

CURRICULUM VITAE

Name: Sumanta Sarkhel, *Ph.D.* (*h-index: 10*)

Scopus Author ID: 22981859800

Google Scholar Citation Page: <https://scholar.google.com/citations?user=UotPqsMAAAAJ&hl=en>

ResearchGate Profile: https://www.researchgate.net/profile/Sumanta_Sarkhel

ORCID iD: <https://orcid.org/0000-0001-5980-2612>

Institute Profile: https://www.iitr.ac.in/~PH/Sumanta_Sarkhel

Our Research Group Webpage: <https://allsky.iitr.ac.in>

Present Position: *Associate Professor* in the Department of Physics and Joint Faculty in the Centre for Space Science and Technology, Indian Institute of Technology Roorkee, India

Address for Correspondence

Present Address

Sumanta Sarkhel
Department of Physics
Indian Institute of Technology Roorkee
Roorkee – 247667
Uttarakhand
INDIA

Email: sarkhel@ph.iitr.ac.in
sumantasarkhel@gmail.com

Phone: +91-1332-284817

Permanent Address

Sumanta Sarkhel
Gurupalli (South)
Santiniketan – 731235
West Bengal
INDIA

Personal Data

Nationality: Indian

Gender: Male

Place of Birth: Santiniketan, India

Date of Birth: 13 January 1982

Academic Records

<i>Degree</i>	<i>University/Institute</i>	<i>Year</i>	<i>Marks</i>	<i>Subjects</i>
<i>Ph.D.</i>	Physical Research Laboratory, Ahmedabad, India (<i>Degree Awarded by Mohan Lal Sukhadia University, Udaipur, India</i>)	2011	—	<i>Science with specialization in Atmospheric and Space Physics</i>
<i>M.Sc.</i>	Visva-Bharati, Santiniketan, India	2005	65.72 %	<i>Physics with specialization in Particle Physics</i>
<i>B.Sc. (Hons.)</i>	Visva-Bharati, Santiniketan, India	2003	75.70 %	<i>Physics with Mathematics and Chemistry</i>

Additional Academic Qualifications (National Level)

- JEST (Joint Entrance Screening Test) (2005) Percentile: 96.87%, All India Rank: 148.
- NET (National Eligibility Test) (CSIR JRF) (June-2005), Jointly conducted by CSIR-UGC (Council of Scientific and Industrial Research and University Grants Commission).
- GATE (Graduate Aptitude Test in Engineering) (2005), Percentile: 91.87%, All India Rank: 290.
- JEST (2006), Percentile: 95.46%, All India Rank: 125.

Academic Pursuit

DOCTORAL STUDENT: August, 2005–October, 2010 at Space and Atmospheric Sciences Division, Physical Research Laboratory, Ahmedabad, India

THESIS TITLE: **Upper Atmospheric Investigations using Radio and Optical Techniques**

THESIS SUPERVISOR: **Prof. Ramanathan Sekar**

SUBMISSION DATE: **13 October 2010**

AWARD DATE: **09 April 2011**

Research Experience

- Post doctoral fellow working with **Prof. Ramanathan Sekar** at Space and Atmospheric Sciences Division, **Physical Research Laboratory, Ahmedabad, India (October, 2010–May, 2011)**.
- Post doctoral fellow working with **Prof. John D. Mathews** at **The Pennsylvania State University, Pennsylvania, USA** and visiting scientist at **Arecibo Observatory, Arecibo, Puerto Rico, USA (May, 2011–August, 2013)**.
- Research Associate at **The Pennsylvania State University, Pennsylvania, USA** and visiting scientist at **Arecibo Observatory, Arecibo, Puerto Rico, USA (August, 2013–February, 2014)**.
- Post doctoral Researcher working with **Dr. Jeong-Han Kim** and **Dr. Geonhwa Jee** at **Korea Polar Research Institute, South Korea (April, 2014–June, 2014)**.
- Visiting Scientist working with **Prof. Jorge L. Chau** at **Leibniz-Institute of Atmospheric Physics (IAP), Germany (May–June, 2017)**.
- Assistant Professor, **Indian Institute of Technology Roorkee, Roorkee, India (August, 2014–March, 2021)**.
- Associate Professor, **Indian Institute of Technology Roorkee, Roorkee, India (March, 2021–Present)**.

