

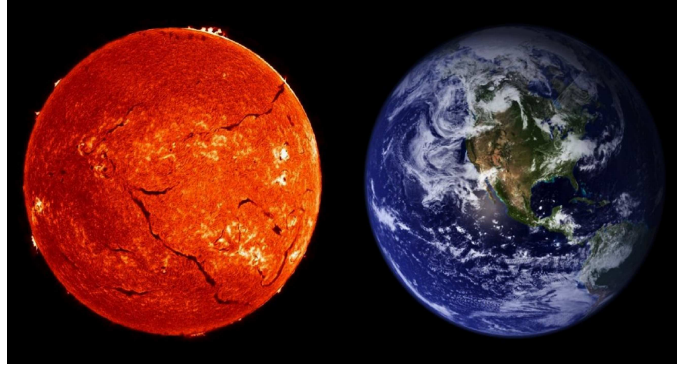
**ASTRONOMICAL SOCIETY OF INDIA  
CONFERENCE SERIES**

**Volume 10**

**PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON  
SOLAR TERRESTRIAL PHYSICS (ISSTP)**

**November 5 – 9, 2012**

**Indian Institute of Science Education and Research  
Pune, India**



**Edited by: N. Gopalswamy, S. S. Hasan, P. B. Rao and  
P. Subramanian**



**ASTRONOMICAL SOCIETY OF INDIA  
CONFERENCE SERIES**

**Volume 10**

**PROCEEDINGS OF THE INTERNATIONAL  
SYMPOSIUM ON SOLAR TERRESTRIAL PHYSICS  
(ISSTP)**

Indian Institute of Science Education and Research, Pune, India

November 5 – 9, 2012

Edited by:

**N. Gopalswamy**

*NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA*

**S. S. Hasan**

*Indian Institute of Astrophysics, Bengaluru, India*

**P. B. Rao**

*National Remote Sensing Centre, Hyderabad 500 625, AP, India*

and

**P. Subramanian**

*Indian Institute of Science Education and Research (IISER), Pune, India*



**ASTRONOMICAL SOCIETY OF INDIA  
CONFERENCE SERIES**

**Volume 10**

**Series Editor: D. J. Saikia**

*Cotton College State University, Panbazar, Guwahati 781 001 and National Centre for Radio  
Astrophysics, TIFR, Pune 411 007, India*

**Associate Editor: Annapurni Subramaniam**

*Indian Institute of Astrophysics, Bengaluru 560 034, India*

**Editorial Board**

*H. M. Antia, Tata Institute of Fundamental Research, Colaba, Mumbai 400 005, India*

*N. M. Ashok, Physical Research Laboratory, Ahmedabad 380 009, India*

*Matthew Bailes, Swinburne Centre for Astrophysics and Supercomputing, Hawthorn,  
Victoria 3122, Australia*

*Anil Bhardwaj, Vikram Sarabhai Space Centre, Trivandrum 695 022, India*

*Sandip K. Chakrabarti, S N Bose National Centre For Basic Sciences, Kolkata 700 098, and  
Indian Centre for Space Physics, Kolkata 700 084, India*

*D. A. Green, Mullard Radio Astronomy Observatory, Cambridge, U.K.*

*Harinder P. Singh, University of Delhi, Delhi 110 007, India*

*R. Srianand, Inter-University Centre for Astronomy and Astrophysics, Pune 411 007, India*

**Editorial Staff**

*Sandra Rajiva, Indian Institute of Astrophysics, Bengaluru 560 034, India*

ISBN : 978-81-922926-8-7

Publisher : D. J. Saikia, NCRA, TIFR for the Astronomical Society of India

© 2013 by the Astronomical Society of India. All Rights Reserved

ASI Conference Series – Volume 10, First Edition

Printed in India by Vykath Prints Pvt. Ltd., Q5, KSSIDC Industrial Area, Veerasandra 2nd Stage,  
Huskur Road, Bengaluru 560 099.

