FIRST GAIA PHOTOMETRY

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ABSTRACT

It is proposed to process the medium-band photometry separately, not integrated in the main Gaia processing as presently foreseen. Results from medium-band photometry for use in science and for monitoring of satellite performance would be obtained earlier in the mission. Scientific use of the photometric results for classification and variability studies is obvious.

Key words: Gaia; Photometry; Techniques: photometric.

1. EARLY MEDIUM-BAND PHOTOMETRY

The medium-band photometry (MBP) data could be processed separate from the main Gaia processing, not integrated in the main Gaia processing as presently foreseen, see Brown (2005) and Torra (2005). The final medium-band photometry needs astrometry (positions, proper motions, parallaxes, multiplicity) for all stars from the main Gaia processing and it needs the attitudes, but broad-band photometry (BBP) is not needed. An accuracy about 100 mas for these astrometric data would be sufficient for the final medium-band photometry since the PSF has a FWHM larger than 1 arcsec.

Earlier during the mission medium-band photometry processing could however be based on less precise data. With data from the on-board attitude and the medium-band photometry data from the Spectro telescope sky mappers (SSMs) and the high-resolution (WM0) window a catalogue of medium-band photometry stars with positions and fluxes can be created, including mapping of a circle with 10 arcsec diameter. At first during the mission, 6 months of data could be analyzed so that proper motions are of minor relevance.

The filtered medium-band photometry data can then be processed to give medium-band photometry for all stars, both as epoch photometry and as average for the given interval of observations. The calibration observations including diffraction spikes can be utilized.

The amount of data is about 18% of the total Gaia data, according to a report by U. Lammers, the Astro-1 and Astro-2 telescopes give 25% each, and the spectra from the Spectro telescope give 32%. For 6 months the Spectro medium-band photometry samples amount to 1.8 Terabytes uncompressed, i.e., assuming 16 bits per sample. These data need mainly be processed star-by-star and should therefore be sorted into sky areas. Lessons may be learnt from the very similar construction of the Tycho-2 Catalogue described by Høg et al. (2000).

The proposed processing of medium-band photometry as a separate task would provide early experience with the observations and give valuable input data for classification and variability studies. Such early processing of medium-band photometry data, independent of the main Gaia processing, would give results of astrophysical interest, give technical experience with the observations and constitute a first step of iteration for photometry.

2. BROAD-BAND PHOTOMETRY

A separation of broad-band photometry analysis from the main Gaia processing is less obvious. Sufficient astrometric accuracy for the final processing of broad-band photometry is about 10 mas along scan and 30 mas across, much more demanding than for the final medium-band photometry, and the broad-band photometry is needed for the astrometric processing to correct for astrometric chromaticity. But a separation of data from broad-band photometry, the Astro telescope sky mapper (ASM), the mapping data from AF11, and the on-board attitude should still be considered in order to obtain early mapping and photometry with high angular resolution.

REFERENCES

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