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(Invited Report)

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Abstract. This paper presents a brief report about the topics discussed at the second Indian National Workshop on Solar Physics held in September 1987.

1. Introduction

The first National Workshop on Solar Physics was held at Kodaikanal, India from September 4–6, 1985 with the aim of bringing together researchers working in various fields of Solar Physics in India. At that time, it was decided that such workshops should be held frequently with more emphasis on tutorials and review lectures in addition to the contributed talks for the benefit of new entrants to the field. The proceedings of the first national workshop are published in a special issue of the *Kodaikanal Observatory Bulletin* (Vol. 6, 1986).

The second National Workshop on Solar Physics was held at Kodaikanal, India during September 24–29, 1987 and the proceedings are published in the *Kodaikanal Observatory Bulletin* (Vol. 9, 1988). This Report reviews the most interesting topics discussed at the Workshop meetings.

The topics dealt in the Workshop can be broadly classified under the following categories:

(1) The structure of the solar interior and the photosphere.
(2) Solar activity and magnetic fields.
(3) The structure of the solar corona.
(4) Particle emission from the Sun.
(5) Radio emission from the Sun.
(6) New instrumentation for solar research in India.
(7) Related topics.

2. The Structure of the Solar Interior and the Photosphere

S. M. Chitre in his introductory lecture reviewed various aspects of the internal structure and pointed out the problems of evolutionary calculations leading to the neutrino

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puzzle, solar oscillations, helioseismology, rotation of the solar interior, and finally the solar-stellar connection. K. V. L. Sarma in his review of the neutrino puzzle pointed out that the resonant enhancement of neutrino oscillations in the solar core may be the most promising way of accounting for the missing solar neutrinos. H. M. Antia in his talk on helioseismology started with the problem of determining the shape of a drum by hearing the normal modes of vibrations. He then went to discuss the classification of normal modes and noted that there may not be a sharp distinction between gravity and acoustic modes. He also discussed the observations and interpretation of modes of intermediate, high and low degrees, and concluded by pointing out the various approaches used in helioseismology to produce a solar model consistent with observations. Solar and stellar convection was reviewed by D. Narasimha. He discussed the flow field in stellar convection zones, characterised by high Reynold's number, low Prandtl number and high Rayleigh number and summarized the results on the maximally growing convective modes analysis.

Vinod Krishan presented a new model of solar supergranulation. In a two-dimensional incompressible fluid, the total energy as well as the total squared vorticity called enstrophy are conserved. It is found that the energy spectrum in two-dimensional hydrodrynamic turbulence cascades to smaller wavenumbers and, therefore, the energy is expected to accumulate at the longest wavelengths that the system allows. The observed two-dimensional nature of the velocity fields in supergranulation permits us to make use of the special properties of two-dimensional hydrodynamic turbulence. Thus, it is proposed that supergranulation is produced from granulation by this selective decay process. The largest scale is determined from the ratio of energy to enstrophy and presumably determines the scale of solar supergranulation.

3. Solar Activity and Magnetic Fields

M. H. Gokhale reviewed theoretical aspects of solar activity including the formation of sunspots, prominences and their structure and magnetic fields while the observational aspects were discussed by A. Bhatnagar. In another lecture Gokhale discussed the vital role played by highly inhomogeneous, asymmetrical and time-dependent magnetic field in the non-radiative energy transport to the atmosphere of the Sun and the importance of Sun's rotation along with convection in maintaining the highly inhomogeneous and time-dependent magnetic field of the Sun. He showed that a 'synoptic toroidal field' defined from sunspot data can be expressed as a superposition of global axisymmetric modes of odd parity and 22-year periodicity with an amplitude spectrum similar to the one given by observed photospheric field. The multipole structure of the heliomagnetic field and the north–south asymmetry in the heliospheric current sheet were discussed by T. E. Girish and S. R. Prabhakaran Nayar.

4. Structure of the Solar Corona

Vinod Krishan introduced the subject of solar corona beginning with historical aspects, and our understanding of its structure through eclipses, coronagraphs, etc. She

described the multitude of structures formed by complex interplay of density, temperature and magnetic field gradients and pointed out that the dynamics of these structures sets up a link between the interior of the Sun and the solar wind. In another lecture she discussed the problem of heating of the solar corona. She described the two basically different mechanisms of heating depending upon the dominance or otherwise of the magnetic field and pointed out the role of bright points in providing large-scale heating through numerous small-scale reconnections. P. K. Raju described various methods to probe the solar corona by using the continuum and line radiation in the optical wavelength region, i.e. from 0.3 to 1.1 μm. The spectroscopic techniques in the X- and EUV-regions to determine the electron density and temperature of solar plasma were presented by B. N. Dwivedi. He discussed the line intensities ratios from berrylium boron, nitrogen and oxygen as a diagnostic probe. Line fluxes from these ions at the Earth distances have also been presented by him.

Suresh Chandra discussed the electron impact polarization of resonance lines from Li-like ions.

Observational and theoretical aspects of solar hard X-ray emission were reviewed by R. R. Rausaria.

5. Particle Emission from the Sun

Recent results of various aspects of solar energetic particles were reviewed by M. N. Vahia. A possible grain component of the polar particles was discussed in brief. The plasma component, namely the solar wind, and the solar energetic particles composition was evaluated. The solar energetic particle flares were separated into large- and small-flare composition. Elemental and isotopic composition were given so as to compare with other measurements. Vahia also discussed the present status of solar flare particle acceleration theories. In this second lecture he showed that currently available data on solar flare particle abundances reveals that solar particles originate from regions of temperature around 6×10^5 K. The direct charge state measurements in small and large flares show that it is possible to distinguish between coronal and photospheric components. These can be used to deduce the thermal conditions that must be existing during various stages of solar particle flare build-up and release.

6. Radio Emission from the Corona

Ch. V. Sastry discussed the measurements of quiet Sun brightness temperature distributions at decameter wavelengths using the decameter wave radio telescope at Gauribidanur, India. He showed that the observed low brightness temperatures of the order of 0.3 to 0.5×10^6 K cannot be explained on the basis of scattering by density inhomogenities in the outer corona. G. Thejappa presented a self consistent theory to explain solar type II radio bursts. He suggested that the electrons accelerated through reflected-ion-beam-excited low-frequency waves from gap distributions get scattered on whistlers and fill a large volume in front and behind the shock and give rise to backbone

emissions. The electrons accelerated by fast Fermi process from electron beam escaping from the shock front give rise to herringbone emission. K. R. Subramanian reported his observations on diffuse echo bursts at decameter wavelengths. Rajmal Jain presented Hα observations of a two-ribbon flare structure and its variation.

7. Instrumentation for Solar Research in India

J. C. Bhattacharyya reviewed new instrumentation efforts in solar studies. Jagdev Singh described a new technique developed by him to study the variability of the Sun. The method involves taking high resolution spectra in ionised calcium K line at different latitudes integrated over visible 180° longitude, and analysing them to study the variability of the line profile as a function of latitude. K. R. Sivaraman described a proposal to build a high spatial resolution solar vacuum telescope in India. Unfortunately, no write-up of the proposal could be included in the proceedings of the Workshop for reasons beyond our control.

In addition to the above, there were interesting discussions on: (i) interplanetary scintillation by S. K. Alurkar, (ii) MAGSAT and Geodynamo by B. P. Singh, and (iii) long-term periodicities of geomagnetic reversals and stability of ancient galactic motion of the solar system by J. G. Negi.

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