Professional Activities

Editorial Assignments:

- Guest Associate Editor in *Frontiers in Astronomy and Space Sciences* (January, 2023–Present)

Reviewer Assignments (in SCI indexed journals):

- Advances in Space Research
- Annales Geophysicae
- Atmosphere
- Atmospheric Chemistry and Physics
- Earth, Planets and Space
- Journal of Atmospheric and Solar-Terrestrial Physics
- Journal of Geophysical Research – Atmospheres

- Journal of Geophysical Research – Space Physics
- Meteorology and Atmospheric Physics
- Space Weather

Memberships

- Life Member in *Astronomical Society of India*.
- Life Member in *Indian Planetary Science Association*.

Teaching Experience

- **Plasma Physics**, Integrated M.Sc. (3rd Year), Autumn Semester 2014-15 & 2015-16 in **IIT Roorkee, India**.
- **Electromagnetic Theory**, B.Tech. (1st Year), Spring Semester 2014-15 & 2017-18 in **IIT Roorkee, India**.
- **Space Science and Technology**, B.Tech. (3rd Year), Spring Semester 2015-16 & 2016-17 and Autumn Semester 2022-23 in **IIT Roorkee, India**.
- **Mechanics**, B.Tech. (1st Year), Autumn Semester 2016-17 & 2017-18 in **IIT Roorkee, India**.
- **Advanced Atmospheric Physics**, M.Sc. (2nd Year), Integrated M.Sc. (5th Year) & B.Tech. (4th Year), Autumn Semester 2018-19 & 2019-20 in **IIT Roorkee, India**.
- **Weather Forecasting**, M.Sc. (2nd Year) & Integrated M.Sc. (5th Year), & B.Tech. (4th Year), Spring Semester 2018-19, 2019-20, 2020-21 & 2023-24 in **IIT Roorkee, India**.
- **Numerical Analysis and Computational Physics**, B.Tech. (3rd Year) & Integrated M.Sc. (3rd Year), Autumn Semester 2020-21 & 2021-22 in **IIT Roorkee, India**.
- **Numerical Analysis and Computational Techniques**, M.Tech. (1st Year), Autumn Semester 2020-21 & 2021-22 in **IIT Roorkee, India**.
- **Physics of Earth's Atmosphere**, M.Sc. (1st Year) & Integrated M.Sc. (4th Year), Spring Semester 2021-22 & 2022-23 in **IIT Roorkee, India**.

Administrative Experience

- Officer in-Charge in Atmospheric Physics Laboratory, 2016–2022, **Department of Physics, IIT Roorkee, India**.

- Member in Annual Reports & Website Committee, 2016–2023, **Department of Physics, IIT Roorkee, India.**
- Coordinator in M.Sc. & Int. M.Sc., 2018–19, **Department of Physics, IIT Roorkee, India.**
- Examination Coordinator, 2019–20, **Department of Physics, IIT Roorkee, India.**
- Faculty Advisor, 2020–2022, **Department of Physics, IIT Roorkee, India.**
- Coordinator in Int. M.Sc. 3rd year, 2022–2023, **Department of Physics, IIT Roorkee, India.**
- Coordinator in BS-MS 3rd year, 2023–Present, **Department of Physics, IIT Roorkee, India.**
- Member in Department Administrative Committee, 2023–Present, **Department of Physics, IIT Roorkee, India.**
- Prof. in-Charge in Stores and Purchases, 2023–Present, **Department of Physics, IIT Roorkee, India.**
- Member in Department Write-off Committee, 2023–Present, **Department of Physics, IIT Roorkee, India.**

