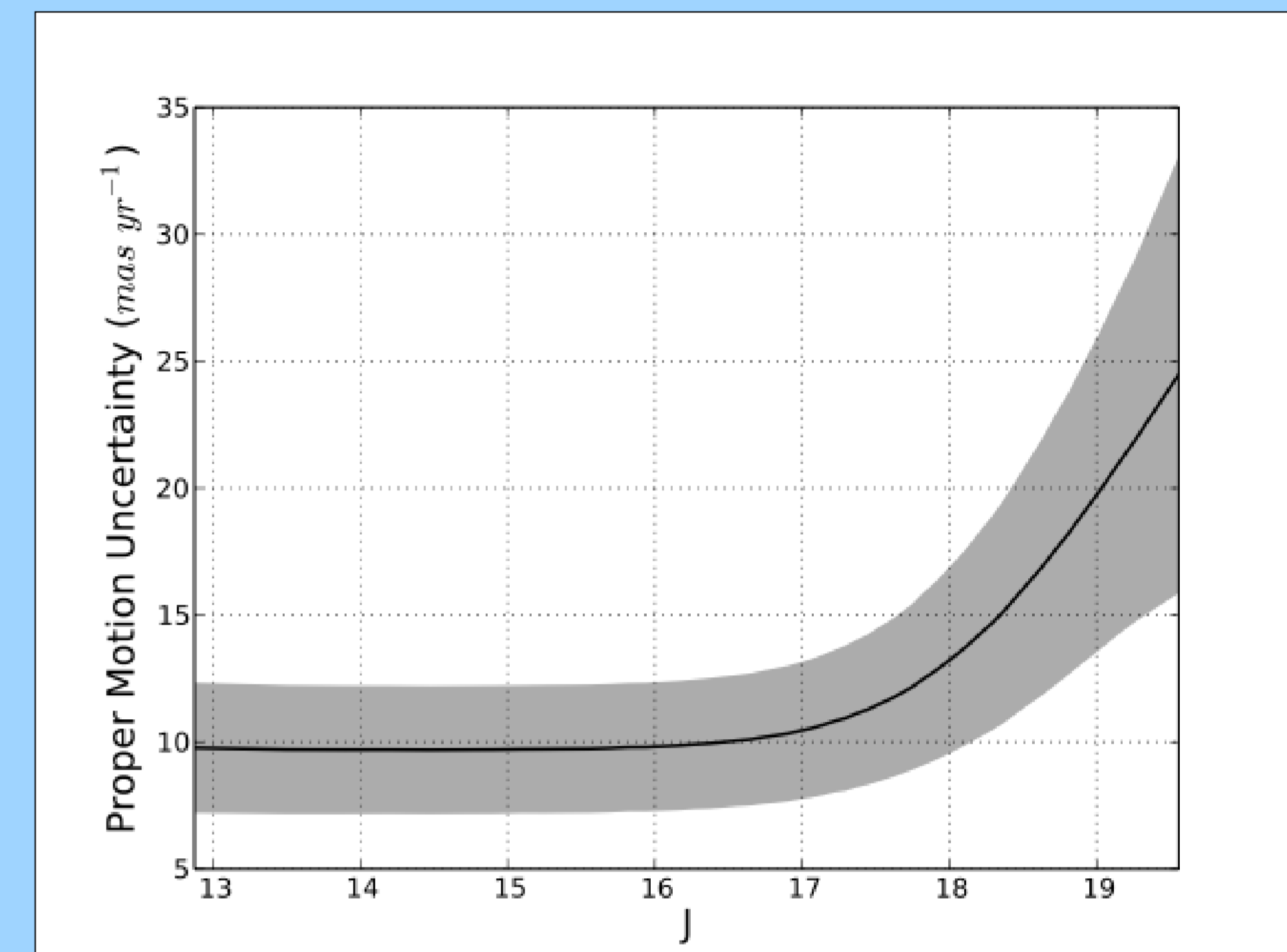
