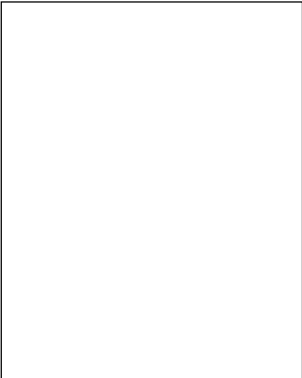


RADIO SCIENCE IN INDIA



This Special Issue of Science and Culture on “Radio Science” was planned as a special commemorative issue, in loving memory of late Dr. Ashesh Prosad Mitra, the doyen of upper atmospheric research in India and an internationally acclaimed global climate scientist, who breathed his last on the early morning of September 3,

2007. His contribution to ionospheric and climate research in India was immense. It is a great honor for me to be the guest editor of this special issue on Radio Science published by the Indian Science News Association of which Dr. Mitra was President. The last important contribution to the nation before the sudden demise of Dr. A. P. Mitra was the formation of the Regional Facility on Radio Science (RFRS) at the National Physical Laboratory in April 2007 with Dr. S.C. Garg as the coordinator. The primary objective of RFRS is the development of Radio Science in the South-

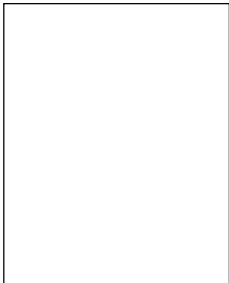
Asian region and other nearby developing countries in the Asia Pacific region through human resource and capacity building by various means. A brief introductory

note of RFRS is included in this issue for general awareness.

In this issue, the first paper is about the great scientific contributions and visions of Dr. A. P. Mitra beautifully depicted by Dr. K. K. Mahajan. This paper gives a glimpse of his great scientific contributions right from his early pioneering works which was on the morphology of ionosphere over Calcutta, solar tides in the ionosphere and electron-ion recombination coefficient. While working at CSIRO, Australia, the discovery of radio noise from cosmos as a technique for studying the ionosphere was his most outstanding and highly cited work. Some of his other earliest contributions in the field of space research were: the development of atmospheric models of the upper

atmosphere from satellite drag data, establishment of a very extensive radio system for studying the ionospheric effects of solar flares, six-ion model on the behavior of D-region electron density and ion composition during normal as well as disturbed conditions. Dr. Mitra played key roles in planning and supervising of many national and international programs like International Geophysical Year (IGY), the Indian Middle Atmosphere program (IMAP), the International project INDOEX- the Indian Ocean Experiment etc. During the later part of his

research career till his end, he was intensely involved in environmental topics of immediate social relevance like the tropospheric and stratospheric ozone, methane emissions



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from rice fields, national inventory on greenhouse gases and problems relating to megacities on emissions of trace gases of particulate matter and thus was as much of an environmental scientist as the earlier more known as radio scientist.

The second paper is about Space Weather and its Prediction through Regional Warning Centers (RWC) by R. S. Dabas et al. This paper briefly describes about the space weather, its origin and effects on different human activities on earth as well as in space. Unlike local weather, which effects the localize regain on the earth for a short period, space weather effects the entire globe for couple of days and affects all human activities on earth as well as in space. Therefore, to provide prior space weather information/alerts and its predictions, there is an international agency, known as International Space Environment Services (ISES) of International Union of Radio Science (URSI), which runs 12 Space Weather Prediction Warning Centers (RWC) all over the globe including the one in India (RWC-India) which is operated by National Physical Laboratory, New Delhi for more than 30 years. This important activity was also started by Late Dr. Mitra. The details about the main activities of RWC-India are presented as well as about the user agencies.

The third paper is by Dr. S.K. Sarkar on the application of modern radars for precipitation studies in India. The paper highlights the capability of radars in precipitation related studies useful for radio propagation through the troposphere. Some aspects of rain and cloud in relation to radio wave propagation have been investigated by using sophisticated radars recently installed in India. Results on rain and cloud parameters are very important for estimation performance of microwave communication and radar propagation in relation to attenuation of radio wave due to rain and cloud as well as extra noise generated by the cloud in the atmosphere when the frequency of operation of radio wave is above 10 GHz.

The fourth paper is about radio channel measurements and modeling for fixed and mobile communications by Dr. M V S N Prasad. Radio channel modeling and measurements are important components of system design and requires continuous research. The paper

highlights the work carried out in the area of fixed and mobile communications in NPL, utilizing data sets collected on various platforms in different environments. It also discusses the model tuning of well known Hata model for cellular applications, model tuning of radio planning tool parameters and model development efforts for broadcasting applications over various regions of India based on the data raised over these regions. The paper highlights the rural communication scenario with reference to broad band wireless and some of the exciting developments taking place in this area like vehicle-to-vehicle communication, mobile computing, 3G applications etc. These studies can be utilized to design advanced fixed and mobile communication systems over various Indian regions.

The last paper is about the effect of radio frequency/microwave radiations on the human body by Prof. K. K. Kesari and Prof. J. Behari. Microwave (MW) at 2.45 GHz and Radio Frequency (RF) emissions from mobile phones at 900 MHz induce several effects on human health. At cellular level it may cause DNA single and double strand break in sperm and brain cells, which may promote apoptosis (programmed cell death) or DNA fragmentation. However, sperm cell death appears to be a cause of male infertility and brain cell death may induce tumor promotion. These effects consequences lead to cell proliferation, which may lead to cancer formation. Some biomarkers, which are responsible for tumor promotion or co-promotion have been identified and have been discussed. This paper also summarizes the current state of evidence concerning whether the RF/MW energy used for wireless communication might be carcinogenic. A special attention was concerned towards the field interaction mechanism with body part and possibility of tumor promotion and infertility. Electromagnetic-field (EMF) exposure limits have been based, in part, on the amount of energy absorbed by the whole body. However, it is known that energy is absorbed non-uniformly by body tissues. EMF should be appropriately and precisely characterized when we consider its interaction with body. The major concern with mobile telephone technology is its rapid growth around the world, putting millions of users at potential risk and the emerging evidence for brain tumor and infertility. □

R. S. Dabas



Dr. R. S. Dabas, is a Scientist-G in the Radio and Atmospheric Sciences Division of National Physical Laboratory, New Delhi. He is responsible for providing Space Weather Alerts/Predictions to different users like Defense Services, ISRO, Air India etc in the country. His broad area of research is on the study of properties, dynamics and modeling of equatorial and low latitude ionosphere. He was the recipient of the prestigious Leverhulme Trust Visiting Fellowship, at the Department of Physics, University of Wales, Aberystwyth, UK to work on Radio Tomographic Imaging of Ionosphere for modeling and other applications. Dr. Dabas is a member of various International and National Committees related to climate and weather of Sun-Earth system.

Editor's Note : This Special issue has been sponsored by the Regional Facility on Radio Science of National Physical Laboratory, New Delhi.