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Section 3. Radio Astronomy

The two year project of a multi-correlator backend system for the λ 8-cm Radioheliograph, which is designated RSIP as it stands for the Real-time Solar Image Processor, is close to completion in its hardware system. Its components for the second year are Fourier tranformation unit, image display unit, data storage unit, and control unit. By the introduction of RSIP, the λ 8-cm radioheliograph is converted from the swept-lobe to the multi-correlator type. RSIP can synthesize two-dimensional and one-dimensional images of the radio Sun at a rate of 0.1 s/image and display them in real time. Right- and left-handed circular polarizations are obtained by time sharing. The real time phase calibration is made by using redundant antenna combinations. In order to obtain this performance, all correlations necessary for image synthesis and phase calibration are calculated simultaneously, and the Fourier transformation of the correlations and some arrangements to display the images are executed by hardware. The correlators used in RSIP are of the one-bit type, which are suitable for solar observations because of their high dynamic range with respect to the input intensity variations with time (Nishio et al., 1985).

The mini computer, NOVA 01, of Solar Radio Data Acquisition and Communication System (SORDACS) was replaced by a mini computer, MS 140 of NEC in November, 1984, which includes development of corresponding software. By this replacement stability of SORDACS is greatly improved.

Magnetic field structure of active regions is examined on the basis of microwave interferometer data of Toyokawa Observatory and vector magnetograms of solar active regions observed at Okayama Astrophysical Observatory, Tokyo Astronomical Observatory. It is shown in one case that low-lying closed magnetic lines of force are associated with an active region with high 3-cm to 8-cm flux ratio of about one, while in another case open field lines, extending high into the corona, are correlated with low flux ratio of around 0.5. It is

suggested from this that high temperature and high density plasma confined by low-lying magnetic field lines intensifies the radio emission at short cm wavelengths (Shibasaki, 1985). In this study magnetic lines of force are calculated assuming potential magnetic fields.

Height of S-components of solar radio emission above photosphere was measured using high resolution radio maps of active regions, which were observed by the Westerbork Synthesis Radio Telescope with 3 arcsec resolution at 6 cm wavelength. Hale Region 17620 was mapped on May 12, 1981 on the west limb. The S-component was extended in shape and the brightest part was 12,000 km above the photosphere. Another active region of Hale Region 16898 was observed on June 16, 1980 on the disk. Careful overlay of the radio map and optical picture showed that the height of weak and small radio sources above small sunspots were 6000 +/- 3000 km and that the skirt of a bright and large radio source above a large sunspot was less than 3000 km above the photosphere. An interpretation is given for emission mechanism of each source in conjunction with observed structure (Shibasaki, 1984).

Solar Observations at millimeater wavelengths were carried out in July, 1984 and in January, 1985 using the Nobeyama 45-m telescope in cooperation with Nobeyama Radio Observatory and Nobeyama Solar Radio Observatory. Excess brightenings of 5 % above quiet Sun were detected in polar regions of both hemisphere at 36 GHz. North pole region was brighter than the south pole region in July, and vice versa in January, 1985. This is in accordance with the tilt of the rotation axis of the Sun, Bo. Another excess brightening of 5 % above quiet Sun was detected , which coincided with a coronal hole. Analysis of data is in progress.

Possibility of maser mechanism or negative absorption is examined on the basis of microwave data of Toyokawa Observatory and X-ray data of SMM/HXRBS from November 12 to 14, 1981. Obtained results are as follows. Narrow-band decimeter wave spike bursts show complex temporal relations with the associated X-ray enhancements. Time coincidence ranges within 10 seconds with one ahead or behind the other emission. Cases of very strict coincidence up to the accuracy of the instruments, which is nominally fraction of a second, are found to be rare, which imposes a constraint on the emission and escape mechanism of narrow-band decimeter wave radiation. Intensity of narrow-band decimeter bursts is 10^3 - 10^4 times stronger than that of normal impulsive bursts, when they are normalized by intensity of the associated X-ray emission. This strongly supports coherent nature of

emission involved, as well as 100 % circularly polarized decimeter radiation, whose sense of polarization is clear without position information of both radiations (Enome and Orwig, 1984).

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- Shinzo Enome -

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