



China

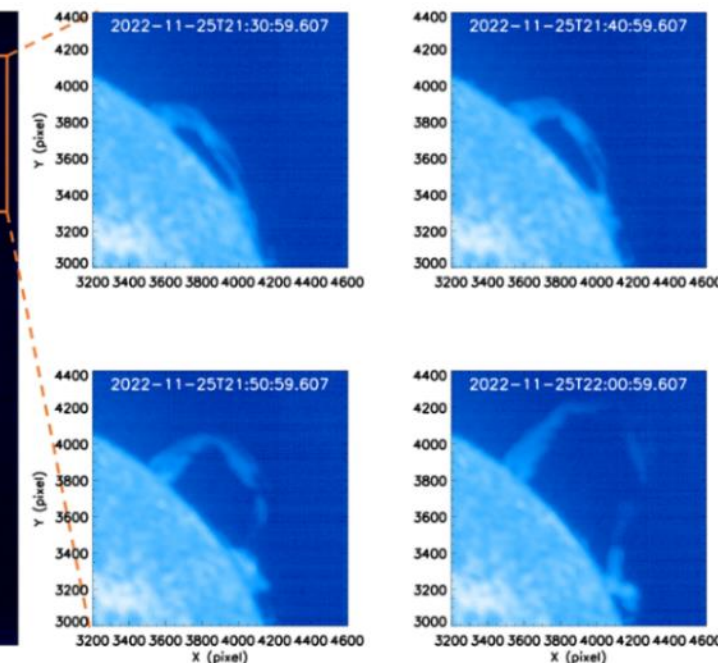
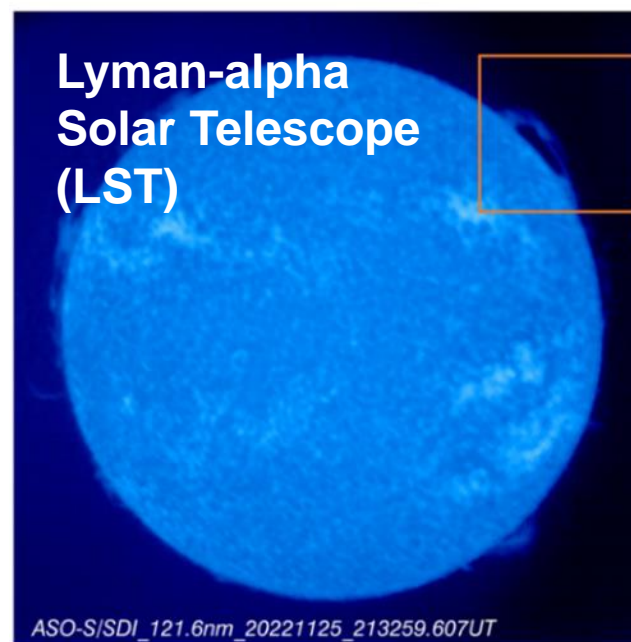
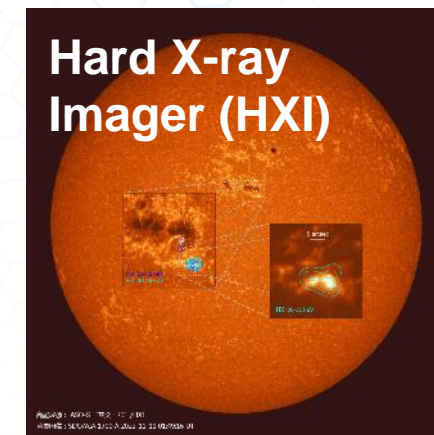
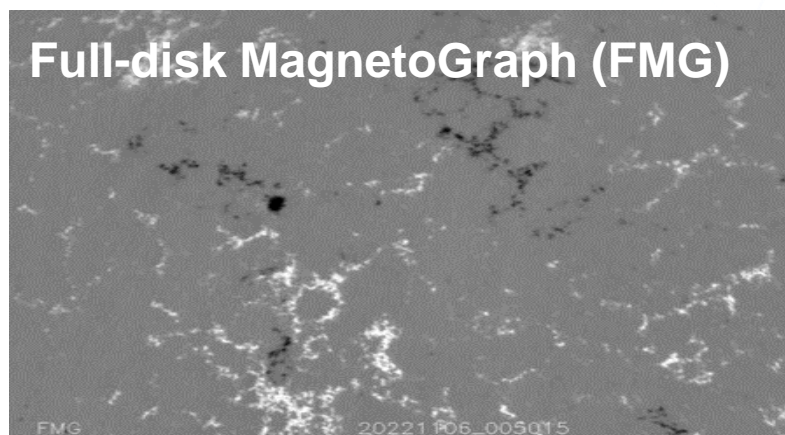
Siqing Liu

1. Advanced Space-based Solar Observatory (ASO-S)

Launched on October 9, 2022

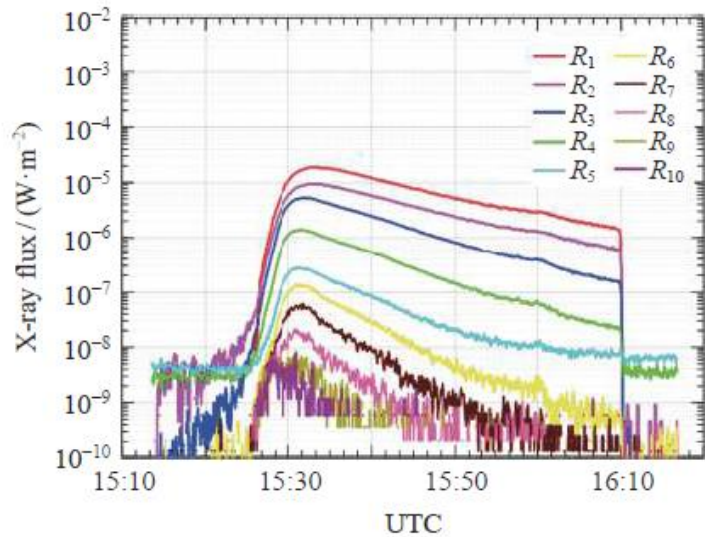


To reveal connections among the solar magnetic field, solar flares, and CMEs.

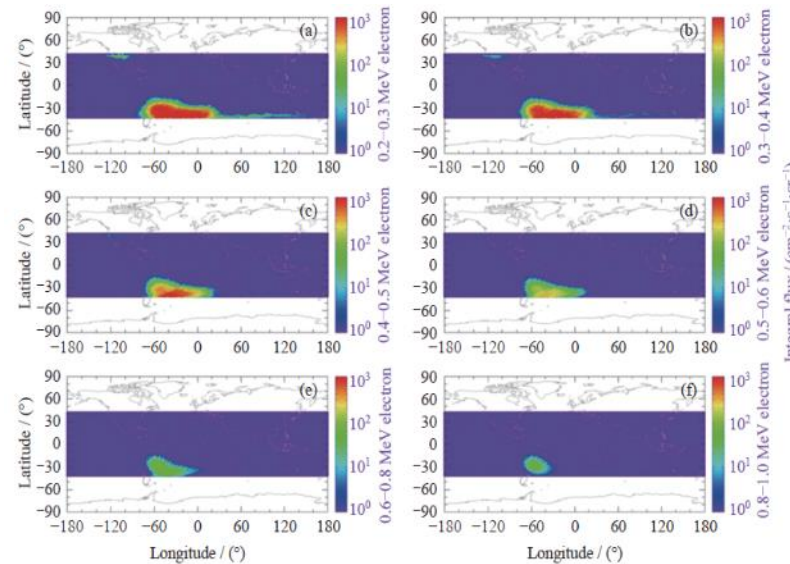


2. The China Space Station

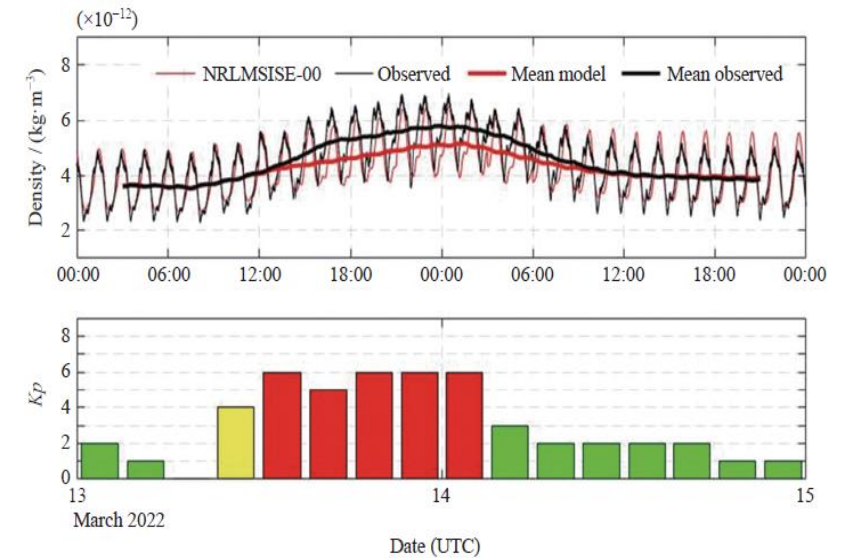
The China Space Station carries several space environment instruments. The instruments provide real-time data of the orbital space environment, including solar flares, energetic particle variation and thermospheric density enhancement. All the data contribute to the CSS space weather service for mission control and astronaut's safety.



X-ray flux in ten fine passbands of an X1.0 flare



Distribution of 0.2–1.0 MeV electrons with 6 channels measured by China Space Station between 1 January 2022 and 8 May 2022



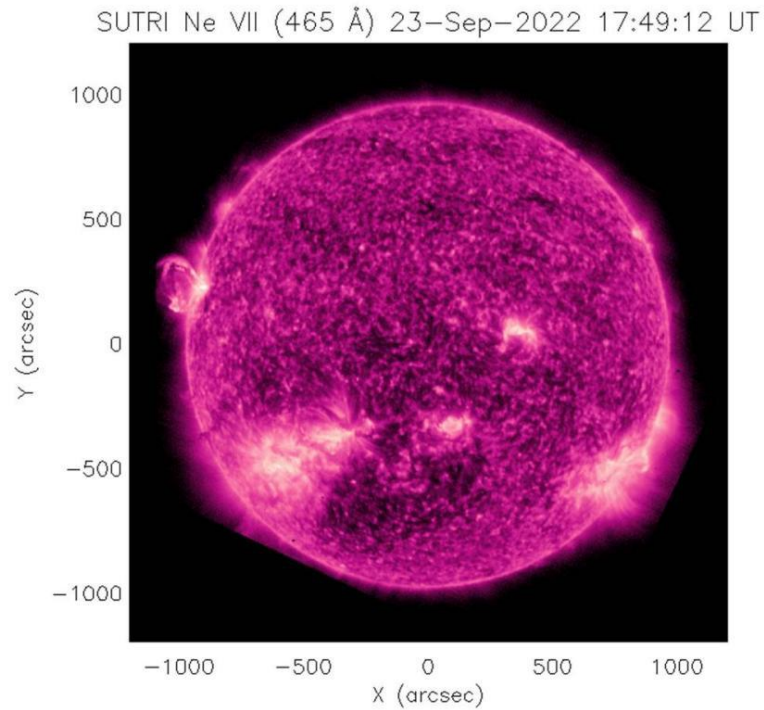
Comparison between observed (black line) and NRLMSISE-00 model (red line) densities (top panel) on 13–14 March 2022

3. The Innovation X satellite (SATech-01)

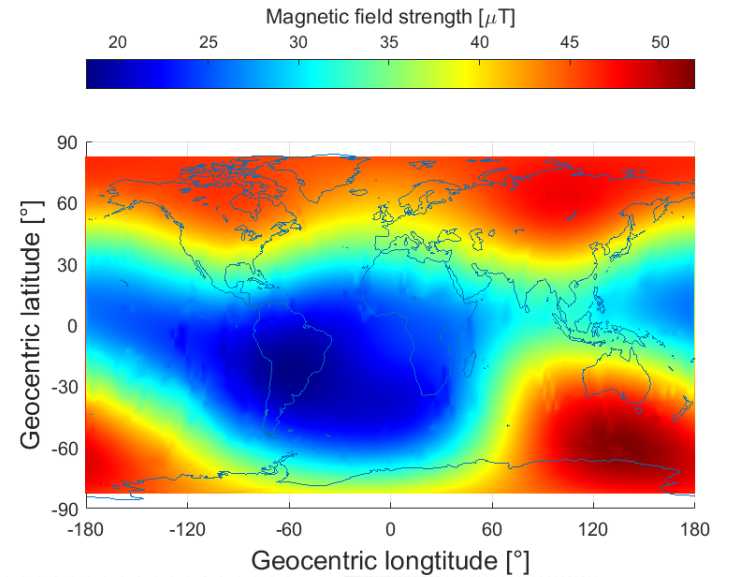
The SATech-01, a Chinese technology demonstration satellite, was the first spacecraft of the country's Innovation X satellite series. It was launched into orbit in the Lijian-1 (ZK-1) solid propellant rocket's maiden flight on July 27, 2022.



