Coordinated Observations of Solar Active Regions (NOAA 7260, 7270 and 7321) at the Beijing Astronomical Observatory

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Abstract

Coordinated observations of solar active regions (NOAA 7260, 7270 and 7321) were made on August -- November, 1992 at the Huairou and Shahe Stations of the Beijing Astronomical Observatory. These observations include photospheric vector magnetic fields, chromospheric longitudinal magnetic fields, Doppler velocity fields, Hα, Hß filtergrams and solar radio patrol observations at 2840 Mhz (total flux) and double frequency channels 2545 -- 2645 Mhz (total flux and polarization).

1. Introduction

During August -- November, 1992 of the coordinated observations made in China and Japan, we continuously observed active regions (NOAA 7260, 7270, 7321) at the Huairou and Shahe Stations of the Beijing Astronomical Observatory.

2. Observational Data

2.1 Huairou Solar Station

The observations for NOAA 7260, 7270 and 7321 were made using the Solar Magnetic Field Telescope at the Huairou Solar Observing Station of the Beijing Astronomical Observatory. This Telescope belongs with the Multi-channel Telescope system. It consists of a 35 cm vacuum telescope, a 1/8 Å birefringent filter with 3 sets of KD*P crystal modulator, a CCD camera and an Imaging Technology 151 system controlled by a AST - 386, which transmits the data to the Sun work station and VAX/11-750 for processing. Two working spectral lines used in this telescope are: FeIλ 5324.19Å and H_{β} λ 4861.34Å. The field of view of the telescope is about 4'×6'and

the scale of each pixel on CCD is ~ 0.4"×0.7".The data on a frame of the solar image can be collected in 1/25 sec. The photospheric vector magnetograms, Dopplergrams, chromospheric longitudinal magnetograms and Dopplergrams of active regions NOAA 7260, 7270 and 7321 and corresponding filtergrams were obtained with this telescope system. In additional, H_α filtergrams, daily full disk calcium filtergrams, and full disk longitudinal magnetograms were also obtained at the Huairou Station.

2.2 Shahe Station

Solar radio observations were made at the Shahe Station of the Beijing Astronomical Observatory. Solar radio patrol observations at 2840 Mhz (total flux) with time resolution of 1 m sec, 10 m sec and 1 sec in the mode of continuous sampling, and at double frequency channels 2545 Mhz -- 2645 Mhz (total flux and polarization) with time resolution of 2 m sec and 1 sec in the mode of real-time spike statistics were obtained during the coordinated observations of active region NOAA 7260, 7270 and 7321. The diameters of paraboloid used are 2.5 m (2840 Mhz) and 2 m (2545 - 2646 Mhz). The sensitivity of the system at 2840 Mhz is 5 s.f.u. (with 10 m sec time constant). A number of microwave bursts occurred in the active regions NOAA 7260, 7270 and 7321 were registered at 2840 Mhz with time resolution of 10 m sec.

3. Brief Discussion

3.1 Active Region NOAA 7260

The magnetic class of active region NOAA 7260 was BGD on August 20 -- 23, 1992. This active region consisted of two large-scale magnetic structures A and B of negative polarity and surrounding magnetic structures of positive polarity in Figure 1. We can see that a magnetic island C of positive polarity formed inside of the large-scale magnetic structure B. Transverse components of the field were parallel to the magnetic neutral lines around the magnetic structures B and C. From a series of magnetograms, we can find that the magnetic structure C emerged in the middle of the magnetic structure B of opposite polarity, then the magnetic structure C disappeared gradually with its motion toward large-scale magnetic structures of same polarity.

3.2 Active Region NOAA 7270

The magnetic class of active region NOAA 7270 was a bipolar magnetic structures when this region rotated out from east limb of the sun (August 29). The distribution of the magnetic field is relative sample and porous. On September 3 and 4, the new magnetic flux emerged around the magnetic structure A of positive polarity. Some magnetic islands of negative polarity formed and the gradients of the longitudinal magnetic field increased in Figure 2. Some optical flares were observed in this active region. The flares occurred in the down flowing areas near the chromospheric velocity inversion line.

