THE 2020GM PDS MICRODENSITOMETER AT MUENSTER

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The 2020GM PDS microdensitometer of Perkin-Elmer, Optical Division, was installed at Muenster University during the summer of 1982. The present communication summarizes the greater part of work performed during its first year of operation and outlines plans for the future. The microdensitometer and the system configuration are shown in Figs. 1 and 2.

THE MONITOR

The Astronomical Data Analyzing Monitor ADAM, developed by D. Teuber, is part of the Astronomical Data Analyzing System ADAS at the Astronomical Institute of Muenster University. ADAM provides the software environment for application programmes and controls the execution of these programmes. The astronomer issues his commands in an application-related language. He is also able to shape the input sequence and the monitor response to resemble closely that of his home system.

TESTS

Mechanical and photometric tests of the microdensitometer were carried out by H.-J. Tucholke following the usual procedures. The orthogonality of the system is about 4", corresponding to a deviation of 10μ over the total travelling distance of 500mm. The mechanical stability of the machine lies within 0.2μ at all speeds (0-230mm/sec) and around 0.1μ at all but the smallest and the largest. Photometric stability is reached after 3 hours of warm-up time and is smooth for the sum of all components. The density readings show a maximum deviation of 2% relative to a standard wedge, generally it is much lower. For more detail see Teuber (1983) and Tucholke (1983a and b).