The SATech-01 satellite



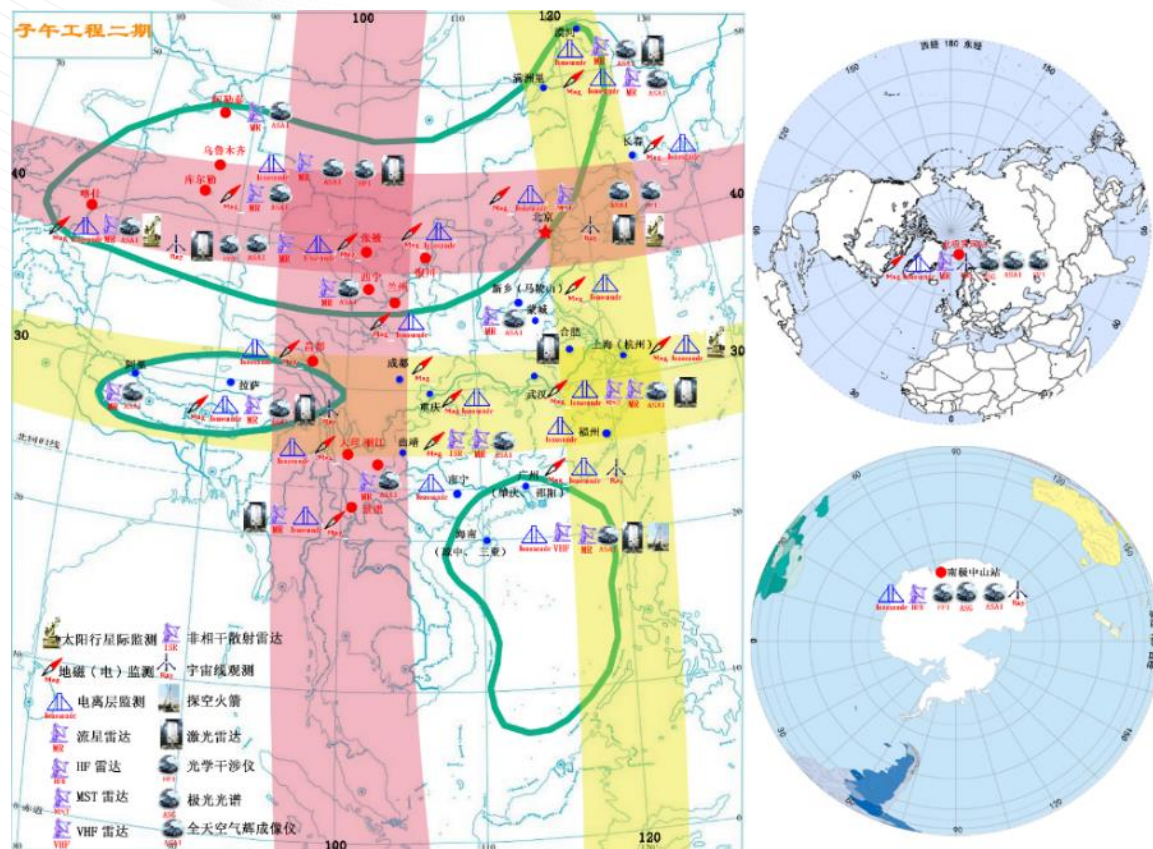
The SUTRI image



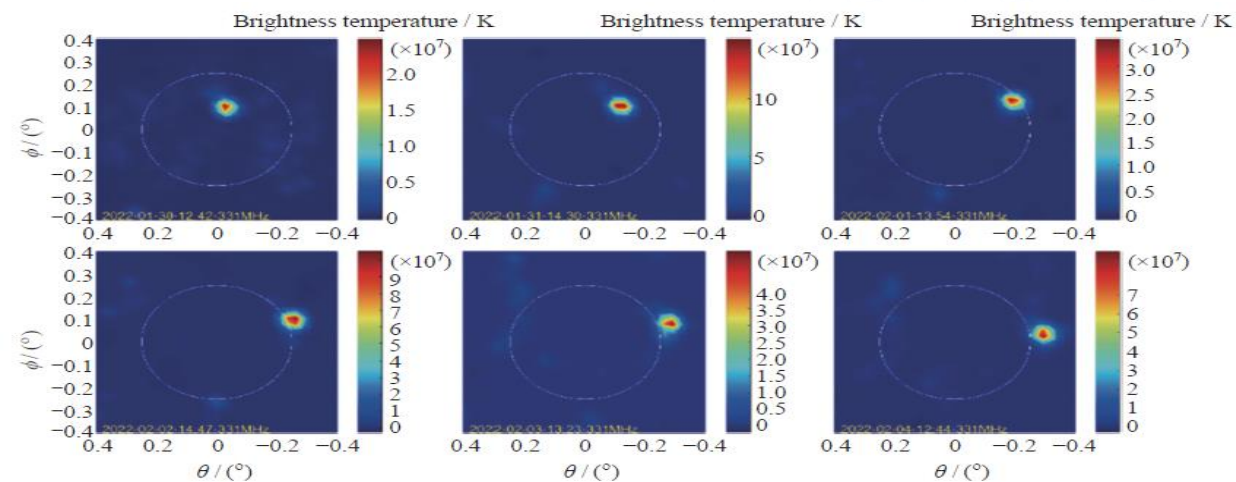
The global magnetic image.

4. Chinese Meridian Project (CMP)

Stations of the CMP



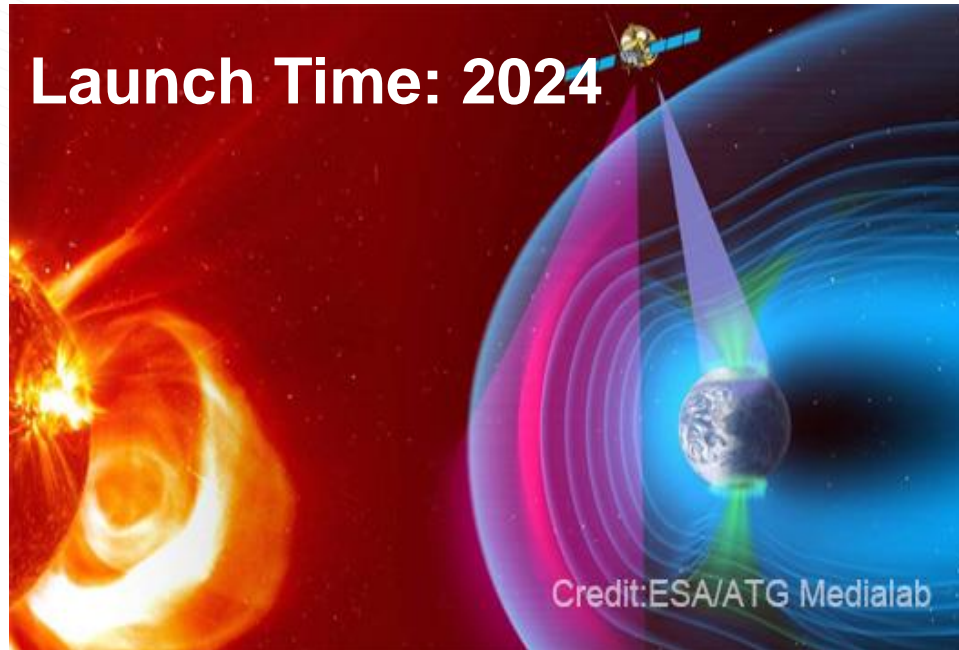
The Daocheng Solar Radio Telescope (DSRT)



Preliminary observation with 16-element only showing the high temperature spot rotating along with the rotation of the Sun in six days.

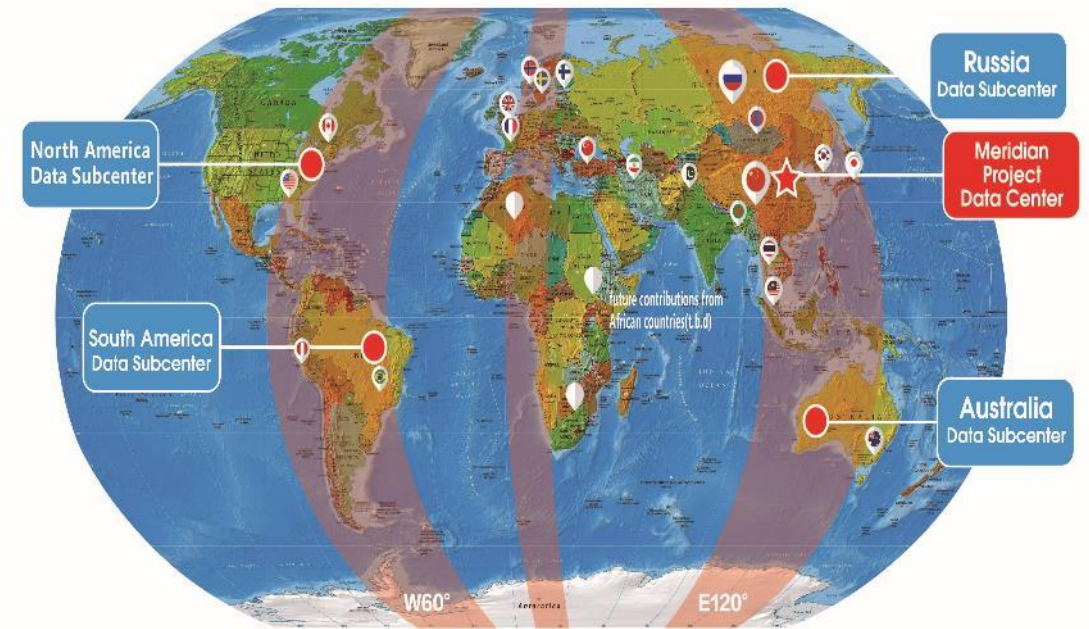
5. Ongoing Space- and Ground-based missions

Solar wind Magnetosphere Ionosphere Link Explorer (SMILE, China-ESA)



- To study the interaction between the solar wind and Earth's magnetosphere

International Meridian Circle Program (IMCP)



- Integrate ground-based observatories along the 120° E and 60° W Great Meridian Circle



Space Weather Studies in India

Nandita Srivastava

Udaipur Solar Observatory, Physical Research
Laboratory, Udaipur, India

nandita@prl.res.in



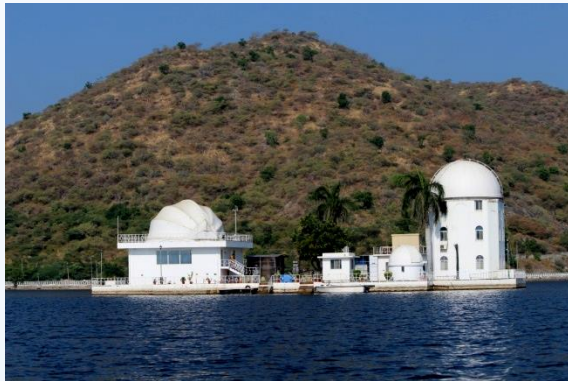
Aimed at understanding the energetics and dynamics of the Sun and near earth space environment employing state-of-the-art experiments

Major Themes relevant to ISWI

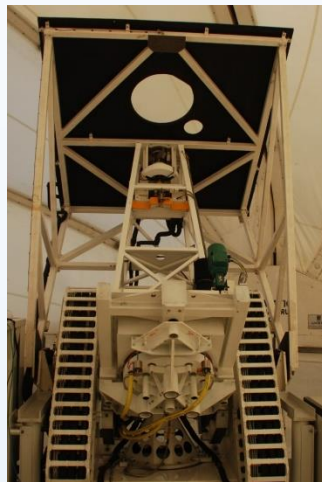
- Solar effects on the interplanetary medium
- Solar terrestrial interactions
- Earth's magnetosphere-ionosphere-thermosphere connection
- Space weather and its effects on societal applications
- Coupled thermosphere-ionosphere dynamics
- Equatorial, middle and high latitude coupling
- Vertical coupling processes: Forcing from above and below
- Topside ionospheric studies and empirical modelling
- Space weather influences on planetary atmospheres

Building space and ground based optical and radio instruments for space weather research

Multi-Application Solar Telescope: 50 cm primary mirror

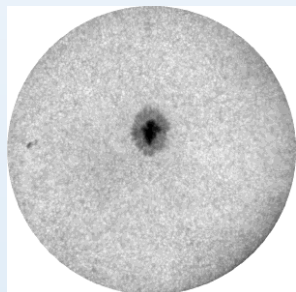


MAST became operational in June 2015. Science instruments built by USO team

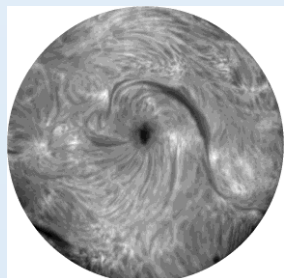


Telescope built by AMOS, Belgium

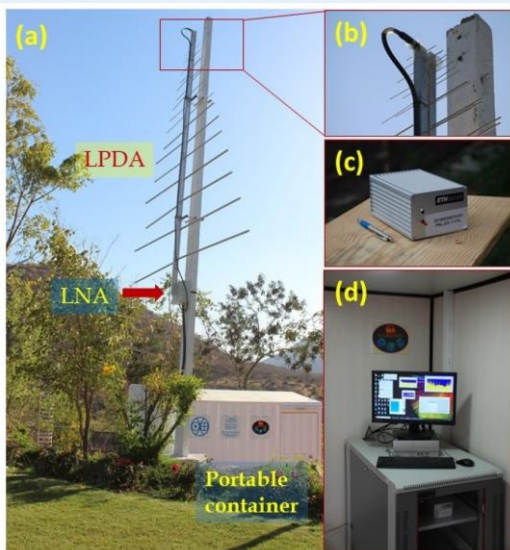
G-band (Photosphere)