## Contents

Foreword .....	vii
Organizing Committees .....	viii
Participants .....	ix
Conference Photograph .....	xiii
<b>Invited Talks</b>	
Prominence formation and oscillations .....	1
<i>P. F. Chen</i>	
STEREO and SOHO contributions to coronal mass ejection studies: Some recent results .....	11
<i>N. Gopalswamy</i>	
The solar corona: What are the remaining fundamental physical questions? .....	25
<i>Petrus C. Martens</i>	
Coronal mass ejections and space weather .....	37
<i>David F. Webb</i>	
<b>Contributed Talks</b>	
Models of force-free spheres and applications to solar active regions .....	51
<i>A. Prasad and A. Mangalam</i>	
MHD seismology as a tool to diagnose the coronae of X-ray active sun-like flaring stars .....	59
<i>A. K. Srivastava and Sairam Lalitha</i>	
Solar eruptive filament studies at USO for the COMESEP project .....	67
<i>N. Srivastava, N. Crosby, A. Veronig, E. Robrecht, B. Vršnak, S. Vennerstrom, O. Malandraki, S. Dalla, L. Rodriguez, M.Hesse and D. Odstrcil</i>	
Heating of active region cores: Impulsive or steady? .....	73
<i>Durgesh Tripathi</i>	
<b>Posters</b>	
Use of a time delay dynamo model to obtain solar-like sunspot cycles .....	83
<i>E. Amouzou, D. Nandy, A. Muñoz-Jaramillo, and P. Martens</i>	
Coronal mass ejections associated with short and long duration X-ray flares .....	87
<i>M. Anna Lakshmi and S. Umapathy</i>	
Dependence of solar wind velocity and interplanetary magnetic field on Pc4 magnetic pulsations at low latitudes in India .....	91
<i>I. A. Ansari, K. A. Nafees, A. K. Sinha and B. M. Pathan</i>	

How are Forbush decreases related with IP magnetic field enhancements? .	95
<i>K. P. Arunbabu, P. Subramanian, Sunil Gupta and H. M. Antia</i>	
Fluctuations in the interplanetary electric potential and energy coupling between the solar wind and the magnetosphere . . . . .	101
<i>Badrudin and O. P. M. Aslam</i>	
Interplanetary coronal mass ejections, their associated features, related plasma/field variations and transient modulation of cosmic rays . . . . .	105
<i>Badrudin and Anand Kumar</i>	
On the statistical aspects of sunspot number time series and its association with the summer-monsoon rainfall over India . . . . .	109
<i>Surajit Chattopadhyay and Goutami Chattopadhyay</i>	
Double ring algorithm of solar active region eruptions within the framework of kinematic dynamo model . . . . .	115
<i>Soumitra Hazra and Dibyendu Nandy</i>	
Constraining the amplitude of turbulence in solar corona using observations of angular broadening of radio sources . . . . .	121
<i>Madhusudan Ingale, Prasad Subramanian and Iver H. Cairns</i>	
Estimating arrival time of 10 October 2010 CME using STEREO/SECCHI and in-situ observations . . . . .	127
<i>Wageesh Mishra and Nandita Srivastava</i>	
Imaging the Sun with the Murchison Widefield Array . . . . .	131
<i>D. Oberoi, L. D. Matthews, I. H. Cairns, S. J. Tingay, L. Benkevitch, A. Donea, S. M. White, W. Arcus, D. Barnes, G. Bernardi, J. D. Bowman, F. Briggs, S. Burns, J. D. Bunton, R. J. Cappallo, B. E. Corey, A. Deshpande, L. deSouza, D. Emrich, R. Goeke, B. M. Gaensler, L. J. Greenhill, B. J. Hazelton, D. Herne, M. Johnston-Hollitt, D. L. Kaplan, J. C. Kasper, B. B. Kincaid, R. Koeing, E. Kratzenberg, C. J. Lonsdale, M. J. Lynch, S. R. McWhirter, D. A. Mitchell, M. F. Morales, E. Morgan, S. M. Ord, J. Pathikulungara, T. Prabu, R. A. Remillard, A. E. E. Rogers, A. Roshi, J. E. Salah, R. J. Sault, N. Udaya-Shankar, K. S. Srivani, J. Stevens, R. Subrahmanyam, M. Waterson, R. B. Wayth, R. L. Webster, A. R. Whitney, A. Williams, C. L. Williams and J. S. B. Wyithe</i>	
Analysis of the solar coronal green line profiles from eclipse observations	137
<i>Maya Prabhakar, K. P. Raju and T. Chandrasekhar</i>	
Indicators of solar filament remnants in ICMEs . . . . .	143
<i>Rahul Sharma and Nandita Srivastava</i>	
<b>Author Index</b> . . . . .	147