Master’s Thesis Supervised

- M.Sc. Thesis entitled “Extraction of Gravity Wave Parameter using Airglow Images” by Yamini Khodia, IIT Roorkee, Spring–2015.
- Summer Project Dissertation for Kishore Vaigyanik Protsahan Yojana (KVPY) entitled “Investigation of Kelvin Helmholtz Instabilities in the Upper Mesosphere and Lower Thermosphere” by Jay Agarwal, IIT Roorkee, Autumn–2015.
- M.Sc. Thesis entitled “Investigation of Kelvin Helmholtz Instabilities in the Upper Mesosphere and Lower Thermosphere” by Jay Agarwal, IIT Roorkee, Spring–2016.
- M.Sc. Thesis entitled “Two-Dimensional Spectral Analysis of Mesospheric Airglow Images” by Apoorva Arora, IIT Roorkee, Spring–2016.
- M.Sc. Thesis entitled “Effect of Prandtl number and Reynolds number on the Lifetime of KH Billow” by Om Prakash Birda, IIT Roorkee, Spring–2017.
- M.Sc. Thesis entitled “Spectral Analysis of Planetary Atmospheres” by Vijay Singh, IIT Roorkee, Spring–2018.
- M.Sc. Thesis entitled “Image Analyses using multiwavelength Airglow Imager over Hanle, Leh Ladakh” by Aman Srivastava, IIT Roorkee, Spring–2019.
- M.Sc. Thesis entitled “Simultaneous meteor wind radar and optical airglow imaging observations over Kuhlungsborn(54.11° N, 11.77° E), Germany”, by Rushith Kalakonda, IIT Roorkee, Spring–2019.

- M.Sc. Thesis entitled “Study of Medium scale travelling ionospheric disturbances” by Govind Gaur, IIT Roorkee, Spring–2020.
- M.Sc. Thesis entitled “Stockwell transform on mesospheric bores” by Adityaveer Singh, IIT Roorkee, Spring–2020.
- M.Tech. Thesis entitled “Development of an Imaging Spectrograph for Space Based Observations of Planetary Atmospheric Emission” by Sandeep Kumar, IIT Roorkee, Spring–2020.
- M.Sc. Thesis entitled “Calculation of total electron content in ionosphere” by Aashish Tiwari, IIT Roorkee, Spring–2021.
- M.Sc. Thesis entitled “Exploration of Earth Plasma Using Imaging Techniques’ by Ateesh Singh, IIT Roorkee, Spring–2022.
- M.Sc. Thesis entitled “Study of Ionospheric Irregularities over The Indian Himalayan Region’ by Adarsh Agrawal, IIT Roorkee, Spring–2022.
- M.Sc. Thesis entitled “Investigation of Mars atmosphere using various satellite-based Measurements’ by Praveen Ranolia, IIT Roorkee, Spring–2023.
- M.Tech. Thesis entitled “Spectroscopic Calibration of AOTF for Space Applications” by Shrikant Muduli, IIT Roorkee, Spring–2023.

Doctoral Thesis Supervised (Ongoing/Awarded)

- Ph.D. Thesis entitled “Investigation of Upper Atmosphere using Optical Techniques” by Subarna Mondal, IIT Roorkee [Awarded].
- Ph.D. Thesis entitled “Airglow Imaging Observations of Earth’s Upper Atmosphere” by Rahul Rathi, IIT Roorkee [Ongoing] [*Registered in July, 2020*].
- Ph.D. Thesis entitled “Investigation of the Martian atmosphere using remote sensing and in-situ measurements” by Lot Ram, IIT Roorkee [Ongoing] [*Registered in July, 2022*].
- Ph.D. Thesis entitled “Investigation of ionospheric plasma using optical and radio techniques” by Dipjyoti Patgiri, IIT Roorkee [Ongoing] [*Registered in August, 2022*].
- Ph.D. Thesis entitled *TBD* by Aadarsh Raj Sharma, IIT Roorkee [Ongoing].
- Ph.D. Thesis entitled *TBD* by Jeevan Upadhyaya, IIT Roorkee [Ongoing].