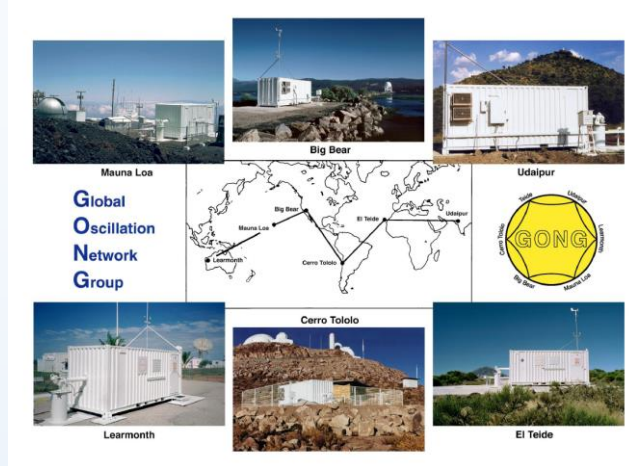
H-alpha (chromosphere)



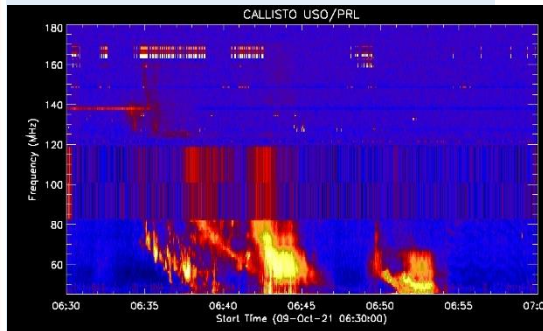
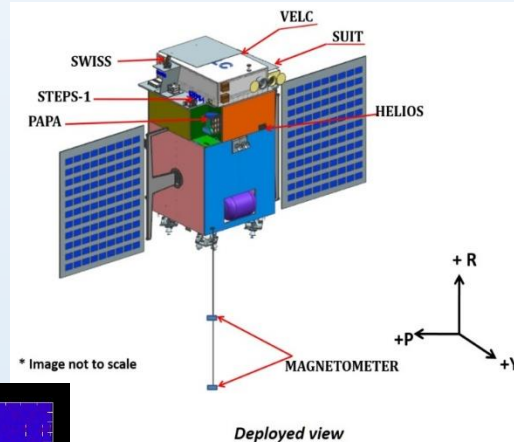
Compound Astronomical Low cost Low frequency Instrument for Spectroscopy and Transportable Observatory, Frequency range: 45.0 MHz to 870.0 MHz



GONG STATION- Six –site network for helioseismology



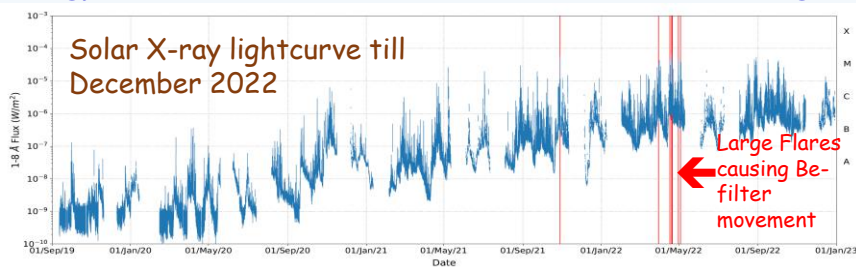
Aditya-L1 solar mission of ISRO



Space based instruments (present & planned)

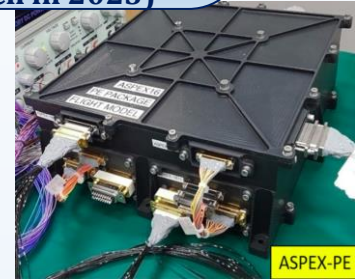
CHANDRAYAAN-2 : Second Lunar Exploration Mission (in operation)

XSM - Solar X-ray Monitor: Solar X-ray spectroscopic observations from lunar orbit
XSM operates at highest time cadence (1 s) with high energy resolution (175 eV @ 5.9 keV) in 1-15 keV range



ADITYA-L1: First Indian observatory-class space-based solar mission (scheduled for launch in 2023)

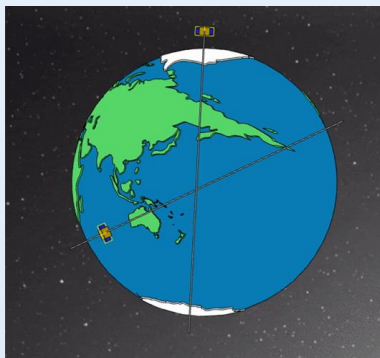
ASPEX - Aditya Solarwind & Particle Experiment: measures solar wind, suprathermal particles and solar energetic particles



ASPEX will constantly monitor heliospheric ions from solar wind, flares, CMEs etc - a step closer to space weather forecasting

Venus Orbiter Mission - First Indian mission to Venus (in pipeline)

DISHA - Disturbed and quiet time Ionosphere-thermosphere System at High Altitudes
First twin-satellite aeronomy mission from India (in pipeline): PRL is the science Lead



LP - Langmuir Probe - Measures electron densities and plasma waves
DM - Drift Meter - Measures ion drifts, major ion densities and ion temperature
AP - Airglow Photometer - Measures airglow emissions at OI 777.4 nm & OI 630.0 nm

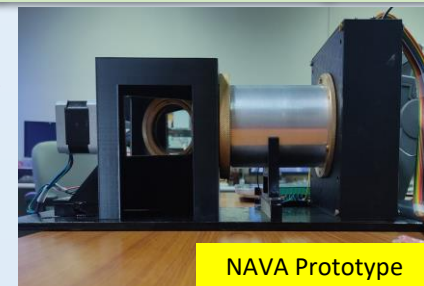
DM, LP & AP in tandem will help understand the influence of space weather on ionosphere-thermosphere system

NAVA - Narrowband Airglow detection in Venusian Atmosphere: Detects hitherto undetected OI green and red line from Venusian atmosphere

VeRad - Venus Radiation environment monitor: Measures high energy particle flux

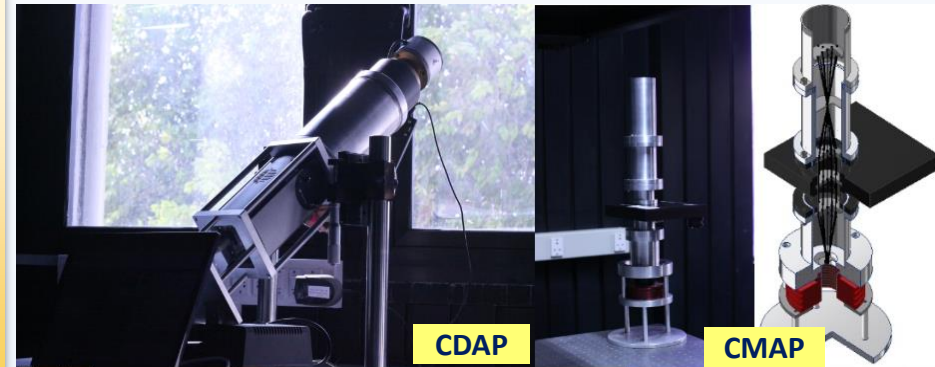
VS³ - Venus Solar Soft x-ray Spectrometer: Continuous measurements of solar X-ray in the 1–15 keV range

NAVA, VeRad and VS³ in tandem will investigate Venusian ionosphere and the impact of space weather on Venus



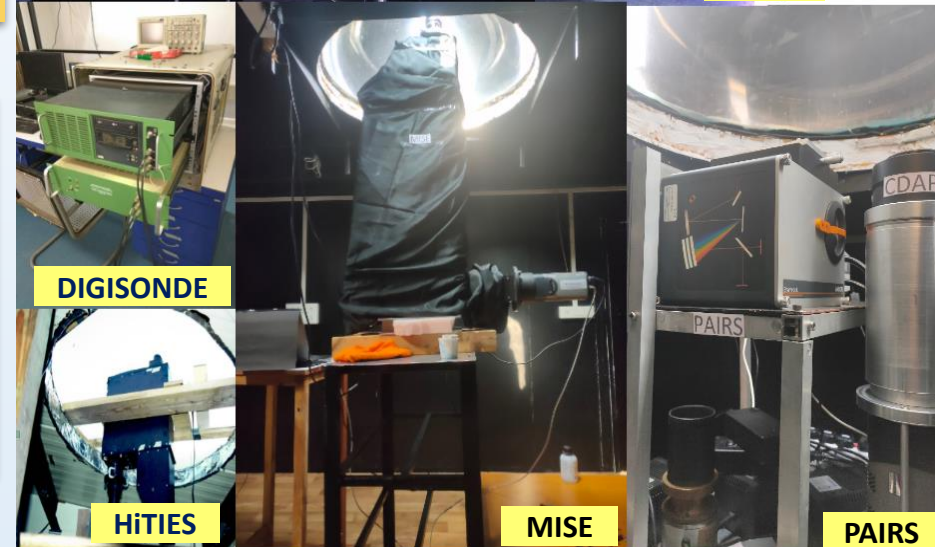
Spectrographs

- ❑ **UVIS** - UltraViolet Imaging Spectrograph
- ❑ **HiTIES** - High Throughput Imaging Echelle Spectrograph
- ❑ **MISE** - Multiwavelength Imaging Spectrograph using Echelle Grating
- ❑ **NIRIS** - Near InfraRed Imaging Spectrograph
- ❑ **PAIRS** - PRL Airglow InfraRed Spectrograph



Photometers

- ❑ **CMAP** - CCD-based Multiwavelength Airglow Photometer
- ❑ **CPMT** - CCD-based Photometer for Mesospheric Temperature
- ❑ **CDAP** - CCD-based Daytime Airglow Photometer
- ❑ **NBNFAP** - Narrow Band Narrow FOV Airglow Photometer



Imagers

- ❑ **ADIC** - Automated Digital Imaging Camera
- ❑ **SIRI** - Short wavelength InfraRed Imager
- ❑ **AI** - Airglow Imager

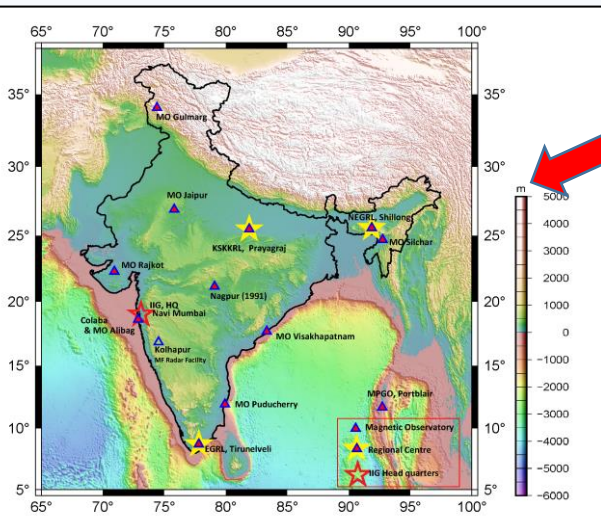
Radio

- ❑ **DIGISONDE** - Digital Ionosonde
- ❑ **GNSS/IRNSS Receivers**

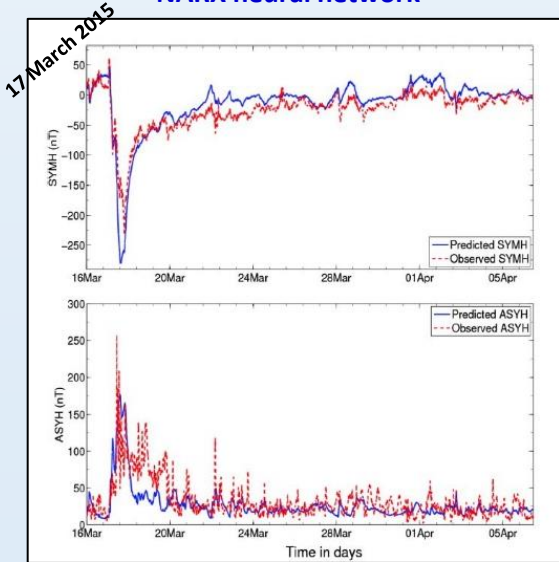
A network of GNSS receivers is being conceived to monitor the dynamics around the EIA crest



Geomagnetic Observatories of IIG



Forecasting of SYMH and ASYH indices using NARX neural network



- ✓ Indian Institute of Geomagnetism (IIG) with its network of twelve geomagnetic observatories, spread over the length and breath of the country, continuously monitor the space-environment of the Earth from various locations in near real-time.
- ✓ The interdisciplinary research program of **Space Weather: Observations and Modelling (SWOM)**, is one of the flagship programs of IIG where researchers from IIG study the inner magnetospheric dynamics, ionospheric current system, and electrodynamic and neutral dynamic coupling between high and low latitudes during geomagnetically disturbed periods.
- ✓ Geomagnetic field measurements from low latitude ground observatories are essentially used for computing the geomagnetic storm indices. Using artificial neural network, prediction of these indices are successfully achieved. The ground geomagnetic data is further used to study the prompt penetration electric fields, over-shielding, disturbance dynamo effects associated with space weather events.
- ✓ Dramatic variations in relativistic electron flux and hence the location of radiation belt are being studied using Van Allen Probes measurements.
- ✓ Efforts are being made to assimilate the available solar and interplanetary parameters along with the ground magnetic data to formulate reliable real time forecast of geomagnetic conditions.