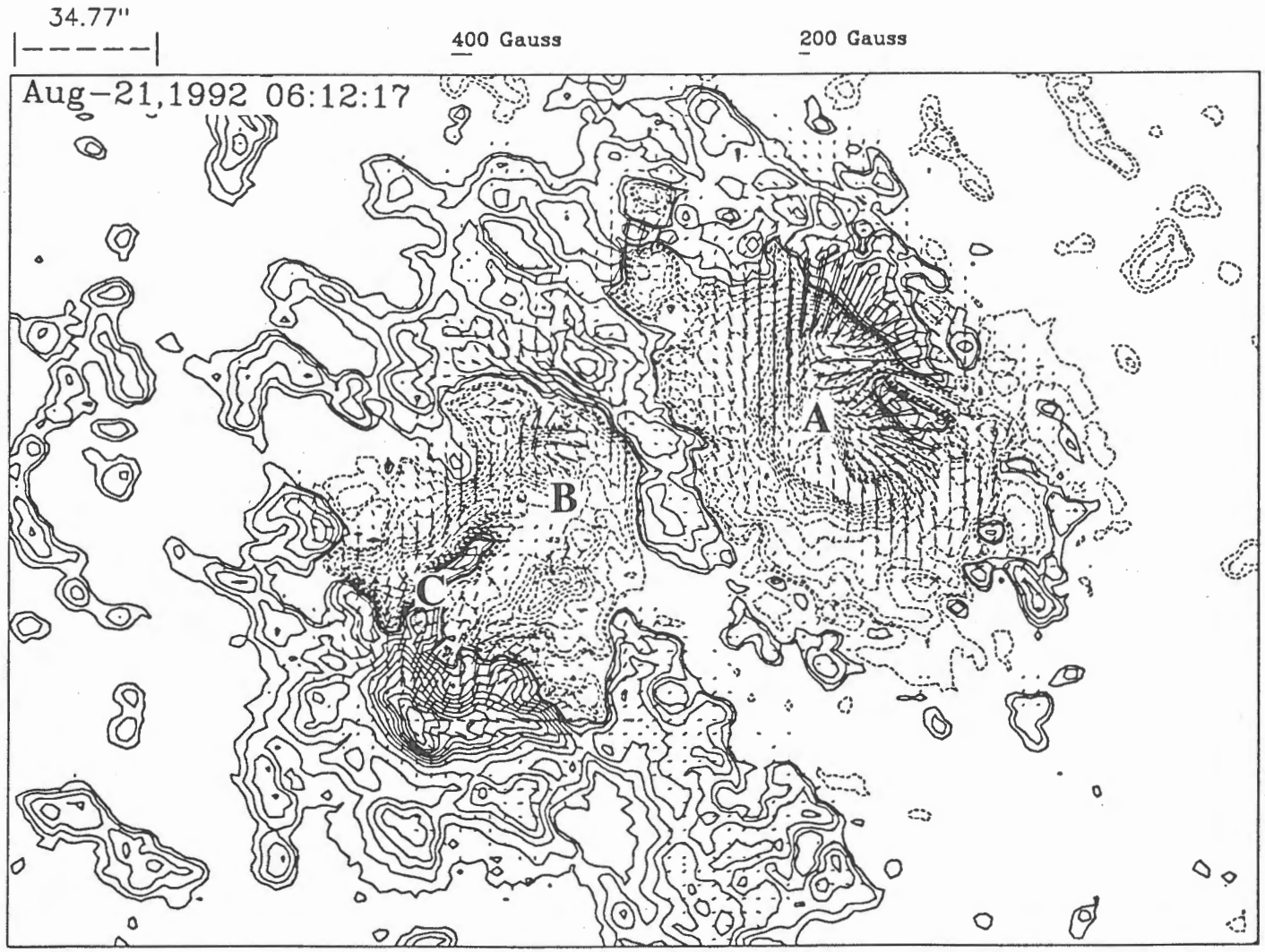

Fig. 1 A photospheric vector magnetograms in active region NOAA 7260. The shear of transverse field occurred near the magnetic neutral lines around the magnetic structure B.

