Solar Observation of Purple Mountain Observatory

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Abstract

At Purple Mountain Observatory, six telescopes are used specially for solar observations. Among them, three radio telescopes (9.4 GHz, 2.7 GHz and 35 GHz respectively) are for daily patrol observation. The 8 inch refractor works both for daily sunspot drawing and large sunspot group photography, while the solar spectrograph for solar spectra and spectroheliogram at HeI 10830 and the fine structure telescope at Ganyu station for Hα and white light aim only to those active regions of interest. The main data available for the active regions 7260, 7270 and 7321 are also listed in this paper.

1. Introduction

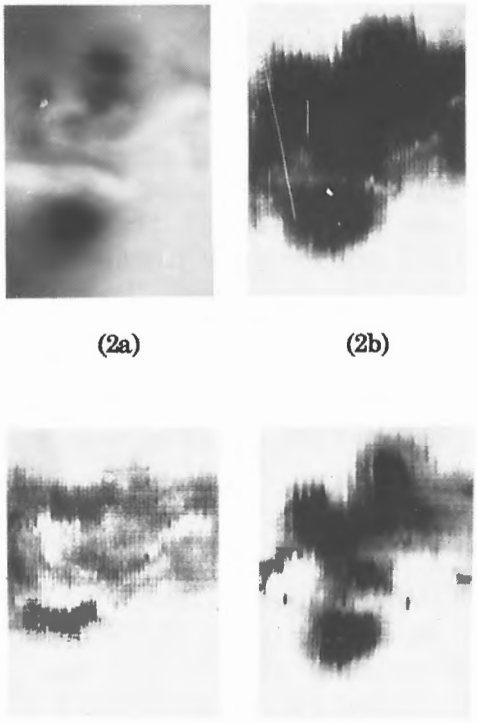
At Purple Mountain Observatory, 7 telescopes are specially devoted to solar observations. Among them, the 14 cm chromospheric telescope for the whole disk patrol observation did not work last year, for its photograph system was being reformed. Therefore in the text, I give a brief decription about the other 6 instruments and also the data obtained with those facilities.

2. Instruments and Observations

(1) The fine structure telescope The telescope made by Nanjing Astronomical Instrument Factory was installed at Ganyu Station in 1990. The station is located $\sim$300 km to the north of Nanjing,where we have more clear days and better seeing than in Nanjing. The telescope consists of two vacuum tubes with 26 cm lens objectives, one for white light and another for Hα. The images at the focal plane are 30 cm and 8.5 cm in diameter and are photographed with Kodak 5460 and 2415 films (35 mm) respectively. The Hα filter was designed to have two pass bands, 0.24A and 0.46A, for selecton and can be tuned to 0, $\pm$0.5A, $\pm$1A, $\pm$1.5A within 30s (Liu *et al.* 1990). This telescope is not for routine use, only for active regions of special interest. The active regions, 7260 and 7321 happened to be the candidates and fortunately a series of flares, including the large limb flare on November 2 were obtained.

(2) Solar spectrograph The 40 cm horizontal telescope and the multi-band spectrograph was put into operation in 1967 (The Solar Telescope Research and production Group, 1975). The solar image is about 11.2 cm and spectra at 9 wavelengths(Hα .....H∞ ,H+K, D and Mgb) can be taken simultanously on plates. Resently the spectrograph was upgraded in some respects. For instance, a slit-jaw system with a DayStar filter (0.5A, 2″) was attached. Meanwhile we began to extend the observation wavelength to near infrared with solid state detectors, first an one dimension Reticon (1024S) system (Wang *et al.*. 1987) and then a CCD camera instead (You *et al.*.). Another innovation which attempted to replace the plates with films failed to complete for some unexpected reasons. Consequently multi-wavelength spectra are not available at present. Last

Fig.1 Limb flare (H)



(2a) (2b)

(2c) (2d)

Fig.2 Decreasing phase of a flare Oct.27,1992 0052UT
(2a) H α
(2b) HeI 10830 —I
(2c) HeI 10830 —I/Ic
(2d) Ic (10820 A)

Fig.3 Profiles of HeI 10830 of bright parts (1,2) and the undisturbed background(3)

October the CCD system was just being adjusted and some test observations in HeI 10830 were taken.

