XXVIth IAU General Assembly - Prague 14-24 August 2006
JD 13 - Exploiting Large Surveys for Galactic Astronomy

KINEMATICS OF NEARBY K-M DWARFS: FIRST RESULTS

Arthur R. Upgren *Yale and Wesleyan Universities, USA*

Richard P. Boyle *Vatican Observatory*

Julius Sperauskas & Stanislava Bartasiute *Vilnius University, Lithuania*

INTRODUCTION

The lists of stars selected spectroscopically by Vyssotsky (1963) at the McCormick Observatory and the 4th version of the Catalogue of Nearby Stars (CNS4) are two major sources of nearby late-type dwarfs, which complement each other. In addition to the 900 McCormick (MCC) K-M dwarfs brighter than ~12 mag, the CNS4 (see, *e.g.*, Jahreiss & Wielen 2000) includes all similar dwarfs believed to be within 25 pc of the Sun that appear to be missed in the former source. These two sources of stars, being limited in magnitude and distance, respectively, should be free of the high-proper-motion selection effect. With the advent of the Hipparcos and Tycho-2 catalogues the samples of MCC and CNS4 stars have become indispensable for obtaining complete and kinematically unbiased information for the lower main sequence stars in the immediate solar neighborhood. Until recently, however, the main limitation in observational data for both samples was the lack of well determined radial velocities, especially for fainter magnitude stars. Therefore our first goal was to perform CORAVEL observations for one-third of the ~1400 MCC and CNS4 K-M dwarfs which had no accurate or any radial velocity data.

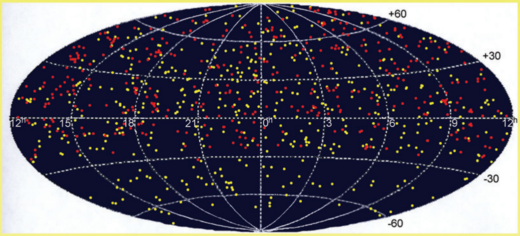

Fig. 1. *Distribution in the sky of the K-M dwarfs within 25 pc, which have accurate radial velocity data, including measurements obtained during the course of our program. Red points represent MCC stars and yellow points represent stars from CNS4. Note the incompleteness among the sample in the deep southerly declinations.*

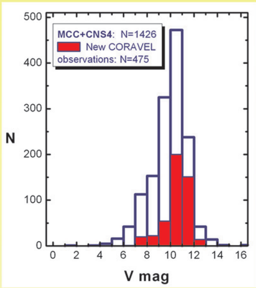

Fig. 2. *Distribution of V magnitude for the combined MCC and CNS4 sample.*

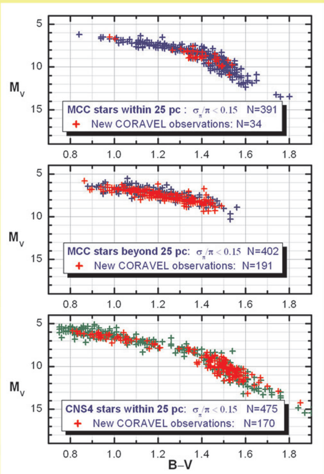

Fig. 3. *M_V, B-V diagrams for the subsamples of MCC and CNS4 stars. Only stars with the relative parallax error <15% are considered. Error bars for M_V are not shown because of their small size.*

OBSERVATIONS

To the date of this report, new radial velocities with an accuracy of 0.5 to 1 km/s are obtained for 475 stars: 298 MCC stars and 177 stars from CNS4. Observations were made with the CORAVEL spectrometer of Vilnius University Observatory, attached to the 1.5-m NASA and 1.6-m Kuiper telescopes at Steward Observatory, US, and the 1.6-m telescope at Moletai Observatory, Lithuania.

We note, however, that repeated radial velocity measuremets are made only for 160 of the program stars, among which 17 new radial-velocity variables were identified. Multiple observations allow identification of spectroscopic binaries for which the derived kinematical parameters will be inaccurate and potentially misleading. Our observational program now is in progress, and we expect to complete repeated observations and also to measure the remaining ~50 of the program stars not yet observed. More details about the program can be found in Upgren, Sperauskas, & Boyle (2002).