Post-Doctoral Fellows Mentored

- Dr. Virendra Yadav, Ph.D. from Indian Institute of Geomagnetism, Mumbai, India (April, 2019–November, 2020) [Presently at Aryabhata Research Institute of Observational Sciences (ARIES), Nainital, Uttarakhand, India].

- Dr. Padma Gurram, Ph.D. from Indian Institute of Geomagnetism, Mumbai, India (March, 2021–December, 2021).
- Dr. Satarupa Chakrabarty, Ph.D. from Kalinga Institute of Industrial Technology, Bhubaneswar, India (September, 2022–Present).

Sponsored Research Projects (Approved/Ongoing/Completed)

- Principal Investigator of an Extramural Research Grant (EMR/2016/000247) entitled “**Investigation of Earth’s Upper Atmosphere using Optical Imaging Techniques**” [Total budget: INR 74.5 Lacs (7.45 Million) for the period of 2017-20] by **Science and Engineering Research Board, Department of Science and Technology (DST-SERB)**, India [Completed].
- Co-Principal Investigator of an Extramural Research Grant (EMR/2017/005188) entitled “**Study of thermospheric and mesospheric cooling by using Nitric Oxide radiative emissions**” [Total budget: INR 33.79520 Lacs (3.379520 Million) for the period of 2018-21] by **Science and Engineering Research Board, Department of Science and Technology (DST-SERB)**, India [Completed].
- Principal Investigator of an Extramural Research Grant (CRG/2021/002052) entitled “**Investigation and characterization of ionospheric two-dimensional plasma structures over the geomagnetic low-mid latitude transition region using Artificial Intelligence and Machine Learning**” [Total budget: INR 29.99 Lacs (2.999 Million) for the period of 2022-25] by **Science and Engineering Research Board, Department of Science and Technology (DST-SERB)**, India [Ongoing].
- Co-Principal Investigator of a payload “**Upper-atmospheric Visible Airglow Spectral Imager (UrVASI)**” onboard Indian twin satellites: **Disturbed and quiet time Ionosphere-thermosphere System at High Altitudes (DISHA-H & DISHA-L)** by Indian Space Research Organisation, India [Approved by ISRO].
- Co-Principal Investigator of a payload “**Venus Atmospheric Spectro-Polarimeter (VASP)**” onboard **Venus Orbiter Mission** by Indian Space Research Organisation, India [Approved by ISRO].

Awards / Honors

- A paper entitled “On the role of collisions in the sodium airglow process” by **Sarkhel et al.** was awarded the **Second Prize** in **16th National Space Science Symposium (NSSS 2010)** sponsored by **Indian Space Research Organisation (ISRO)** held at Rajkot, India.
- Principle author of a collaborative proposal (**AGS 1241407**; PIs: John D. Mathews, The Pennsylvania State University and Shikha Raizada, Arecibo Observatory, SRI International) entitled “**Collaborative Research: New Directions in Optical-Instrument-Driven Aeronomy at Arecibo Observatory**” is approved for full funding (Total budget: US\$ 759,643 for 5 years) by **National Science Foundation (NSF)**, USA.

Invited Talks / Colloquia / Special Lectures

- “Identification of large scale billow-like structures in the neutral sodium layer over Arecibo” on **30 January, 2012** at **Physical Research Laboratory, Ahmedabad, India.**
- “New directions in understanding the origin of unusual structures in the MLT region using active and passive remote sensing techniques” on **10 February, 2014** at **Physical Research Laboratory, Ahmedabad, India.**
- “Upper atmospheric investigation using active and passive remote sensing techniques” on **08 May, 2014** at **Chungnam National University, Daejeon, South Korea.**
- “Physics in the Upper Atmosphere (Active and Passive Remote Sensing Techniques)” on **16 October, 2014** at **Indian Physics Association (Roorkee Chapter), IIT Roorkee, India.**
- “Physics in the Upper Atmosphere (Understanding the origin of unusual phenomena using active and passive remote sensing techniques)” on **08 July, 2015** at **Indian Institute of Astrophysics, Bengaluru, India.**
- “Does Meteoric Metals Exist in the Martian Atmosphere?” on **24 May, 2016** at **U. R. Rao Satellite Centre, Bengaluru, India.**
- “Research in the Upper Atmosphere using Optical Remote Sensing Techniques” on **21 October 2019** at **National Atmospheric Research Laboratory, Gadanki, India.**
- “Planetary Aeronomy: Optical Emissions” on **28 April 2020** (Webinar conducted by **Indian Space Research Organisation Bengaluru, India.**)

