THE MAGELLANIC CATALOGUE OF STARS (MACS): AN INPUT CATALOGUE OF UNCROWDED STARS FOR GAIA*

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ABSTRACT

It has not yet been decided whether the GAIA interferometric astrometry satellite will need an input catalogue. An input catalogue probably would be of great importance for the data reduction process. While Schmidt surveys available already now are sufficient to provide input information for uncrowded regions of the sky, fields of high object density remain problematic. The Magellanic Catalogue of Stars (MACS) (Tucholke et al. 1996) lists positions better than 0.5 arcsec for 244 000 stars in the Large and Small Magellanic Cloud brighter than $B = 16.5$ mag, and fills in the gap left by the Schmidt surveys for these regions. In addition, MACS stars are selected to be undisturbed by neighbouring stars, providing a sample of relatively uncrowded objects.

Key words: space astrometry; GAIA; Magellanic Clouds; catalogues.

1. INPUT CATALOGUES FOR GAIA

The GAIA astrometric interferometer in its present concept (Lindegren & Perryman 1994) is planned to measure positions and their changes in time with an accuracy of 10 μas and 10 μas/yr for 50 million objects down to a magnitude of $V = 15$ mag. Fainter stars in the magnitude range 16–20 can be observed in a direct imaging mode of somewhat lower accuracy. It is currently under discussion whether GAIA will need an input catalogue analogous to the case of the Hipparcos satellite. While in principle all information can be extracted from the observations themselves, the previous knowledge of object positions and magnitudes will facilitate the data reduction process.

For the case that an input catalogue would be needed, a large amount of data suitable for that purpose is already available due to several large-scale Schmidt-plate based surveys. Lasker et al. (1995) give an up-to-date presentation of the Guide Star Catalog GSC–I and the upcoming GSC–II, which should provide completeness to $V \approx 18$ with accuracies of 0.2 arcsec for positions and 4 mas/yr for proper motions. Crowded regions like the Galactic plane, the Galactic bulge or the Magellanic Clouds remain difficult, however.

While it will be possible to deconvolve two stars falling within the same 27×13.5 arcsec^2 subfield of the modulating grid of GAIA, this will no longer be possible for more than three stars in the same subfield, or if the brightest star is near the limiting magnitude of the interferometric mode ($V \approx 16$). Therefore, a careful pre- or post-selection of stars in crowded regions will be necessary, unless the yet hypothetical direct fringe detection will be available. Here I suggest to use the just completed Magellanic Catalogue of Stars for the GAIA input catalogue in the regions of the Magellanic Clouds.

2. THE MAGELLANIC CATALOGUE OF STARS

The Magellanic Catalogue of Stars (MACS) (de Boer et al. 1995, Tucholke et al. 1996) has been created in response to the growing need for accurate (in the sense of telescope pointing) positions of stars in the LMC and SMC.

The MACS is based on scans of ESO Schmidt plates taken in 1989/90 in a blue passband with limiting magnitudes of about $B = 20.5$ mag, covering areas of 200 and 120 square degrees for the LMC and SMC, respectively. 21 plates of 12 fields were used. Objects detected by an automatic search program with a selection threshold set at $B \approx 16.5$ mag (differing slightly from plate to plate) were screened interactively to be *undisturbed* by neighbouring stars (separations between 2–11 arcsec). In the same step, artifacts and galaxies were eliminated. The reason for this selection is to provide a catalogue of reference stars for the astrometric reduction of CCD frames, which appear 'single' on Schmidt plates. Discarded stars might be resolved and unproblematic for CCD observations (and for GAIA), but would have inferior positions on the plates.

Details of the astrometric reduction and compilation process are given in Tucholke et al. (1996). The plate positions were reduced with the PPM South catalogue (Bastian et al. 1991). A common systematic pattern in the residuals probably caused by the bending of the Schmidt plates was detected and removed from the positions. After combining the positions from plates of the same field and in overlap regions, the final catalogue contains 175 779 and 67 782 stars for the LMC and the SMC region, respectively. The minimum surface density is 0.15 stars per arc minute squared. From comparison in overlap regions we estimate that typical internal errors

*Based on observations at the European Southern Observatory, La Silla, Chile

are 0.27 arcsec in position and 0.15 mag in internal magnitude. Less than 1% of the stars have internal errors exceeding 0.5 arcsec. Proper motions and colours are not yet available. Proper motions could be obtained by scanning plates from the ESO Quick Blue Survey taken in 1973–78. The nomenclature introduced for MACS stars is detailed in de Boer et al. (1995).

The MACS is a convenient source of positions better than 0.5 arcsec for uncrowded stars in the directions of the Magellanic Clouds, filling in a gap left by the present Schmidt-based surveys. It could form part of an input catalogue for the GAIA satellite down to the limiting magnitude of the interferometric mode.

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