A UNIVERSAL MICROPHOTOMETER WITH A ROTATING SLIT: BRIEF DESCRIPTION AND USE IN ASTRONOMICAL TASKS

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Several types of fast digitization devices consisting of CCD cameras and frame grabbers have appeared and been implemented in astronomical practice during the last decade. Nevertheless, various types of classical scanning devices are still used for precise digitization of astronomical images and spectrograms. Among them, a new type of microphotometer with a rotating slit (UMF) was adjusted and installed at the Ondřejov Observatory (Zicha et al. 1992). Technical parameters of the device are as follows:

Technical Parameters of the Universal Microphotometer	
Table size in X axis	0-230 mm
Table size in Y axis	0-115 mm
Minimum sampling step	0.5 μm
Precision of a position setting	1-2.5 μm
Maximum velocity of scanning	10 mm/s
Rectangular slit — minimum size	3 μm x 3 μm
Rectangular slit — maximum size	15 mm x 15 mm
Precision of the slit size setting	5%
Position angle of the slit	0-360 degrees
Precision of the slit angle setting	5 arcmin
Light source — stabilized halogen lamp	24 V / 150 W
Photocurrent stability	≤ 0.1%
Dynamic range	12 bits

H. T. MacGillivray et al. (eds.), Astronomy from Wide-Field Imaging, 185–187.

The exceptional two merits of the UMF are:

1) possibility to scan according to a general curve defined either analytically or experimentally by at most 30 points
2) possibility to vary the position angle of the slit during the scanning.

Both characteristics were established for making possible some special needs in astronomical and astrophysical practice.

When digitizing a series of pictures with a certain type of symmetrical distribution of intensity or with presence of special non-rectangular patterns, some unusual ways of scanning can be advantageously used. Typical examples of such objects are various circular, elliptical or curved sky objects recorded in astronomical plates. Some special astronomical tasks are measurements of the light intensity distribution along individual cometary curved tails, the flash spectra of meteors or those of solar corona. In such cases, the spectral lines couldn't generally be linear bars perpendicular to the direction of dispersion. Therefore, to measure the spectral characteristics properly, we have to vary the position angle of the slit during scanning.

As an example we present in Fig. 2 a set of loops on the solar disk recorded through a narrow band $H\alpha$ filter. When we measure the intensity of radiation (or a related quantity) along all the loop, we can simply perform it using the mode of scanning along a general curve while the slit axis follows the normal to the scanning curve.

Even if many similar problems can be in a first approximation solved by various sophisticated numerical methods applied to data files obtained by the usual rectangular process of digitization, still some frame distortion remains. Instead of a permanent estimation of this distortion, we can eliminate it principally using a digitization slit, the size and, especially, inclination of it could be changed in a desirable way relevant to peculiarities of its astronomical, astrophysical or imaging essentiality.

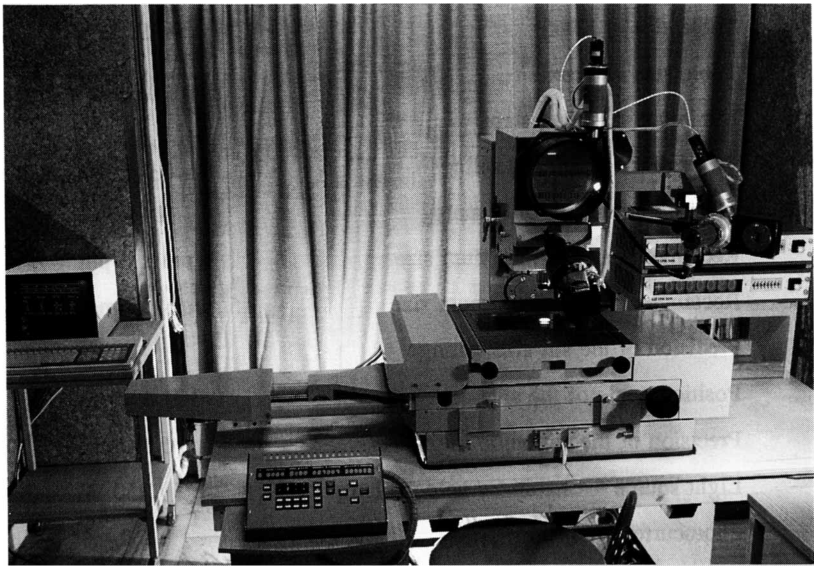

Figure 1. A general view of the Universal Microphotometer.

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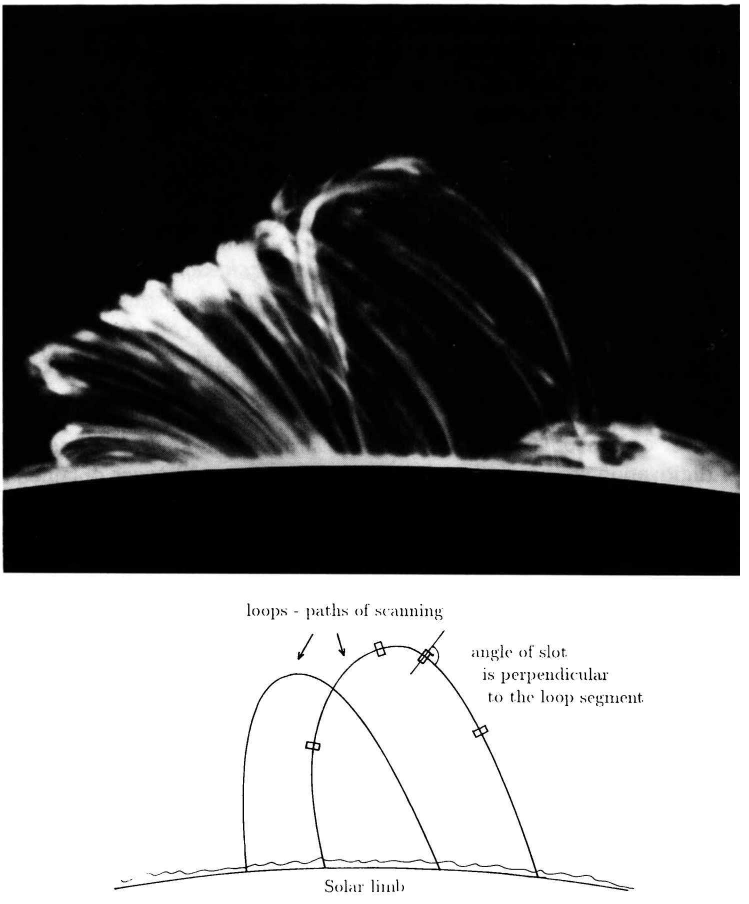

Figure 2. Flare loops visible in Hα above the solar limb are a typical example for measuring intensity of radiation along a general curve. (Courtesy B. Rompolt, Bialkovo Observatory, University of Wroclaw).

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References

Zicha, J., Kotrč, P., Klvaňa, M. and Knížek, M., 1992. IAU Working Group on Wide-field Imaging, Newsletter No. 2, ed. H.T. MacGillivray, Royal Observatory Edinburgh, p. 72.