Recent Results from the AGK3U

Having completed the AGK3U catalog (Bucciarelli, et al., 1992) based on the new Schmidt plate reduction techniques demonstrated in Taff, Lattanzi, and Bucciarelli (1990; see also Taff 1989 and Lattanzi and Bucciarelli 1991), we have begun to investigate the catalog from the point of view of Galactic structure and kinematics.

The first problem we have tackled is that of finding common proper motion pairs (see for instance Halbwachs 1986). Once we went to the trouble of designing our code, we also executed it on the *Positions and Proper Motions* (PPM) catalog of Roeser and Bastian (1989), the *Astrographic Catalog Reference Star* (ACRS) project of Corbin and Urban (1990; Part 1 and northern hemisphere only), and the AGK3 (Heckmann et al. 1975). The results are in Daou et al. (1992). Figure 1 contains a quick summary of the overall results; there is an exponential decrease in the number of found common proper motion pairs with mean catalog proper motion error. Extrapolating to zero error, for a 5 degree search circle, yields only a couple of common proper motion pairs in the *AGK* star list. We conclude from this that these types of catalogs can not be profitably searched to find physically associated stars (because they do not contain any?).

Next we went on to perform a standard, two dimensional, galactic kinematics analysis using the AGK3U proper motions. The development of the computer code to analyze the systematic trends in the proper motions of the AGK3U stars, and our familiarity with other catalogs, naturally suggests that we execute it on the same triplet too. We first used the AGK3 as a test case for the software and reproduced the results already obtained by Asteriadis (1977). In particular, as viewed for instance through the Oort parameters of galactic rotation, where Asteriadis obtained $A = 26.5 \pm 6.6$ *km/sec/kpc*

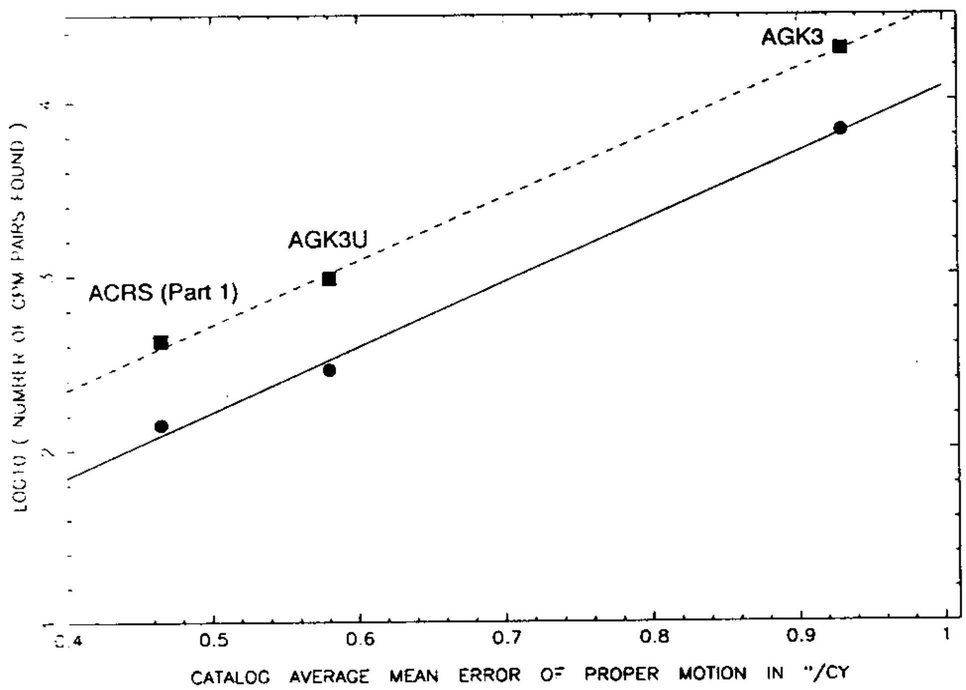

Figure 1. Results of common proper motion pair searches through three catalogs using 10 deg (squares) and 5 deg (circles) search radii. The least squares best fitting straight lines are shown. Note that they are parallel.

