

PROPER MOTIONS FROM CARTE DU CIEL PLATES

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ABSTRACT. The existing data on proper motions from meridian catalogues and proper motion surveys appear to be reasonably complete for motions larger than 0.24 arc seconds per year and down to the 19th magnitude visual but for motions between 0.24 and 0.18 there exists a lacuna for stars between 8.5 and 11.5 visual which could easily be observed by repeating Carte du Ciel plates.

The Statistical Summary of the NLTT Catalogue given in No. LVII of the Schmidt Proper Motion Survey shows clearly the lacuna in the motions between 0.24 and 0.18 annually for stars in the magnitude range 8.5 to 11.5 V. I believe it is virtually safe to assume that the proper motions of all stars brighter than 8.5 have been determined, and are listed in the SAO Catalogue. The Bruce Survey, the Wolf, Ross and other surveys as well as the hand-blinked plates of the Palomar Survey, are probably reasonably complete for motions larger than 0.24 annually. In the machine-processed plates of the Palomar Survey we generally went down to motions of 0.09 annually, but the images of stars brighter than 11.5 V were a little too erratic to be centered accurately, and were usually left out—except for a few which were needed as anchors to the determination of R.A. and Dec. of the Proper Motion Stars measured. This explains the lacuna shown in the Table, and while the indications are definite the lacunae are not so large that we cannot make some reasonable statistical corrections for them. Still, it would be much better if we had the actually observed data, and, fortunately, this region, from 8.5 to 11.5 V is exactly where the Carte du Ciel plates, if now repeated, could give us the accurate motions needed. Personally, of course, I am not so much interested in the smaller motions, yet, these would be useful for another purpose.

For some strange reason, ever since van Maanen published the first catalogue of proper motions larger than 0.5 annually, this has become the lower limit of "large proper motions". Similarly, when the Royal Greenwich Observatory, more than fifty years ago, published the proper motions of virtually all B.D. stars in the Greenwich zone—from +64 to +90—in the Astrographic Catalogue, and stressed especially, the motions

larger than 0.2 annually, this became the dividing line between motions which were individually interesting, and those only statistically interesting. I tried to follow this when I published the LTT and the NLTT Catalogues after I had finished the analysis of all Palomar Schmidt plates with galactic latitude of more than 15 degrees. Since all these proper motions determined from photographic plates are relative, they require corrections to render them absolute. In some parts of the sky these may amount to 0.018 and hence, in the NLTT, I attempted to include all motions larger than 0.18 annually, in order not to lose any absolute motions of 0.20 annually.

We have now hand-blinked or machine processed all but 53 regions in the Palomar Survey, and have included some 25 regions in the Whiteoak Extension, mainly near the South Galactic Pole. At the moment we are engaged in hand-blinking some of the ESO Schmidt plates which will extend the Bruce lower limit of magnitude to almost the same as that of the Palomar Survey. If we ever succeed in completing both of these missing sections we may then hope to have a reasonably complete catalogue of motions larger than 0.2 annually in the entire sky for stars brighter than 18 V.

What we shall further need, then, will be a fairly large number of parallaxes -especially of stars fainter than 16 V- in order to calculate the mean absolute magnitudes and their dispersion for stars of known apparent magnitude and proper motion. Once we have all this it will be possible to determine a really definitive luminosity function for stars in the solar neighborhood -now several functions.

In recent years many attempts have been made to label anything derived from proper motions as biased, and thus we have seen several approaches made through spectra, or color-indices which always claim to be completely free from such bias. However, the attempt made by just using the parallaxes in Gliese's catalogue can hardly qualify since it is reasonably certain that we have -as yet- no more than the parallaxes for all stars brighter than absolute magnitude +8 or +9, and these occupy only a small fraction of the luminosity function, and from known parallaxes alone it is not possible to estimate what is still missing.

The performance of the other two methods have, in the past, been nothing but disastrous, since they always seem to have involved rather systematic errors, thus leading to the fantastic predictions of the Messiahs of the Missing Mass. The ultimate was reached by M. Schmidt's prediction that there should still be twenty five as yet undiscovered M dwarfs brighter than the twelfth magnitude and nearer than TWO parsecs.

Since the older plates of the Carte du Ciel are between 50 and almost 100 years old and we would be able to get two different sets of plates to measure the motions we obtain should be quite accurate. The total number of motions to be measured is probably of the order of a million and with the modern automatic machines this is not a really big job -probably it will take much less time than the taking of the plates.

Table I
 Distribution of Stars by Magnitude and Annual Proper Motion

V	0".180	0".198	0".250	0".316	0".397	0".500
8.25						
8.75	215	400	218	136	73	
9.25	269	513	223	129	54	
9.75	193	350	187	100	48	
10.25	205	391	208	94	56	
10.75	289	440	269	132	70	
11.25	378	563	350	150	88	
11.75	408	713	381	211	110	
12.25	611	887	465	247	129	