Newsletter

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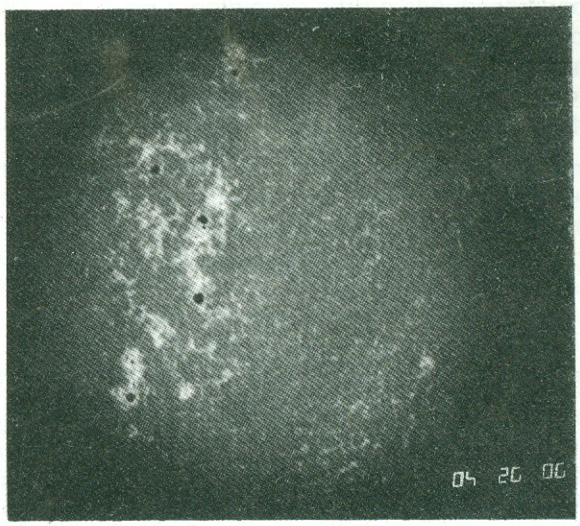
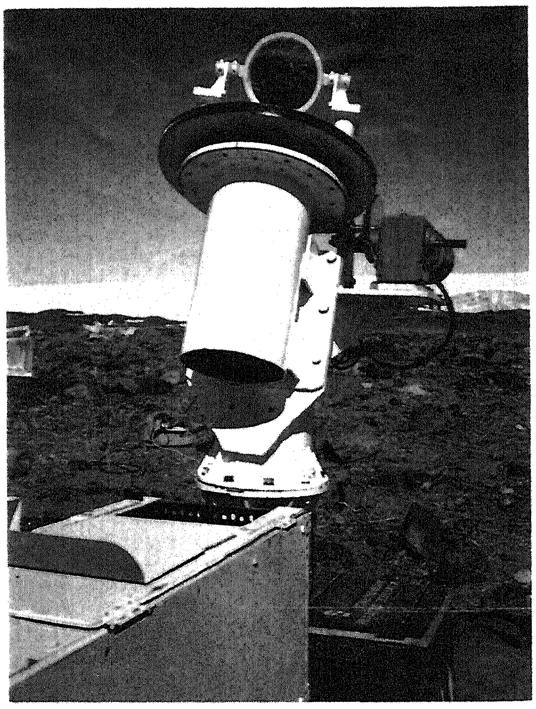
Solar Astronomy from Maitri, Antarctica