Special Issues Organized

- **JGR-SP (2019-2020) : ISEA-15**
- **JASTP (2019-2021): VarSITI Symp.-2019 & STP-14**
- **EPS (2022-23): ISEA -16**
- **ASR (2022-23): MTI Studies (COSPAR C1.1 Sess.)**

Research Fellows

Doctoral: 5 Ongoing, 4 Completed

Post-Doctoral: 5 Ongoing, 8 Completed

Conferences organized

- **15th International Symposium on Equatorial Aeronomy (ISEA-15)**
22-26 October 2018 (200 participants from different parts of the globe)
- **First Indian Space Weather Conference (ISWC-2022),**
11-12 January 2022
180 participants (Students > 50%)
- **Short Courses on Space Weather/Upper atmosphere (CSSTEAP)**
(07-14 Dec. 2020, 04-08 Oct. 2021, 20-30 Dec., 2022)
>75 Participants from >15 countries
- **PG Course on Space and Atmospheric Sciences (UN-CSSTEAP),**
Every alternate year, (Around 15 participants from Asia-Pacific Region)

Publications
(past 5 years)
70

Professional Contributions in Space Weather Science

Prof. D. Pallamraju

- ❖ Vice-Chair, Scientific Commission C (2021-2024) of COSPAR
- ❖ Co-leader (2020-2024) for the Pillar-2 of SCOSTEP-PRESTO

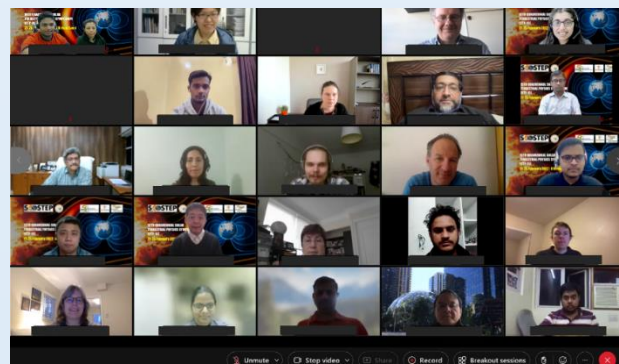
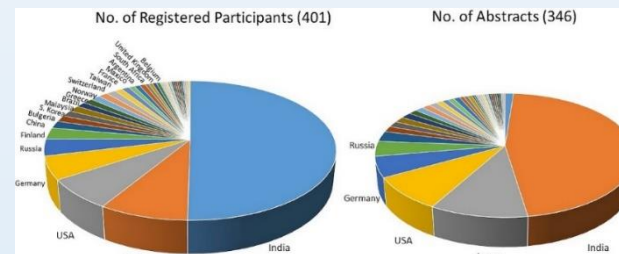
Prof. Dibyendu Chakrabarty

- ❖ Member, COSPAR Task Group on International Geospace Systems Program (TGIGSP) (2021-2025)
- ❖ Member, AGU Space Physics and Aeronomy Fellows Committee (SPAFC) (2022-2023)

Prof Nandita Srivastava

- ❖ Science Discipline Representative, SCOSTEP (2020-2024)
- ❖ National Coordinator, ISWI, 2022

15TH QUADRENNIAL SOLAR TERRESTRIAL PHYSICS SYMPOSIUM (STP-15), 21 - 25 February 2022 (IIG, Mumbai)



Session structures

- Session 1.** Overarching topics in Sun-Earth connection
- Session 2.** PRESTO Pillar 1: Sun, Planetary Space, and Geospace
- Session 3.** PRESTO Pillar 2: Space Weather and Earth's Atmosphere
- Session 4.** PRESTO Pillar 3: Solar Activity and its Influence On Climate
- Session 5.** Space Weather Prediction and Implementation
- Session 6.** Modeling, Database and Data Analysis Tools for Solar-Terrestrial Physics
- Session 7.** New ground- and space-based initiatives for Solar-Terrestrial Physics
- Session 8:** Special session on "Geomagnetism- The connecting link between Sun and Earth"



Indonesian Space Weather Activities

Dhani Herdiwijaya

Astronomy Division, Bandung Institute of Technology (ITB)

Email: dhani.herdiwijaya@gmail.com

Capacity Building

- **Courses**

Space Weather and Heliophysics courses are given at Bandung Institute of Technology (ITB), at least 60 under-graduate students/year. Some topics become undergraduate final projects, thesis, or dissertation. Collaborations are welcome.

- **International Seminars**

- The 2nd International Conference On Radioscience, Equatorial Atmospheric Science and Environment (INCREASE) 2022 on 22 – 23 November 2022 (on-line)
 - Link: <https://conference.brin.go.id/increase2022/>
 - Publication link: <https://link.springer.com/book/10.1007/978-981-19-0308-3>
- The 9th International Seminar on Aerospace Science and Technology (ISAST) 2022 on 22-23 November 2022 (on-line)
 - Link: <https://conference.brin.go.id/isast2022/>
 - Publication link: <https://iopscience.iop.org/issue/1742-6596/2214/>

- **Collaborations**

National Institute of Information and Communications Technology (NICT) Japan; Research Institute for Sustainable Humanosphere(RISH), Kyoto University, Japan; Space Environment Research Center(SERC), Kyushu University, Japan; IPS Australia (Asia Oceania Space Weather Alliances), SEALION

Space Weather Information and Forecast Services (SWIFtS)

SWIFtS officially become the 18th member of International Space Environment Service (ISES) as Regional Warning Center (RWC) Indonesia. First Space Weather Services of ISES in South East Asia. Maintained by LAPAN-BRIN

Android application



SWIFtS - LAPAN Space Weather Information Services

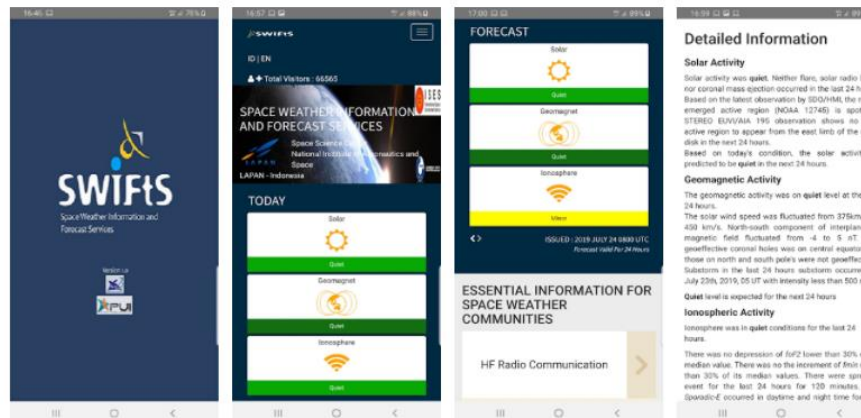
Space Science Center of LAPAN Weather



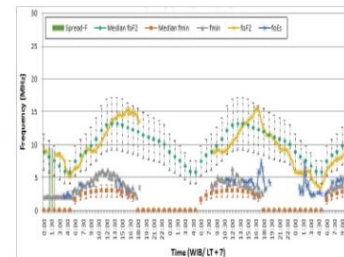
This app is available for your device

Add to wishlist

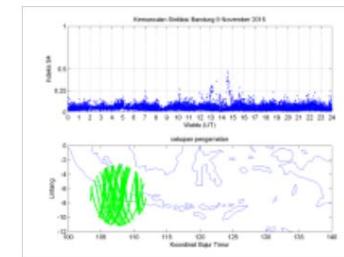
Install



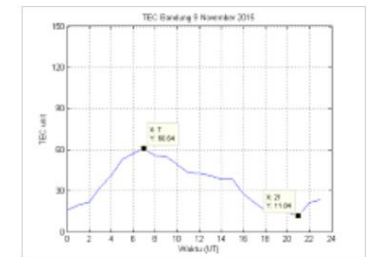
IONOSPHERE & RADIO PROPAGATION



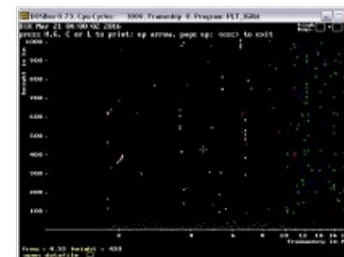
LAPAN foF2 PLOT



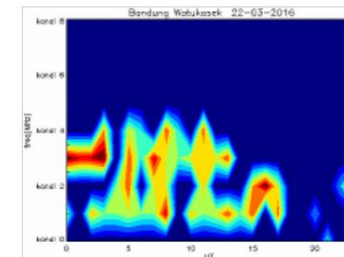
LAPAN S4



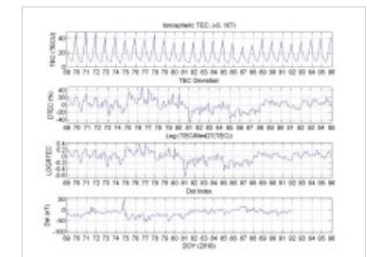
LAPAN TEC



LAPAN IONOGRAM



LAPAN ALE Channel Connectivity



LAPAN IONOSPHERIC TEC DISTURBANCE INDEX

<https://swifts.brin.go.id/>
<https://swifts.brin.go.id/deluna>

The 1st Cube Satellite

- Surya Satellite 1 (SS-1) is the first Indonesian Cubesat developed by the Surya University and other institutions (Indonesia Amateur Radio Organization (ORARI), National Research and Innovation Agency - BRIN) launched on 26 November 2022
 - http://www.surya.ac.id/content/3/90/Tentang_Surya_Satelit_1.
- The Japan Aerospace Exploration Agency (JAXA) and the United Nations Office for Outer Space Affairs (UNOOSA) have selected Surya Satellite 1 for the third round of the UNOOSA-JAXA KiboCUBE programme.
 - https://global.jaxa.jp/press/2018/09/20180918_kibocube.html
 - <https://suryasatellite1.wixsite.com/home/blog>
- KiboCUBE is an initiative that offers educational and research institutions from developing countries the opportunity to deploy cube satellites (CubeSats) from the Kibo module of the International Space Station.

The Centenary of Bosscha Observatory – Commemoration January 1923 – January 2023

Bosscha Observatory, which was inaugurated on January 1st, 1923 on the initiative of K. A. R. Bosscha with Nederlandsch-Indische Sterrenkundige Vereeniging (NISV), is the first modern astronomical observatory in Southeast Asia. With that, the science of astronomy in Indonesia started an international contribution to the development of astrophysics on the topic of stars, galaxies, the solar system, solar physics, etc.

On January 30th, 2023, Bandung Institute of Technology has commemorated the 100th anniversary of the Bosscha Observatory in collaborative spirit, to honor its contributions while also honoring all the individuals and groups who have worked with the observatory over the years. In keeping with collaborative mindset, we are developing future strategies to enhance astronomy in Indonesia and ensure that the Bosscha Observatory keeps playing significant part in the development of science and culture worldwide.

<https://www.youtube.com/watch?v=Y6DDIgNX4AA>

<https://bosscha.itb.ac.id/>



Prof. Paul Ho, Director General of East Asia Observatory

Timau National Observatory

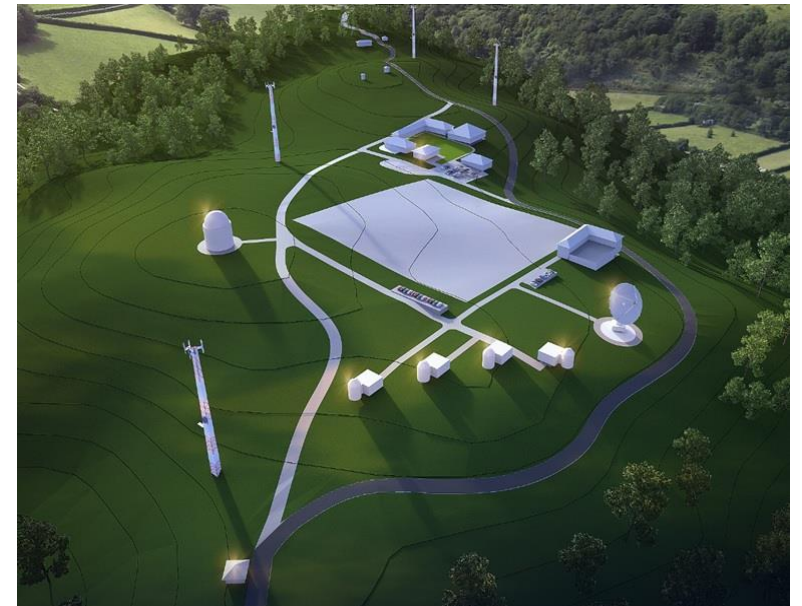
The new Observatory with 3.8m class telescope will be built at near Timau mount (1300m) in the East Nusa Tenggara by BRIN and ITB. First light will be planned in 2024-2025. Solar telescope and other instruments could be installed in the observatory.