In Figs. 1 and 2 the stars with new radial velocities are plotted together with other stars from the MCC and CNS4 samples, which have well determined radial velocity measures (with an error 1 to 2 km/s) from the literature and which were used, together with our CORAVEL data, in the current analysis of the kinematics of the sample stars.

FIRST RESULTS AND FUTURE WORK

The space velocity components have been calculated with respect to the Sun. A summary of the kinematical information on the MCC and CNS4 subsamples and on the whole sample of 1262 stars is given in the table. The mean velocities and the velocity dispersions indicate that the CNS4 sample is, to some extent, kinematically biased, a consequence of inclusion in this catalog of nearby stars from high-proper-motion surveys.

For the *U*- and *W*-components of the peculiar motion of the Sun with respect to the LSR, the kinematically unbiased sample of MCC stars gives the values 9.3±1.3 km/s and 6.9±0.7 km/s, respectively. No attempt was made at this stage of work to determine the component *V* of the LSR.

The distribution of the *V*-velocity (Fig. 4) clearly shows the presence of different age populations dominating the distribution in different regions of the asymmetric drift: the young disk component showing no lag behind the motion of the Sun, the intermediate age component with the central peak at the asymmetric drift $V_a \cong 10$ km/s (if to assume the Sun's motion relative to the LSR $V_o = 5$ km/s), and the old disk population with the larger rotational lag. The stars which make up an asymmetric tail to the left of the dip at $V_a \cong 35$ km/s might plausibly be assigned to the thick disk component.

	Sample	N	<U>	<V>	<W>	σ_U	σ_V	σ_W	σ_V/σ_U	σ_W/σ_U
			in km/s			in km/s				
I	MCC I within 25 pc	388	-7	-19	-7	38	23	18	0.60	0.49
II	MCC II beyond 25 pc	399	-12	-20	-7	37	25	18	0.66	0.49
I+II	MCC I + II	787	-9	-20	-7	38	24	18	0.63	0.49
III	CNS4 within 25 pc	475	-13	-25	-9	41	28	21	0.69	0.52
I+III	MCC+CNS4	863	-10	-22	-8	40	26	20	0.65	0.51
I+II+III	MCC+CNS4	1262	-11	-22	-8	39	26	20	0.66	0.50

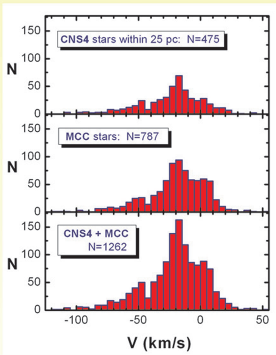

Fig. 4. *Distribution of the velocity component V for the CNS4 and MCC stars and for the combined sample.*

Selection effects are still rife within both stellar samples. Therefore the next step will be to evaluate the completeness of each of the sample and to evaluate the Malmquist and Lutz-Kelker biases inherent in each group. Hopefully, age related stellar measures will also be provided in a later phase of the program.

Acknowledgements. The authors wish to thank Steward Observatory for providing telescope time. Collection of astrometric and photometric data for the sample stars and radial velocity data for non-program stars was greatly aided through the use of ARICNS and SIMBAD.

Authors' e-mails: aupgren@wesleyan.edu
rboyle@as.arizona.edu
julius.sperauskas@ff.vu.lt
stanislava.bartasiute@ff.vu.lt

References

Jahreiss, H., & Wielen, R. 2000, In *IAU Symp. 200*, eds. B. Reipurth & H. Zinnecker, p.129
Upgren, A.R., Sperauskas, J., & Boyle, R.P. 2002, BaltA **11**, 91
Vyssotsky, A.N. 1963, In *Stars and Stellar Systems*, vol. III, ed. K.Aa. Strand (Univ. of Chicago, Chicago), p. 92