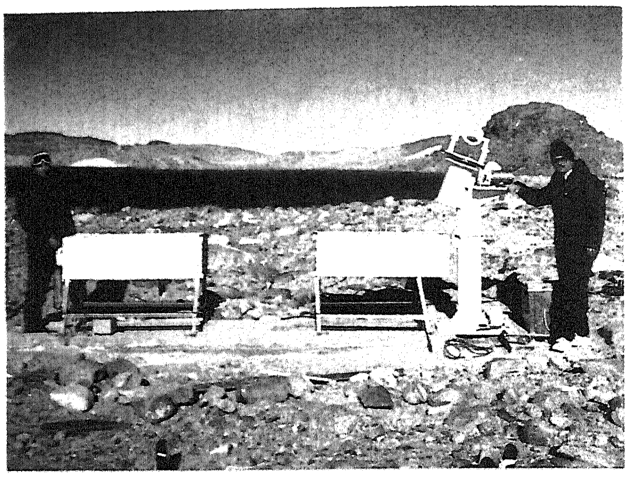
Jagadev Singh

As reported earlier in the Newsletter (Vol. 5, No. 1, 1990) an experiment to study the evolution of calcium network was planned to be done from Maitri, Antarctica. To achieve this objective a three member team consisting of Jagdev Singh (Leader), G. S. D. Babu and Wahabuddin (UPSO) was deputed to Antarctica for making observations. The Astronomy team, which formed a part of the Ninth Indian Antarctica expedition team of 86 members, left Goa on 1989 November 30 by a huge ice-class ship named 'Thuleland'. The ship reached close to the Indian station in Antarctica region on 1989 December 26. The astronomy team reached Maitri station by MI8 helicopter on December 27 and surveyed the places around the station and nearby hills to select a site for the telescope from where the Sun could be observed for maximum number of hours on a given day. A hill on the northern side of the lake Priyadarshni appeared best for the purpose; but keeping in view the logistics and time available for observations it was decided to put up the telescope on the southern side of the lake nearer to the Maitri station. The members of the team had to organize themselves for all odd jobs connected with installation, such as preparation of the ground, grouting the base of the telescope and had it erected by 1990 January 6. The alignment and testing of the telescope was done during the available sunshine hours on the next three days. On each day, sunshine at the telescope was available for 21.5 hours during the end of December and first week of January, whereas 24 hours' sunshine prevailed at the hill on northern side of the lake. The number of sunshine hours available gradually decreased and reached about 18 hours towards the end of January. A glacier in the southern direction obstructed the view of the Sun for about 2 hours each day. The temperature on a clear sunny day varied between −12°C to +3°C and wind speed varied between 10 to 40 km per hour during January–February. The wind speed more than 20 km per hour affected the observation and data quality.



A photograph of calcium K line filtergram taken on 1990 January 10, through a narrow band filter of 1.2 A pass band showing the sunspots, plages and network (supergranules). The time of observation in U.T. is printed on the right-hand corner of the photograph.





Photographs of the solar telescope installed at Maitri, Antartica. (Left) The glacier in the south direction is seen in the background.

During the total stay of about 50 days, there were 10 fully clear days out of which there were 5 days with negligible wind. It was possible to photograph the Sun through K-line filter on 7 days. These filtergrams taken on Kodak 2415 film of 35 mm format were developed in D-19 developer in a make-shift arrangement at the Thuleland ship. The data on four days are of good quality representing quiet and steady atmospheric conditions while on the remaining 3 days they are just good, indicative of moderate seeing. These filtergrams show the sunspots, plages and network pattern very well and provide a good collection for the study with which the experiment was conceived. In all, we have been able to obtain about 2000 filtergrams of the Sun in the K line, at the rate of one photograph every 10 min. The longest sequence spanned a period of four days from 1990 January 9–13. These filtergrams are under analysis to study the evolution and decay of these convection cells.

In order to study the evolution and decay of solar regions showing flare activity, we have also obtained filtergrams at a rapid rate, once every 40 seconds, on two days. A preliminary look at the data has shown that a flare occurred on 1990 February 12.

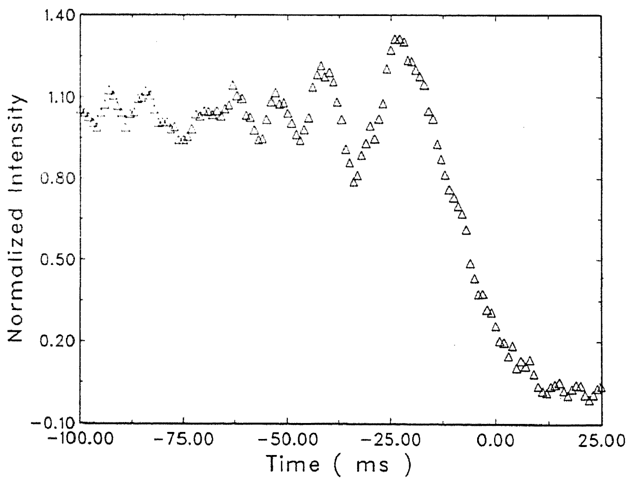
The telescope's optics and drive units were dismantled on the evening of February 12 as the time for departure of ship to India approached. Finally the astronomy team was back at Bangalore 1990 March 29, after conducting the astronomy experiment successfully.

Lunar Occultations

Lunar occultations of stars have been recorded using a single channel photometer at the Cassegrain focus of the 0.75 m telescope at VBO. The data is acquired using a PC based photon counting system developed in our electronics laboratory.