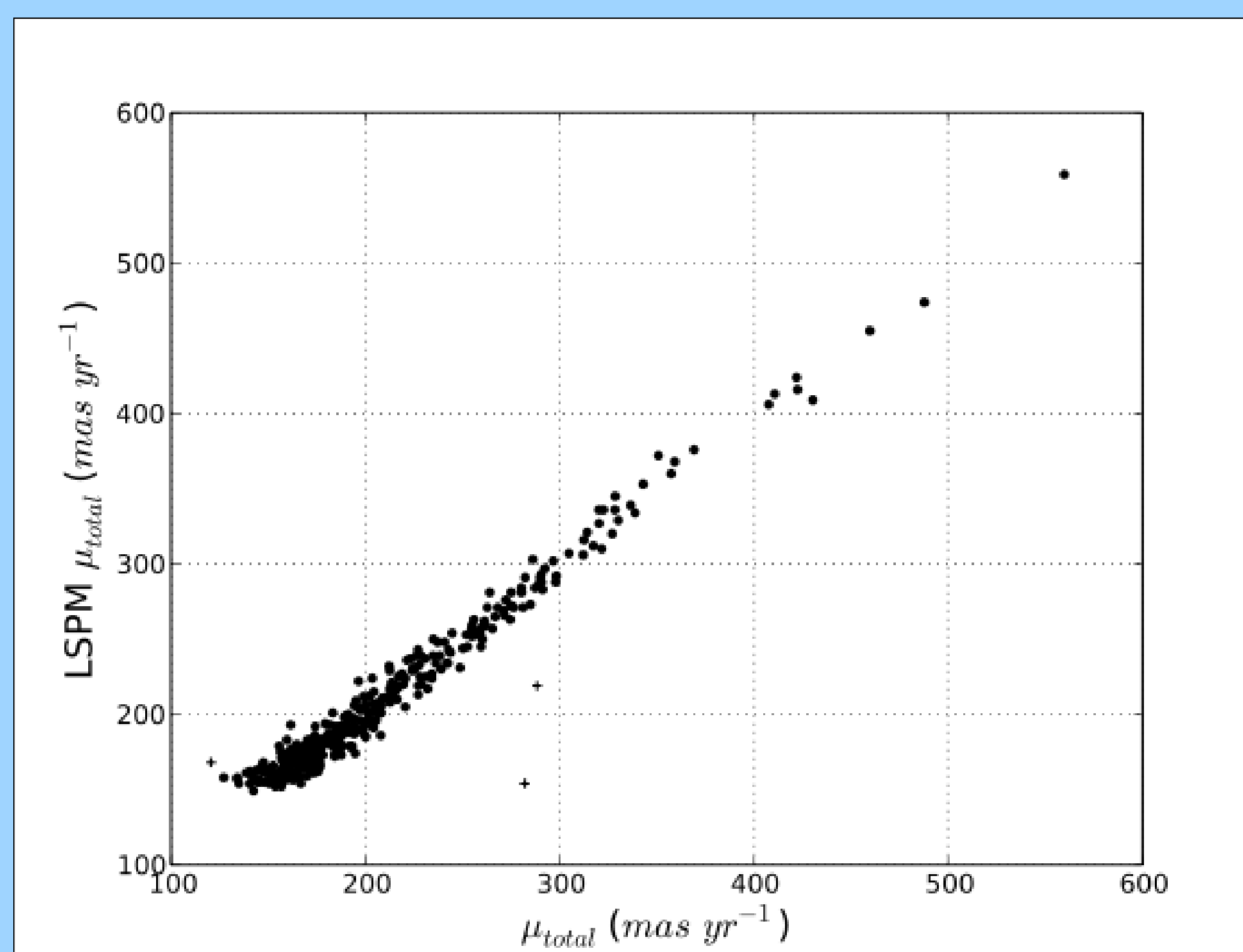


