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HIPPARCOS PROGRAMME FOR FIELD METAL-DEFICIENT F–M STARS

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Abstract. The programme contains 445 subdwarfs, metal-deficient giants, RHB and CH stars. The aim of the programme is to obtain very accurate trigonometric parallaxes ($\pm 0.''002 \div \pm 0.''004$) and proper motions ($\pm 0.''002 \div \pm 0.''004$/year) for these stars, to significantly improve the determination of their positions in the HR diagram and to calculate accurate kinematical parameters. About half of the programme stars are measured in the Vilnius photometric system. For all stars, the colour indices $B-V$ have been compiled or reduced from other photometric systems. 100 of the programme stars have ground-based trigonometric parallaxes. The mean parallax of these stars is $+0.''0347$, and its mean standard error is $\pm 0.''0104$. The list of the programme stars is available on magnetic diskette.

Key words: astrometry: HIPPARCOS programme, trigonometric parallaxes, proper motions – stars: HR diagram – stars: Population II

European Space Agency (ESA) astrometric satellite HIPPARCOS (*HIgh Precision PARallax COllecting Satellite*) was launched on August 8, 1989. Despite the fact that the satellite did not reach the planned geostationary orbit and had some other difficulties, the primary goal of the HIPPARCOS programme to measure stellar positions and parallaxes with the accuracy $\pm 0.''002 \div \pm 0.''004$ and proper motions with the accuracy $\pm 0.''002 \div \pm 0.''004$/year is thought to be achieved (Perryman 1992, 1993, McBreen 1993).

The proposed programme (Proposal No. 57) "The HR diagram and Kinematical Properties of F–M Stars with Metal-Deficiency" was approved by the HIPPARCOS Programme Selection Committee in 1982 (Perryman 1989). From the 455 proposed stars, 445 were selected for measurements. The programme includes subdwarfs, metal-deficient giants, RHB and CH stars. All of the extreme metal-deficient ([Fe/H] < -2.3) stars known to the programme's compilation date (to the beginning of 1982) were included. For the programme, the stars were selected from a sample of $\sim$ 5000 metal-deficient or suspected metal-deficient stars known at that time.

Very precise and homogeneous HIPPARCOS trigonometric parallaxes of subdwarfs will allow us not only to significantly update their individual distances, but also to obtain accurate positions of their sequences with different [Fe/H] in the HR diagram. This is very important in determining the distances of globular clusters by the method of main - sequence fitting and in establishing helium abundances of Population II stars.

Obtaining the precise positions of the field metal-deficient stars near the turn-off point allows us to determine their ages. Up to now this has been done only for globular clusters.

Absolute magnitudes, M_V, of the programme metal-deficient giants obtained from HIPPARCOS proper motions by the statistical parallax method and supplemented with M_V obtained from trigonometric parallaxes of nearby giants will allow us to determine directly the location of field Population II giants in the HR diagram.

An important feature is that the HIPPARCOS will enable us to locate in the HR diagram extremely metal-deficient stars ([Fe/H] < -2.3) which are more metal-poor than any of the known most metal-deficient globular clusters.

The programme stars with reliable M_V from the HIPPARCOS measurements will be used as primary standards for luminosity calibration in different photometric and spectrophotometric systems.

It is well known that the main sources of uncertainties in calculating stellar kinematical parameters are large errors in proper motions and distances, which will be significantly improved by the HIPPARCOS measurements.

And finally, the programme stars were observed at each of the 300 or so epochs of observations (Perryman 1993), and, along with the astrometric parameters, the precise very broad-band magnitude H_p was measured (Mingard et al. 1992). This provided for the first time a unique opportunity for detecting Population II variables (even

having small amplitudes) without various selection biases. Also, information on the binary or multiple nature of the programme stars will be given (Soderhjelm et al. 1992).

The magnitudes B of the programme stars are distributed as follows: 105 stars have $B < 9.0$, 280 have $9.0 \leq B \leq 11.0$ and 70 stars have $11.0 < B < 13.0$. For all of the stars, the magnitude V and colour-index $B - V$ are compiled from the literature. For stars without original photoelectric UBV measurements, the colour index $B - V$ is reduced from the index $Y - V$ of the Vilnius system (Bartkevičius and Lazauskaitė 1992), from the index $b - y$ of the *uvby* system, from the index $B2 - V1$ of the Geneva system or from the index 45-48 of the DDO system (Bartkevičius 1983), taking into account the metallicity and luminosity class of a star.

213 programme stars have been measured in the Vilnius photometric system (Straižys and Kazlauskas 1993). J. Sperauskas (see Bartkevičius and Sperauskas 1990, 1994) has carried out radial velocity measurements of a number of the HIPPARCOS programme stars with a CORAVEL-type radial velocity speedometer.

100 of the programme stars have ground-based trigonometric parallaxes. Preliminary analysis of those measurements has been carried out by Lazauskaitė et al. (1992). Absolute parallaxes and their external errors were taken from the Catalogue of Trigonometric Parallaxes of Population II Stars (Bartkevičius 1992, 1993). The mean parallax of these stars is $+0.''0347$ and the mean standard error is $\pm 0.''0104$. Only 25% of these stars have $\sigma_\pi/\pi \leq 0.20$.

In the future we plan to compile and generalize data for the programme stars, including [Fe/H], radial velocity, binarity, variability, etc.

A list of the programme stars, together with some known parameters, is available on diskette.

References

Bartkevičius A. 1983, Preprint, Vilnius

Bartkevičius A. 1992, Catalogue of Trigonometric Parallaxes of Population II Stars, Vilnius (on diskette)

Bartkevičius A. 1993, Standard Star Newsletter (submitted)

Bartkevičius A., Lazauskaitė R. 1992, Baltic Astronomy, 1, 111

Bartkevičius A., Sperauskas J. 1990, in Proceedings of Nordic-Baltic Astronomy Meeting, eds. C.-I. Lagerkvist, D. Kiselman and M. Lindgren, Uppsala, p. 45

Bartkevičius A., Sperauskas J. 1994, Baltic Astronomy, 3, 49
Lazauskaitė R., Bartkevičius A., Bartkevičienė D. 1992, Preprint, Vilnius
McBreen B. 1993, EAS Newsletter, 5, 9
Mignard F., Froeschlé M., Falin J.L. 1992, A&A, 258, 142
Perryman M.A.C. 1989, in The HIPPARCOS Mission Pre-Launch Status. Vol. II. The Input Catalogue. ESA SP-1111, p. 250
Perryman M.A.C. 1992, Letter to the HIPPARCOS Principal Investigators, December 17, 1992
Perryman M.A.C. 1993, ESA Astronews, 20, 6
Soderhjelm S., Evans D.W., van Leeuwen F., Lindegren L. 1992, A&A, 258, 157
Straižys V., Kazlauskas A. 1993, General Photometric Catalogue of Stars Observed in the Vilnius System, Baltic Astronomy, 2, 1