Annual Report

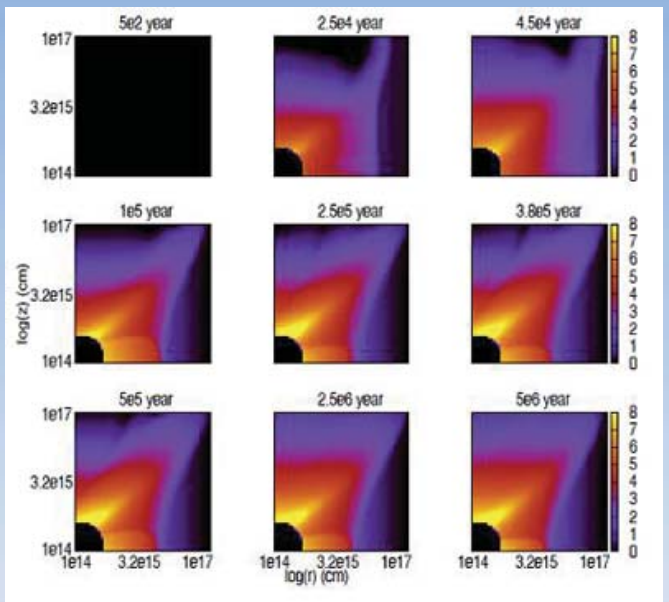
(2010-2011)

Indian Centre for Space Physics

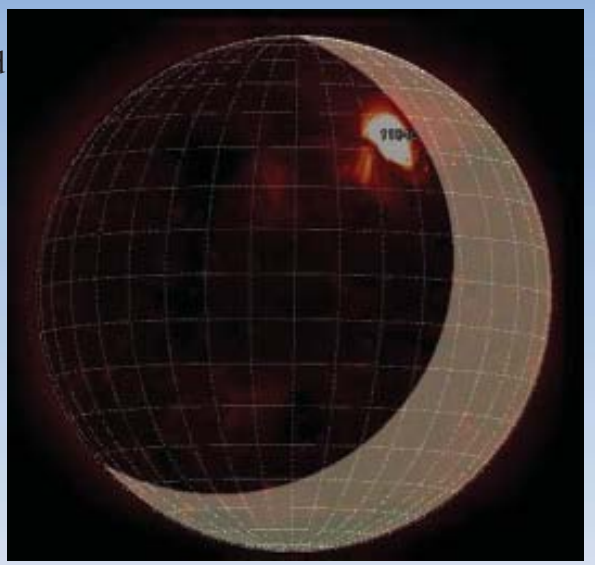
Survey of the land in a remote village (Sitapur, Pashchim Medinipur) for construction of an ionospheric and Earth-quake research Center (right).

The ground breaking of the research center at Sitapur by Prof. S.K. Chakrabarti, General Secretary (below, left). The construction of the center is on its way at the site (below, right).

The newly acquired CNC machine helps our scientists to make low noise printed circuit boards, a must for space based instrumentation (below, left). The circuit components are tested at low pressure and temperature of the upper atmosphere in a climate chamber (below, right).



Hydrodynamic simulation of a rotating, self-gravitatiing collapsing cloud produces the proto-stellar disk and the outflows where chemical evolution of bio-molecules are also studied (left). In a unique observation, ICSP scientists radio monitored the lunar occultation of a solar flare during a solar eclipse. They reconstructed the event from multiple satellite data and their VLF data (right).



INDIAN CENTRE FOR SPACE PHYSICS

ANNUAL REPORT
(2010-2011)

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Front Cover: The present head-quarter of Indian Centre for Space Physics.

Report of the Governing Body

This is the Twelfth Annual report of our Centre. This year ICSP has reached new heights in terms of making a totally new field station for ionospheric research and earthquake studies and obtaining space astronomy data from its own payloads.

ICSP participated in the process of fabrication, test and evaluation of the RT-2 payloads which flew on board Russian Satellite CORONAS PHOTON. The data is being analyzed. Several papers on test and evaluation and the data received from these payloads were published in International journals.

ICSP is spearheading in its activities of obtaining space data using its balloon programme. Several successful balloon flights were conducted and for the first time, we obtained the height variation of Cosmic rays from our own payloads. More complex payloads for muon detection and photomultipliers with scintillators to obtain X-ray spectrum are being readied for our next launches scheduled in the forthcoming year.

Our former PhD students and Post-Doctoral Fellows have been quite successful. Dr. Anuj Nandi joined ISRO Satellite Center, Bangalore. Dr. Vipin Yadav of ISRO Cell has joined Vikram Sarabhai Space Centre, Trivandrum. Dr. Ritabrata Sarkar completed his tenure at INFN, Italy and joined ICSP as an Assistant Professor. Dr. Dipak Debnath has joined as a Faculty of the Centre as well.

As far as the manpower development is concerned three of our scientists received Ph. D. degree. Representatives from the Calcutta University visited ICSP and renewed the affiliation by another five years. Several students successfully completed all the requisite course works of UGC.

Several scientists went abroad for attending conferences. ICSP has been playing a major role in helping scientists from the nearby colleges. Last year, six students from various colleges carried out their M. Sc. projects at ICSP. A student from Nepal is working at our Centre as an ICTP (Italy) Senior Research Fellow.

In the field of Very Low Frequency (VLF) studies extraordinary achievements were obtained in the field of earthquake predictions and several papers were published in International Journal on how to decipher signatures of seismic activities in VLF signals. Intense study is in progress on how to predict the epicenters from various anomalies.

The building at Sitapur is nearing its completion. This field station will be used to obtain the noise free data of Very Low Frequency radio signals which will carry information about upper atmosphere. This data will be valuable to look for pre-cursors of earthquakes.

The ICSP, Malda branch is also active. The Malda branch scientists are completing several works on VLF astronomy.

I thank Dr. D. Debnath and Mr. Rajkumar Maiti for helping me with initial compilation of the report for 2010-2011.

Prof. S.K. Chakrabarti, Honorary General Secretary
Indian Centre for Space Physics Kolkata: September 25, 2011

Governing Body (GB) of the Centre

Dr. B.B. Bhattacharyya, *President*
Dr. Jogendra N. Chakravorty, *Vice President*
Dr. Sandip K. Chakrabarti, *Secretary*
Dr. Dipak Bhaumik, *Treasurer*
Dr. Sonali Chakrabarti, *Member*
Dr. S. C. Chakravarty, *Member*
Dr. A. R. Rao, *Member*
Mr. Gurusaran Das Gupta, *Member*
Dr. Asish Das Gupta, *Member (Nominated by Calcutta University)*
Dr. P. K. Das Poddar, *Member (Nominated by Calcutta University)*

Members of the Research Advisory Council (RAC)

Prof. S. N. Ghosh, FNA, Ex Allahabad Univ. & Calcutta Univ. (Chairman)
Prof. J. N. Chakravorty, Indian Centre for Space Physics
Prof. A.R. Rao, Tata Institute of Fundamental Research, Mumbai
Mr. K. K. Chakraborty, Ex-Director, Positional Astronomy Centre
Prof. A.M. Basu, Jadavpur University, Kolkata
Prof. S.K. Chakrabarti, S.N. Bose Nat'l Centre for Basic Sciences, Kolkata & ICSP
Prof. D.C.V. Mallick, Indian Institute of Astrophysics, Bangalore
Prof. S. Ananthakrishnan, Ex-Senior Prof., GMRT, Pune
Prof. D. J. Saikia, National Center for Radio Astronomy, Pune
Prof. B. G. Ananda Rao, Physical Research Laboratory, Ahmedabad
Prof. P. J. Wiita, Georgia State University, USA

Faculty Members

Dr. Ankan Das	Assistant-Professor
Dr. D. Debnath	Scientist -B
Dr. Ritabrata Sarkar	Assistant-Professor
Mr. D. Bhawmik	Hardware Engineer

Honorary Faculty Members

Dr. D. Bhaumick, ICSP	(Hony. Scientist)
Dr. S. Chakrabarti, M. M. Chandra College	(Hony. Reader)
Dr. S. K. Chakrabarti, SNBNCBS	(Hony. Professor)
Dr. J. N. Chakravorty, ICSP	(Hony. Professor)
Dr. A. K. Chatterjee, Malda College	(Hony. Scientist)
Dr. T. K. Das, Narasimha Dutta College	(Hony. Assoc. Professor)
Dr. P. K. Jana, Panipukur BEd College	(Hony. Scientist)
Dr. M. M. Majumdar, DPI	(Hony. Scientist)
Dr. S. K. Midya, Serampore College	(Hony. Assoc. Professor)
Dr. S. Mondal, RKMR College	(Hony. Scientist)
Dr. R. Chattopadhyay (Haripal Instituion)	(Hony. Scientist)
Dr. G. Tarafdar (Barasat Govt. College)	(Hony. Scientist)

Research Scholars

Dr. Broja Gopal Dutta	Mr. Santanu Mondal (CSIR)	Mr. Kumaresh Chakrabarti
Mr. Partha S. Pal (CSIR)	Mr. Sudipta Sasmal (ISRO)	Dr. M. M. Majumdar
Mr. Tilak Kotoch (ISRO)	Mr. Sushanta K. Mondal (CSIR)	Mr. Wasim ul Bari
Mr. Sourav Palit (CSIR)	Mr. Suman Ray (ISRO)	Mr. Asit K. Choudhury
Mr. Liton Majumdar (DST)	Mr. Surya Maji	Mr. M.M. Samanta

ICTP Senior Research Fellow

Mr. Chandra Bahadur Singh

UGC Teacher Fellow(FIP)

Broja Gopal Dutta, is a teacher of Y. S. Palpara College, Purba Medinipur and has completed his Ph.D as a “Teacher Fellow” at ICSP under “Faculty Improvement Programme” of UGC from Calcutta University.

Administrative Section

Mr. Rajkumar Maiti

(Accountant/ Office Assistant)

Mr. Hriday Roy

(Laboratory Assistant)

Mr. Ram Chandra Das

(Office Helper)

Mr. Uttam Sardar

(Office Helper)

Security

Mr. Barun Chakraborty

Research Facilities at the Centre

Library: The library has well cataloged journals and conference proceedings in Astronomy, Astrophysics and Space sciences and an excellent collection of text books.

Computers: The Centre has modern high-speed computers and several servers which are connected through LAN/Wi-Fi and through the lease-line Internet.

Seminar room: The seminar room at ICSP is well equipped with modern amenities and wireless Internet.

Guest house: This facility is to provide lodging for residential scientists and visitors to stay overnight.

Future Sites of ICSP: The future sites of ICSP and the remote VLF station are being developed. At Sitapur a new site was selected for ionospheric and earthquake research. The branch will start functioning very soon.