Schools / Workshop / Conference / Symposium

- Attended **International School on Atmospheric Radar (ISAR-NCU 2006)**, **Chung-Li, Taiwan** and delivered a talk entitled “Mesosphere-lower ionosphere investigations using Indian MST radar and optical techniques.”
- Presented a paper entitled “Simultaneous sodium airglow and sodium lidar observations from Gadanki” by **S. Sarkhel et al.** in **15th National Space Science Symposium (NSSS 2008)**, **Ooty, India.**
- Presented a paper entitled “On the role of collisions in the sodium airglow process” by **S. Sarkhel et al.** in **16th National Space Science Symposium (NSSS 2010)**, **Rajkot, India.**
- Presented a paper entitled “Sodium Airglow Observations from India” by **S. Sarkhel et al.** in **Asia Oceania Geosciences Society 2010, Hyderabad, India.**
- Presented a paper entitled “Mesospheric Gravity Waves over Indian Regions using Sodium Airglow Measurements” by **S. Sarkhel et al.** in **COSPAR Scientific Assembly 2010, Bremen, Germany.**

- Presented a paper entitled “Identification of large scale billows-like structure in the neutral Na layer over Arecibo” by **S. Sarkhel et al.** in **American Geophysical Union, Fall Meeting, 2011, San Francisco, USA.**
- Presented a poster entitled “Penn State Airglow Imagers at Arecibo Observatory: Operation and Image Analyses” by **S. Sarkhel et al.** in **CEDAR 2012, Santa Fe, USA.**
- Presented a paper entitled “A study of an unusual event observed in the Na layer over Arecibo” by **S. Sarkhel et al.** in **CEDAR 2012, Santa Fe, USA.**
- Presented a paper entitled “New directions in understanding the origin of an unusual structure in the MLT region using active and passive remote sensing techniques” by **S. Sarkhel et al.** in **KSSS Spring Meeting, 2014, South Korea.**
- Presented a paper entitled “Investigation on Meteoric Metals in the Martian Atmosphere using Airglow Emissions” by **S. Sarkhel** in **MOM Data Analysis Workshop (04-05 September, 2015), Physical Research Laboratory, Ahmedabad, India.**
- Invited presentation entitled “Exploration of the Venus Atmosphere using Hyper-spectral imaging of Optical and Infrared emissions” by **S. Sarkhel** in **Symposium on Vision & Explorations for Planetary Sciences in Decades 2020-2060 Brain Storming Session (8-10 November, 2017), Physical Research Laboratory, Ahmedabad, India.**
- Presented a paper entitled “New directions in understanding the origin of an unusual structure in the sodium layer over Gadanki, India” by **S. Sarkhel et al.** in **15th International Symposium on Equatorial Aeronomy (ISEA-15) (22-26 October, 2018) at PRL, Ahmedabad, India.**
- Presented a paper entitled “On the life-time of Kelvin-Helmholtz billows in the mesosphere and lower thermosphere region” by **S. Sarkhel et al.** in **20th National Space Science Symposium (NSSS) (NSSS-2019) (29-31 January, 2019) at Savitribai Phule Pune University, Pune, India.**
- Presented a paper entitled “All-sky Airglow Imaging Observations of Terrestrial Upper Atmosphere from Hanle, Leh Ladakh, India” by **S. Sarkhel et al.** in **15th Quadrennial Solar-Terrestrial Physics Symposium (STP-15) (21 - 25 February 2022), A Virtual Event Hosted by Indian Institute of Geomagnetism (IIG), Navi Mumbai, India.**
- Presented a paper entitled “Simultaneous Occurrence of Three Non-Interacting Characteristically Different Ionospheric Plasma Structures Over the Geomagnetic Low-Mid Latitude Transition Region” by **S. Sarkhel et al.** in **16th International Symposium on Equatorial Aeronomy (ISEA-16) (12-16 September, 2022) at Kyoto University, Uji, Japan.**
- Presented a paper entitled “A case study on multiple self-interactions of MSTID bands: New insights” by **S. Sarkhel et al.** in **European Geosciences Union - 2023 (23–28 April 2023) at Vienna, Austria.**