Figure 3: The distribution in total proper motion uncertainty of a selection of 5.4 million low ellipticity LAS sources that are classified as stellar in both J band images and have no error flags. The mean proper motion of the bright sources (J < 17) is 10mas/yr with 70% falling between 7.5 and 12.5 mas/yr.

Figure 4: We blinked 980 red LAS sources and found them to be very reliable for J<19. Reliability diminishes toward the faint end, though there are still many genuine high proper motion sources. Reliability is worse in the GPS owing to the higher source density and increase in the number of mismatches.

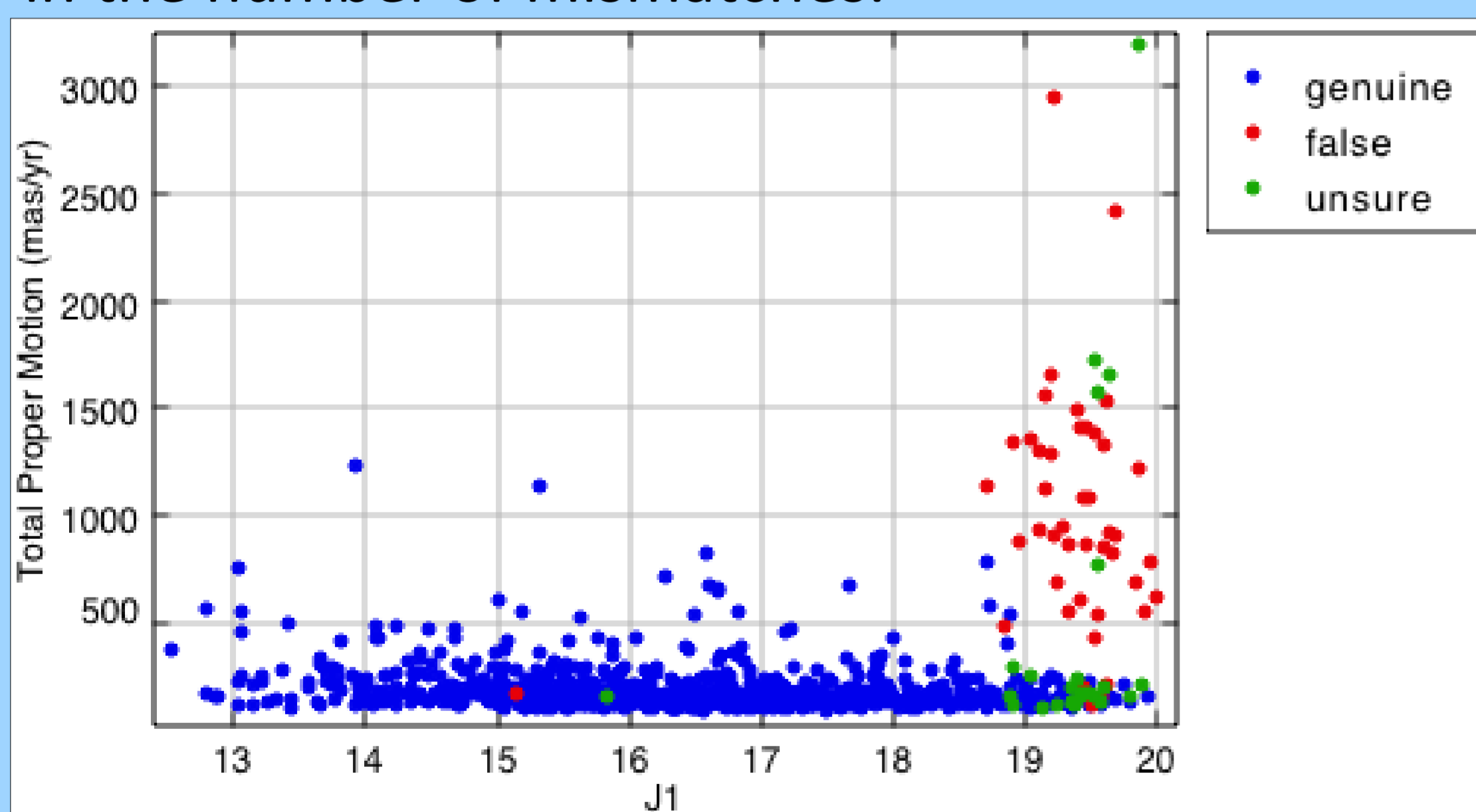


Figure 6: High contrast binaries are among the results of our GPS proper motion search. This is a newly identified companion to a 266 mas/yr Luyten star, the pair span nearly 11 magnitudes in the J band. The first epoch is mapped to the red channel and the second to the green. They are separated by 55" and the epoch baseline is 5.2 years.