<https://en.wikipedia.org/wiki/Indonesia>



Progress for 3.8m telescope
(BRIN)



Master Plan

Thank you

Space Weather activities in Kazakhstan

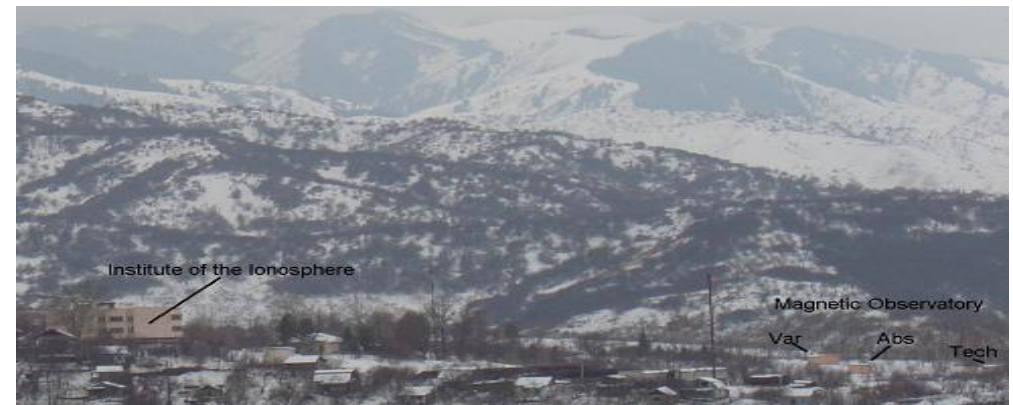
Olga Kryakunova

Institute of Ionosphere,
Almaty, Kazakhstan

E-mail: krolganik@yandex.kz

ISWI Steering Committee Meeting, 10 February, 2023

Kazakhstan multi-level complex for key space weather parameters measurements



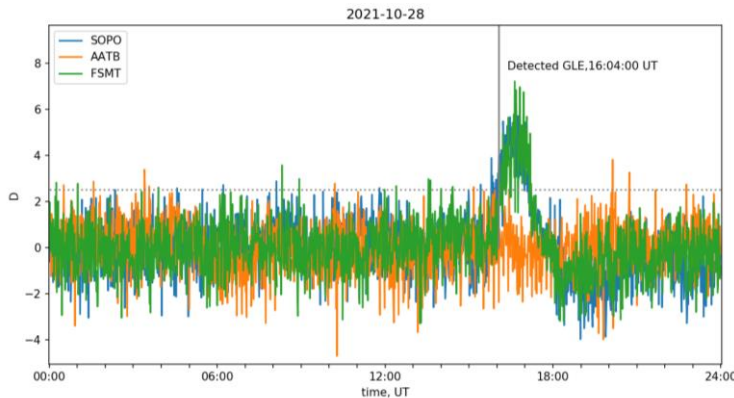
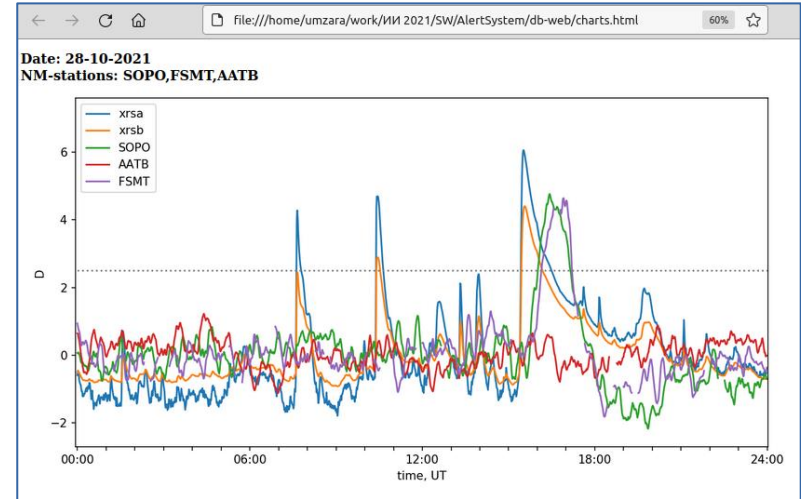
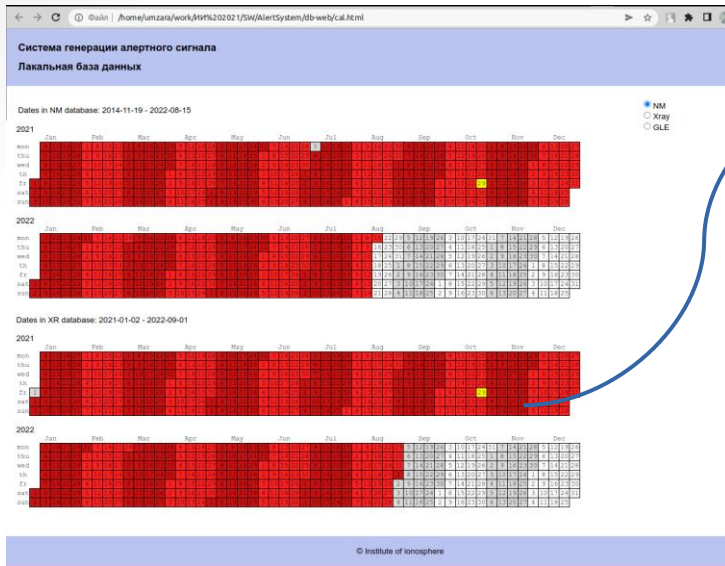
Neutron Monitor 18 NM-64 at high mountain cosmic ray station (**3340 m a.s.l.**) (www.nmdb.eu)

Geomagnetic observatory "Alma-Ata" (**1300 m a.s.l.**)

Measurements of the solar radio spectra of the Sun in the range of 40 - 800 MHz from the CALLISTO spectrometer at Almaty and the solar radio emission flux density at frequencies of 1.08 GHz and 2.8 GHz (**2700 m a.s.l.**)

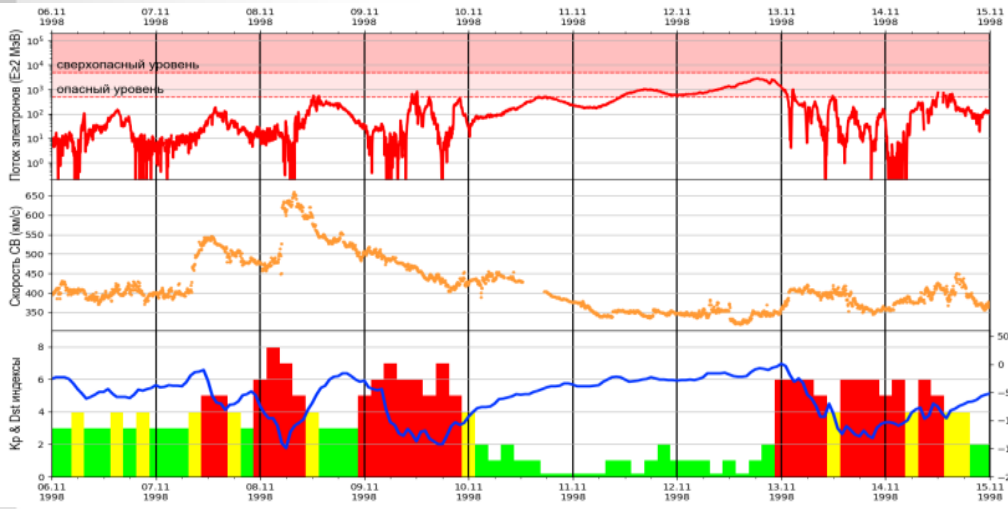
All measurements are included in a common information system that displays real-time measurements with high resolution

Development of a prototype system for generating an alert signal about the beginning of a large proton enhancement in solar cosmic rays on the Earth for warning about radiation danger in spacecraft orbits

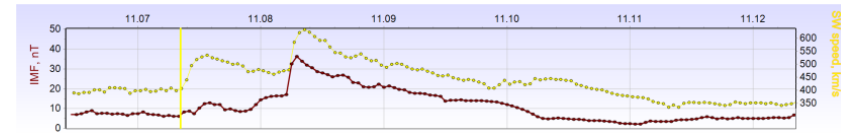
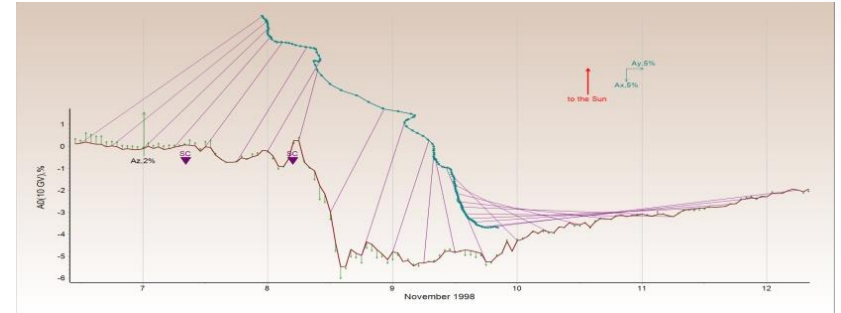


Data	Events	Results
17 May 2012	GLE № 71	Identified at 01:49 UT
10 Sep 2017	GLE № 72	Identified at 6:17 UT
29 Oct 2021	GLE № 73	Identified at 16:04 UT
27 Jan 2012	Sub-GLE	Not identified
07 Mar 2012	Sub-GLE	Not identified
06 Jan 2014	Sub-GLE	Not identified
29 Oct 2015	Sub-GLE	Not identified
07 Jun 2015	ACRE	Identified at 10:10 UT
26 Aug 2018	ACRE	Identified at 15:54 UT

The features of the behavior of the density and vector anisotropy of galactic cosmic rays according to the data of the worldwide network of neutron monitors, before and during electron enhancements

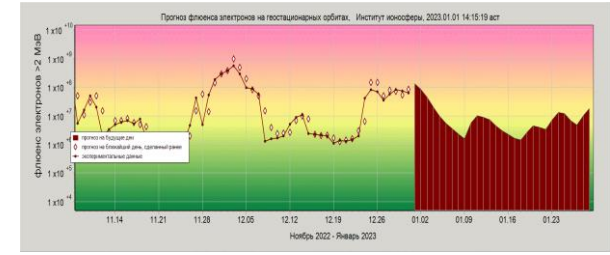
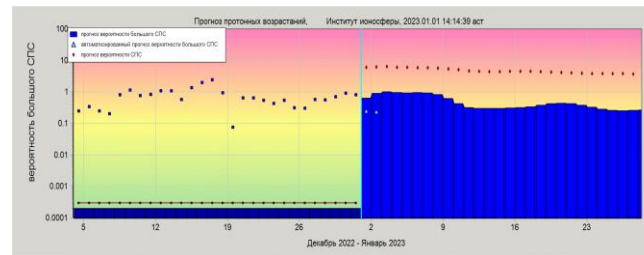
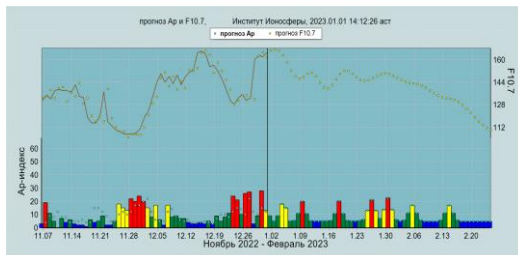
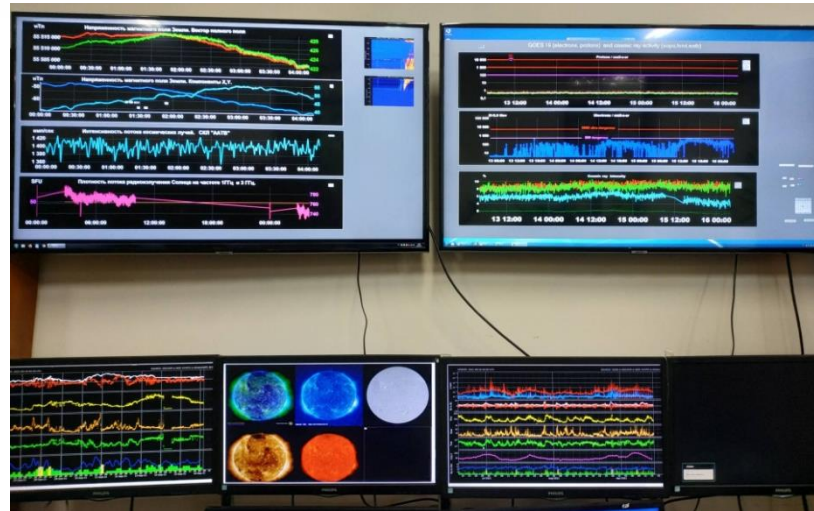


The enhancement of magnetospheric electrons and the state of the interplanetary medium on November 6-12, 1998



The event of a dangerous enhancement in magnetospheric electrons on November 11-12, 1998 is associated with the influence on near-Earth space of a coronal mass ejection from a solar flare that occurred on November 4, 1998 at 07:13 UTC and a coronal mass ejection from the disappearance of the solar filament.