- Presented a paper entitled “Interaction between nighttime MSTID and mid-latitude field-aligned plasma depletion structure: First results from Hanle, India” [Invited Talk] by **S. Sarkhel et al.** in **Asia Oceania Geosciences Society 20th Annual Meeting (AOGS 2023)** (30 July - 05 August 2023) at Singapore.

Lecture Series/Workshop/Conference Organized

- ARIES Lecture Series (A virtual event organized by Indian Physics Association (IPA), Roorkee Chapter, Physics and Astronomy Club, IIT Roorkee and in association with Department of Physics, IIT Roorkee), 04-28 December, 2020.
- 40th Annual Meeting of the Astronomical Society of India (ASI-2022) (A hybrid conference organized in the campus of IIT Roorkee in association with ARIES, Nainital), 25-29 March, 2022.

Papers Accepted/Published in Refereed Conferences/Journals

36. Martian M2 peak behavior in the dayside near-terminator ionosphere during interplanetary coronal mass ejections, L. Ram, D. Rout, R. Rathi, P. Withers, **S. Sarkhel**, *Icarus*, *408*, 115857, doi: 10.1016/j.icarus.2023.115857, 2024. **Impact Factor: 3.2, Citations: 0.**
35. NO radiative cooling and ionospheric response to the HILDCAA events following geomagnetic storms, A. K. Ranjan, M. V. Sunil Krishna, A. Kumar, **S. Sarkhel**, D. Chakrabarty, & G. D. Reeves, *Journal of Geophysical Research: Space Physics*, *128*, e2023JA032028, doi: 10.1029/2023JA032028, 2023. **Impact Factor: 2.8, Citations: 0.**
34. Signature of Y-forking in ionogram traces observed at low-mid latitude Indian station, New Delhi, during the earthquake events of 2020: ionosonde observations, A. Bhardwaj, A. Gupta, Q. Ahmed, A. Singh, S. Gupta, **S. Sarkhel**, M.V. Sunil Krishna, D. Pallamraju, T. Pant and A.K. Upadhayaya, *Front. Astron. Space Sci.*, *10*:1170288, doi: 10.3389/fspas.2023.1170288, 2023. **Impact Factor: 3.0, Citations: 0.**
33. A case study on multiple self-interactions of MSTID bands: New insights, D. Patgiri, R. Rathi, V. Yadav, **S. Sarkhel**, D. Chakrabarty, S. Mondal, M. V. Sunil Krishna, A. K. Upadhayaya, C. G. Vivek, S. Kannaujiya, S. Sunda, *Advances in Space Research*, doi: 10.1016/j.asr.2023.05.047, 2023. **Impact Factor: 2.611, Citations: 0.**
32. A case study of mesospheric frontal interaction and associated processes over the western Himalaya, S. Mondal, A. Guharay, **S. Sarkhel**, M.V. Sunil Krishna, Martin G. Mlynczak, *Advances in Space Research*, doi: 10.1016/j.asr.2023.05.019, 2023. **Impact Factor: 2.611, Citations: 0.**
31. Unusual simultaneous manifestation of three non-interacting mid-latitude ionospheric plasma structures, R. Rathi, P. Gurram, S. Mondal, V. Yadav, **S. Sarkhel**, M.V. Sunil Krishna, A. K. Upadhayaya, *Advances in Space Research*, doi: 10.1016/j.asr.2023.04.038, 2023. **Impact Factor: 2.611, Citations: 1.**