## Foreword

The articles published in this special issue constitute a subset of papers presented at the International Symposium on Solar Terrestrial Physics (ISSTP) held in Pune, India during November 5 - 9, 2012. The purpose of the symposium was to review the current status of solar terrestrial physics and plan for future research programs. The symposium was held under the aegis of the Scientific Committee on Solar Terrestrial Physics (SCOSTEP), which is an interdisciplinary body of the International Council for Science (ICSU). SCOSTEP has been tasked with conducting long term scientific programs in Solar Terrestrial Physics. SCOSTEP also promotes Capacity Building activities in the form of International space science schools and public outreach activities.

SCOSTEP symposia highlight results from the primary scientific program running at the time of a symposium. ISSTP 2012 featured the results from the Climate and Weather of the Sun-Earth System (CAWSES) program, which concluded in 2013. India has been an active participant of the CAWSES program and the articles in this volume reflect CAWSES-India activities.

The symposium featured tutorial sessions, regular scientific sessions (oral and poster), and a panel discussion on the future scientific program of SCOSTEP. The scientific sessions covered the following topics: Solar interior, solar atmosphere, solar wind, interplanetary medium, magnetosphere-ionosphere-thermosphere coupling processes, atmospheric coupling processes, and space weather and climate. The papers included in this issue are from the scientific sessions. The papers went through the regular review process before accepting for publication. We thank the reviewers for their time and effort.

This SCOSTEP symposium was hosted by the Indian Institute of Science Education and Research (IISER), Pune. In addition to SCOSTEP and IISER Pune, the Symposium was co-sponsored by the International Space Weather Initiative (ISWI), the Committee on Space Research (COSPAR), the Indian Institute of Tropical Meteorology, the Indian Institute of Astrophysics, the Indian Institute of Geomagnetism, the Inter-University Centre for Astronomy and Astrophysics, IISER Kolkata, and the TIFR National Center for Radio Astronomy. We thank the host institution and all the sponsors whose generous support enabled many young scientists participate in the symposium.

**N. Gopalswamy**

NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

**S. S. Hasan**

Indian Institute of Astrophysics, Bangalore, India

**P. B. Rao**

National Remote Sensing Centre, Hyderabad 500 625, AP, India

**P. Subramanian**

Indian Institute of Science Education and Research (IISER), Pune, India

## **International Advisory Committee**

M. A. Abdu (Brazil)  
S. Basu (USA)  
A. Bhattacharyya (India)  
J. L. Bougeret (France)  
S. M. Chitre (India)  
J. Davila (CAWSES, USA)  
K. N. Ganesh (India)  
J. Goswami (PRL, India)  
A. Jayaraman (NARL, India)  
R. Harrison (UK)  
B. Heber (Germany)  
R. Koleva (Bulgaria)  
J. Leibacher (USA)  
F. J. Lubken (SCOSTEP, Germany)  
S. Martin (USA)  
A. Ozguc (Turkey)  
M. Potgeiter (South Africa)  
K. Radhakrishnan (Chairman ISRO, India)  
S. Radicella (ICTP)  
M. Rajaram (IIG, India)  
K. Shibasaki (Japan)  
T. Tsuda (CAWSES, Japan)  
K. Krishnamoorthy (SPL, India)  
P. Venkatakrishnan (India)  
R. Vincent (Australia)  
C. Wang (China)  
P. Wilkinson (Australia)  
S. T. Wu (USA)  
L. Zhelenyi (Russia)  
G. A. Zherebtsov (Russia)

## **Scientific Organizing Committee**

I. Cairns (Australia)  
K. Georgieva (Bulgaria)  
N. Gopalswamy (Co-chair) (USA)  
S. Gurubaran (India)  
S. S. Hasan (Co-chair) (India)  
P. K. Manoharan (India)  
H. Mason (UK)  
D. Pallamraju (India)  
P. B. Rao (Co-chair) (India)  
B. Schmeider (France)  
K. Shibata (Japan)  
K. Shiokawa (Japan)  
P. Subramanian (India)  
Y. Yan (China)

