Update of the discovery of the very asymmetric distribution of the nearest brown dwarfs and of associated results

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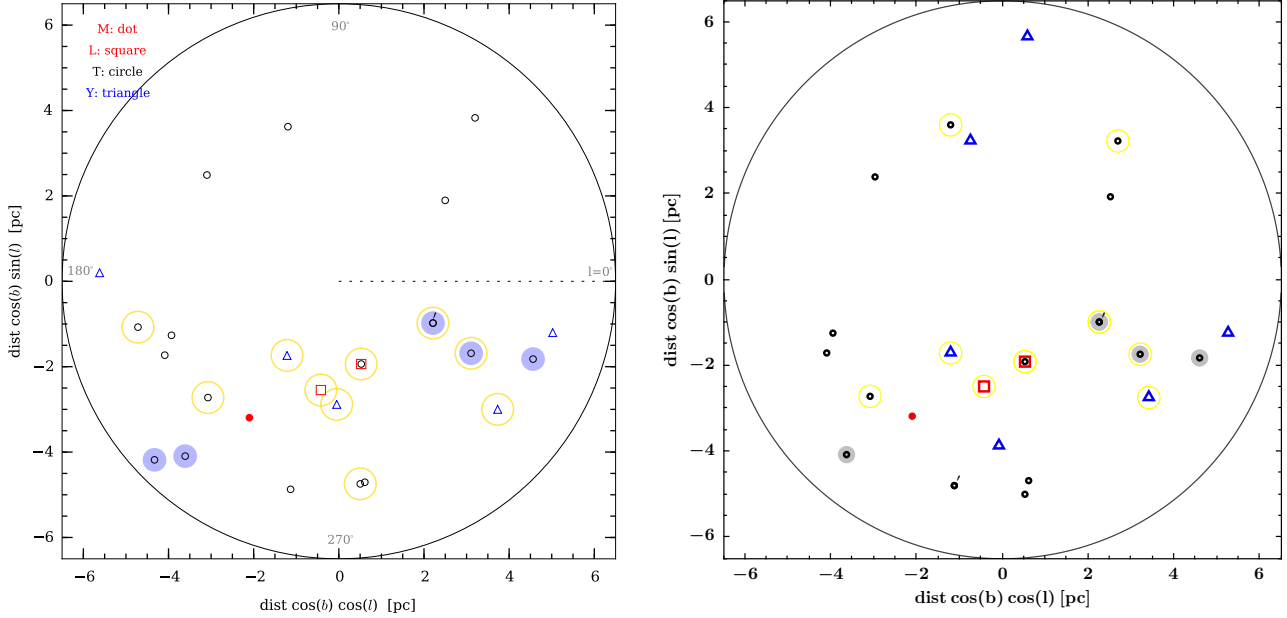Bihain & Scholz (2016, A&A, 589A, 26)   Update 2023.12

Figure 1. Same description as in figure 1 of Bihain & Scholz (2016). The Sun (not shown) is at the centre of the plots, at (0,0) pc. The brown dwarfs are projected onto the Galactic plane, according to their distance (*dist*), longitude (*l*), and latitude (*b*). The Galactic centre is towards $l = 0°$ (*rightwards*) and the sense of Galactic rotation is towards $l = 90°$ (*upwards*). One parsec (pc) equals to about 3.26 light-years.

Surprisingly, after almost eight years and several new brown dwarf searches and new distance measurements, the significant asymmetry on the Galactic plane of the local brown dwarf distribution persisted (Fig.1, Table 1, and Fig. A1). From Table 1, the asymmetry is within 7 pc of the Sun.

Table 1. Asymmetry as a function of the radius ranges of heliocentric spheres and equivolume shells.

	2016A&A...589A..26B*	Upd. 2023.12
	0 – 5.16 pc (*V*/2)	
Number of brown dwarfs at *l* < 180°	0	2
Number of brown dwarfs at *l* > 180°	12	9
	0 – 6.50 pc (*V*); 5.16 – 6.50 pc (*V*/2)	
Number of brown dwarfs at *l* < 180°	5; 5	6; 4
Number of brown dwarfs at *l* > 180°	21; 9	20; 11
	0 – 7.44 pc (3V/2); 6.50 – 7.44 pc (V/2)	
Number of brown dwarfs at *l* < 180°	*12; 7*	13; 7
Number of brown dwarfs at *l* > 180°	*21; 0*	26; 6
	0 – 8.19 pc (2V); 7.44 – 8.19 pc (V/2)	
Number of brown dwarfs at *l* < 180°	13; *1*	20; 7
Number of brown dwarfs at *l* > 180°	24; *3*	26; 0

* Numbers in italic for the 2016A&A...589A..26B sample were obtained now for the comparison.

