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Section 3. Radio Astronomy

A two-year project of a multi-correlator backend system for the λ 8-cm Radioheliograph started last year. The first half of the system is near completion. This includes video converters, analogue to digital converters, delay compensators and digital correlators. Characteristics of this system are: one-bit correlators, real time calibration using redundant antenna combinations, and double side band correlators. The last half of the system will be completed within a year. This includes a fast Fourier transformer, an image processor, and a data storage. The main part will be a mini computer and a graphic display terminal.

Long term phase stability of the improved frontend of the λ 8-cm Radioheliograph was found to be less than 6° rms in four month(Nishio et al., 1984). This value is better than that of the initial design. The mean system temperature of the frontend receivers are as low as 800 K and strong cosmic sources (Cyg-A, Tau-A, and Ori-A) can be mapped by fan beam scanning.

An antenna drive system of the λ 8-cm Radioheliograph was replaced from common shaft drive to independent stepping motor drive (Kobayashi and Yoshimi, 1984). Each of the 52 antennas has two stepping motors: one is for hour angle tracking and the other is for declination change. This replacement made it easy to check pointing of each antenna and to change the declination. This also extended the observing time which had been limited by the common shaft.

The mini computer system of the Solar Radio Data Aquisition and Communication System (SORDACS) will be replaced from NOVA-01 to MS140(NEC) in March this year. This is due to frequent system down and no more maintenance of several peripherals. The old computer was installed in 1974 and graded up two times. The new computer has high speed communication channel with a host computer by an optical fibre loop.

A new building for observation was completed last year. Most of the backend receivers moved into the building: of the four set of polarimeters, of one set of λ 8-cm Radioheliograph and of one set of λ 3-cm Radioheliograph which were formaly housed in small huts near each instruments. The mini computer of the SORDACS also moved into the building and the multi-correlator backend will be installed in the building.

Modified Self Calibration was proposed for data reduction of the one-dimensional grating compound array of the λ 8-cm Radioheliograph (Nishio and Shibasaki, 1984). Phases and amplitudes of the 32 regularly spaced antennas are calibrated by redundancy technique invented by M. Ishiguro. The phases and the amplitudes of the widely separated two antennas relative to the regularly spaced 32 antennas cannot be calibrated by the redundancy technique. They applied SELF CAL technique, which has been applied in VLA data reduction, to determine the phases and the amplitudes of these two antennas. They found that the combination of redundacy and SELF CAL is very effective in phase and amplitude calibration of grating compound interferometer using solar data whose distribution is a combination of compact sources and a diffuse background.

A two-dimensional radio map of the Sun was synthesized by rotational synthesis technique using E-W and N-S fan beam scan data of the λ 8-cm Radioheliograph (Shibasaki, 1984). The synthesized map is a preliminary one which uses the fan beam scan data by grating interferometer. As a next step, data by grating compound interferometer will be used for higher spatial resolution. To find the absolute position of the observed distribution which cannot be calibrated by redundancy method, new method is proposed which uses the rotational axis of the earth as a reference. Back projection method is used for synthesis combined with CLEAN technique to restore the distorted map due to the lack of position angle coverage.

A negative burst was observed on April 18, 1983 by four sets of polarimeters (9.4, 3.75, 2.0, 1.0 GHz) and two sets of interferometers (9.4, 3.75 GHz). The negative burst was followed by a positive burst, and the locations of the negative burst (west hemisphere) and the positive burst (east limb) are far away. The two sets of interferometers detected the motion of the negative burst source. Detailed studies are in progress.

S-component study at 17 GHz togather with 9.4 and 3.75 GHz is going on as a joint study with Nobeyama solar radio group. It was found that the center to limb variation of the polarized flux of S-component at 17 GHz showes a maximum at around $\pm$ 45° longitude. This is interpreted as gyroresonance emission from a third harmonic layer where the magnetic field strength is 2000 gauss. Results of the study are in preparation.

S. Enome attended the SMM Workshops at GSFC/NASA in June 1983 and in February 1984. He, as a member of Group C(Impulsive Phase Transport Group), reported a summary of hard X-ray and microwave morphology of X-ray events observed by HINOTORI satellite and associated microwave events.

He reviewed an activity of radio astronomy in Japan during 1981-1983 as a chairman of Japanes commitee of URSI comission J which will be published in a Review of Radio Astronomy (1981-1983) and will be presented at the general assembly of URSI at Florence this summer.

Two projects are planned for the next solar maximum. One is a Microwave Heliograph of Arcsecond Resolution (K. Kai et al., 1983). This is a joint project of solar radio astronomy group in Japan. Detailed design study and the discussion on the organization are going on. The other is a High Energy Solar Physics (HESP) satellite which consists of high energy particle deterctors (HESP-P) and high energy electromagnetic radiation detectors (HESP-R). Solar radio astronomy group in Japan is pushing these two projects for deeper understanding of the acceleration of high energy particles in solar flares.

February 26, 1984
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