30. A comparison of the impacts of CMEs and CIRs on the Martian dayside and nightside ionospheric species, L. Ram, D. Rout, R. Rathi, S. Mondal, **S. Sarkhel**, J. Halekas, *Journal of Geophysical Research: Planets*, e2022JE007649, 128, doi: 10.1029/2022JE007649, 2023. **Impact Factor: 4.8, Citations: 1.**
29. Aspects related to variability of radiative cooling by NO in lower thermosphere, TEC and O/N₂ correlation, and diffusion of NO into mesosphere during the Halloween storms, Alok Kumar Ranjan, M.V. Sunil Krishna, Akash Kumar, **S. Sarkhel**, Gaurav Bharti, Stefan Bender, Miriam Sinnhuber, *Advances in Space Research*, 71, doi: 10.1016/j.asr.2022.07.035, 2023. **Impact Factor: 2.611, Citations: 0.**
28. A case study on the interaction between two MSTIDs, their dissipation and a curious case of MSTID's rotation over geomagnetic low-mid latitude transition region, R. Rathi, V. Yadav, S. Mondal, **S. Sarkhel**, M. V. Sunil Krishna, A. K. Upadhayaya, S. Kannaujiya, P. Chauhan, *Journal of Geophysical Research: Space Physics*, 127, e2021JA029872 doi: 10.1029/2021JA029872, 2022. **Impact Factor: 3.11, Citations: 0.**
27. A case study of a ducted gravity wave event over northern Germany using simultaneous airglow imaging and wind-field observations, **S. Sarkhel**, Gunter Stober, Jorge L. Chau, S. M. Smith, C. Jacobi, S. Mondal, Martin G. Mlynczak, and James M. Russell III, *Annales Geophysicae*, 40, 179–190, doi: 10.5194/angeo-40-179-2022, 2022. **Impact Factor: 2.19, Citations: 0.**
26. Signature of a mesospheric bore in 557.7 nm airglow emission using all-sky imager at Hanle (32.7°N, 78.9°E), A. Guharay, S. Mondal, **S. Sarkhel**, M. Sivakandan, M. V. Sunil Krishna, *Advances in Space Research*, 69, doi: 10.1016/j.asr.2021.12.006, 2022. **Impact Factor: 2.611, Citations: 1.**
25. Evidence for the in-situ generation of plasma depletion structures over the transition region of geomagnetic low-mid latitude, M. Sivakandan, S. Mondal, **S. Sarkhel**, D. Chakrabarty, M. V. Sunil Krishna, A. K. Upadhayaya, A. Shinbori, T. Sori, S. Kannaujiya, and P. K. Champati Ray, *Journal of Geophysical Research: Space Physics*, 126, e2020JA028837, doi: 10.1029/2020JA028837, 2021. **Impact Factor: 3.11, Citations: 3.**
24. A case study of a thermally ducted undular mesospheric bore accompanied by ripples over the western Himalayan region, S. Mondal, M. Sivakandan, **S. Sarkhel**, M. V. Sunil Krishna, Martin G. Mlynczak, James M. Russell III, and G. Bharti, *Advances in Space Research*, 68, 1425–1440, doi: 10.1016/j.asr.2021.03.026, 2021. **Impact Factor: 2.177, Citations: 3.**
23. Interaction between nighttime MSTID and mid-latitude field-aligned plasma depletion over the transition region of geomagnetic low-mid latitude: First results from Hanle, India, V. Yadav, R. Rathi, G. Gaur, **S. Sarkhel**, D. Chakrabarty, M. V. Sunil Krishna, P. Pavan Chaitanya, A. K. Patra, R. K. Choudhary, T. K. Pant, A. K. Upadhayaya, *Journal of Atmospheric and Solar-Terrestrial Physics*, 217, 105589, doi: 10.1016/j.jastp.2021.105589, 2021. **Impact Factor: 1.503, Citations: 3.**
22. Evidence for simultaneous occurrence of periodic and single dark band MSTIDs over geomagnetic low-mid latitude transition region, R. Rathi, V. Yadav, S. Mondal, **S. Sarkhel**, M. V. Sunil