Brief Profiles of the Scientists of the Centre

Prof. Bimalendu B. Bhattacharyya: He is the President of the governing body of ICSP. He was an ex-Director of Indian School of Mines, Dhanbad. He is an INAE Distinguished Professor associated with S.N. Bose National Centre for Basic Sciences. His field of specialization is the study of deep crustal structure on earth from magneto-telluric data.

Dr. Dipak Bhaumick: He is an Ex-Reader at the Ramakrishna Mission Residential College, Narendrapur and an honorary scientist and Treasurer of the Governing Body of the Centre. His interest lies in the airglow, reaction properties of molecules in the upper atmosphere and also VLF research.

Mr. Debashis Bhowmik: He is a hardware engineer at ICSP and is the laboratory in Charge which overseas the activities related to VLF and balloon experiments.

Mr. Wasim ul Bari: He is a teacher in Malda and is an honorary Junior Research Fellow at ICSP, Malda branch. He works on VLF studies of ionosphere and also data analysis of NASA/ISRO satellites.

Prof. Sandip K. Chakrabarti: He is a Senior Professor and Dean (Academic Program) of the S.N. Bose National Centre for Basic Sciences and an honorary Professor, In-Charge of Academic activities and the General Secretary of ICSP. His research interests range from physics of black hole accretion and outflows; high energy astrophysics; instrumentation for X-ray/gamma-ray observations; ionospheric perturbations due to terrestrial and extra-terrestrial phenomena and their effects on very low frequency radio waves; Chemical Evolution of star forming regions.

Dr. Sonali Chakrabarti: She is an Assistant Professor at the Maharaja Manindra Chandra College and an honorary Reader of the ICSP. Her research interest lies in the formation of bio-molecules in space, VLF research and computing the possibility to produce high

resolution millimeter and microwave grating instruments.

Prof. J. N. Chakravorty: He is an honorary Professor of ICSP. He had been the Head, Physics Department of Ramakrishna Mission Residential College, Narendrapur. His current field of interest is millimeter and microwaves, airglow, etc.

Dr. Ankan Das: He is an Assistant-Professor at ICSP. He is also the Dean (Academics) of the centre. His main research interest is to study the chemical evolution during the collapsing phase of proto-stars.

Dr. Dipak Debnath: He is a Scientist-B at ICSP. His main research interest is observational and theoretical studies of the properties of transient stellar mass black hole candidates (for e.g., GRO J1655-40, GX 339-4, H 1743-322 etc.) during their outbursts. He is also involved in various instrumentation projects of the centre.

Dr. Achintya K. Chatterjee: He is the Head, Physics Department, Malda College and an honorary scientist of ICSP. He is currently doing data analysis RXTE satellite and observing SID by VLF antenna. He is also the President of Malda Branch of Indian Centre for Space Physics.

Dr. R. Chattopadhyay: He is a Teacher at Haripal G. D. Institution. His research work includes Airglow and Ozone depletion.

Mr. K. Chakrabarti: He is a selection grade Assistant Professor in Hooghly Mahsin College and is an honorary Senior Research fellow of ICSP. He is working on similarities of accretion flows around black holes and fluid dynamics in a converging-diverging duct.

Mr. K. K. Chakrabarti: He was the director of Positional Astronomical Society of India. His field of interest is the cause of Cyclonic activities. He is in the Advisory Committee.

Mr. Asit Kumar Choudhury: He is a Teacher at the L.M.S.M. Institution, Malda and is an honorary senior research fellow of the ICSP. He is working on data analysis of RXTE satellite and also observing SID using VLF. He is also the Secretary of the Malda branch of Indian Centre for Space Physics.

Dr. T. K. Das: He is an honorary Associate Professor of ICSP. His work is on the solar physics, especially on sunspots and classification of radio bursts. He also works on the geo-spot model of earthquakes, relationships between earthquakes and VLF etc.

Dr. Broja G. Dutta: He is a teacher of Y. S. Palpara College, Purba Medinipur and has completed his Ph.D as a “Teacher Fellow” at ICSP under “Faculty Improvement Programme” of UGC. He is working on the data analysis of X-ray emission from accretion disks around black holes.

Dr. P. K. Jana: He is teaching at the Panipukur B. Ed. College and is an honorary scientist of ICSP. He works on trends of Ozone depletion over India.

Mr. R. Khan: He is a teacher of Bidhan Nagar Govt. High School and is involved in activities of the ICSP observatories. He is working on interfacing equipments with computers, VLF experiments, etc.

Mr. Tilak C. Kotoch: He was a Senior Research Fellow (SRF) appointed under RT-2 project (ISRO funded) for software development and data analysis, in order to study Solar

Activity. Presently he is finishing the Ph.D. Thesis.

Mr. Surya Maji: He is a school teacher and an honorary Junior Research Fellow at ICSP. He works on the effect of eclipse on VLF signals.

Mr. Liton Majumdar: He is a DST project research scholar at ICSP and has started working on theoretical studies in Astrochemistry/Astrobiology as a Junior Research Fellow.

Dr. M. M. Majumdar: He is an honorary scientist of ICSP. He is working on similarities of accretion flows around black holes and fluid dynamics in a converging-diverging duct.

Dr. S. K. Midya: He is a Reader of the Dept. of Atmospheric Science of the Calcutta University and an honorary Associate Professor of ICSP. He works on Airglow experiments and Ozone depletion problem.

Mr. Santanu Mondal: He is a CSIR Junior Research Fellow and working at ICSP. He is doing his research on theoretical aspects of Black Hole accretion flow.

Mr. Sushanta K. Mondal: He is a CSIR Senior Research Fellow and working at ICSP on radio and VLF studies of very high energy gamma ray activities in space.

Dr. Anuj Nandi: He is a Scientific Officer D of ISRO HQ posted at ICSP. His present activity is data analysis of black hole candidates using RXTE data and GRBs using RT-2 data.

Mr. Partha Sarathi Pal: He is a CSIR senior research fellow. He is working at ICSP on spectral and timing properties of Black hole Astrophysics.

Mr. Sourav Palit: He is a CSIR Senior Research Fellow, working at ICSP. He is working on theoretical and experimental study X-ray imaging with Fresnel Zone plates. He is also involved on GEANT-4 simulations of ionospheric study.

Mr. Suman Ray: He is working *as a Junior* Research Fellow in an ISRO project. He is in VLF group and is working on the earthquake related perturbations of VLF signals.

Mr. M. M. Samanta: He is a teacher of B.M. Institution, Tarakeswar and is an honorary Senior Research Fellow (SRF) of ICSP. His field of interest is time dependent accretion around black holes.

Dr. Ritabrata Sarkar: He is an Assistant-Professor at ICSP. He is working on GEANT4 simulation part for balloon experiment.

Mr. Sudipta Sasmal: He is a Senior Research Fellow working at ICSP under ISRO RESPOND project. He is working on earthquake predictions using VLF data.

Mr. Chandra B. Singh: He is an ICTP Senior Research Fellow. He is working on outflows from accretion disks around Black holes.

Dr. G. Tarafdar: He is an honorary scientist of the Center. He is permanently with Barasat Govt. College.

Dr. Vipin K. Yadav: He is a Scientific Officer D of ISRO HQ posted at ICSP. He is doing experiments with quasi-parallel beams in the X-ray Laboratory of ICSP.

Research Work Published or Accepted for Publication

Papers in Journals and Proceedings

Basak T., Chakrabarti S. K., and Pal S., "Global effects on Ionospheric Weather over the Indian subcontinent at Sunrise and Sunset", 2010, AIPC., 1286, 137

Bhoumik, D., Chakrabarti, S. K., Sasmal, S., and Mondal, S. K., "Studies of VLF Signals Using Balloon Borne and Undersea Antennas, Propagation Effects of Very Low Frequency Radio Waves, Proceedings of Very Low Frequency Radio Waves", 2010, AIPC, 1286, 345-347.

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Dutta, B. G, Chakrabarti, S.K, "Evidence for two-component flows around the black hole candidate XTEJ1550-564 from spectral features during its 1998-1999 outburst", 2010, MNRAS, 404, 2136.

Kotoch, T. B., Chakrabarti, S. K., Nandi, A., and Debnath, D., “Gamma-Ray Bursts from RT-2 payloads and VLF signals”, 2010, AIPC, 1286, 339

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Maji, S. K., Chakrabarti, S. K., and Mondal, S.K., “Partial effects on VLF data due to solar flare during 2010 annular solar eclipse”, 2010, AIPC, 1286, 214-222.

Mondal, S. K., and Chakrabarti, S. K., “Earth's ionosphere as a gigantic detector of extra-terrestrial energetic phenomena: A Review”, 2010, AIPC, 1286, 270-290.

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Pal. S., and Chakrabarti S. K., “Theoretical models for Computing VLF wave amplitude and phase and their applications”, 2010, AIPC., 1286, 42

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Sarkar, R., and Chakrabarti, S.K., “Feasibility of Spectro-Photometry in X-rays (SPHINX) from the Moon”, Exp. Astron. 2010, 28, 61

Sarkar, R., Mandal, S., Debnath, D., Kotoch, T. B., Nandi, A, Rao, A. R., and Chakrabarti, S. K., “Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation IV: Background Simulations using GEANT-4 Toolkit”, 2011, Exp. Astron., 29, 85-107.

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Singh, C.B. and Chakrabarti, S.K. "Outflow rates in a black hole environment in presence of a dissipative standing shock", MNRAS, 2011, 410, 2414 -2421.

Sreekumar, S., Vinod, P., Samuel, E., Malkar, J. P., Rao, A. R., Hingar, M. K., Madhav, V. P., Debnath, D., Kotoch, T. B., Nandi, A., Begum, S. S., and Chakrabarti, S. K., "Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation V: Onboard software, Data Structure, Telemetry and Telecommand", 2011, Exp. Astron., 29, 109-133.

Wani, M. R., Iqbal, N., Sasmal, S., "Possible Observations of Very Low Frequency (VLF) Radio Waves in Kashmir Region", 2010, AIPC, 1286, 211-213.

Books

S.K. Chakrabarti (Editor) PROPAGATION EFFECTS OF VERY LOW FREQUENCY RADIO WAVES, 2010, AIP Conf. Ser. 1286 (New York).

Members of Scientific Societies/Committees

Sandip K. Chakrabarti was an International Advisory Committee member of International Workshop on Seismo Electromagnetics and Atmospheric Science (IWSE-AS 2010), Agra; Honorary In-Charge, Academic Affairs and General Secretary of the Governing Body of Indian Centre for Space Physics; An Editorial Board member: Open astronomy Journal, Indian Journal of Physics and Bulletin of Astronomical Society of India. At S.N. Bose National Centre for Basic Science he is serving as the Dean (Academic Programme) and the Head of the Dept (Astrophysics and Cosmology), the Academic & Research Advisory Committee (ARPAC); Departmental Research Committees (DRC); Consultative Advisory Committee (CAC); Students' Curriculum & Research Evaluation Committee (SCREC); Library Committee and several Thesis committee. He is also the Adjunct Faculty of International Centre for Relativistic Astrophysics network (ICRA-NET), Pescara, Italy.

