

For direct imaging in the B-, G-, V-, R-colour system limiting magnitudes  $> 21$  mag are reached within 5-10 min exposure time with the Sonnar- and Z-B/V- camera lenses. Very faint surface luminances are obtained ( $> 25$  mag/arcs<sup>2</sup>) with interference filters (5 - 10 nm HWFM) outside the night sky line wavelength regions.

For slit spectroscopy we use a longslit of 13.2 arcmin length and 3 arcs width as well as masking slits of 1 to 3 mm width for slitless spectroscopy. These slit arrangements are moveable over the telescope field, so that the different spectral ranges of grating prisms must not be separated by colour filters. With the 1 mm slit mask we observed in the red spectral range an asteroid of 17th mag with an S/N  $\approx 10$ . The long slit spectroscopy is especially effective for faint extended emission objects (Fig. 2).

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## Wide-field CCD Astrometry at Hoher List Observatory — First Results

### 1. Introduction

Over the past twelve years CCDs have become more and more important for astrometric work. The first attempts demonstrated that parallaxes of stars can be measured more efficiently with this new technique (see Tinney 1993 and references herein). Later, also the measurement of angular separations of double star components with classical methods was nearly completely replaced by measurements with CCDs (e.g. Sinachopoulos 1988). Further applications of CCDs in astrometry are the determination of optical positions of extragalactic objects (Argue 1984; Wei et al. 1989) and of x-ray sources in the cores of globular clusters (Geffert et al. 1989, 1994).

At Hoher List observatory two new independent facilities with CCD detectors, which are also usable for astrometry, became available last year. We will present here the first results of the astrometric tests.

## **2. SBIG ST6 CCD at the Visual Tube of the Double Refractor**

The visual tube of the Double Refractor has been equipped with a 242 x 375 pixel ST6 CCD camera. In this configuration, the usable field is 5' x 6' and the scale is about 1"/pix. B,V,R,I,G filters may be used. The same equipment but with a ST4 CCD camera was already used for the development of a new method for the determination of separations of visual binaries (Müller & Geyer 1993). First tests with the ST6 have shown that objects of 17<sup>m</sup> can be reached within 4 minutes, which is a gain in exposure time of about 15 with respect to the photographic plates at the Double Refractor. In March 1993 we have taken six frames of the core of the open cluster M67. Rectangular coordinates of all stars of our field which form also the catalogue of Girard et al. (1989) were determined using IRAF software. From the intercomparison of the different CCD frames we obtained a mean internal accuracy of better than 0".1 for one star on one frame. The deviations of the catalogue of Girard et al. (1989) were of the same order. These results indicate that the visual tube of the double refractor may be usable for astrometric work, although the designation 'wide field' for this instrument is only partly justified.

## **3. WWFPP at the 1.0 m Cassegrain Telescope**

The WWFPP (Weit Winkel Flächen Polarimeter and Photometer) was developed by the Radioastronomisches Institut and the Sternwarte of the University of Bonn (Reif et al. 1993) mainly for surface photometry and surface polarimetry. It uses a nitrogen cooled 2048 x 2048 Loral CCD chip. In combination with the focal reducer system at the 1 m telescope of the Hoher List Observatory the WWFPP has a field diameter of 25 arcmin and a scale of 0".8/pix. In addition to the applications mentioned above, the system is now going to be used partly for photometry of open clusters (Herkendell et al. 1993) and astrometric projects (see below). During test runs at Hoher List Observatory in 1993, frames of the globular cluster M53 were taken. Three V and three R frames were used in this investigation with exposure times of 60 sec, 300 sec, and 600 sec for each colour. We were able to identify 80 stars of the catalogue of Geffert et al. (1993) on our frames. Rectangular coordinates were determined using DoPHOT and MIDAS software. We have analyzed the astrometric accuracy by intercomparison of the positions of the stars on different frames and comparison with the catalogue. For the latter a reduction model with terms up to the third order in rectangular coordinates x and y had to be used. No indication of magnitude and coma terms has been found. The following results were obtained:

- 1) using frames of the same colour yields an accuracy of 0".07;
- 2) using frames of different colours gives an accuracy of 0".08;
- 3) the comparison with an independent catalogue yields 0".09.

The values are mean accuracies for one star on one frame. Since the major part of the stars used is located near to the globular cluster M 53, we cannot rule out systematic effects due to crowding and blended images especially in the construction of the catalogue from the photographic plates. These effects may cause the slightly higher deviations from the catalogue.

## **4. Future Projects**

Our future projects may be summarised as follows:

- 1) a more extensive astrometric test of the WWFPP will be performed by comparing overlapping frames and using additional fields of open clusters;
- 2) observations will be performed of close pairs of extragalactic objects and stars from the HIPPARCOS input catalogue. A combination of these data with measurements of old photographic plates may contribute to the calibration of the HIPPARCOS proper motion system;

- 3) due to the gain in exposure time the CCD technique is very suited for the astrometric observations of asteroids. Precise positional differences of asteroids and radio sources or HIPPARCOS stars may improve the astrometric accuracy of the measurements for the mass determination of asteroids and the link of the dynamical reference frame to other reference frames;
- 4) observations of open and globular star clusters with small angular sizes will be used for combined photometric and astrometric studies of these clusters. Membership probabilities of single stars may be calculated which may also lead to a better determination of the turnoff point in the colour-magnitude diagram of these clusters.

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