The thereby lower star to brown dwarf number ratio of 5:1, or 4:1 depending on assumptions of completeness, also persisted (Table 2).

Table 2. Star to brown dwarf number ratio.

	2016A&A...589A..26B	Upd. 2023.12
Number of stars at < 6.5 pc	136	129
Number of brown dwarfs at < 6.5 pc	26	26
Star to brown dwarf number ratio	5.2	5.0

Assuming the following completeness-related assumptions:
1) the significant helio and geocentric asymmetry suggests in part an observational bias,
2) brown dwarfs tend to distribute uniformly as stars do, and
3) given 1) and 2), some brown dwarfs would be missing and amount to 2/3 of the observed excess relative to a uniform distribution, then

|	2016A&A...589A..26B	Upd. 2023.12
Brown dwarfs to recover at $l < 180°$	2/3 (13-5) = 5.3 = 5	5 − (6-5) = 4
Number sum of brown dwarfs	31	30
Star to brown dwarf number ratio (accounting for Poissonian uncertainties of the number of brown dwarfs)	$136/31 = 4.4^{+1.0}_{-0.7}$	$129/30 = 4.3^{+1.0}_{-0.7}$

The characteristics of the proper motions of the brown dwarfs at < 6.5 pc as a function of Galactic longitude (figure 3 in Bihain & Scholz 2016) remained unchanged too.

The update is based on the 20 pc Census data at https://exoplanetarchive.ipac.caltech.edu/docs/20pcCensus.html, corresponding to Table 4 in Kirkpatrick et al. 2024, The Astrophysical Journal Supplement Series, accepted.

Appendix A
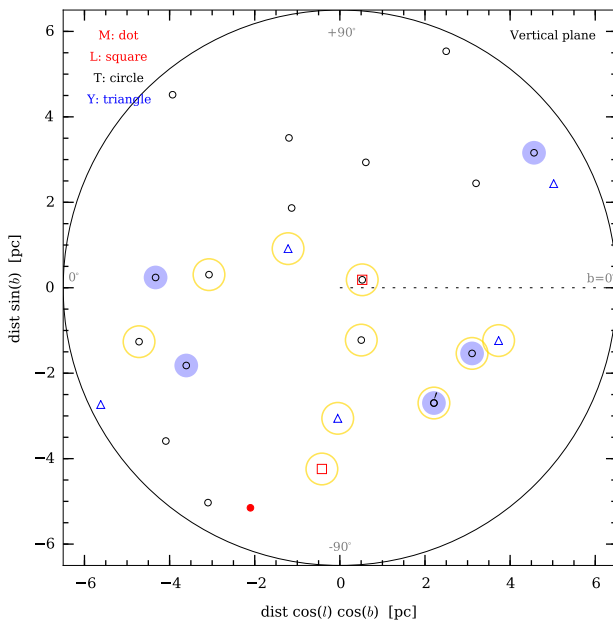
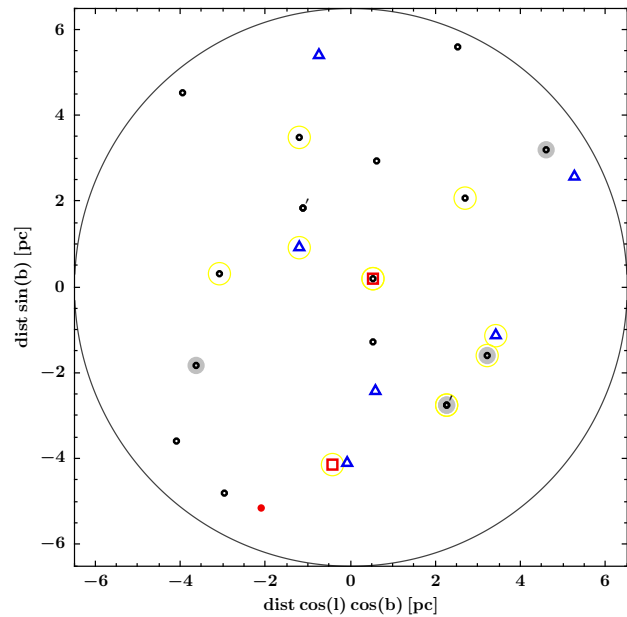Bihain & Scholz (2016, A&A, 589A, 26)   Update 2023.12

Figure A.1. Brown dwarfs projected on the vertical plane along *l = 0* deg.