The photon pulses are counted by a cascaded 16 bit binary schottky counter. The data-acquisition software is written in Turbo-Pascal. A 32 kilobyte RAM buffer is provided to store 16 kilo-samples. The buffer is a cyclic one and on a keyboard operation stops acquisition and wraps around to order the last 16 k sample data. Display is provided on a CRT screen as well as on a standard video-monitor.

J. C. Bhattacharyya, R. Vasundhara, R. Srinivasan, K. Jayakumar, N. Dinakaran & A. K. Venkataramana.



The occultation trace of the star η Psc, (m_v = 3.7, G7 IIIa) recorded on 1990 February 1, through a narrow band filter centered at H_α. The data will be analysed to estimate the projected separation between the components.

Anthropomorphism in magnetospheric nomenclature

It is interesting that various nomenclatures for physical features and plasma processes in the Earth's magnetosphere (our neighbourhood space) are anthropomorphic. The earth's magnetosphere approximates a closed cavity on the side facing the Sun but it extends more than 1000 earth radii on the opposite or midnight side. The thin extended part of the magnetosphere is called the geomagnetic tail. A reasonably complete picture of the magnetospheric tail was given by IMPI satellite measurements of the geomagnetic field made by N. F. Ness in 1965. The doughnut-shaped regions of trapped electrons, girdle the earth at distances of about 1.5 and 6 earth radii from the planets' centre. These were discovered by James A. Van Allen and colleagues in 1958 and are called the Van Allen *Belts*. Another distinct feature of the magnetosphere beginning just beyond the ionosphere is the plasmasphere. In certain region of the plasmasphere there is an abrupt change in the density possible. This sharp drop at $4R_E$ is called the *Knee*. This term was first used by D. L. Carpenter in 1963 as this region shows slow movements; moving radially inward during the night and slow outward movement during the day. Plasmasphere also has a region of 'new' high density plasma which is supposed to have moved inward from the tail of the magnetosphere. This enormous new plasma region measures 1 to 1.5 R_E (R_E=earth radii) across and is called the *bulge*. Another term which reminds of the ear to be is the 'lobe plasma' region defining the plasma region across the geomagnetic *tail*. The boundary layer plasma formed due to solar wind flowing past the magnetospheric boundary is called the plasma *mantle*.

The *whistlers* (whistling radio waves) which originate in a lightning flash near the earths' surface propagate through the magnetospheric plasma along the magnetic lines of force. Usually a column of plasma or 'duct' is formed along the lines of force and whistlers are guided along these ducts. These are called ducted whistlers. There are nonducted whistlers also. Whistlers are sometimes heard which contain both rising and falling whistles. These are called nose whistlers. Phenomenon of nose whistlers was first studied by R. A. Helliwell and colleagues in 1956. Most of these features are shown in Fig. 1.

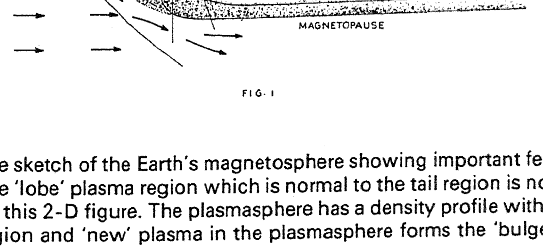


FIG. 1

The sketch of the Earth's magnetosphere showing important features. The 'lobe' plasma region which is normal to the tail region is not seen on this 2-D figure. The plasmasphere has a density profile with 'knee' region and 'new' plasma in the plasmasphere forms the 'bulge'.

The terms 'nose' whistler, Van Allen Radiation 'belt', plasmaspheric 'knee' and geomagnetic 'tail' inspired Brian J. O'Brien to characterize the anthropomorphic magnetosphere by 'Mickey Mouse', the popular cartoon figure in United States of America. Hindu mythology offers another characterization of the magnetosphere which can cover anthropomorphically some more plasma processes in the magnetosphere.