Students Registered for Ph.D. Degree

Mr. Chandra B. Singh, Mr. Tilak B. Kotoch, Mr. Sourav Palit and Mr. Sushanta K. Mondal have been registered for Ph.D. degree at Jadavpur University.

Ph.D. Thesis Submitted

Broja Gopal Dutta has submitted his thesis tilted ***"X-ray Properties of a few Galactic Black hole Candidates during their outbursts"*** to the Calcutta University for the Ph.D degree.

Dipak Debnath has submitted his thesis tilted ***"X-Ray properties of the Sun and some compact objects of our Galaxy"*** to the Calcutta University for the Ph.D degree.

Ph.D. Degree Received

Ritabrata Sarkar received Ph.D. degree on his thesis tilted ***"X-ray Studies of Compact Objects: Data Analysis, Development of Instruments and their characterization"*** from Jadavpur University in December, 2010.

Broja Gopal Dutta received Ph.D. degree on his thesis tilted ***"X-ray Properties of a few Galactic Black hole Candidates during their outbursts"*** from Calcutta University in December, 2010.

Dipak Debnath received Ph.D. degree on his thesis tilted ***"X-Ray properties of the Sun and some compact objects of our Galaxy"*** from Calcutta University in January, 2011.

Course of Lectures offered by ICSP members

Sandip K. Chakrabarti, Ankan Das, Dipak Debnath, Ritabrata Sarkar, and J.N. Chakravorty gave a series of about 40 lectures to the Physics post-graduate students of R. K. Mission Residential College on High Energy Astrophysics and Cosmology in 2011 as part of the Astronomy and Astrophysics Course. This is offered on a regular basis every year.

Prof. S. K. Chakrabarti also gave a series of lectures in PMSc Projects for PHY501 and reviews for PHY510 of H. Ghosh, K. Giri, S. Garain, T. Basak, S. Pal, S. Sasmal, S. Mondal, C.B. Singh, R. Sarkar, A. Das, S. Mandal, P.S. Pal, S. Maji, S. Ray, B.G. Dutta, L. Majumdar, A. Sen, A. Choudhuri and D. Debnath.

Ankan Das, Ritabrata Sarkar, Sushanta Modal, and Debashis Bhaumik supervised several M.Sc. students to complete their obligatory project courses.

Participation in National/International Conferences & Symposia

Ankan Das presented a talk to defend ISRO respond project titled "Study of the Interstellar processes leading to the deuterium enrichment", at ISRO Respond meeting, PRL, Ahmedabad, from 30th - 31st March, 2011.

Dipak Debnath presented a poster on "*Properties of the propagating shock wave in the accretion flows around GX 339-4 in 2010 outburst and GRO J1655-40 in 2005 outburst*" at International conference on "Accretion and Outflow in Black Hole Systems" from October 11 - 15, 2010 at Hotel Radisson, Kathmandu, Nepal. He also presented a poster on "*Properties of the propagating shock wave in the accretion flows around a few transient black hole candidates during their X-ray outbursts*" at International conference on "Wideband X-ray Astronomy: Frontiers in Timing & Spectroscopy" from January 13 - 16, 2011 at Baskara-3, IUCAA, Pune, India. He also gave an oral presentation on "*Nature of GRBs seen by RT-2 on board Russian CORONAS-PHTON Satellite*" at the Indo-Russian bi-lateral workshop on "Gamma-ray bursts, evolution of massive stars and star formation at high redshifts" from February 2 - 4, 2011 at ARIES, Nainital, India.

Chandra B. Singh presented a poster on "*Outflow rates in a black hole environment in presence of a dissipative standing shock*" at International conference on Accretion and Outflow in Black Hole Systems from October 11 - 15, 2010 at Hotel Radisson, Kathmandu, Nepal and at another International conference on "Wideband X-ray Astronomy: Frontiers in Timing & Spectroscopy" from January 13 - 16, 2011 at IUCAA, India.

Santanu Mondal presented a poster on *"Comptonization in transonic accretion flows" at* International conference on Accretion and Outflow in Black Hole Systems from October 11 - 15, 2010 at Hotel Radisson, Kathmandu, Nepal and at another International conference on "Wideband X-ray Astronomy: Frontiers in Timing & Spectroscopy" from January 13 - 16, 2011 at IUCAA, India.

Sushanta Mondal gave an oral presentation titled "Results of VLF detections of soft Gamma ray repeater SGR J1550-5418 & GRB 090424" at 7th Annual Meeting of the Asia Oceania Geosciences Society (AOGS) and Geosciences World Community Exhibition was held at Hyderabad on July, 2010 and at a International Workshop on Seismo-Electromagnetics & Atmospheric Science (IWSE-AS 2010) at R.B.S. College, Bichpuri, Agra on November 2010.

Partha Sarathi Pal has attended an International conference on "Wideband X-ray Astronomy: Frontiers in Timing & Spectroscopy" from January 13 - 16, 2011 at IUCAA, India, and presented a poster there.

Sandip K. Chakrabarti gave following presentations: **April, 2010:** "Status of RT-2 Payloads on board CORONAS-PHOTON Satellite" in front of ADCOS Committee, ISRO-HQ. **July, 2010:** "VLF Campaigns in summer, winter and during solar eclipse all over India" at the AOGS conference, Hyderabad, July, 2010. **July, 2010**, "Accretion onto outbursting black holes: How do they do it?" At the 2nd Galileo-Xu Guanqi meeting at Ventimiglia, Italy. **July, 2010:** Presentations of "RT-2 observations of Solar flares", "Possible First Evidence of a double gamma ray burst", "RT-2 observations of Gamma-Ray Bursts","Variability Classes of GRS1915+105: Physical Picture" and "Evidence of two component accretion flow around the black hole candidate XTE J1550-564 during the outbursts" at 10th COSPAR meeting (17th-25th July) Bremen, Germany. **Sept. 2010:** A Series of 5 lectures to Erasmus Mundus Joint Astronomy Programme Students at the University of Nice, France. **October 2010:** "Accretion processes on Black Holes: the Spectral and temporal properties" at the "Accretion and Outflow in Black Hole Systems" (10-16th October, 2010), Kathmandu, Nepal. **November, 2010:** Chaired the sessions and gave Invited talk on "VLF Campaigns in Summer, Winter and Solar eclipses" at the International Workshop on Seismo-Electromagnetics and Atmospheric Science (IWSE-AS 2010), Agra. **January, 2011:** Invited talk on the Observational Evidence for Transonic Astrophysical Flows Around Black holes, at "Wideband X-ray astronomy" International Conference at IUCAA, Pune. **February, 2011:** Invited talk on "Imaging in X-rays for space astronomy" DST SERC School on Guided Wave Optics and Devices, at CGCRI, India. **February, 2011**, Invited talk on "Excitements in Astronomy and Space Physics" at Students Reunion, St Xavier's College, Kolkata. **March 2011:** Invited talk on "Astrochemistry in Relation to Origin of Life" at the 41st Annual Re-union of Department Of Chemistry at Jadavpur University. **March 2011**: Talks on "QPO of black hole spectra", "Correlations between VLF anomaly and Seismic effects" and "VLF observations during total and annular Solar Eclipse" at the ISRO-RESPOND meeting at PRL, Ahmedabad.

Suman Ray gave an oral presentation titled "Study of the anomalous behaviors of the ionosphere during earthquake for VTX-Malda and VTX-Kolkata baseline" on 17th November, 2010 at International Workshop on "Seismo-Electromagnetics and Atmospheric Science (IWSE-AS 2010)" during 16-18 November 2010 at RBS College, Bichpuri, Agra.

Sudipta Sasmal gave an oral presentation on "Study the correlation Between Ionospheric Anomaly and Seismic Activities in the Indian Subcontinent" at 7th Annual Meeting of the Asia

Oceania Geosciences Society (AOGS) and Geoscience,, Hyderabad on 5th - 9th July 2010. He also presented a lecture on "Correlation Between the Ionospheric Anomaly With Seismic Activities and Comparison With Other Networks" at International Workshop on Seismo-Electromagnetics & Atmospheric Science (IWSE-AS 2010), R.B.S. College, Agra during 16th to 18th November 2010,.

Visits abroad from the Centre

Sandip K. Chakrabarti visited at the University of Nice , France in Sept. 2010 for Erasmus Mundus Joint Astronomy Programme. He visited Pescara and University of Rome for Annual Meeting of International Centre for Relativistic Astrophysics (ICRA). He visited Nepal for a conference on Accretion and Outflow in Black Hole Systems in October, 2010.

Dipak Debnath visited Kathmandu, Nepal; to attend an International conference on "Accretion and Outflow in Black Hole Systems" from October 11 - 15, 2010 and also visited Dhaka, Bangladesh for attending ICTP, Italy, organized first regional microelectronics workshop on "VHDL for Hardware and FPGA Design in South Asia" from January 31 - February 18, 2011.

Debashis Bhowmick visited Dhaka, Bangladesh; to attend first ICTP organized first regional microelectronics workshop on "VHDL for Hardware and FPGA Design in South Asia" from January 31 - February 18, 2011.

Ritabrata Sarkar visited ICTP, and INFN, Trieste, Italy an ICTP Trill Fellow.

Visitors to the Centre

Prof. S.K. Ghosh, Director of NCRA, Pune, and Prof. J. Murthy of Indian Institute of Astrophysics visited ICSP and presented seminars. Dr. U. Desai (NASA scientist) visited ICSP for collaborative purpose.

Collaborative research & project work

RT-2 experiment aboard Russian satellite CORONAS-PHOTON and Associate Data Analysis, S.K. Chakrabarti [Co-PI] (SNBNCBS and ICSP), A. Nandi (ICSP/ISRO), D. Debnath (ICSP), V. K. Yadav (ICSP/ISRO) R. Sarkar (ICSP) and A. Rao [PI] (TIFR) Funded by Indian Space Research Organization (June 2005 – March 2012).

Abstract: Assuming Solar activity would peak in ~ 2009-2010, RT-2 payloads were launched on 30th January, 2010. It received data from several GRBs and Solar flares. The analysis of the result is in progress. Several papers on Instrumentations and flares/GRBs have been published.

Time dependent evolution of gas/grain chemistry, S. Chakrabarti (MMC and ICSP), S.K. Chakrabarti (SNBNCBS and ICSP), L. Majumdar (ICSP) Funded by Department of Science and Technology (March 2010 – May 2013).

Abstract: We carry out time dependent simulations of the collapsing molecular clouds and at the same time carry out the Monte-Carlo simulations on grains and simulations of chemical evolutions. We compare with observational results.