KAZAKHSTAN SPACE WEATHER PREDICTION CENTER



Kazakhstan Space Weather Prediction Center works daily. We issue the short-term and long-term forecasts of the magnetic activities (Ap-indexes) and solar activity (F10.7) for 55 days, the forecast of probability of a large proton enhancement for 28 days and the forecast of fluence of magnetospheric electrons with energy > 2 MeV at geostationary orbit for 28 days. We provide this information to all interested organizations in Kazakhstan.

NEW scientific and technical program

NEW scientific and technical program “Development of the National System for Space Situational Awareness: Monitoring of Near-Earth and Deep Space and Space Weather” (2021-2023)

The participants of the program are: Fesenkov Astrophysical Institute and the Institute of Ionosphere.

The goal of the Program

Development of the means for near-Earth and deep space observations. Development of the Space Situational Awareness (SSA) system to monitor the situation in the NES and beyond, identify and predict situations that pose a threat to the operation of spacecraft.

Key indicator of the Program:

- a) Space Situational Awareness System (SSA);
- b) Wide-angle optical system;
- c) Methods and technologies for monitoring near-space objects;
- d) Low and medium resolution spectrograph for spectral and spectrophotometric observations of extremely dim objects with fast spectral variability;
- e) Methods of space weather diagnostics and forecasting;
- f) Online resource for providing access to SSA data for clients.

Near future and perspectives

- Installation of new instruments, including instruments of our partners
- Widening international collaboration in SSA segment
- Integration into world-wide near-Earth space safety programs, SSA and asteroid defense programs

Our recent publication

- ✓ Kryakunova O.N., et al. Average characteristics of high-energy magnetospheric electron flux enhancements and the parameters of near-Earth and interplanetary medium in 1987-2021. *Monthly Notices of the Royal Astronomical Society*, stac2382 (Q1)
- ✓ Kryakunova O.N., et al. A statistical relationship between the fluence of magnetospheric relativistic electrons and interplanetary and geomagnetic characteristics. *Advances in Space Research* (Q2).
- ✓ Kryakunova O.N., et al. Relationship between the Fluence of Magnetospheric Electrons with Energies above 2 MeV and Geomagnetic and Interplanetary Characteristics in 1987–2021. *Bull. Russ. Acad. Sci. Phys.* 86, 1532–1536 (2022)

Recent Research Progress in Space Weather in Nepal



Dr. Narayan P. Chapagain

Professor

Department of Physics

Amrit Campus, Tribhuvan University

Kathmandu, Nepal

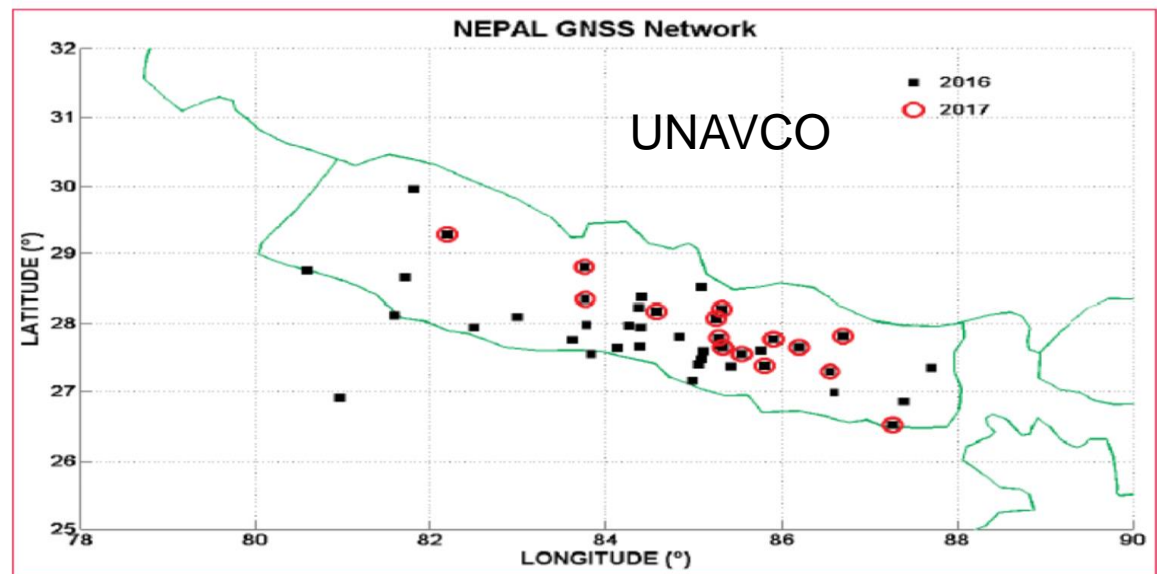
Workshop on Space Weather and Upper Atmosphere Physics (WSWUAP) Kathmandu, Nepal, September 23-27, 2019



Jointly organized by the Department of Physics, Amrit Campus, Tribhuvan University, Kathmandu, Nepal and The Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy

GPS Network in Nepal

- Recently, GNSS is Deployed in Western Regional Campus, Pokhara, Nepal



International Conference on Frontiers of Physics – 2022 (e-Conference)

January 22-24, 2022

24 Research Papers in Space Physics

Plenary Speakers in Space Physics

Dr. Bruce Tsurutani Jet propulsion Laboratory, NASA, USA
Space Weather: A New/Old Plasma Physics Science

Dr. Kazuo Shiokawa, Nagoya University, Japan
Current Outstanding Scientific Topics in the Solar-Terrestrial Physics

Dr. Christine-Amory, Université Pierre et Marie Curie, France
Sun-Earth System And Space Weather: An Historical Approach

Dr. Jason Jackiewicz, New Mexico State University. New Mexico, USA
Seismology of the Sun, Stars, and Giant Planets

Establishment of CORS Station at Pokhara



CORS Receiver: PolaRx5
Capable to receive all GNSS signals in all frequencies
Data from this receiver is available for R&D

GNSS training workshop has been conducted in collaboration with

- International Committee on GNSS (ICG)
- Center for Spatial Information Science (CSIS), The University of Tokyo
- University Grants Commission (UGC), Nepal



Dr. Krishna Adhikari
-3 MSc students working on this data

Research Group in Space Physics in Nepal



Dr. Narayan Prasad Chapagain
Professor of Physics, TU,
Kathmandu, Nepal



Dr. Binod Adhikari
St. Xaviers' College,
Kathmandu, Nepal

4 PhD Scholars



Dr. Drabindra Pandit
(Graduated, May 2022)



Basudev Ghimire



Hari Bahadur KC



Suresh Poudel

27 MSc Students did their Thesis in Space Physics

Collaborators



**Dr. Christine Amory-
Mazaudier**
Senior Scientist
Université Pierre et Marie
Curie, France



**Dr. Yenca Migoya-
Orue**
Abdus Salam Internal
Center For Theoretical
Physics (ICTP)
Trieste, Italy

Publications in 2022



Research Article - Atmospheric & Space Sciences | [Published: 11 February 2022](#)

Annual and semi-annual variations of TEC over Nepal during the period of 2007–2017 and possible drivers

[Basu Dev Ghimire](#) , [Bibek Gautam](#), [Narayan P. Chapagain](#) & [Karan Bhatta](#)

[Acta Geophysica](#) **70**, 929–942 (2022) | [Cite this article](#)



[Published: 21 September 2022](#)

Ionospheric Anomalies Due to Nepal Earthquake-2015 as Observed from GPS-TEC Data

[Basu Dev Ghimire](#)  & [Narayan P. Chapagain](#)

[Geomagnetism and Aeronomy](#) **62**, 460–473 (2022) | [Cite this article](#)

GPS Observations of Ionospheric TEC Variations Over Nepal During 22 July 2009 Solar Eclipse

EUREKA: Physics and Engineering, (2), 3–14, 2022. doi: <https://doi.org/10.21303/2461-4262.2022.002340>

12 Pages • Posted: 23 Apr 2022

Publications in 2022



Original Paper | [Published: 23 August 2022](#)

VTEC observations of intense geomagnetic storms above Nepal: comparison with satellite data, CODE and IGSG models

[D. Pandit](#) , [C. Amory-Mazaudier](#), [R. Fleury](#), [N. P. Chapagain](#) & [B. Adhikari](#)

[Indian Journal of Physics](#) (2022) | [Cite this article](#)



Original Article | [Published: 19 April 2022](#)

A study of vTEC above Nepal exploring different calibration techniques, including a comparison with the NeQuick-2 model

[P. Poudel](#), [A. Silwal](#), [B. D. Ghimire](#) , [S. P. Gautam](#), [M. Karki](#), [N. P. Chapagain](#), [B. Adhikari](#), [D. Pandit](#) & [C. Amory-Mazaudier](#)

[Astrophysics and Space Science](#) **367**, Article number: 41 (2022) | [Cite this article](#)

[Journals & Magazines](#) > [Radio Science](#) > [Volume: 57 Issue: 5](#) 

Ionospheric signatures during G2, G3 and G4 storms in mid-latitude

Publisher: **AGU**

[Cite This](#)

 [PDF](#)

[Subodh Dahal](#) ; [Binod Adhikari](#) ; [Anil Kumar Khadka](#) ; [Ashok Silwal](#) ; [Suresh Prasad Gupta](#) ; [Narayan Prasad Chapagain](#) **All Authors**

Publications in 2022

Study of Solar Wind and Interplanetary Magnetic Field Features Associated with Geomagnetic Storms: The Cross Wavelet Approach

SOLAR SYSTEM PHYSICS

 **Sujan Prasad Gautam** , **Ashok Silwal**  , **Prakash Poudel** , **Monika Karki**, **Binod Adhikari** , **Narayan P. Chapagain**

 Springer Link

Published: 07 June 2022

Tracking IMF Fluctuations Nearby Sun Using Wavelet Analysis: Parker Solar Probe First Encounter Data

[S. P. Gautam](#), [A. Silwal](#) , [A. Bashyal](#), [K. Chaudhary](#), [M. Khanal](#), [B. Ale](#), [B. Adhikari](#), [P. Poudel](#), [M. Karki](#) & [N. P. Chapagain](#)

Advances in Meteorology

Journal overview 

For authors

For reviewers

For editors

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Abstract

Introduction

Materials and Methods

Estimation of Solar Insolation and Angstrom–Prescott Coefficients Using Sunshine Hours over Nepal

U. Joshi  ^{1,2}, **P.M. Shrestha**¹, **S. Maharjan**³, **A. Bhattarai** ⁴, **N. Bhattarai**⁴, **N.P. Chapagain**⁵, **I.B. Karki**^{1,6} and **K.N. Poudyal**⁷

Publications in 2022

DOWNLOAD PDF



14 VIEWS



1 DOWNLOAD



Variation of Solar Wind Parameters and Total Electron Content from Indian, Australian, Brazilian and South African Sectors during the Intense Geomagnetic Storms

SOLAR SYSTEM PHYSICS



Binod ADHIKARI , **Roshan Kumar Mishra**, **Narayan P. Chapagain**, **Rabin Baral**, **Priyanka Kumari Das**, **Virginia Klausner** , **Manisha Sharma**

Springer Link

Original article | [Published: 12 August 2021](#)

Estimation of daily solar radiation flux at Western Highland, Simikot, Nepal using RadEst 3.0 software

[Usha Joshi](#) , [N. P. Chapagain](#), [I. B. Karki](#), [P. M. Shrestha](#) & [K. N. Poudyal](#)

[International Journal of System Assurance Engineering and Management](#) **13**, 318–327 (2022) | [Cite this article](#)

Space Weather Activities in Pakistan

ISWI Steering Committee Annual Meeting
February 11, 2022

Presented By:

Dr. Najam Abbas Naqvi

National Coordinator - ISWI

Chairman - National Center of GIS & Space Applications

Head of Space Science Department

Institute of Space Technology, Islamabad



SEQUENCE OF PRESENTATION

1. GNSS Winter School 2022
2. Space Weather Monitoring/Modelling
3. Establishment of GISTM Station
4. Academic Research Outputs

GNSS WINTER SCHOOL 2022

SPACE WEATHER AND APPLICATIONS

1. Conducted at Institute of Space Technology, Islamabad from **October 19 – 21, 2022**
2. **3-day school** targeted at Space Weather & Applications through GNSS for Students & Professionals
3. Participants: International & National Students and Professionals from Public & Private Sector Organizations
4. Participant Countries: **Pakistan, China and UK**