ASTROMETRY

Investigations of 160mm x 160mm plates by M. Geffert and H.-J. Tucholke

M. Capaccioli (ed.), Astronomy with Schmidt-Type Telescopes, 159–163.

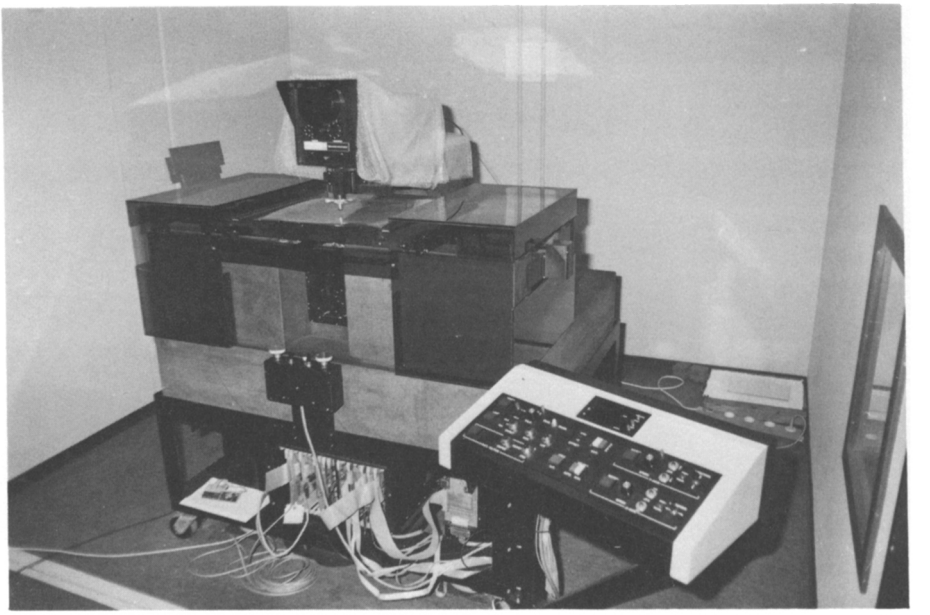

Fig. 1. The 2020GM PDS microdensitometer at Muenster

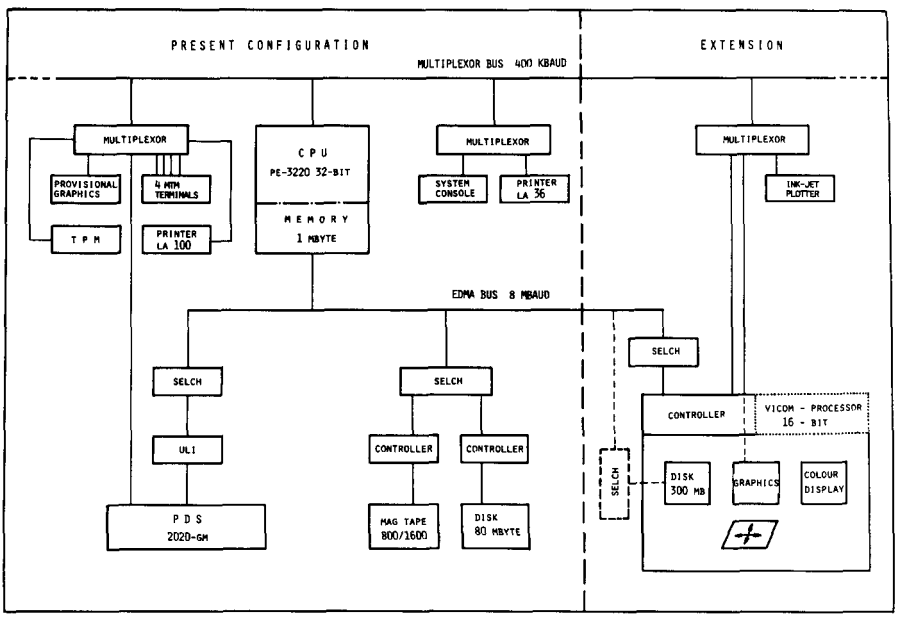

Fig. 2. The system configuration including the 2020GM PDS

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show differences between measurements in position 0°+180° and position 90°+270° of 0.7μ in x and 0.5μ in y. Comparison with catalogue positions by Vasilevskis et al. (1979) gives deviations of 1.4μ in both x and y when linear reduction models are used, and 1.3μ in x, 1.1μ in y with quadratic models. The errors consist of four contributions: PDS measuring rods, fit routines of the programme, photographic plate and comparison catalogue.
The programme, based on work by R. Dettmar, includes the following steps: data sampling, reconstruction of stellar images from scan lines, transformation and comparison of two measurements of the same field scanned under different angles, iteration of parameters, comparison with catalogue star in the catalogue system.

STAR COUNTS AND PHOTOMETRY

The programme steps are: data acquisition with medium resolution, determination of pixels of maximum density under exclusion of multiple maxima due to saturation, determination of limits of stellar images centered on maximum pixels, intensity calibration (several methods in preparation).

The results are: stellar positions accurate to within scan step width, stellar luminosity functions and plots of star fields with symbols of different sizes representing different intensities.
The coarse data may serve as input for individual scans of stars leading to high positional and photometric accuracies.
The programme was developed and tested by W. Goerigk, T. Richtler and H.-J. Tucholke.

RADIAL VELOCITIES

The programme includes the following steps: data acquisition, search for comparison lines in given x-intervals, determination of line curvatures, derivation of the dispersion curve, rectification of the stellar continuum, identification of stellar lines and profile fittings, heliocentric corrections and Julian dates, determination of radial velocities for individual lines, mean values and the total radial velocity for the spectrum, error determinations.
The programme is fully automatic for normal stars. It was written and tested by R. Dettmar and R. Duemmler.

MORPHOLOGY OF GALAXIES

The programme sequence is: data acquisition, derivation of the characteristic curve using the Honeycutt-Chaldu method, determination of central coordinates of elliptical galaxies, sequential fits of ellipses to isodensity curves, determination of semimajor and semiminor axes a and b of ellipses, position angles Θ of major axes, ratios of major to minor axes, mean densities and mean intensities along ellipses.

The final results are shown as data tables and in the following plots: $I(r)$ with $r = (ab)^{1/2}$, $\log I(r)$, $\Theta(r)$, $a/b(r)$ and $\log I(r^{1/4})$.

The program was written and is applied by H.-G. Scheuer with the assistance of E. Willerding. For more detail see Scheuer (1983a and b).

FUTURE WORK

Long-range aim is the reduction of entire Schmidt-plates.

The determination of BASIC DATA will include: stellar magnitudes in three (or more) colours, colour indices, colour excesses, stellar types from objective prism plates and/or colours, distances; isophotes of galaxies in different colours, radial velocities from objective prism plates, distances.

The FINAL DATA will be: distribution of stars in the galactic plane and perpendicular to it as a function of type, galactic isophotes; distribution of galaxies of different morphological types; positions, structures and physical properties of bright and dark clouds.

NUMERICAL EXAMPLE

350mm x 350mm Schmidt-plate, step width 15μ.

Measuring time 20 hours, total number of data points 1.1 Gigabyte. After arrival of 1000 scan lines on-line reduction commences. With an estimated number of 2 million stars and galaxies up to 21st magnitude on a typical plate the number of data points (total density and center position of each object) will reduce to 12 Megabyte. Another two Megabyte will give the values of a smooth sky background.

For the analysis of extended cloud regions digital storage of entire plates will be necessary.

PRELIMINARY TIME TABLE

September 1983	End of basic mechanical and photometric tests
1983	Morphology of southern elliptical galaxies from SRC-J atlas plates
after glass copy of POSS is received	Morphology of northern elliptical galaxies
1983	Radial velocities: stars and interstellar lines
1983/1984	Investigations of globular and galactic star clusters: membership, masses, variable stars
1983/84	Spectral classification from objective prism plates using line identifications, cross correlations, combination of procedures

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1984	Reduction programmes using various image structures, photometric programmes of high accuracy
1984	Start collecting photometric sequences for plate calibrations
1984	Installation of image processing system and tests (assuming grant is provided)
1985	Tests of photometric properties of different wide-angle plates
1985/86	Reduction programmes for entire Schmidt-plates
1986	Test runs with three-colour Schmidt-plates and follow-up algorithms
1987	Commence long-range programme for the reduction of entire Schmidt-plates

For the 1983/84 programmes a total of about 650 direct and spectral plates is available, not counting the atlas plates.

The contents of this communication are the combined work of all full and temporary members of the Astronomy Department of Muenster University, including, besides the coworkers mentioned above, Dr. A. Bruch and Messrs. R. Budell, F. T. Lentes and C. C. Volkmer.

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