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Multiwavelength solar radio telescopes at microwaves using easily available low cost electronics subsystems

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Introduction

The Sun emits radiowaves at microwaves and millimeterwaves, which often flares up in the form of bursts during solar disturbances associated with solar flares. During solar outputs, the solar bursts often occur at multiwavelengths including radio, infrared, optical, ultraviolet, x-rays and γ-ray wavelength and these events are related to high energy solar physics which has now been of widespread interest all over the world through the International Solar Terrestrial Energy programme (STEP) launched in 1990. It has been found that the microwave solar bursts are usually associated with high energy solar bursts in the ultraviolet, x-rays, which are difficult to observe from ground based measurements due to the heavy absorption of these rays in the earth's upper atmosphere. We were, therefore, prompted to undertake a comprehensive study of the microwave signatures of solar radio bursts at multiwavelength with a view to correlating with and predicting the ultraviolet and x-ray solar bursts. For the purpose, we have tried to develope a number of Solar radiotelescopes in different microwave bands including the L-band (1 GHz), S band (2.6 GHz), C band (4 GHz), K band (8 GHz) and Ku band (12 GHz), based on the satellite TV Direct Reception Systems (DRS). The first unit in fact, was developed at C-band, at the Institute of Radiophysics and Electronics, University of Calcutta and the concept was then transferred to other ECRA organizations for the development of similar radiotelescopes at L-band at Kalyani University, S-band at Centre of Radio Astronomy, Cotton College Guwahati, Assam. Besides these, similar microwave radiotelescopes for x-ray band and Ku band are under development for Jadavpur University and for the Darjeeling Hill Station of the Bose Institute respectively. The structure of these low cost microwave radiotelescopes at multiwavelengths and their salient features are presented in this paper.

Structure of microwave radiotelescopes at multiwavelengths

The microwave radiotelescopes at multiwavelengths have got a basic structure as indicated in the block diagram of Fig. 1. The microwave dish antenna with prime focus horn feed is connected to a LNBC (Low Noise Block Converter) at the microwave band chosen to increase the sensitivity of the radiotelescope. The 1st IF output of 950-1450 MHz from the LNBC is

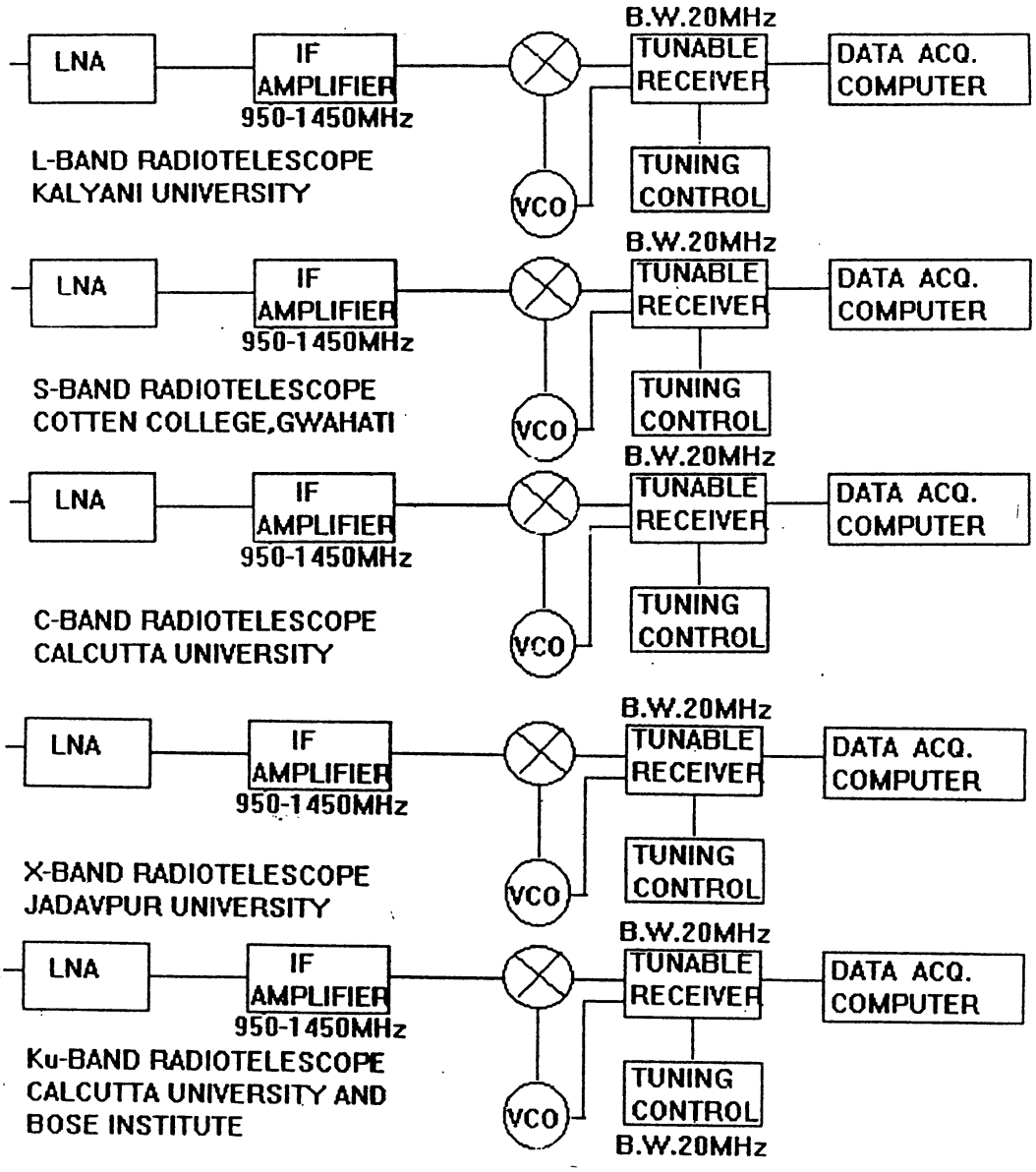

Figure 1. Microwave radiotelescope at multiwavelength in the L,S,C,X and Ku bands.

connected to the IF Processor (a satellite tuner) through a co-axial cable. The detector is also incorporated within the satellite tuner which uses PLL (Phase Lock Loop) technique for detection. A computer based data acquisition system is then connected with some analysis software.

For L-band radiotelescope the 1st conversion after LNA is excluded, while for each of the microwave bands, S-band, C-band, X-band and Ku bands separate LNA's with down converters are used. The diameters of the dishes are reduced with increasing frequencies to keep the beamwidth comparable to that of the angular width of the Sun. The beamwidth is, in fact kept somewhat larger than the solar angular width to accommodate within the beam the solar corona, which is the seat solar microwave bursts.

Observations

The C-band radiotelescope has been made operational with a steerable mount and solar scans have been made at the Institute of Radio Physics and Electronics. This C-band unit was also used for the observations of the total solar eclipse on 24th October, 1996 from Diamond Harbour. The radiotelescopes in other microwave bands, L-band and S-band are installed at Kalyani University and Radio Astronomy Centre, Cotton College, Guwahati, Assam. The K and Ku bands are under development.

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References

Progress Report of ECRA, ECRA-2, November 1994.

Progress Report of ECRA-3, September, 1996.