Study of Correlation between ionospheric activities with earthquakes by monitoring Very Low Frequency (VLF) signals: Funded by RESPOND (ISRO):

Abstract: We study the shifting of the sunset and sunrise terminators and try to correlate with earthquake related activities. We also find correlations between the seismic activities and the time to produce and destroy the D-Layer in the ionosphere. Similar relation with night-time fluctuations was found. These project is being completed.

Effects of Solar Eclipse on the VLF signals: Funded by RESPOND (ISRO) project

Abstract: In July, 2009 and January, 2010, the Solar eclipses were observed from Indian subcontinent. We study the perturbations of the ionosphere by these natural processes through the observations of the VLF signals.

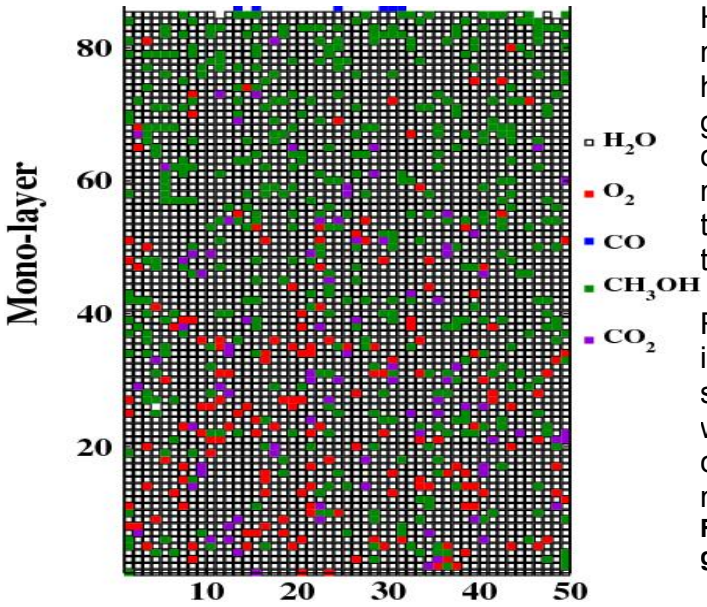
Summary of Research Activities of the Scientists at the Centre

Astrobiology/Astrochemistry

Astrobiology is an emerging field of research in which ICSP has made major contribution. For the first time its scientists asked the question: Can complex molecules which are the constituents of the RNA/DNA be formed during collapse and fragmentation of a star? Preliminary study says: Yes! It was also suggested that these complex molecules would be back to earth with the comets when they bombarded it at early history of the planet.




S. Chakrabarti, A. Das, L. Majumdar and S.K. Chakrabarti



However, an accurate answer necessarily involves the study of hydrodynamics of the collapsing gas, the grain chemistry inside the gas, the chemical evolution of the collapsing matter and most importantly, the study of the energetics of possible reactions. All these activities are done at ICSP.

Recently, the evolution of grain mantles in various interstellar environment is studied. We concentrate mainly on water, methanol, carbon di-oxide, which constitute nearly 90% of the grain mantle.

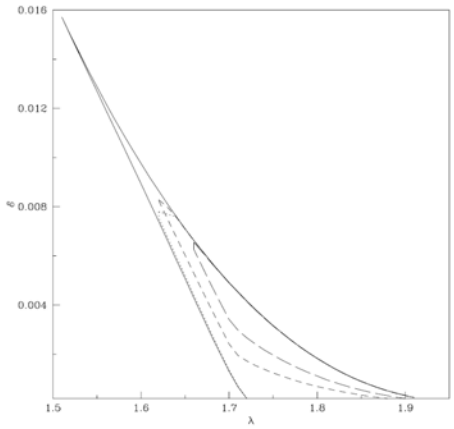
Fig. 1: A cross sectional view of a typical grain mantle.

We investigate how the production rates of these molecules depend on the relative gas phase abundances of oxygen and carbon monoxide and constrain the relevant parameter space which reproduces these molecules closed to the observed abundances. Allowing to accrete, only H, O and CO on the grains and using the Monte-Carlo method, we follow the chemical processes for a few million years. We allow formation of multi-layers on the grains and incorporate the freeze-out effects of accreting O and CO. We find that the formation of these molecules depends on the initial conditions as well as the average cloud density. Using available reaction pathways it appears to be difficult to match the exact observed abundances of all the three molecules simultaneously. Only in a narrow region of parameter space, all these three molecules are produced within the observed limit. In addition to this, we found that the incorporation of the freeze-outs of O and CO leads to almost steady state on the grain surface. We also consider a case where the gas number density changes with time due to gradual collapse of the molecular cloud and present the evolution of composition of different species as a function of radius of the collapsing cloud.

Black hole Astrophysics

A. Nandi, D. Debnath, C. B. Singh, S. Mondal and S. K. Chakrabarti

Black Hole astrophysics basically consists of the theoretical studies of how matter is accreted into the black holes, how matter is ejected from accretion disks in the form of jets and outflows, how radiation is emitted from these disks and outflows and what is the time dependence of the spectrum of radiation. All these works are done at ICSP.



Outflows from inflows in presence of mass-loss and cooling: One of the most important aspects of quasars to nano-quasars is the formation of jets and outflows from the accretion disks. The centrifugal barrier of the incoming matter close to the jet creates a standing shock wave which is hot and has very high entropy. This is the region which produced outflows. We have been able to compute the outflow rates from the inflow rates for various models of the accretion flows even after inclusion of the energy loss and the matter loss from the post-shock region (C. B. Singh and S. K. Chakrabarti).

Fig. 2: Parameter space spanned by energy (y-axis) and the angular momentum (x-axis) in which the standing shocks can form in the accretion flows. The region shrinks when the energy loss parameter is increased (short and long dashed curves).

Self-consistent Transonic flow solution in presence of Comptonization:

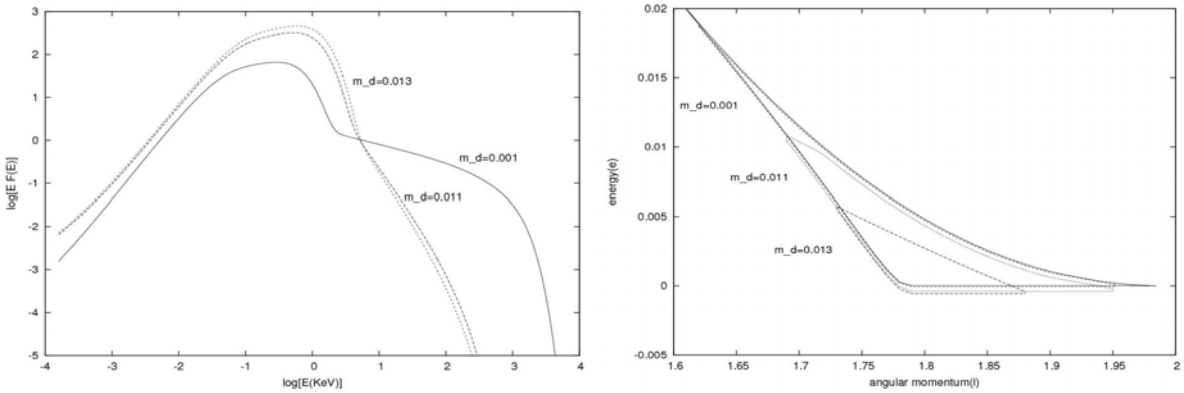


Fig. 3 (Left): The softening of the spectrum when the disk accretion rate is increased. (Right) The cooling in the whole of parameter space contracts the region of the parameter space in which such a shock can be produced.

Since Comptonization depends on the electron temperature, optical depth and the radiation field present, its effects are highly non-linear. In this work, we iteratively solve the transonic solution of a sub-Keplerian flow in presence of a standard accretion disk. By varying the Keplerian and the sub-Keplerian rates, we show how the shock location is corrected and the spectrum is produced self-consistently (S.K. Chakrabarti and S. Mondal).

Time dependent simulation of matter with viscosity and radiative transfer: Numerical simulations as well as analytical works using non-dissipative flows indicated that the matter does not require viscosity in order to fall into a blackhole even when they have angular momentum as high as the marginally abound values. The flow may or may not form a shock around the black hole. When viscosity is added, the shocks tend to be weaker and shifts outward. Above a critical value of viscosity parameter, the shock disappears altogether. We have simulated with both the $r\phi$-component of the viscous stress as well as with all the three components. We found that smoother shocks are produced when all the components are added (S.K. Chakrabarti and K. Giri).

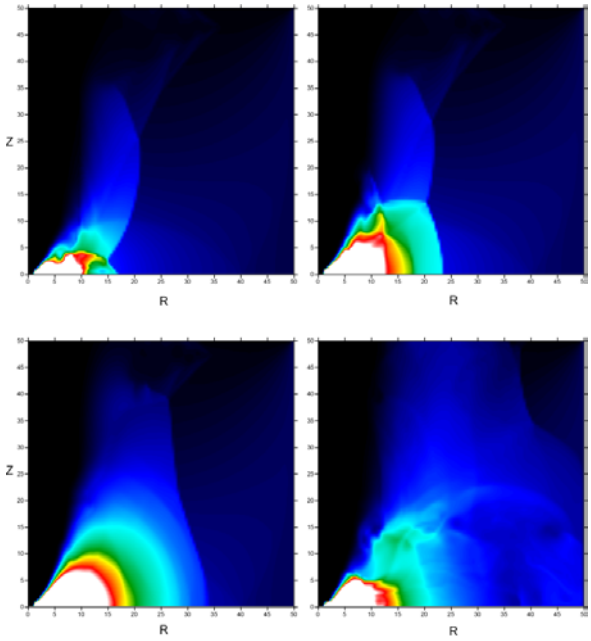


Fig. 4: The meridional cross section of an axisymmetric flow in presence of increasing viscosity. The shock moves out (top-left, top-right, bottom-left) and eventually moves out of the grid (bottom-right) as the viscosity is slowly increased and critical value is crossed.