## **Local Organization Committee**

P. Subramanian (Chair) (IISER Pune, India)  
D. Tripathi (IUCAA, India)  
D. Oberoi (NCRA-TIFR, India)  
R. Ramesh (IIA, India)  
S. Ananthkrishnan (Pune University, India)  
P. Janardhan (PRL, India)  
N. Srivastava (USO, India)  
V. S. Rao (IISER Pune, India)  
M. Shepherd (Canada: SCOSTEP Scientific Secretary)  
K. P. Arunbabu (IISER Pune, India)  
S. Nevse (IISER Pune)  
M. Ingale (IISER Pune, India)

## Participants

Ambili K. M. (VSSC, Trivandrum, India)  
Amouzou E. (Montana State University, Bozeman, USA)  
Ananthakrishnan S. (University of Pune, Pune, India)  
Ansari I. A. (Aligarh Muslim University, Aligarh, India)  
Antia H. M. (TIFR, Mumbai, India)  
Arunbabu K. P. (IISER, Pune, India)  
Asai A. (Kyoto University, Kyoto, Japan)

Badruddin (Aligarh Muslim University, Aligarh, India)  
Banerjee D. (IIA, Bangalore, India)  
Bardhan A. (Manav Rachna College of Engineering, Faridabad, India)  
Behera J. K. (IIG, New Panvel, India)  
Beig G. (Indian Institute of tropical Meteorology, Pune, India)  
Bhattacharyya A. (IIG, New Panvel, India)

Candidi M. (IFSI-INAF, Via Fosso avaliere, Roma, Italy)  
Chakraborty S. K. (Raja Peary Mohan College, Hooghly, India)  
Chattopadhyay S. (Pailan College of Managment and Technology, Kolkata, India)  
Chen P. F. (Nanjing University, Nanjing, China)  
Chowdhury P. (University of Calcutta, Kolkata, India)

Davila J. M. (NASA Goddard Space Flight Center, Greenbelt, MD, USA)  
Dwivedi V. C. (NCRA-TIFR, Ooty, India)

Fontaine D. (LPP, Ecole Polytechnique, Palaiseau, France)

Gokhale M. H. (Pune, India)  
Gopalswamy N. (NASA Goddard Space Flight Center, Greenbelt, MD, USA)  
Gordienko G. (Institute of Ionosphere, Almaty, Kazakhstan)  
Grandhi K. K. (University Rostock, Germany)  
Guharay A. (National Institute for Space Research, Sao Paulo, Brazil)

Hasan S. S. (IIA, Bangalore, India)

Ingale M. (IISER, Pune, India)

Jaykumar J. H. (Pope's College, Thoothukudi, India)  
Jayashree B. (IIG, New Panvel, India)

Kaila O. A. (NIT, Srinagar, India)  
Kale G. (Pune, India)  
Kaushik S. (Jiwaji University, Datia, India)  
Khandagale A. A. (Raisoni college of Engineering, Nagpur, India)  
Kontar E. (School of Physics and Astronomy, Glasgow, UK)  
Koushik G. (University of Burdwan, Burdwan, India)  
Kumar A. (Aligarh Muslim University, Aligarh, India)  
Kumthekar B. K. (Nutan Mahavidyalaya, Parbhani, India)