Table 1. Oort Constant Results

Spectral Type	Magnitude Range	Proper Motion Range ("/cy)	AGK3U Results Number of stars	A	B	ACRS Results Number of stars	A	B
				(km/sec/kpc)			(km/sec/kpc)	
O -B2	MAG≥8	MU<6	595	16.3	-29.3	381	77.6	-90.8
			598	21.3	-34.0	383	81.2	-98.4
	9.9≥MAG≥8	MU<6	502	19.2	-31.8	337	84.6	-102.6
			505	24.9	-37.2	339	88.0	-110.7
	MAG≥10	MU<6	93	4.0	-12.3	44	2.7	37.2
			93	4.0	-12.3	44	2.7	37.2
B3 - B9	MAG≥8	MU<6	4556	8.1	-6.1	2930	33.4	-20.8
			4568	7.7	-7.6	2955	29.6	-27.5
	9.9≥MAG≥8	MU<6	3997	7.5	-6.7	2704	19.0	-6.3
			4006	5.9	-8.4	2723	13.5	-15.8
	MAG≥10	MU<6	559	10.2	0.5	224	5.2	-12.3
			562	18.5	-0.5	230	22.3	-21.7
O - B	MAG≥8	MU<6	5151	9.7	-7.9	3316	35.9	-24.6
			5166	9.5	-9.7	3343	32.2	-31.2
	9.9≥MAG≥8	MU<6	4499	9.3	-8.6	3045	21.8	-12.6
			4511	8.1	-10.6	3066	16.4	-21.6
	MAG≥10	MU<6	652	9.9	-1.3	269	9.7	-14.3
			655	17.5	-2.1	275	26.0	-23.3
O - A	MAG≥8	MU<6	31445	14.0	-5.3	20404	17.2	3.6
			31663	13.9	-7.1	20610	13.1	5.3
	9.9≥MAG≥8	MU<6	25256	13.9	-5.9	17996	17.8	4.6
			25430	14.0	-7.4	18166	12.9	7.2
	MAG≥10	MU<6	6189	13.6	-2.5	2389	19.4	4.8
			6233	13.3	-5.5	2425	19.0	3.1
A5 - K	MAG≥8	MU<6	111774	10.1	-0.8	71074	1.7	5.7
			129320	13.3	-6.5	83956	8.2	2.3
	9.9≥MAG≥8	MU<6	50569	8.3	1.4	41763	4.0	0.7
			61430	10.4	-7.9	51034	7.6	-27.2
	MAG≥10	MU<6	61205	11.5	-3.7	29216	5.2	4.6
			67890	13.5	-8.3	32815	17.3	10.1

Spectral Type	Magnitude Range	Proper Motion Range ("/CY)	AGK3U Results			ACRS Results		
			Number of stars	A	B	Number of stars	A	B
				(km/sec/kpc)			(km/sec/kpc)	
ALL-(O-B2)	MAG≥8	MU<6	144394	10.1	-2.7	91808	6.3	2.2
			162402	12.9	-10.7	105004	11.3	-4.0
	9.9≥MAG≥8	MU<6	73062	9.1	-2.1	58049	10.9	-4.1
			84118	11.3	-14.3	67503	13.4	-29.6
	MAG≥10	MU<6	71332	11.4	-4.4	33645	6.7	4.2
			78284	13.1	-9.5	37374	15.2	8.1
ALL STARS			170464	13.4	-10.8	112542	9.2	-5.7

and B = -37.0 ± 6.2 *km/sec/kpc* using 599 O, B0, B1, and B2 spectral type stars we find A = 26.1 ± 6.3 *km/sec/kpc* and B = -44.3 ± 6.5 *km/sec/kpc* using 621 O-B2 stars. The closeness of these two sets of results, in view of the fact that we used a slightly different version of the AGK3 than he did, is gratifying. Note that this is true for the error estimates of A and B too.

Next we turned to the ACRS (Part 1) which, according to both its creators and the aforementioned common proper motion analysis, does, in general, really have good proper motions. Table 1 presents the values for the Oort A and B parameters, as obtained from the same computer code, for both the ACRS and the AGK3U. The spectral type, apparent magnitude, and total proper motion intervals are indicated on the left-hand side of the table. In general the AGK3U results do not show an unusual (or unexpected) systematic variation with spectral type. This was to be expected because we could not find an appreciable apparent magnitude nor color index effect in our double-checking (see Figs. 5 and 6 of Bucciarelli, et al. 1992). On the other hand, there is a very strong systematic trend in the ACRS columns, especially for the earliest spectral type stars. We have repeated these computations using the identical stellar subsets from both the AGK3U and the ACRS — while their overlap in the northern hemisphere is high it is not 100% — and the phenomenon remains. We are forced to come to the conclusion that the ACRS proper motions are contaminated by a systematic color index term, especially for the bluest stars. As these only represent a few hundred of the hundreds of thousands of stars in the ACRS, this effect is washed away in any but a spectral type or color index partitioning. (The original ACRS does not, in fact, have spectral types; we matched ACRS stars to the *AGK* list by DM number and then used the spectral types in the AGK3).

In summary, these scientific uses of the AGK3U proper motions clearly demonstrate that one can mix astrometrically reduced wide field-of-view Schmidt plates with astrographic material and materially improve the positions and proper motions. Moreover, it appears that no sensible magnitude nor color index dependent systematics are introduced.

The Space Telescope Science Institute is operated by AURA, Inc. for NASA under contract NAS5-26555.

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