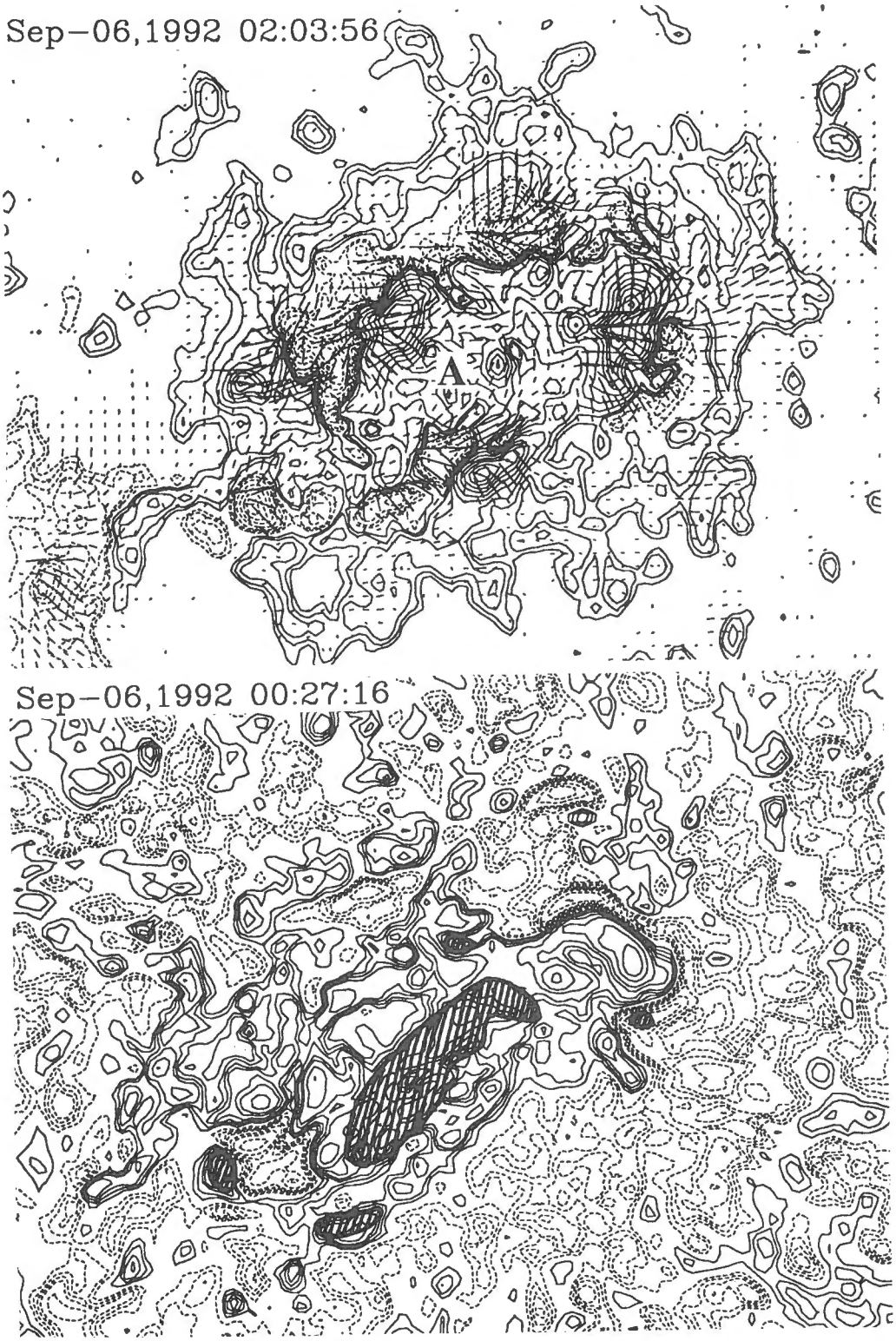

Fig. 2 A photospheric vector magnetogram top and a chromospheric Dopplergram bottom in active region NOAA 7270 on Sep.6, 1992. The solid (dashed) contours in the Dopplergram correspond down (up) ward flow and the shaded structures in the Dopplergram indicate the positions of flares at 0027UT.