Lakshmi A. M. (Madurai Kamraj University, Madurai, India)  
Lakshmi Narayanan V. (IIG, Tirunelveli, India)  
Lara A. (Universidad Nacional Autonoma de Mexico, Mexico)  
Mahajan S. (IIT-BHU, Varanasi, India)  
Manoharan P. K. (NCRA-TIFR, Ooty, India)  
Martens P. C. (Montana State University, Bozeman, USA)  
Mishra S. K. (Office of district education officer, Sidhi, MP, India)  
Mishra W. (Udaipur Solar Observatory, Udaipur, India)  
Mourya A. (IISER, Pune, India)  
Muhammed Aslam O. P. (Aligarh Muslim University, Aligarh, India)  
Muhammed Kutty P. V. (Equatorial Geophysical Research Laboratory, Tirunelveli, India)  
Mulay S. M. (Fergusson College, Pune, India)  
Nandi D. (IISER, Kolkata, India)  
Oberoi D. (NCRA, Pune, India)  
Ogino T. (Solar Terrestrial Environment Laboratory, Nagoya, Japan)  
Olugbon B. (University of Lagos, Lagos, Nigeria)  
Padmanabhan J. (PRL, Ahmedabad, India)  
Pallam Raju D. (PRL, Ahmedabad, India)  
Pant V. (IIA, Bangalore, India)  
Pascal O. T. (Obafemi Awolowo University, Ile Ife Osun, Nigeria)  
Patil P. (Shivaji University, Kolhapur, India)  
Patra A. K. (National Atmospheric Research Laboratory, Gadanki, India)  
Prabhakar M. (IIA, Bangalore, India)  
Prabhu K. (IIA, Bangalore, India)  
Prasad A. (IIA, Bangalore, India)  
Rangarajan K. E. (IIA, Bangalore, India)  
Rao N. V. (Kyoto University, Kyoto, Japan)  
Rawat R. (IIG, New Panvel, India)  
Robertus Erdelyi (SP2RC, U of Sheffield, UK)  
Sachdeva N. (IISER, Pune, India)  
Sandeep Kumar (IIG, New Panvel, India)  
Sathishkumar S. (Equatorial Geophysical Research Laboratory, Tirunelveli, India)  
Satya Narayanan A. (IIA, Bangalore, India)  
Selvakumaran R. (IIG, New Panvel, India)  
Sharma D. K. (Manav Rachna College of Engineering, Faridabad, India)  
Sharma K. (Govt. H.S.S. Masudpur, Vidisha, India)  
Sharma R. (Udaipur Solar Observatory, Udaipur, India)  
Shetti D. J. (Smt. Kasturbai Walchand College, Sangli, India)  
Shiokawa K. (Nagoya University, Nagoya, Japan)  
Shri Kanekal (NASA GSFC, Greenbelt, MD, USA)  
Singh Ashutosh Kumar (B.H.U., Varanasi, India)

Singh A. K. (IIG, New Panvel, India)  
Singh Jagdev (IIA, Bangalore, India)  
Singh Y. P. (Mangalayatan University, Aligarh, India)  
Sinha A. K. (IIG, New Panvel, India)  
Sola Rufus Fayose (Adekunle Ajasin University, Akungba Akoko, Nigeria)  
Soumitra Hazra (IISER, Kolkata, India)  
Sreejith Padinhatteeri (University of Calicut, Calicut, India)  
Sridharan S. (National Atmospheric Research Laboratory, Gadanki, India)  
Srivastava A. K. (ARIES, Nainital, India)  
Srivastava N. (Udaipur Solar Observatory, Udaipur, India)  
Srividya S. (IUCAA, Pune, India)  
St-Maurice J-P (Univ of Saskatchewan, Saskatoon, Canada)  
Subramanian G. (IIG, New Panvel, India)  
Subramanian P. (IISER, Pune, India)  
Swarup G. (NCRA-TIFR, Pune, India)  
  
Thomas N. (IIG, New Panvel, India)  
Tripathi D. (IUCAA, Pune, India)  
  
Vasantharaju N. (IIA, Bangalore, India)  
Vasnath V. (Madurai Kamaraj University, Madurai, India)  
Venkat Ratnam M. (NARL, Tirupathi, India)  
Venkatakrisnan P. (Udaipur Solar Observatory, Udaipur, India)  
Victor J. N. (Equatorial Geophysical Research Laboratory, Tirunelveli, India)  
  
Webb D. (Institute for Scientific Research, Boston College, USA)  
  
Yihua Y. (Key Lab of Solar Activity, National Astronomical Observatories,  
Chinese Academy of Sciences, China)  
Young-deuk Park (Korea Astronomy and Space Science Institute, Korea)  
Zhumbabayev B. (Institute of Ionosphere, Almaty, Kazakhstan)