We have coupled radiative transfer with time dependent flows and computed spectral feature variation with time. A typical Monte-Carlo grid is shown in Fig. 6. We show that the quasi-periodic oscillations are the consequences of the oscillations of the shocks in presence of cooling effects: (S.K. Chakrabarti, H. Ghosh, K. Giri, S. Garain)

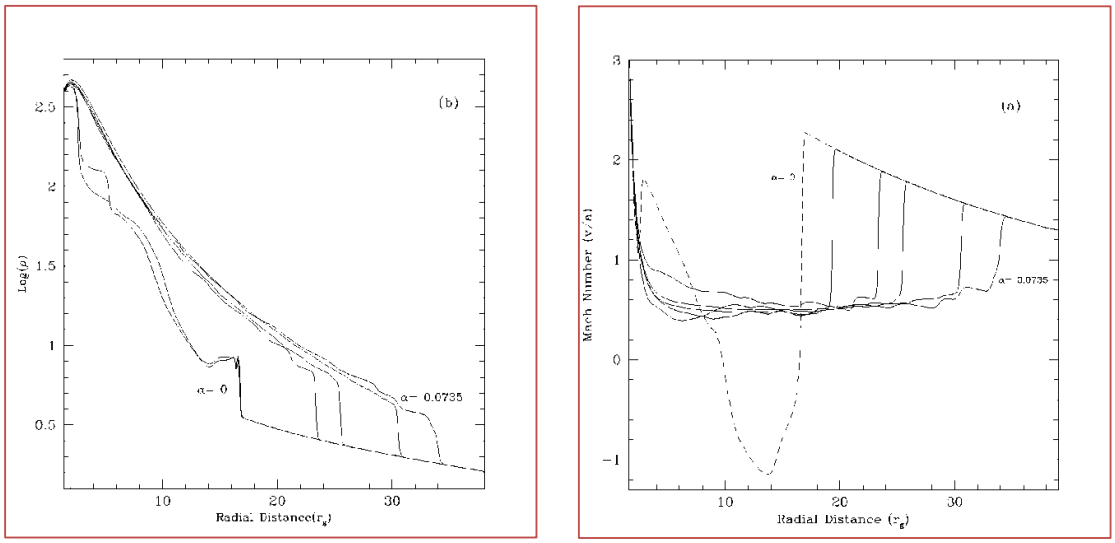


Fig. 5(a-b): (a) Mach number and (b) density variation as a function of the radial distance as the viscosity parameter alpha is increased. This shows how the shock wave moves outwards.

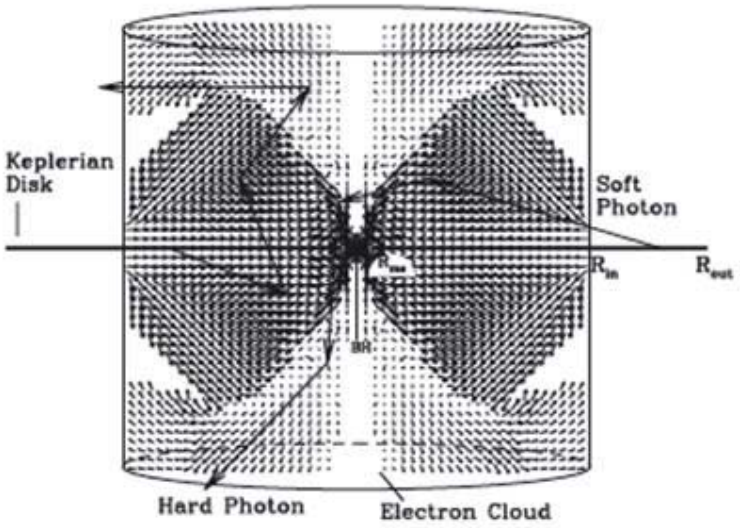


Fig. 6: A typical Monte Carlo grid where soft photons from Keplerian disks are intercepted by the sub-Keplerian halo and are inverse Comptonized to produce high energy photons.

Black hole astrophysics as an Engineering problem

Visiting scientists: K. Chakrabarti, M. M. Majumdar, M. M. Samanta

We have been able to show that the flow solution in a black hole accretion is intimately connected to a combination of two converging-diverging ducts back to back. This has been shown for Schwarzschild geometry and Kerr geometry respectively. We are now concentrating on the viscous isothermal flow and find how the duct cross-section should change as the viscosity is enhanced and the shocks disappear. (K. K. Chakrabarti, M. M. Majumdar and S.K. Chakrabarti).

X-ray Astronomy

D. Debnath, B. G. Dutta, P.S. Pal and A. K. Choudhury

The parameter governing the variability class transition:

We compute the Comptonizing efficiency (CE) defined as the ratio of the photons in the power-law component and the photons in the soft (black body) component. The ratio gives directly the geometry of the Compton cloud including the base of the jet. We find that the observed class transition by IXAE instrument on-board IRS-P3 follows the sequence that we obtained by simply arranging the Comptonizing efficiency of various classes in an increasing order. This gives insight into the fact that it is not the accretion rate of either of the Keplerian or Sub Keplerian components, but a complex combination dictating CE which determines the order in which the class transition would be taking place.

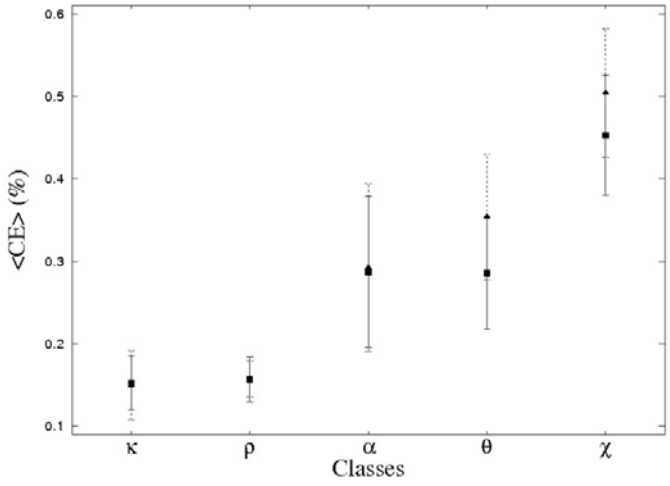


Fig. 7: The Comptonizing Efficiency of five classes are arranged in an increasing order. The class transition in IXAE payload is seen in the same order.

Timing properties of the Outburst sources:

Evolution of the accretion flow dynamics during the initial rising phase of the 2010-11 outburst of Galactic black hole candidate GX 339-4 was done by studying spectral and timing properties in details. Here we use archival data of the NASA satellite. Like 2005 GRO J1655-40 outburst and 1998 outburst of XTE J1550-564, evolutions of the QPO frequencies was also observed during this present source.

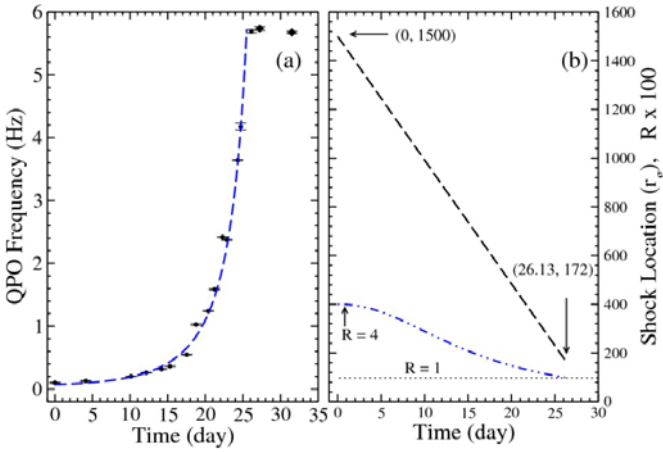


Fig. 8: In (a), the variations of the QPO frequency with time (in day) with the fitted Propagating Oscillatory Shock (POS) model (dotted curve) in the rising phase of the 2010-11 outburst of GX 339-4. In (b), Variation of the shock location and shock strength (R). The shock seems to be stagnating at around 172 Schwarzschild radii.

This QPO evolution was also fitted with the same Propagating Oscillating Shock (POS) model, with which we explained GRO J1655-40 & XTE J1550-564 outbursts. Unlike rising phase of 2005 outburst of GRO J1655-40 outburst (where shock was found to fall in black hole horizon few hours after our last rising phase QPO observation), here we observed the shock to stalled at ~172 Schwarzschild radii and as a result of the QPO is observed at ~ 6 Hz for the next ~ 26 days. With the help of detailed spectral and timing analysis, initial rising phase of the outburst was classified into four spectral states: hard, hard-intermediate, soft-intermediate and soft.

X-ray Experiments

Top- R. Sarkar, A. Nandi, V. K. Yadav , D. Bhawmick and S.K. Chakrabarti

Bottom – D. Debnath, T. Kotoch and S. Palit

R.C. Das, H. Roy and U. Sardar

RT-2 Payloads onboard CORONAS-PHOTON Satellite:

The data analysis of the RT-2 payloads yielded treasures in solar and high energy gamma-ray astronomy. A solar flare of 5th July, 2009 appears to exhibit oscillations in various energy bands. (RT-2 teams of ICSP, TIFR and VSSC). A very unique Gamma-Ray Burst (GRB) was observed (GRB 090628) which is nearby (z=0.52). It has a very broad pre-cursor which appears to have totally different spectral properties as compared to the more strong activities that follow. The time lags, spectral evolution and other properties indicate that the origin of the first episode could be totally different from that of the second episode (RT-2 team).

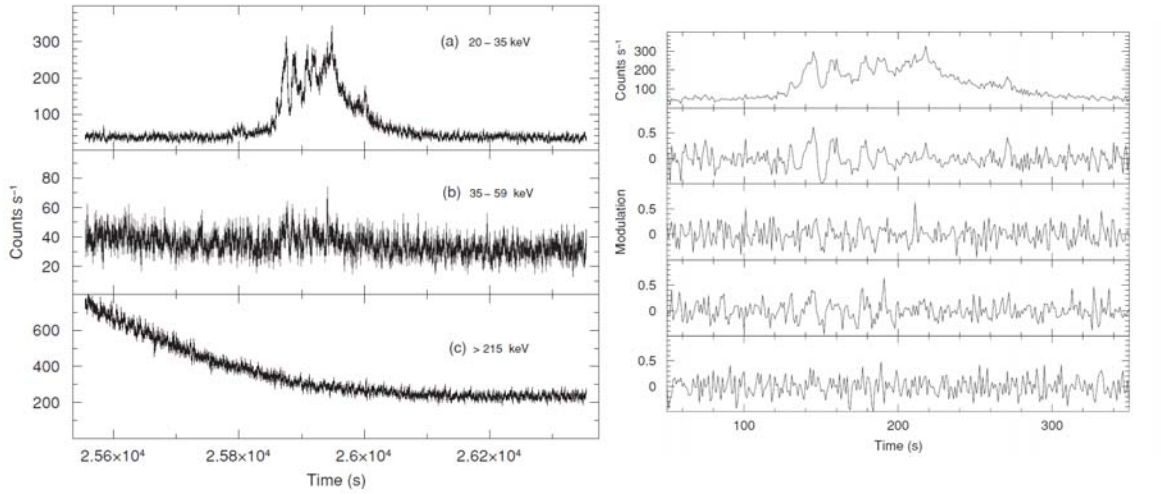
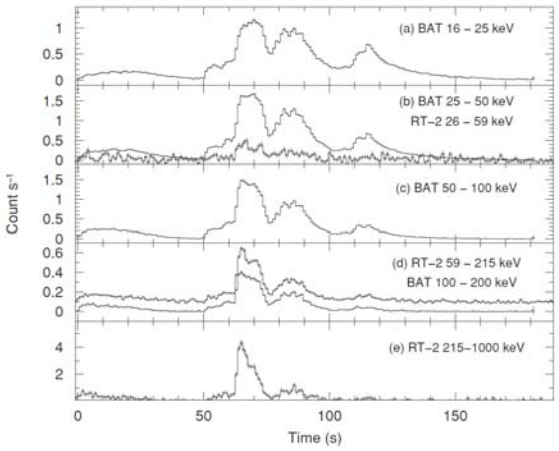


Fig. 9: (left) The light curves at different energy bands of a Solar flare of July 5th, 2009 as obtained by RT-2 payloads. The zoomed in oscillations at energy bands of RT-2/S 20-35keV, RT-2/S 35-59keV, RT-2/G 20-35keV, RT-2/G 35-59keV.



