

-- The Revised SDSS Equatorial Proper Motion Catalogue -- A test-bed for scientific exploitation of Gaia data

Introduction

In the Autumn and Winter of 2010 I undertook a three months at the Institute of Astronomy (IoA) in Cambridge. The research which was carried out was directly related to the goals of the Gaia mission and the resulting catalogues form a crucial test-bed for the tools which will, in the near future, be applied to data from the Gaia catalogue. In the following report I shall outline the achievements that were made during the course of this ESF Exchange Visit.

Research Report

During my time at the IoA we made significant progress towards the goals outlined in the original research plan. The plan revolved around the Sloan Digital Sky Survey (SDSS) equatorial stripe, which researchers at Cambridge (including myself) have previously utilised to construct a proper motion and variability catalogue (Bramich et al., 2008, MNRAS, 386, 887). One of the goals for the trip was to obtain an improved catalogue constructed using relative (rather than absolute) astrometry. This catalogue has been constructed by Sergey Koposov and so during the visit I obtained the data and carried out some preliminary analysis. Fig. 1 shows the improvements that have been made in this new catalogue. By utilising relative astrometry it has been possible to achieve a factor of up to five increase in precision. Clearly, in the magnitude range of 15th to 19th in r , the precision reaches close to 1 mas/yr, which is an amazing achievement when one considers that the time-baseline for this catalogue is only 7 years. With such accurate proper motions it will be possible to trace distant halo structures.

A number of collaborative projects were discussed and, as proposed, I am now working with a student in Beijing who is going to carry out some studies using this dataset. We will start by undertaking verification work and then attempt to constrain the proper motion of the Sagittarius stream. Afterwards we will use the catalogue to identify new kinematic over-densities. This will hopefully result in at least one publication, but the work is currently at an early stage.

In addition to this work I also carried out some analysis of 6D phase-space using this equatorial stripe. The work focussed on the kinematic properties of the disc and we aim to publish this work soon.

Whilst visiting the IoA I also carried out some preparatory work for the Gaia-ESO Spectroscopic Survey, which is being spearheaded by the GREAT network. This consisted of testing photometric selection algorithms to identify giant stars, utilising SDSS data cross-matched with near-UV data from the Galex mission.

Summary

The work described above will lead to work which will be of huge importance in the pre-Gaia era. No other proper motion catalogue is as wide and deep as the one described above. As a consequence it is a great training field for the kinds of astrometric studies which will be enabled by Gaia, placing us in an ideal position to exploit the Gaia data. In the coming months I will be returning to Cambridge to continue the work which has been made possible by this ESF Research Visit.

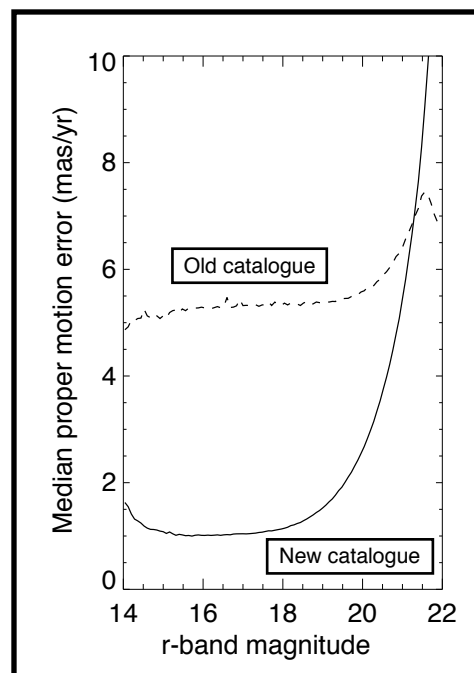


Fig. 1 - The precision on the total proper motion as a function of r -band magnitude for the previous catalogue (dashed) and the improved revised catalogue (solid).