GNSS Winter School
Space Weather & Applications
Institute of Space Technology, Islamabad
October 19 – 21, 2022

KEY TOPICS

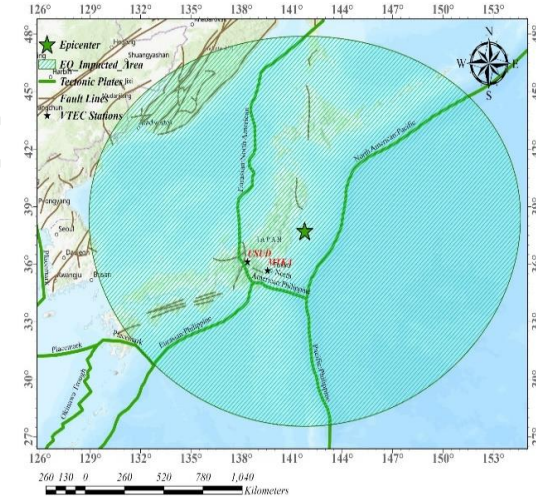
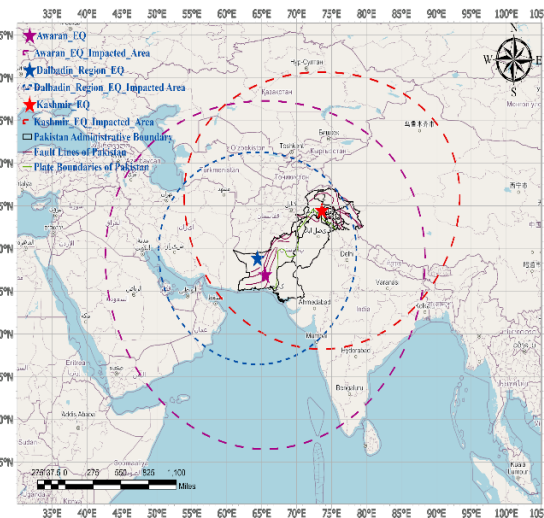
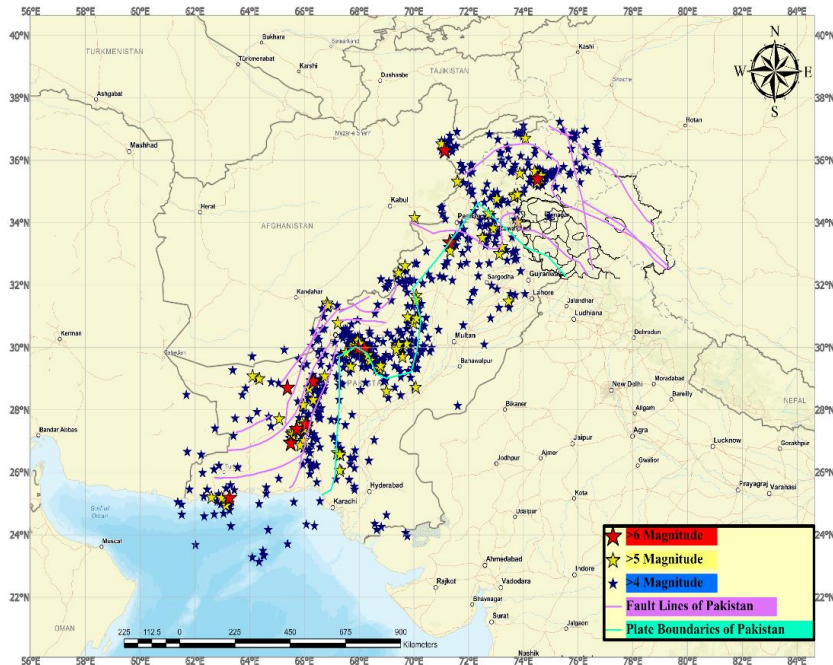
• Introduction to GNSS & Space Weather
• Solar Physics & Solar Effects
• Sun Earth Connection
• Geomagnetic Drivers & Indices
• Magnetosphere- Ionosphere- Thermosphere Coupling
• Space Weather Instrumentation and Data Acquisition
• Ionosphere Irregularities, Monitoring & Modeling Through GNSS
• Lithosphere, Ionosphere & Atmosphere Coupling
• Earthquake Monitoring Using GNSS & Space Weather

GNSS & Space Education Research Lab
 National Center of GIS & Space Applications
 Institute of Space Technology, Pakistan
 051-9075799 | ncsa@ist.edu.pk | www.ncgsa.org.pk



SPACE WEATHER MONITORING/MODELLING

1. Research on multiple Natural Disasters including Earthquakes and Geomagnetic Storms were studied to measure the severity of these events using Space Weather Monitoring through GNSS
2. An earthquake portal for Pakistan has been developed



ESTABLISHMENT OF GISTM STATION

GNSS Ionospheric Scintillation and TEC Monitoring Reference Receiver has been commissioned at Institute of Space Technology, Islamabad for continuous monitoring of Ionosphere

1. Real time output of TEC & scintillation indices
2. 100Hz code, phase and intensity output
3. Signal tracking across the full GNSS spectrum, multi-frequency, multi-constellation
4. High-precision geodetic full GNSS spectrum choke ring antenna



Septentrio PolaRx5



Septentrio PolaNt Choke Ring antenna

ACADEMIC RESEARCH OUTPUTS

Graduate Research Thesis Completed (MS GNSS at Institute of Space Technology)

Sr. No.	Title of Thesis
1	Investigation of the Possible Ionospheric Anomalies Coupling associated with the Earthquakes in Pakistan from Machine Learning Procedures
2	Investigation of seismo ionospheric anomalies associated with the Mw 6.7 Mongolia Earthquake
3	GNSS TEC Based Ionospheric Anomalies Related to The 2019 Mw 6.2 Thailand Earthquake
4	Atmospheric Anaomalies Due to Seismic Stress using GNSS and Remote Sensing
5	Statistical Analysis of GPS TEC Anomalies Associated With Earthquakes And a Case Study Of Mw>7 Earthquakes In Japan
6	Multi-Parametric Approach to Investigate the Pre-Seismic Anomalies of Mw>6.0 using GNSS and Remote Sensing Satellites: A Case Study of Four Earthquakes from Mid Latitude Regions
7	Ionospheric Anomalies Detected by GPS TEC Measurement and Swarm Satellite during an Earth of Magnitude 6.5 in Sumatra, Indonesia



ACADEMIC RESEARCH OUTPUTS

Graduate Research Thesis Completed

Sr. No.	Title of Thesis
8	Comparison of VTEC from GIS and IRI Models and its Validation by Wavelet Correlation During the 2019-2020 Solar Minimum Phase
9	Integrated Analysis of Lithosphere-Ionospheric Coupling Associated with The 2021 Mw 7.2 Haiti Earthquake from Multiple Satellites
10	Swarm Satellite Based GNSS Ionospheric Data Analysis for Earthquakes Prediction
11	Deep Machine Learning based possible Atmospheric and Ionospheric Precursors of the 2021 Mw 7.1 Japan Earthquake


Research Publications

Sr. No.	Title of Paper	Journal
1	Wavelet analysis based VTEC variability over mid-latitude region Sukkur, Pakistan and its comparison with IRI models during 2019-2020	Natural and Applied Sciences International Journal
2	Atmospheric Anomalies Associated with the 2021 Mw 7.2 Haiti Earthquake Using Machine Learning from Multiple Satellites	Sustainability
3	Possible seismo-ionospheric anomalies associated with the 2016 Mw 6.5 Indonesia earthquake from GPS TEC and SWARM satellites	Frontiers in Astronomy and Space Sciences




Thank you!

 National Center of GIS & Space Applications,
Institute of Space Technology, Pakistan

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 najam@mail.ist.edu.pk

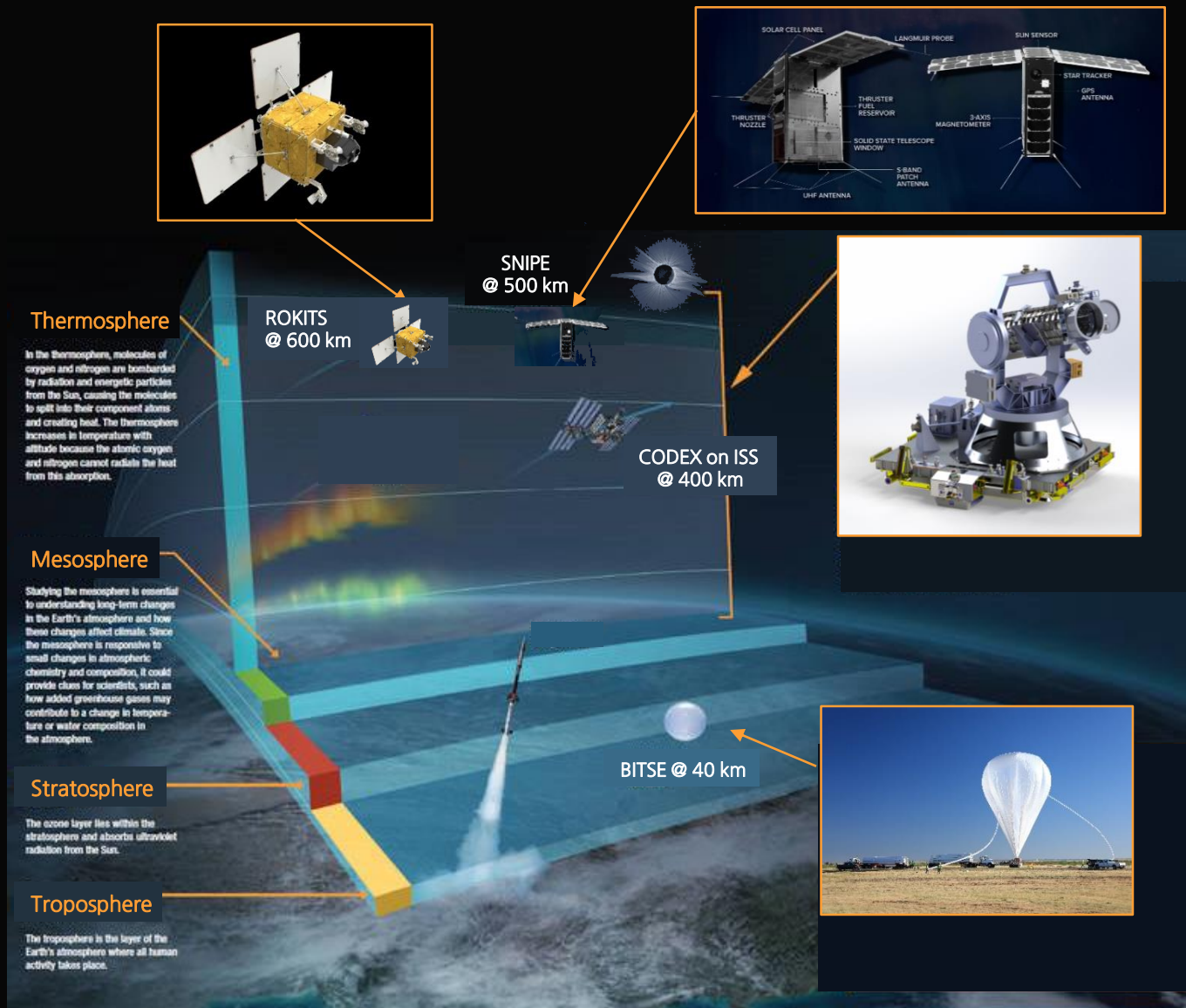
 ist.edu.pk | ncgsa.org.pk

KASI activities for solar and space weather



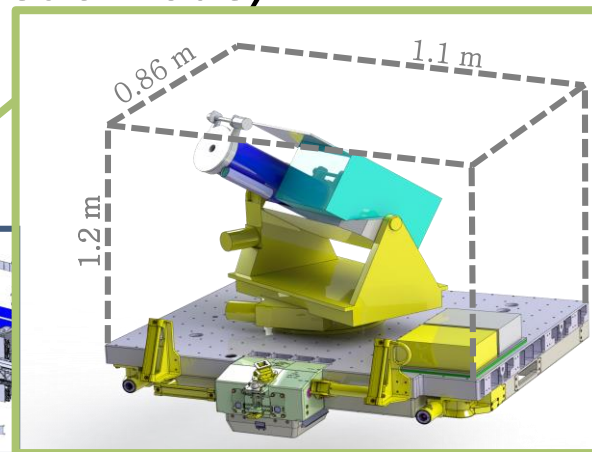
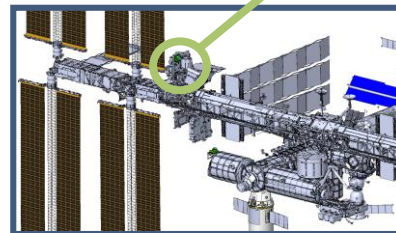
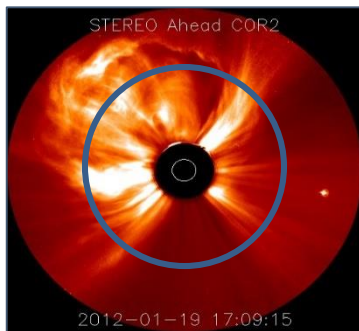
Kyung-Suk Cho (kscho@kasi.re.kr)
 Korea Astronomy & Space Science Institute (KASI)

