MULTI-CHANNEL SUBTRACTIVE DOUBLE PASS SPECTROGRAPH

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1. Principle

In the MSDP spectrograph, the slit is replaced by a two-dimensional window (Fig.1). At the focus where the spectrum is usually formed, a multiple slit selects N wavelengths (N = 9). Then N prisms translate the beams in order to isolate N different pictures of the field, after a second pass on the grating which compensates the previous dispersion (subtractive double pass). These N pictures are recorded simultaneously on a 70 mm film. The useful wavelength λ depends on the channel number n ($1 \leq n \leq 9$), and also on the location inside the channel (x and y coordinates). Fig. 2 shows the relationship between x, y and λ for each channel. Using a full scanning by a microdensitometer, we can restore the intensities in N points of the spectrum for the whole observed field. If the spectral range includes a solar line, we can derive dopplergrams, intensity maps and any function of the line profile. The spectral resolution is limited by the multiple slit, but this limitation is not cumbersome in case of broad chromospheric lines.

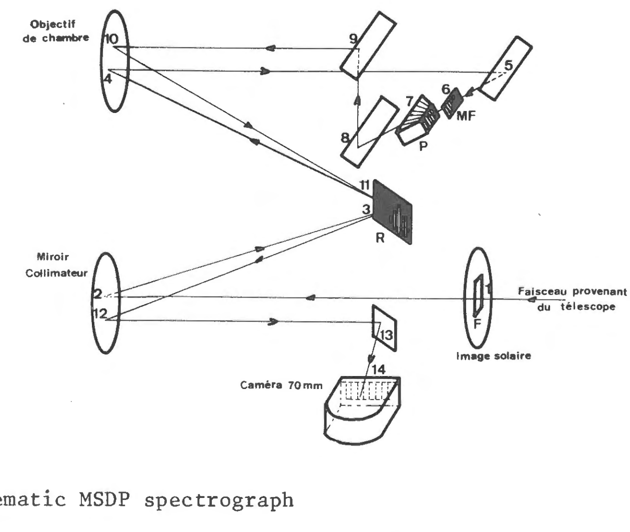

Fig.1 - Schematic MSDP spectrograph

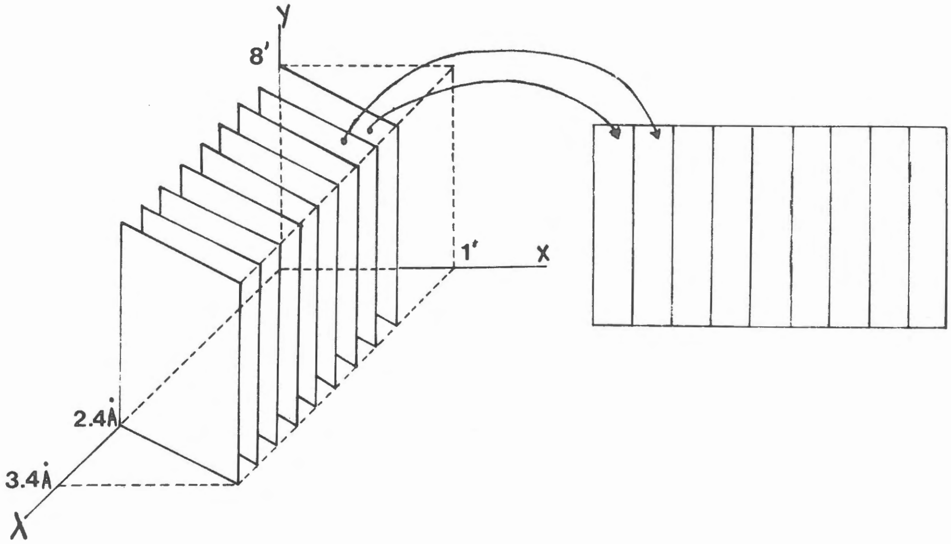

Fig. 2 - Wavelength as a function of the location inside the N channels of the MSDP

2. Comparison with other techniques

It is interesting to compare the capabilities of MSDP with capabilities of classical techniques. In each case, we list below the coordinates which are recorded simultaneously:

Single pass spectrograph:	λ, x	
Filter, interferometer:	x, y	
Multiple slit spectrograph:	λ, x, y	(y degraded)
MSDP spectrograph :	λ, x, y	(λ degraded, sufficient for broad lines)

The MSDP spectrograph appears to provide in many cases the largest rate of useful data. As a consequence, it is very well appropriate for fast phenomena observations (instabilities) and also in case of events the locations of which are difficult to predict accurately (flares). Let us note that the spatial resolution of MSDP is highest both in the x and y coordinates, so that it is very efficient for spectrography of small fine structures.

3. Existing or planned MSDP

We summarize some characteristics of three MSDP : Meudon Solar Tower (operating), Pic du Midi (turret dome, early 81), Canary Islands (attached to the Freiburg telescope, 1982-83) :

	Meudon	Pic du Midi	Canary Islands
φ telescope (cm)	60	50	60
F telescope (m)	45	33 (equivalent)	45
F' spectrograph (m)	14	8	15
Typical H_α exposure time	1/3 s		
Spatial resolution	∿1"(limited by seeing)	.3" ?	.3" ?
field	4' x 35"	5' x 45"	4'30 x 35"
field with enlarger	8' x 1'		
field with automatic scanning	8' x 5' (with enlarger)		4'30" x 4'30"
shortest cycle	∿ 2 s	∿ 2 s	∿ 2 s
channel number	9	9	9 (x2 simultaneous lines)
possible successive lines	2	2 or 3	4 or 6
wavelength resolution	∿ .15A	∿.25A	∿.15A

4. Coordinated observations in 1980 with the MSDP of the Meudon Solar Tower

The Meudon MSDP has already been used many times in connection with other instruments. We list the programs for which observations have been obtained in 1980 :

- Prominences : coordinated with Pic du Midi
- Flare Build up Study : actions 1, 2, 4, 5, 6, 7, coordinated with SMM (spacecraft), Grand Siderostat Meudon, 3 λ-heliograph Meudon, Radioheliograph Nançay,....
- Guest Investigator Program on SMM (Moreton wave study)

We hope that this list will be extended in the future, especially with Japan for simultaneous as well as complementary observations.

REFERENCES

Mein, P. : 1977, Solar Phys. 54, 45.