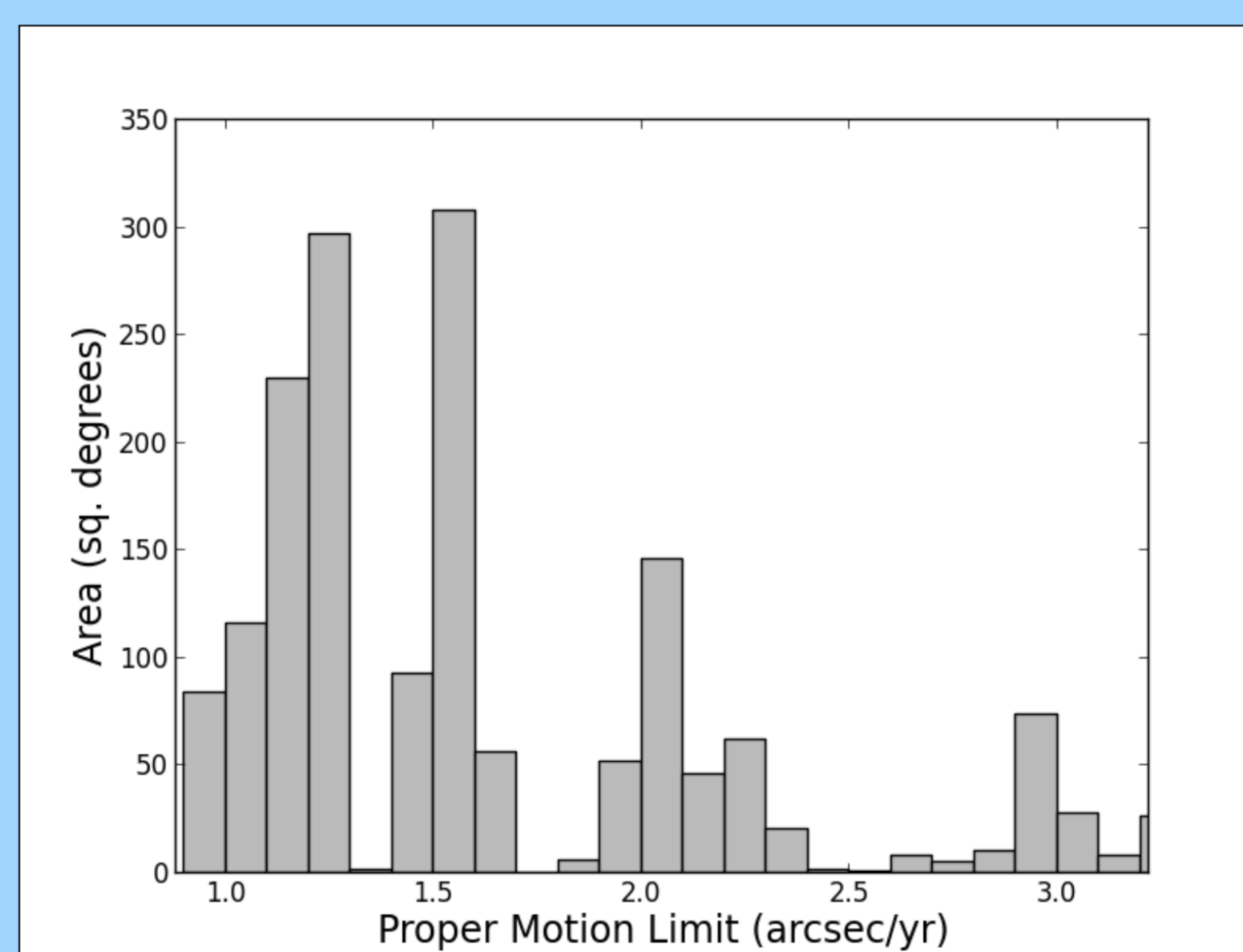
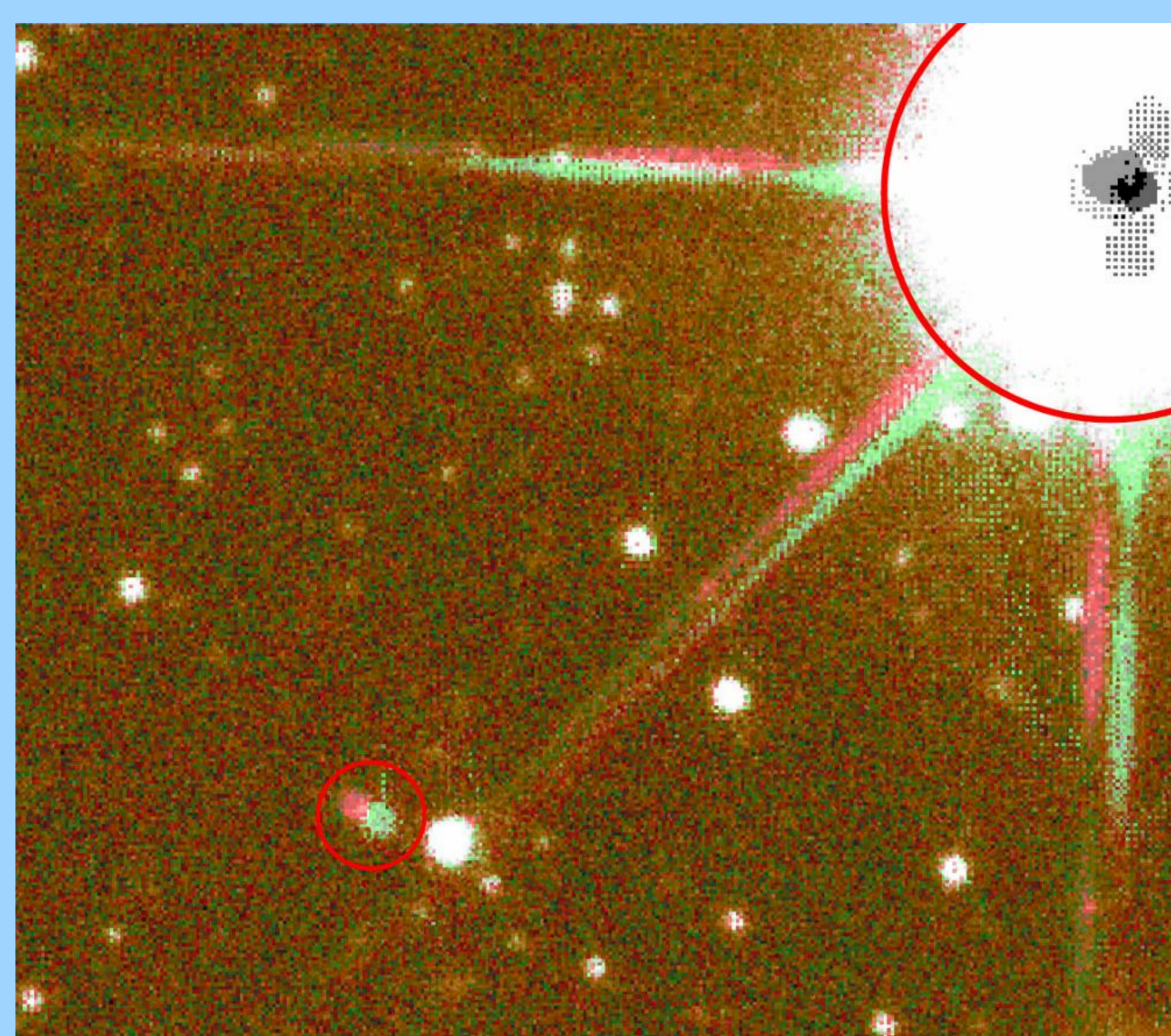