On-going Project : Space-based observations



Toward Next-Generation Solar Coronagraph

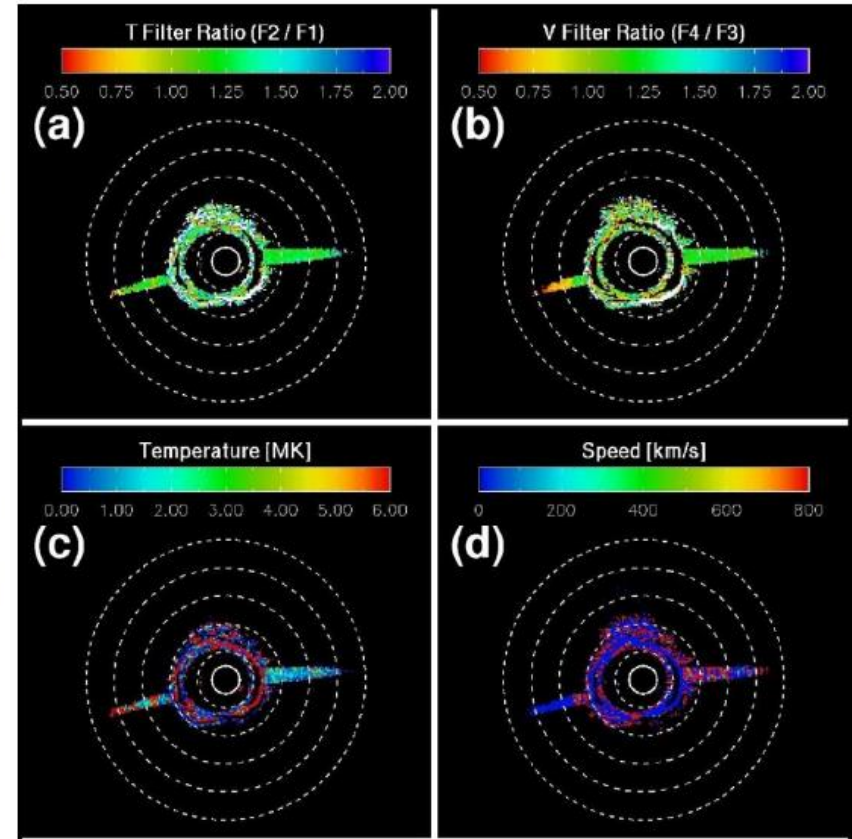
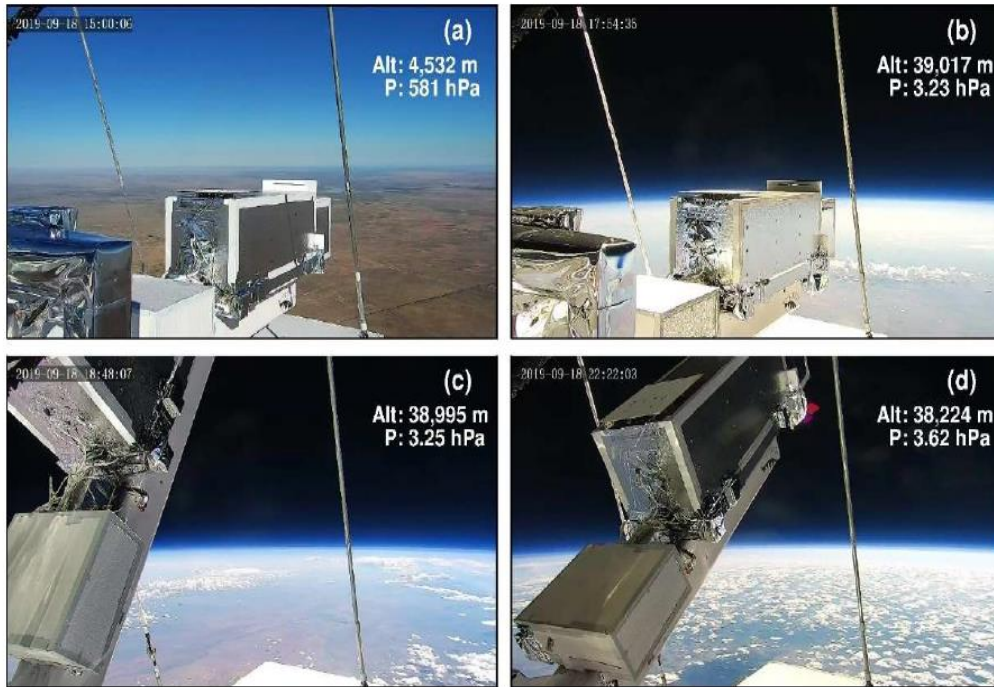
- Coronagraph on the International Space Station
- Joint development with KASI (Main Electronics & Camera) and NASA (Manage & Optical/Mechanical assemblies)
- DICE (2017)-> BITSE (2019)-> CODEX (2023)
- Wavelength: 3934 Å / 4025 Å (Temperature)
3990 Å / 4249 Å (Velocity)
- FoV: 2.5 – 15 Rs, Time cadence: 15 sec (Dynamic mode)
- Solar Corona Density, Velocity and Temperature from 2.5 – 8 Rs
- Time cadence: 90 min (Diagnostic mode)



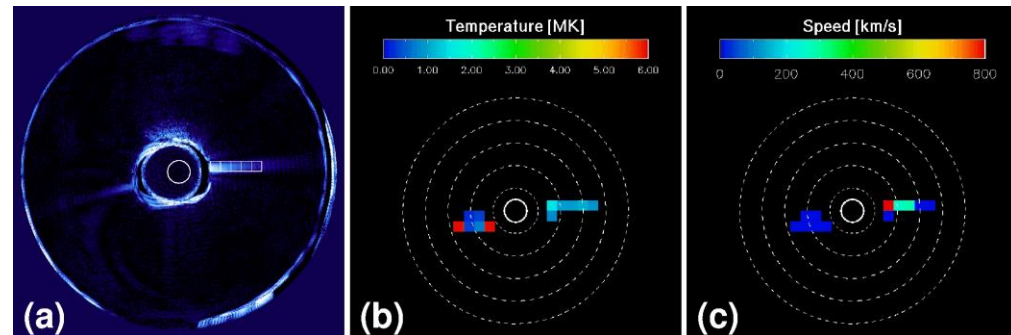
DICE: Diagnostic Coronagraph Experiment, CODEX: Coronal Diagnostic Experiment

BITSE: Balloon-Borne Investigation of Temperature and Speed of Electrons in the Corona

BITSE First Images (Sep. 18, 2019)



“We obtained a temperature of $\approx 1.0 \pm 0.3$ MK and a flow speed of ≈ 260 km s⁻¹ with a large uncertainty interval.” (Gopalswamy et al., 2021, Solar Physics)

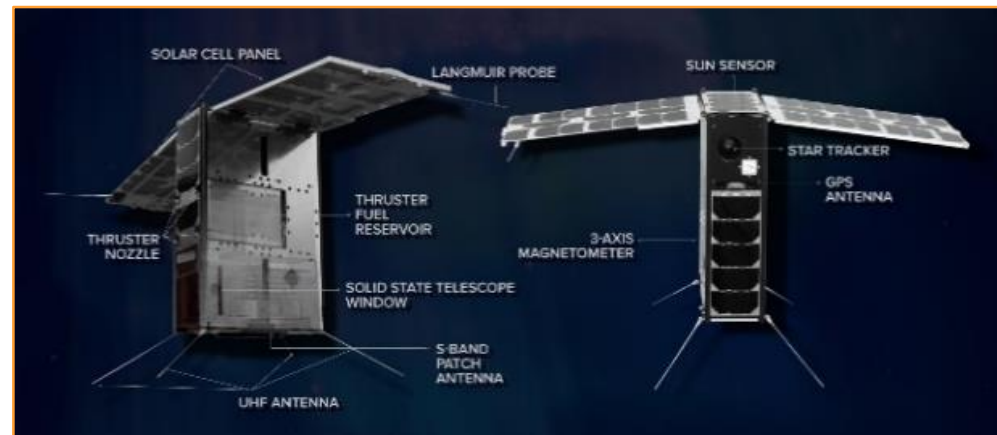


SNIFE (Small scale magNetospheric and Ionospheric Plasma Experiment)

- Constellation of **four 6U CubeSats** (~10 kg for each satellite)
- **Formation Flying** (Slow separation from 10 km to >100 km for 6 months~1 year)
- Scientific Instruments: **Langmuir Probe, Solid State Particle Detector, Magnetometer**
- Orbit: ~500 km, **Sun Synchronous** Launch: by Nuri at Korea in 2023

Science Targets

- Spatial scale and energy dispersion of **electron microbursts**
- Measuring the length of coherence for Ionospheric **bubbles/blobs**
- Temporal and spatial variations of electron density & temperature in **polar cap patches**



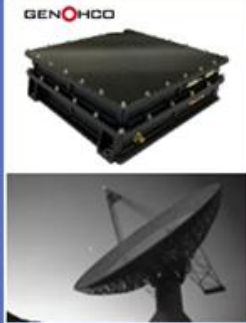
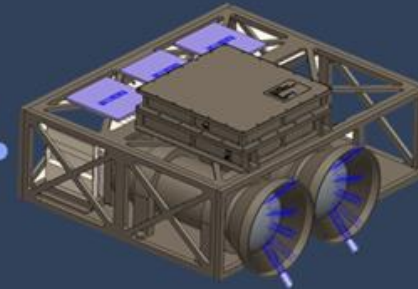
ROKITS – Republic Of Korea Imaging Test System

ROKITS개요



우주관측기술

1. NASA와 공동 개발로 우주 관측용 탑재체의 핵심 기술인 이미징 카메라, 비행/지상 SW 기술 확보
2. X-band 고속 데이터 송신 기술: 차중 1호 헤리티지를 가진 (췌제노코 개발)
3. 정밀 관측을 위한 협대역 필터: 미국 Alluxa 제작



X-band 고속 데이터 송신기 (TRL9)



비행 소프트웨어/지상 소프트웨어 (TRL7)



협대역 필터 (TRL9)

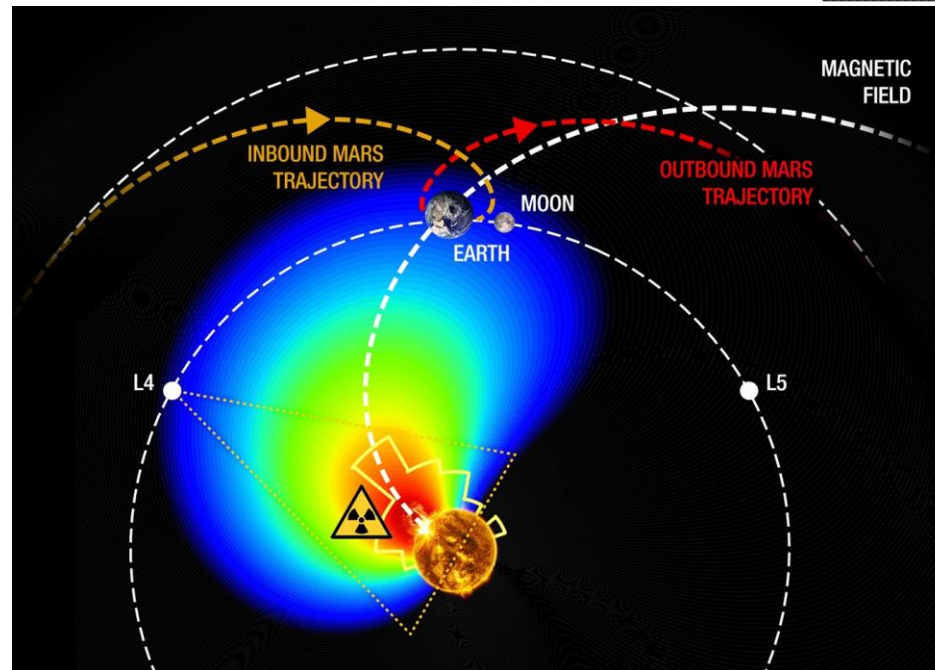


OBC/Camera (TRL7)

Payload Overview

- Wide-field airglow imager for ionosphere/upper atmospheric study
- In progress under 'Compact Advanced Satellite 500 (CAS500) - 3' program
- Collaboration with JHU/APL

Future Plan: Sun-Earth L4 Mission



- L4 is a meta-stable locations at 1 au and the best location for a solar remote sensing observatory that would oversee the entire solar radiation hemisphere.
- The Unusual Attribute of L4 is that it Covers entire “Solar Radiation Hemisphere” that is relevant for Lunar and Mars Exploration
- KASI selected a planning study for the L4 mission as a part of internal projects to investigate national space technology for international collaboration

KASI

Thanks for your attention!

감사합니다