The solar image scanning is performed by rotating the second mirror of the coelostat with 1.8″/step. A TM860 CCD camera (11x11.5μ, 590x800 pixels) works at the first order of grating (10x10 cm, 600 grooves/mm). In order to match the resolution of CCD, a lens system is inserted between the camera lens and CCD so that the dispersion may be reduced to 4.17 A/mm and the spacial resolution perpendicular to the dispersion is about 0.34″/pixel. The video output is led to an image processor, Imaging Technology 151, and a PC microprocessor is used to acquire the image data. For saving memory and time, usually for each picture, we fetch two windows, 10830.3+1A and 10820+0.35A (continuum). In general, it takes 5—6 minutes for a two-dimensional HeI 10830 spectra of 3′x 3′. The spectroheliograms of various off-band as well as the profiles can, at the same time, be obtained. Further processing such as dark and flat field corrections were made afterward. Two image spectra at HeI 10830 were taken on AR 7321 and one of them on Oct. 27 was at its decreasing phase of a M1/1N flare.

From figure 1, some results can be summarized:

(a) Though the observation was made almost 30 minutes after the flare maximum, some parts in HeI 10830 still appeared bright. All the bright parts occurred in the penumbra of spots.

(b) The bright features in HeI 10830 coincide on a whole with those in Hα, but some differences could be noticed between Hα and HeI and between the images of different off-band HeI as well.

(c) For checking the bright regions at HeI 10830, we plot their profiles in figure 3. The HeI 10830 appears to be a emission profile for the brightest region in I/Ic, while the faint ones still keep absorption, but shallower than the undisturbed region nearby. The appearances obtained here confirm our previous conclusions (You *et al.*, 1993).

(3) 20 cm equatorial The 20 cm refractor, made by Zeiss, is mainly used for daily sunspot drawing. Sometimes photographs were made with an amplified

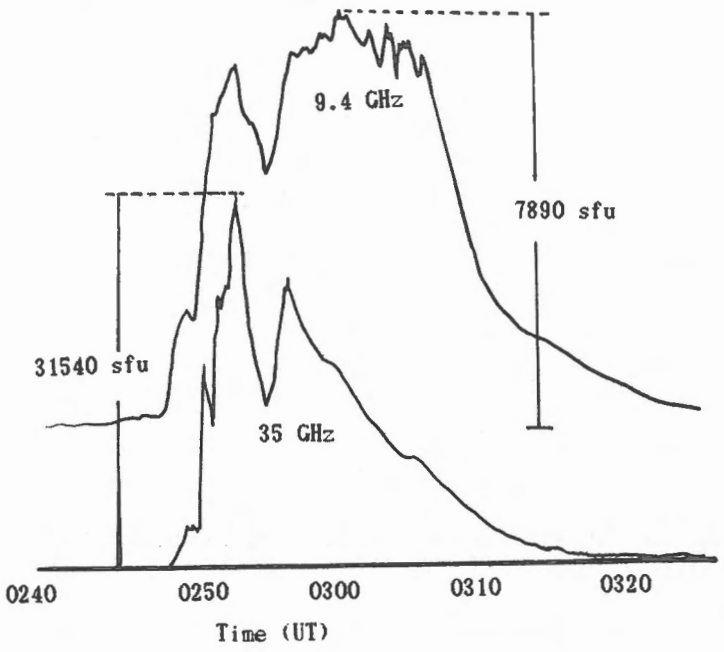


Fig.4 The solar radio burst on Nov.2, 1992

system, but only for those large sunspot groups. The image is 30 cm at focal plane and a 135 camera is used for photograph. From Aug.17 to Aug.22, 1992, we obtained many photos of AR 7260 with $\sim 1''$.

(4) Radio telescopes There are 3 radio telescopes, 2.7 GHz, 9.4 GHz and 35 GHz in frequency, used for routine observation. The first two sample every 10 ms regularly, but only 1/100 data are reserved except the radio bursts. An outstanding burst was observed at all these three frequencies on Nov. 2, 1992 (figure 4). This impulse emission came from AR 7321, 10° behind the west limb. This event was characterized by its two peaks and some subsecond intensity fluctuation around its peak.

Finally the observations of AR 7260, 7270 and 7321 made at PMO are briefly listed in table 1 for reference.

Table 1 Observations of AR 7260, 7270 and 7321 made at PMO

Active region	Date 1992	H_α Time(UT)	Flare	White light Time(UT)	HeI 10830 Time(UT)	flare	Radio burst
7260	Aug.17	0059–0341		0236–0334			
				0635–0705			
	18	0131–0158		0612–0656			
		0240					
	19			0257–0320			
				0628–0738			
	20	0645–0837	2	0149–0327			
				0615–0700			
	21	0254–0317	2	0227–0259			
	22			0120—124			
	23	0748–0836	1				
	24	0058–0153					
		0306–0317	1				
		0654–0703					
7270	Aug.30						1
	Sept.4						1
	Sept.5						1
	Sept.6						3
	Sept.7						2
7321	Oct.25				0055		
	Oct.27	0153–0721			0052	1	1
	Oct.28						1
	Oct.30	0026–0620					
	Oct.31	0107–0647					
	Nov.1	0105–0741					
	Nov.2	0420–0531	1				1

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