From the spectral property one can measure the size of the evolving object. It is conjectured that the first episode is the signature of the formation of a black hole (ICRA-net team, Pescara and S.K. Chakrabarti).

Fig. 10: The light-curve of GRB 090628 as obtained by BAT and RT-2. They generally agree. The first long episode of ~ 50s is believed to be the signature of a black hole formation.

Si-PIN photo-diode based miniature X-ray detectors were built for future space missions. The actual model and its model for doing Geant4 simulation are shown below.

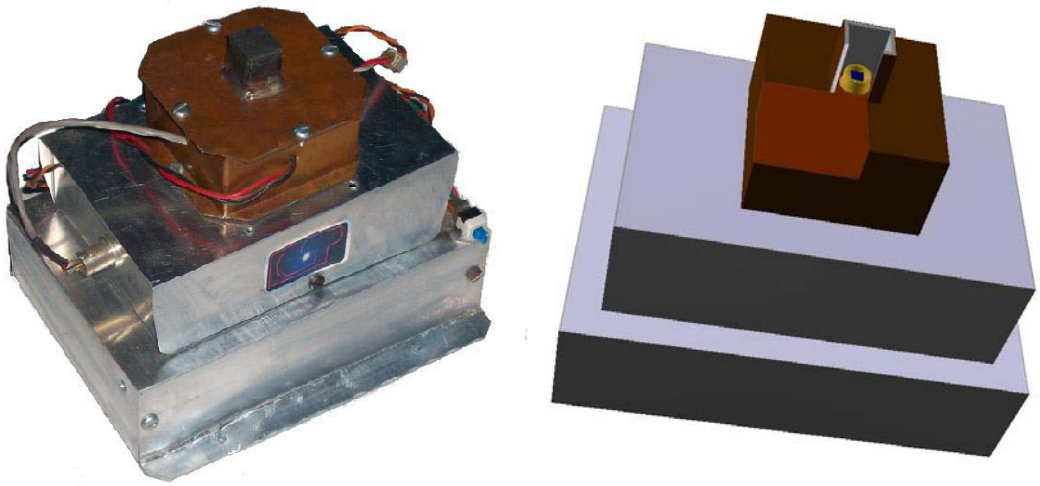
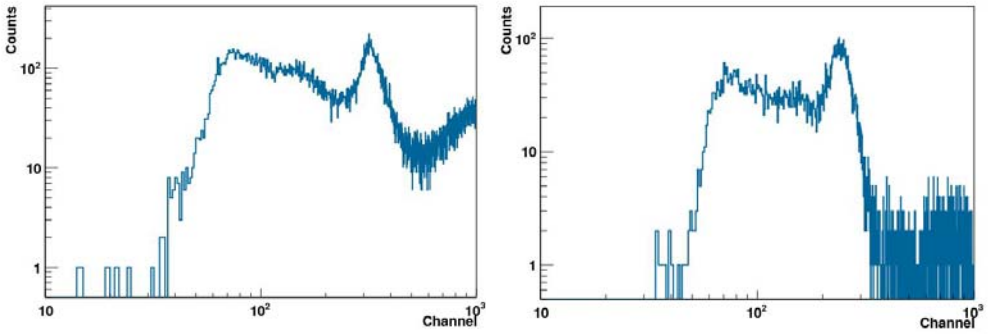


Fig. 11: Si-PIN photo diode for future space mission (left) and its analog for geant4 simulation (right).



The results for two calibrators of these detectors are shown in Fig. 12.

Fig.12: Calibration with Eu152 (left) and Ba133 (right).

Fig. 13: Energy-Channel calibration of the Si-PIN photo-diode.

Energy-Channel calibration is shown in Fig. 13. This will be used to obtain the spectrum from high energy sources (S. K. Chakrabarti, R. Sarkar, D. Bhawmick, S. Palit).

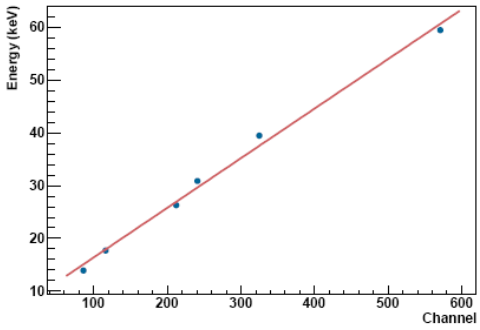


Fig. 13: Energy Channel calibration for the Sphinx payload presented in Fig. 11.

Radio and VLF Astronomy

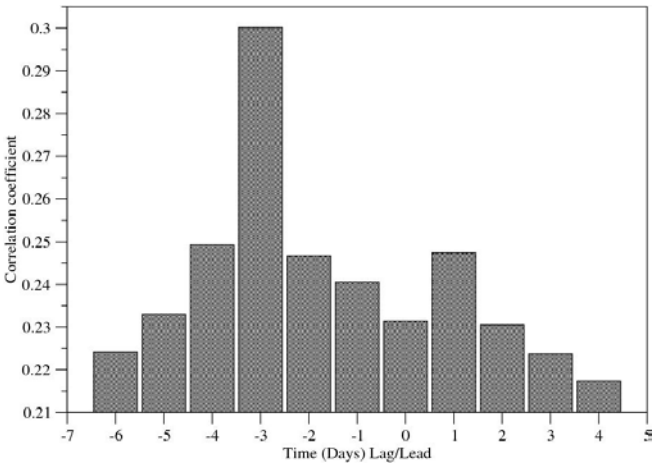
ICSP has been monitoring VLF signals from various stations since 2002. It is engaged in modeling the signals over different propagation paths. It is specialized in detecting and interpreting anomalous VLF signals generated by high energy processes in the sun, gamma-ray bursts, soft-gamma-ray repeaters etc. Two solar eclipses have been covered. Most importantly, it has taken a pioneering role in detecting the relations among the ionospheric anomalies and the seismic phenomena. Some examples of activities in this year are provided below.

Top (L to R): ***D. Bhowmick, S. Sasmal, S. Mondal, S. Maji, S.K. Chakrabarti,***
Bottom (L to R): S. Chakrabarti, A. K. Choudhury, S. Ray

The group has a large number of Gyrator-III receivers and antenna systems which were made by ICSP. It has two AWESOME receivers and antenna systems and one SOFTPAL receiver/Antenna system. The data is taken from various stations in India.

Studies of ionosphere-Lithosphere coupling using very low Frequency Radio Waves

We find a net amplitude variation of the signal by about 100db in the Kolkata-VTX propagation path roughly three days before any major earthquake in the nearby region (epicenter less than 3000km from the mid reflection point). We studied the correlation between the night-time fluctuations of the VLF signals and the effective magnitude of the earthquakes with one year's data and found that the coefficient peaks three days before the earthquakes.



So far, we have obtained such correlations using the VLF-day length, the D-layer preparation time or dis-appearance time as well as the night time fluctuations. The peaks lead the seismic day by one day, two days and three days respectively. Similar correlations with other propagation paths are being studied (S. Ray, S. Sasmal, S. Chakrabarti, S. K. Chakrabarti).

Fig. 14: Correlation between the anomaly in the night time signal amplitude and the earthquake magnitudes

Studies of ionospheric perturbations during the total solar eclipse on July 22nd, 2009 and the Annular Solar Eclipse on January 15th, 2010

During the total solar eclipse, the solar disk is obscured by the moon and the height of the lower ionosphere increases. However the propagation path from the VTX to various stations in India caused different types of interference between the ground waves and sky waves with various hops. As a result, at some locations, the VLF signal (18.2kHz) signal is enhanced and at some other locations, the signal is reduced. These data is now analyzed with the help of Long Wave Prediction Code (LWPC) as well as our own code written using wave-hop model (S. Pal, S. Mondal, S. Ray, S. Sasmal, S. Chakrabarti, S. K. Chakrabarti).

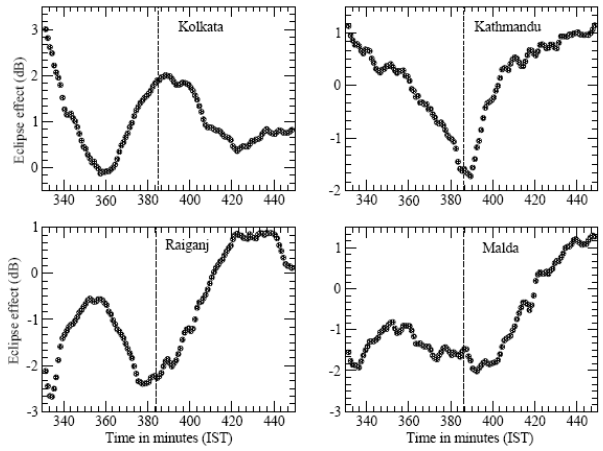


Fig. 15: The deviation from normal amplitude at four locations. The vertical lines give the eclipse maxima at respective locations.

The deviations are seen to be positive as well as negative. The result appears to be strictly

dependent on the propagation path. We are in the process of computing the effects using LWPC code.

Partial solar eclipse (75%) was observed on January 15, 2010 from Kolkata area. Clear depression in the VLF signal amplitude was observed during the period of partial eclipse. There was also a solar flare of C1.3 magnitude (as observed by GOES satellite) at that same time when moon obscured the sun. The occultation of the solar flare by the moon when the ICSP VLF observation was also going on is truly unique. The effects of the solar flare has been carefully subtracted to obtain the effects if the eclipse along. It is clear from the VLF signal itself that the flare must have been blocked by the moon.