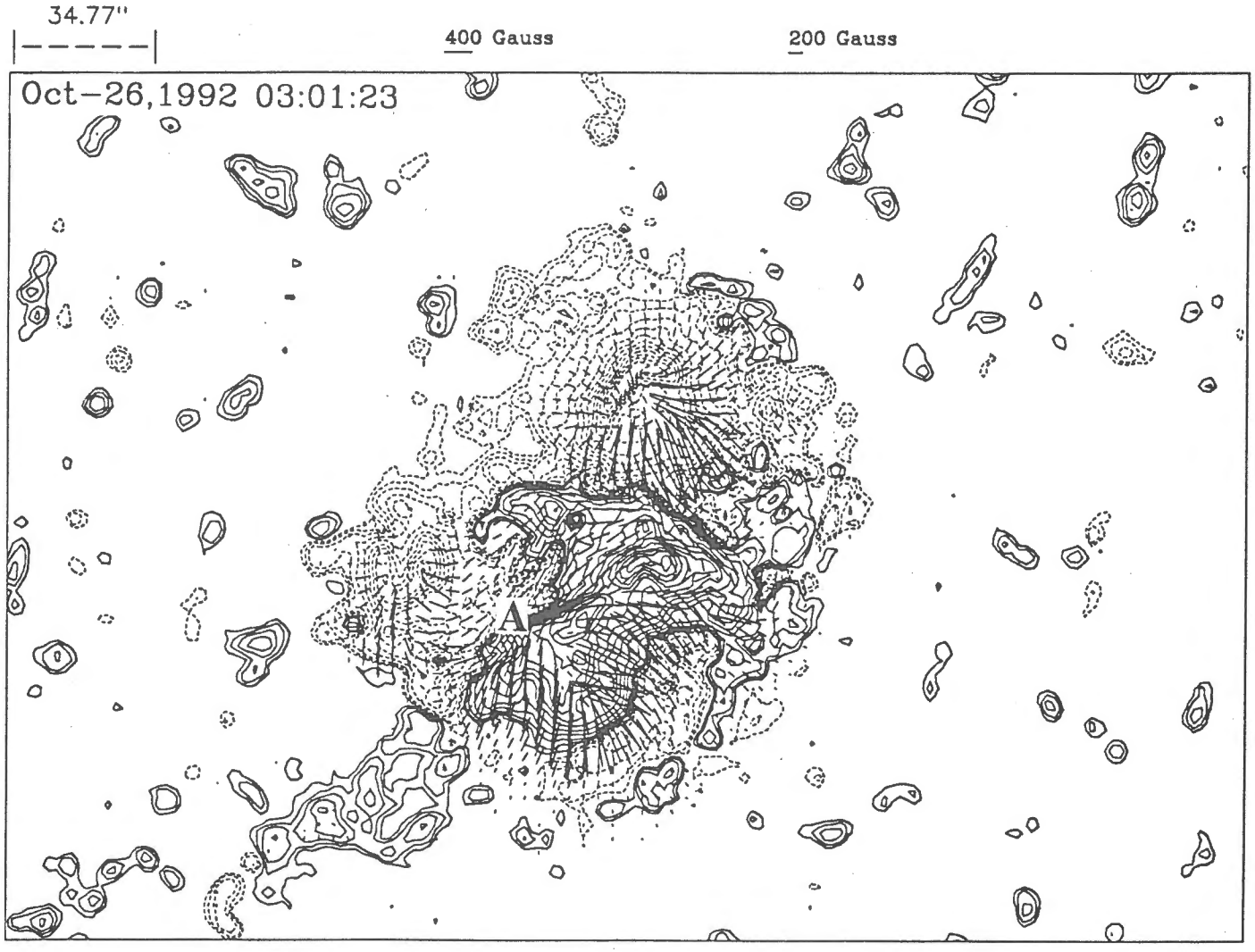

Fig. 3 A photospheric vector magnetogram in active region NOAA 7321. The transverse components of the field were parallel to the magnetic neutral line in the middle of the active region.

3.3 Active Region NOAA 7321

Active region NOAA 7321 was a emerging flux region. This region was born on October 24. The polarities of this region reversed from the Hale -- Nicholson law. We can find that the strong shear of transverse magnetic field formed near the magnetic neutral line A in Figure 3. The shear of the field accompanied the emergence of the magnetic flux. Some flares occurred near the magnetic islands, where the transverse magnetic field sheared. If compare with a series of photospheric vector magnetograms, we can infer that the shear of the transverse field probably was caused by the emergence of new flux of opposite polarities and the reconnection of the field at the lower solar atmosphere.