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### Section 3. Radio Astronomy

The routine observations of the sun have been made as before with emphasis on the high-resolution observations on 3- and 8-cm wavelengths. By combining these observations, URALS messages (IUWDS Synoptic Codes, Second Revised Edition 1969) have been sent daily since the beginning of IASY, which are useful for the short-term forecasting of solar flares. Since the solar activity has fallen rapidly, only 8 ADALERT TENFLARE messages were issued from Toyokawa in 1971. The observations will be continued after IASY as the MONSEE program of IUCSTP.

In May 1970, we published a data booklet entitled 'Complete Summary of Daily Solar Radio Flux, Toyokawa, Series 70, Absolute Values'. This is not the simple summary of daily values which have been tabulated in our Monthly Reports or in the Quarterly Bulletin of Solar Activity published from IAU. In this booklet, these values are all corrected to absolute values according to the result of the 'Working Group on the Absolute Calibration of Solar Radio Flux Density', Commission V, URSI, which was organized in 1966. Though the final report of this Working Group is to be presented to the General Assembly of URSI in 1972, a preliminary result was obtained at the General Assembly in 1969. Based on this preliminary result, which was later proved to be true for the data of Toyokawa, we have decided to change the scale of calibration at the beginning of 1970's so that the daily values give absolute values of flux density. Due to this change, urgent need has arisen to correct all the daily values published until the end of 1969, for making all the daily data consistent throughout the whole period. This is the reason of having published the booklet mentioned above. The data series based on the absolute calibration is called 'Series 70'. A sufficient number of copies are prepared so that we can supply it to any scientist immediately upon request.

As the World Data Center, WDC-C2, a special analysis center for solar radio emission, we published in March 1971 a data book called 'Solar Activity Chart' for 1969, which is the synoptic summary of centimetric observations of the active regions and bursts with the aid of the positional information of  $H\alpha$  flares. A table is attached in which outstanding 10-cm radio bursts and corresponding  $H\alpha$  flares are

summarized in a simple form. This chart has been distributed through the national affiliates or correspondents of IUCSTP, and it has also been introduced in the STP Note, No. 9. Copies are available at any time. Compilation of the second issue for 1970 is now almost completed, which will become available in early spring 1972.

We are also preparing a contribution to the 'Catalogue of Particle Events' which will be published in 1972 in the Reidel book series 'Astrophysics and Space Science' according to the decision of IUCSTP Working Group 2 on May 16, 1970. A new expression of radio events is now being proposed.

The 8-cm interferometer system at Toyokawa will be expanded in such a way as to enable to form a T-shaped radioheliograph by adding 17 elements in the north-south direction. This interferometer system will be operated in various modes, in which an operation mode of high-speed mapping, one frame in 40 seconds, will be included. A remarkable feature of this equipment will be the ability of correcting phase errors by data processing. The design of the whole system is in progress and this project is expected to be realized within two years.

A full automatic radiometer for solar patrol at 5 GHz, which was designed at Toyokawa and placed at the Kagoshima Space Center in August 1970, has been successfully in operation except a significant trouble due to a lightning occurred in August 1971.

Énomé (1972) has studied microwave aspects of flare plasmas, which are often divided into three subgroups; cold and dense plasma, hot plasma, and energetic particle plasma. The latter two associate with microwave distinctive events, so that investigations of structure and position of sources of these events through radio interferometers with resolutions of 1.1 and 0.4 min. of arc enable us to get better understandings on acceleration, deceleration, heating and cooling of electrons in solar flares. Most important results are (i) most of hot flare plasmas are generated in the sunspot magnetic fields and localized in areas as small as  $2 \times 10^4$  km in diameter or less and probably in the form of loops, and (ii) energetic electrons which are responsible for intense microwave bursts are produced between  $10^4$  km and  $2.5 \times 10^4$  km high above the associated sunspot. The implications of the conclusions including the above two have been discussed.

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### Publications (1971-1972)

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- Énomé, S. and H. Tanaka: Magnetic Fields in the Lower Corona Associated with the Expanding Limb Burst on March 30th 1969 Inferred from the Microwave High-Resolution Observations, *Solar Magnetic Fields*, Howard (ed), IAU, 413 (1971).
- Énomé, S.: Source Structure of Solar Microwave Bursts, to be submitted to *Solar Physics* (1972).
- Ishiguro, M., M. Arisawa, S. Énomé and H. Tanaka: Data Processing in Multi-Element Radio Interferometer, *Summaries of Papers-1971 International Symposium on Antennas and Propagation, Japan, Institute of Electronics and Communication Engineers of Japan*, 131 (1971).
- Ishiguro, M., S. Énomé and H. Tanaka: A new Project of 8-cm Radioheliograph, *Proc. Res. Inst. Atmospheric, Nagoya Univ.*, **19**, — (1972).
- Tanaka, H. and S. Énomé: Observations of a Solar Radio Burst on September 27, 1969, *Solar Physics*, **17**, 408 (1971).
- Tanaka, H. and C. Torii: Full Automatic Radiometer for Solar Patrol at 5 GHz, *Proc. Res. Inst. Atmospheric, Nagoya Univ.*, **19**, — (1972).