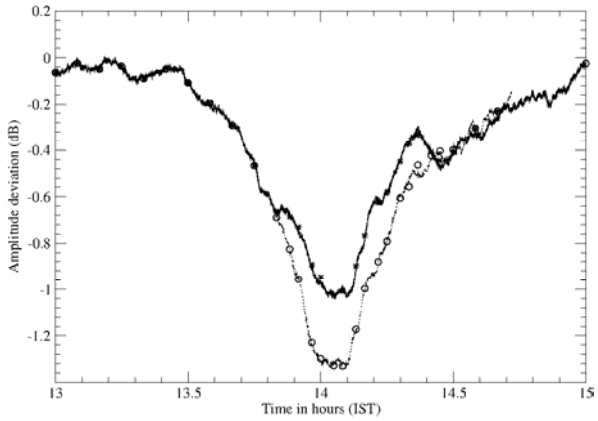


Fig. 16: Dark curve shows the combined effects of the eclipse, flare and the occultation, as obtained by subtracting the Jan. 15th data from the average data. The dotted curve is the deduced signal deviation by subtracting the effects of the occulted flare.

Balloon borne experiments

ICSP has been doing pioneering experiments in near space environment (~40km) last few years. Dignity X-XIII missions were sent in this year which obtained cosmic ray count distribution with altitude while going to space and while landing by parachutes. X-ray detectors were also sent (Balloon team).

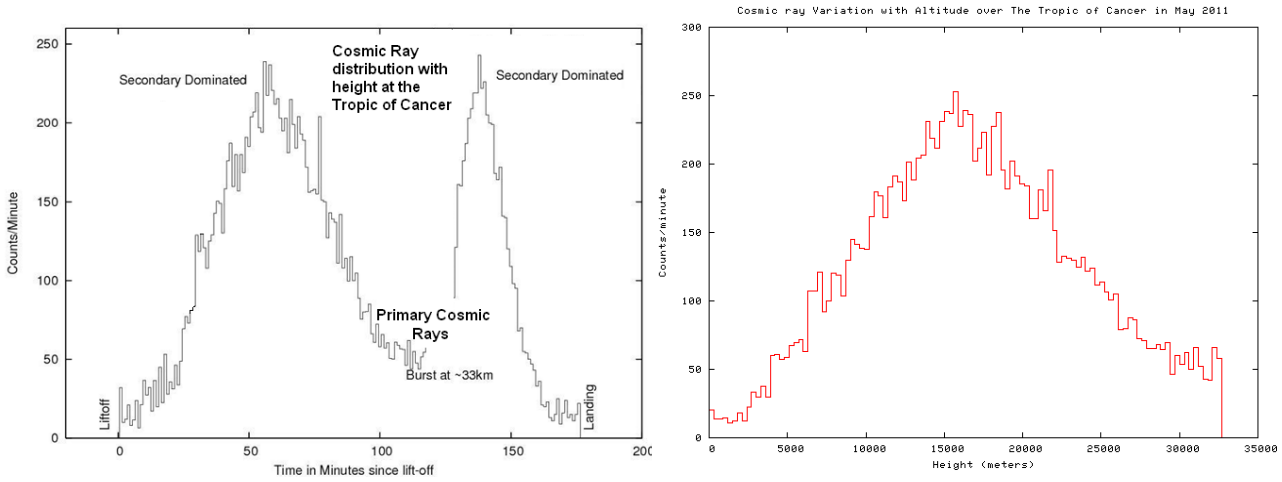


Fig. 17: Cosmic ray counts as a function of time between launching and landing of the payload (left). Generally the same profile is seen while rising and falling after the balloon burst. When converted to height the average data is shown on the right. At ~ 15km, the count rate is highest as most of the secondary cosmic rays are generated there. At a higher altitude the count is lower, since the air is thin.

Since the air absorbs X-rays, it is imperative to understand how the X-ray is absorbed at different heights so that we may be able to interpret the data properly. Fig. 18(a-b) shows how an X type solar flare may be viewed by a Si-PIN detector and a CdTe detector respectively. Clearly, a balloon borne experiments are less sensitive to soft photons.

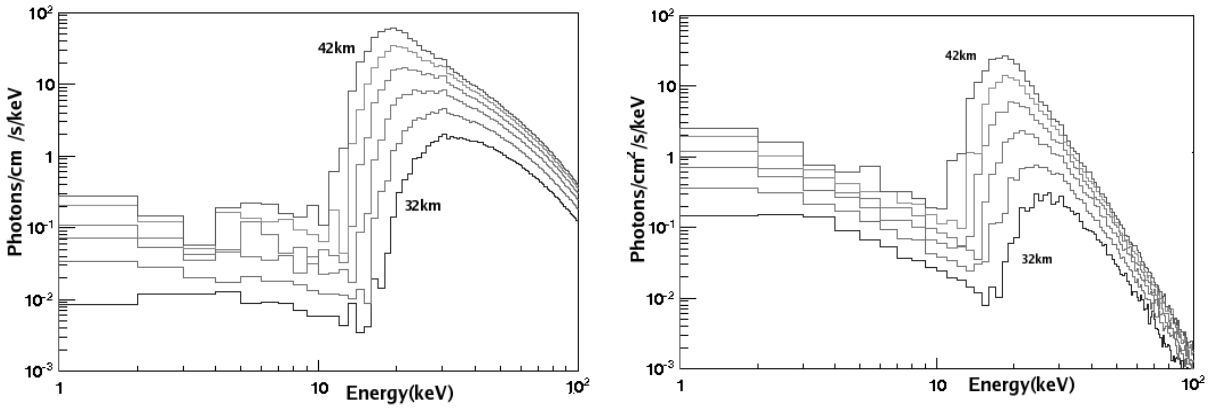


Fig. 18(a-b): The spectrum of an X type solar flare as seen by a Si-PIN detector (left) and cdTe detector (below) at various heights.

Airglow and Ozone Depletion studies

J.N. Chakravorty, D. Bhaumik, S.K. Midya, R. Chattopadhyay and P.K. Jana

Airglow and Ozone depletion activities are conducted mostly by the visiting and honorary scientists of ICSP. The activity includes the study of the effects of solar parameters on the airglow emission lines. Other work includes the study of variation of Ozone over India and Antarctica. It is recently shown that sharp depletion of absolute humidity may be one possible method of predicting Nor'wester.

ICSP teaching programme & Service to University/Colleges

ICSP has been contributing to human resource development by nurturing college and school teachers to continue research works. Indeed, many of its visiting research fellows and honorary scientists are from University/college/school sectors. Several papers in international Journals were published by these scientists and many are working towards their Ph.D. degree. ICSP is recognized by Calcutta University, a premiere University of the country. One college teacher has received PhD for his work at ICSP under the Faculty Improvement Programme (FIP).

ICSP is developing its teaching programme for the MSc and Post-MSc students. Last several years its course on Astrophysics and Cosmology is taken by R.K.M.R. College (Autonomous) students. Its scientists also gave series of lectures as a part of course at nearby Institutes.

Each year ICSP receives several M.Sc. students who wish to complete their mandatory project course. In 2010-2011, seven such Physics postgraduate students whose projects

include studies of Ionosphere, Interstellar space, Stars, Gamma ray bursts (GRBs), Solar flares, etc. These various projects are as follows: (1) "Study of the effects caused by solar Flares on VLF data in quiet background and in the background of another flare", by Saikat Bhowmick and Amit Chanda with Sushanta Kumar Mondal (2) "Design of a light weight Sun tracker using LDRs for a balloon bourn payload", by Sourav Das and Gourav Das with Dr. Ritabrata Sarkar and Debashis Bhowmick (3) "Designing a high voltage power supply for the study of a Geiger Muller counter with different radioactive sources", by Surajit Basu and Shyam sundar Dutta with Dr. Ritabrata Sarkar and Debashis Bhowmick (4)"Formation of molecular Hydrogen on the interstellar grain: A time dependent study" by Gourav Ghosh with Dr. Ankan Das (5) "Statistical studies of solar flare and comparison with satellite and VLF data", by Sampath Mukherjee with Sudipta Sasmal.

Participation of ICSP at the Science Day Exhibition organized by the Government of West Bengal

ICSP exhibited several payloads and posters in a large stall (10' x 20') at the exhibition organized by the State Science Congress of the Government of West Bengal (28th February – 1st march, 2011). ICSP organized sky-watching activities with two telescopes. NASA scientist Dr. U. Desai gave inspiring demonstration of the balloon borne payloads to the captivating students in both the days of the programme.

Activities of the Indian Centre for Space Physics, Malda Branch

The Malda Branch of Indian Centre for Space Physics organized various types of scientific activities along with research work since its inception. These mostly include the VLF radio astronomy and X-ray astronomy.

Corresponding Address for Malda branch:

Dr. A.K. Chatterjee/ Mr. A. K. Choudhury/ Mr. S. Das
Indian Centre for Space Physics, Malda Branch, Atul Market, Malda, 732101

Co-ordinating Body of the Malda Branch of the Centre

Dr. Achintya K. Chatterjee, *President*
Mr. Kankar Bandopadhyay, *Vice President*
Mr. Asit K. Choudhury, *Secretary*
Mr. Subhankar Das, *Treasurer*
Mr. Zahirul Islam, *Member*
Mr. Gobinda Chandra Mandal, *Member*
Mr. Nilmadhab Nandi, *Member*
Mrs. Sutapa Chatterjee, *Member*
Mr. Utpal Chatterjee, *Member*

P.K. Chakraborty and Associates
Chartered Accountants
F/52, Bapujinagar, P.O. Regent Estate,
Kolkata 700 092, Phone: 033 2412 5244

AUDITOR'S REPORT TO THE MEMBERS

1. We have audited the attached Balance Sheet of Indian Centre for Space Physics, 43, Chalantika, Garia Station Road, Kolkata 700 084 as at March 31, 2011 and also the Income and Expenditure, Account for the year ended on that date annexed thereto. These financial statements are the responsibilities of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audit.

2. We conducted our audit in accordance with auditing standards generally accepted in India. Those Standards require that we plan and perform the audit to obtain a reasonable assurance about whether the financial statements are free from material misstatement. An audit includes examining, on a test basis, evidence supporting, the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion and report that: -

   a) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our Audit.

   b) In our opinion, proper books of account as required by law have been kept by the Indian Centre for Space Physics so far as appears from our examinations of these books.

   c) The Balance Sheet and Income and Expenditure Account dealt in this report are in agreement with the books of accounts.

   d) In our opinion, the Balance Sheet and Income and Expenditure Accounts comply with the Accounting Standards referred to in Sec. 211 (3c) of the Company's Act 1956, to the extent applicable.

   e) An income omitted in the previous year, which is adjusted and included in this accounting year.

   f) On the basis of our information and explanations given to us and representations received from the committee of management, we report that no committee member is disqualified from being appointed as committee member of the Centre under clause (g) or sub-section (i) of Section 274 of the Companies Act 1956.

   g) In our opinion and to the best of our information and according to the explanation given to us, the said accounts read with the notes thereon give a free and fair view in conformity with the accounting principles generally accepted in India.

      i. In the case of Balance Sheet of the state of affairs of the Centre as at March 31 2010 and

      ii. In the case of Income and Expenditure Account of the surplus of the Centre for the year ended on that date.