Figure 5: In the LAS we use two epoch observations with a range of baselines (1.8 to 7 years) and a static matching radius (6"). The hard LAS proper motion detection limit is 3.3"/yr. Here we show the distribution of resultant proper motion limits of the catalogue by area. In the GPS we use two epoch observations again with similar epoch baselines. This time we used a larger matching radius and a K band magnitude limit of 17 to try to combat the increase in the number of mismatched sources.

Candidate	#1	#2
μ_{tot} (mas/yr)	469	267
J	16.2	16.3
J-H	-0.37	-0.07
H-K	+0.08	+0.05

Table 1: Details of two new, bright mid-T dwarf candidates. Identified in the GPS proper motion search.

Summary: Within the LAS catalogue we have identified 15 new candidate ultracool dwarf benchmark binaries (Smith et al. submitted) including one likely mid-L dwarf. The brightest H rich ultracool white dwarf^[2] and two thick disk/halo T dwarf candidates. We also provide proper motions for 128 UKIDSS T dwarfs and two new confirmed benchmark T dwarfs^[3]: LHS 6176B and HD 118865B. So far within the GPS sample we have identified two new T dwarf candidates (see Table) and a handful of L dwarf candidates and high contrast binaries. The LAS catalogue paper has been submitted to MNRAS and the catalogue itself will be available soon.