In Hindu mythology 'Lord Ganesha' is represented as a short fat man with a protuberant belly, four hands and the head of an elephant, which has only one tusk (the other being broken). He is considered to be a God for removing all the obstacles, therefore the very first deity to be prayed before one ventures on a new endeavour. He is prayed even before the prayers of 'navagrahas' (the nine planets of the solar system). Lord Ganesha is attended by a mouse and rides on him occasionally. The characterization of anthropomorphic magnetosphere by Lord Ganesha is now straight forward. The long tail of the mouse, as in the case of Mickey Mouse reminds us of the geomagnetic 'tail'. The ears of the mouse are plasma 'lobes' in the magnetospheric tail region. The bulging stomach of Ganesha is the 'bulge' in the plasmasphere. The bending knee of Ganesha's posture is the 'knee' of the plasmaspheric density profile. The belt round the fat waist worn by Ganesha represents the radiation 'belts' girdling the earth. The long elephant trunk (prehensile nose) is the magnetospheric 'duct' guiding the 'nose' whistler. The large elephant ears of Ganesha give rise to 'cusps' representing the polar cusps in the magnetosphere.

C. Uberoi

from the director

An ambitious plan of starting a new form of scientific activity was conceived in the early eighties by Indian Academy of Sciences, Bangalore. The plan was to create a permanent centre for holding scientific workshops and meetings, at the Kodaikanal Observatory. The idea of starting a 'Kodai School' for science on similar lines as the Varenna Centre has finally come close to reality. The Academy proposes to inaugurate the first school on 10th of August 1990; the date coincides with the sixty-third birthday of M. K. V. Bappu.

The description of the new CCD system given in an earlier issue of the Newsletter has caught the imagination of a group of astronomers at the Beijing Astronomical Observatory, China. They have written to us about details of the new system for adoption in their development programmes.

The instrumentation cell has received more requests from other national institutions seeking help in their efforts in astronomical research.

As a result of new assessment, four more scientists have joined our Faculty as Associate Professors, thus raising the strength to sixteen. Anticipating sizeable expansion of instrumentation activities, a committee utilising the services of senior technical personnel in the Institute has been formed. The newly formed body will ensure quick, critical examination of the proposals and projects, ensuring efficient execution.

J. C. Bhattacharyya

newsline

N. Kameswara Rao has been awarded Shri Hari Om Ashram Prerit Dr. Vikram Sarabhai Research Award for the year 1989 for his contributions to astronomy in the general field of space Sciences.

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The essay titled 'Torsion, Wormholes and the Problem of the Cosmological Constant' by C. Sivaram received Honorable Mention at the 1990 essay competition of the Gravity Research Foundation.

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K. E. Rangarajan has been awarded a Ph.D. degree by the Punjabi University, Patiala for his thesis on *Effect of Partial Frequency Redistribution on Spectral Line Formation.*

* * *

IIA, Kodaikanal has bagged several prizes once again for its garden and cut flowers. At the 29th flower show competition held in May this year, it won the following prizes: Rolling cup (first prize) under the large garden category, as also the highest score in cut flowers, third prize for its rose garden, and three merit certificates. Cups were also won for individual cut flowers.

* * *

A. Jayaraj passed away on 1990 April 20, at a young age of 27. Though he was not a permanent staff of IIA, Jayaraj impressed the community by his efficient and careful handling of the PDS microdensitometer during 1986–88 and won the friendship of all. It was discovered in 1988 that he was suffering from acute lymphoblastic Leukaemia. He was given the best medical attention possible and joined VBO after treatment, since it was closer to his native town. He operated the VAX 11/780 system during 1989–90. Unfortunately the illness recurred this year, and no treatment could save him. We pray for his soul.

* * *

V. Palanichamy age 51, passed away on 1990 April 11, after a brief illness. He had been associated with the upkeep of the Kodaikanal Observatory gardens for the past 30 years. This period saw the gardens winning a number of prizes in the annual flower shows. We will all miss his charming personality.

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Editors: T. P. Prabhu & A. K. Pati
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Indian Institute of Astrophysics
Bangalore 560 034.