P.K. Chakravorty & Associates
Chartered Accountant

P.K. Chakravorty, Proprietor
M.No. 5170I
Place: Kolkata
Date: 23rd Sept'2011
F/52, Bapuji Nagar, PO: Regent Estate
Kolkata 700 092

Sd/- S.K.Chakrabarti
Honorary Secretary, Indian Centre for Space Physics

Sd/- D. Bhaumik
Honorary Treasurer, Indian Centre for Space Physics

Sd/- B.B.Bhattacharyya
Honorary President, Indian Centre for Space Physics

P.K. Chakraborty and Associates
Chartered Accountants
F/52, Bapujinagar, P.O. Regent Estate,
Kolkata 700 092, Phone: 033 2412 5244

ANNEXURE TO THE AUDITOR'S REPORT

Referred to in Paragraph 1 of our Report of even date

1. The Centre has not taken any loan from Companies, Firms or Other parties listed in the register maintained under Section 301 of the Companies Act, 1956. There are no Companies under the same management.
2. The Centre has not given any loans/advance to parties/companies during the year.
3. The Centre has not accepted any deposit from public during the year.
4. The Provident Fund Act is not applicable to the Centre.
5. Other clauses of manufacturing other companies (auditor's report) order issues by Company Law Board in terms of Section 227 (4A) of the Companies Act 1956 are not applicable in this case.

Schedule – 11 **SIGNIFICANT ACCOUNTING POLICIES**

BASIS OF ACCOUNTING

a) The Company prepares its account on accrual basis, except otherwise stated in accordance with normally accepted accounting policies.
b) Donations and Annual membership fees received from patrons are treated as revenue receipts and life-member-ship fees as capital receipts.
c) Preliminary expenses and deferred Revenue Expenditure are chargable in 10 years and 3 years respectively.

FIXED ASSETS

Fixed Assets are stated at cost including installation expenses if any.

DEPRECIATION

Depreciation on fixed assets has been provided on straight-line method at the rates specified in Schedule XIV of the Companies Act, 1956.

P.K. Chakravorty & Associates
Chartered Accountant

(P.K. Chakravorty)
Proprietor
M.No. 5170I
F/52, Bapuji Nagar, PO: Regent Estate
Kolkata 700 092

Place: Kolkata
Date: 23rd Sept'2011

Sd./- S.K.Chakrabarti
Honorary Secretary, Indian Centre for Space Physics

Sd./- D.Bhaumik
Honorary Treasurer, Indain Centre for Space Physics

Sd./- B.B.Bhattacharyya
Honorary President, Indian Centre for Space Physics

INDIAN CENTRE FOR SPACE PHYSICS
43 Chalantika, Garia Station Road
Kolkata-700084

BALANCE SHEET AS AT 31.03.2011

		As on 31.03.2011	As on 31.03.2010
SOURCE OF FUNDS	Schedule	**Amount (Rs.)**	**Amount (Rs.)**
Capital Funds	1	5209573.00	4019759.00
Loan Funds	2	67446.00	73946.00
TOTAL		**5277019.00**	**4093705.00**
APPLICATION OF FUNDS			
Fixed Assets			
Gross Block	3	2232659.00	2027210.00
Less: Depreciation		741960.00	511735.00
Net Block		**1490699.00**	**1515475.00**
Current Assets,Loans & Advances:			
Security Deposit		5100.00	5100.00
Cash & Bank Balances	4	4627121.00	3675424.00
Dues from funding agencies	4A	78582.00	190657.00
Total		**4710803.00**	**3871181.00**
Less: Current Liabilities	5	628717.00	1010500.00
Less: Unspent during the year	9	295766.00	282451.00
Net Current Assets		**3786320.00**	**2578230.00**
Miscellaneous Expenditure			
to the extent not written off	6	0.00	0.00
		5277019.00	**4093705.00**

Schedules referred to above from an integral part of the Balance Sheet
As per our Annexed Report of even date

P.K. Chakravorty & Associates
Chartered Accountant

Sd./- S.K.Chakrabarti
Honorary Secretary, Indian Centre for Space Physics

Sd./- D.Bhaumik
Honorary Treasurer, Indian Centre for Space Physics

(P.K.Chakraborty)
Proprietor
Place: Kolkata
Date: 23rd Sept. 2011

Sd./- B.B.Bhattacharyya
Honorary President, Indian Centre for Space Physics

INDIAN CENTRE FOR SPACE PHYSICS
43 Chalantika, Garia Station Road
Kolkata-700084

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2011

	Schedule	As on 31.03.2011 Amount(Rs.)	As on 31.03.2010 Amount(Rs.)
INCOME			
Income	7	5759210.00	3996502.00
		5759210.00	**3996502.00**
EXPENDITURE			
Administrative & Other Expenses	8	4339171.00	3739367.00
Preliminary Expences written off		0	0.00
Depreciation		230225.00	182516.00
		4569396.00	**3921883.00**
Excess of Income Over Expenditure		**1189814.00**	**74619.00**
Surplus(Deficit) brought forward from the earlier year		4003259.00	**3928640.00**
Balance transffered to the Balance Sheet		**5193073.00**	**4003259.00**
Notes on Account	10		
Significant Accounting Policies	11		
Schedules referred to above from an integral part of the Balance Sheet As per our Annexed Report of even date			
P.K. Chakravorty & Associates Chartered Accountant		Sd./- S.K.Chakrabarti Honorary Secretary, Indian Centre for Space Physics	
		Sd./- D.Bhaumik Honorary Treasurer, Indian Centre for Space Physics	
(P.K.Chakraborty) Proprietor Place: Kolkata Date: 23rd Sept. 2011		Sd./- B.B.Bhattacharyya Honorary President, Indian Centre for Space Physics	

INDIAN CENTRE FOR SPACE PHYSICS 43 Chalantika, Garia Station Road Kolkata- 700084		
	As on 31.03.2011	As on 31.03.2010
	Amount (Rs.)	Amount (Rs.)
Schedule -1		
Capital Fund		
Life Membership Fees	16500.00	16500.00
Balance Transferred from		
Income & Expenditure Account	5193073.00	4003259.00
TOTAL	**5209573.00**	**4019759.00**
Schedule -2		
Loan Fund		
Loan from Directors	67446.00	73946.00
TOTAL	**67446.00**	**73946.00**
Schedule-4		
Cash & Bank Balances		
Cash in hand	351.20	121.20
Fixed Deposit at Axis Bank, Salt Lake	4080323.00	3666254.00
Axis Bank Ltd, Salt Lake, Sector-III	536513.66	0.00
Malda Dist. Central Co-op Bank Ltd.	9933.00	8389.00
TOTAL	**4627121.00**	**3674764.00**
Schedule-4A		
Loans & Advances		
ICTP Fellow	36118.00	43136.7
Advance to Employees	18388.00	69950.00
CSIR Fellows	24076.00	77570.00
TOTAL	**78582.00**	**190656.70**
Schedule-5		
-		
Current Liabilities		
Audit Fees	7500.00	7000.00
Liability for Projects	621217.00	1003500.00
TOTAL	**628717.00**	**1010500.00**
Schedule-6		
Miscellaneous Expenditure		
Preliminary & Pre-operative Expenses	0.00	0.00
TOTAL	**0.00**	**0.00**
Schedule-7		
Income		
Grant-In-Aid	5203990.00	3466994.00
Overhead recovery from project	70000.00	112600.00
Guest House Rent	70050.00	37800.00
Interest & other Income (Prev. yr. Adj.)	413170.00	280668.72
Misc. Income	2000.00	98439.00
TOTAL	**5759210.00**	**3996502.00**

Schedule-8		
Administrative & Other Expenses		
Fund draw for Project Expenses	349923.00	1848020.00
Salaries	2635209.00	349120.00
Office Expenses	296185.73	314375.00
Postage	4121.00	19391.00
Travelling & Conveyance	89908.00	81594.00
Telephone, Fax & Internet	107247.00	109123.00
Stationary,Consumables & Printing	66313.00	10558.00
Filing Fees	2440.00	2080.00
Bank Charges	941.27	1114.00
Rent & Electricity	153389.00	111531.00
ICSP Development	603670.00	48000.00
TDS	26975.00	0.00
Provision for expenses	0.00	837188.00
Miscellaneous Expenses	2349.00	3273.00
Audit Fees(For Statutory Audit)	500.00	4000.00
TOTAL	**4339171.00**	**3739367.00**
Schedule-9		
Unspent During the Year		
DST Projects	241162.00	0.00
ISRO Projects	54604.00	282451.00
Total unspent (committed) during the year	**295766.00**	**282451.00**

Schedule – 10 **NOTES TO ACCOUNTS**

1. This is a Company limited by Guarantee and Liabilities of each member will be as per the provisions specified by the Memorandum of Association.

2. Loan from Directors represent preliminary expenses incurred at the time of incorporation as well as pre-operative expenses incurred time to time.

3. Accounts have been regrouped and re-arranged wherever necessary.

   Depreciation on fixed assets has been provided on straight-line method at the rates specified in Schedule XIV of the Companies Act, 1956.

P.K. Chakravorty & Associates
Chartered Accountant

(P.K. Chakravorty)
Proprietor
M.No. 5170I
F/52, Bapuji Nagar, PO: Regent Estate
Kolkata 700 092

Place: Kolkata
Date: 23rd Sept'2011

Sd./- S.K.Chakrabarti
Honorary Secretary, Indian Centre for Space Physics

Sd./- D.Bhaumik
Honorary Treasurer, Indain Centre for Space Physics

Sd./- B.B.Bhattacharyya
Honorary President, Indian Centre for Space Physics

Scientists working on Very Low Freqeuncy (VLF) radio observations after attending a conference took time off at the Taj (extreme left). VLF students at AOGS conference in Hyderabad convention center (left).

Black Hole Astrophysicists at the Kathmandu conference (right). Black hole experts from SNBNCBS and ICSP including present and past students at a conference in Pune (extreme right).

Among the distinguished visitors who gave seminars at ICSP: Prof. J. Murty from Indian Institute of Astrophysics (left) and Prof. S.K. Ghosh (right) from Giant Meter Radio Telescope facility, Pune.

Dr. Srikumar Banerjee (BARC) visiting the ICSP stall at Ramkrishna Mission, Narendrapur campus on the occasion of the Science day (right). Dr. U. Desai (NASA scientist) busy in demonstrating ICSP made balloon payloads to the visiting students at the stall (extreme right).

Students (with four instructors on their right) who did their MSc projects at ICSP (extreme left). A project student connecting two Geiger counters to do coincidence study (left).

It is always a tensed period after the payload is launched (top) for the near space study ~ 40km above earth (a cloud photo and a mosaic photo of the earth from the payload camera, middle) and its welcome homecoming by a parachute bringing a sigh of relief.