- Krishna, A. K. Upadhayaya, *Journal of Atmospheric and Solar-Terrestrial Physics*, 215, 105588, doi: 10.1016/j.jastp.2021.105588, 2021. **Impact Factor: 1.503, Citations: 5.**
21. Multi-Instrument Observations of MSTIDs: 1. ISR and GPS TEC Results, Ross Dinsmore, J. D. Mathews, Anthea Coster, R. M. Robinson, **S. Sarkhel**, Philip J. Erickson, Julio Urbina, *Journal of Atmospheric and Solar-Terrestrial Physics*, 213, 105515, doi: 10.1016/j.jastp.2020.105515, 2021. **Impact Factor: 1.503, Citations: 4.**
 20. A unique case of complex interaction between MSTIDs and mid-latitude field-aligned plasma depletions over geomagnetic low-mid latitude transition region, V. Yadav, R. Rathi, **S. Sarkhel**, D. Chakrabarty, M. V. Sunil Krishna, A. K. Upadhayaya, *Journal of Geophysical Research: Space Physics*, 126, e2020JA028620, doi:10.1029/2020JA028620, 2021. **Impact Factor: 2.8, Citations: 5.**
 19. Mid-latitude Spread-F structures over the geomagnetic low-mid latitude transition region: An observational evidence, M. Sivakandan, S. Mondal, **S. Sarkhel**, D. Chakrabarty, M. V. Sunil Krishna, P. Pavan Chaitanya, A. K. Patra, R. K. Choudhary, T. K. Pant, A. K. Upadhayaya, T. Sori, *Journal of Geophysical Research: Space Physics*, 125 doi:10.1029/2019JA027531, 2020. **Impact Factor: 2.82, Citations: 9.**
 18. Investigation of spatio-temporal morphology of plasma bubbles based on EAR observations, L.M. Joshi, L.-C. Tsai, S.-Y. Su, Y. Otsuka, T. Yokoyama, M. Yamamoto, **S. Sarkhel**, K. Hozumi, C.-H. Lu, *Journal of Geophysical Research: Space Physics*, 124, 10549–10563, doi:10.1029/2019JA026839, 2019. **Impact Factor: 2.82, Citations: 3.**
 17. Allsky Airglow Imaging Observation from Hanle, Leh Ladakh, India: Image Analyses and First Results; S. Mondal, A. Srivastava, V. Yadav, **S. Sarkhel**, M. V. Sunil Krishna, Yamini K. Rao, Vir Singh, *Advances in Space Research*, 64, 1926–1939, doi:10.1016/j.asr.2019.05.047, 2019. **Impact Factor: 1.75, Citations: 13.**
 16. On the long lasting “C-type” structures in the sodium lidargram: The lifetime of Kelvin-Helmholtz billows in the mesosphere and lower thermosphere region; S. Mondal, **S. Sarkhel**, Jay Agarwal, D. Chakrabarty, R. Sekar, Tao Yuan, Xuguang Cai, Alan Z. Liu, Satonori Nozawa, Norihito Saito, Takuya D. Kawahara, Martin G. Mlynchak, James M. Russell III, *Journal of Geophysical Research: Space Physics*, 124, 3110–3124, doi:10.1029/2019JA026630, 2019. **Impact Factor: 2.82, Citations: 6.**
 15. A Review on the Upper Atmospheric Sodium Observations from India: Insights; **S. Sarkhel**, S. Mondal, R. Sekar, D. Chakrabarty, and S. Sridharan, *Advances in Space Research*, 63, 3568–3585, doi:10.1016/j.asr.2019.02.019, 2019. **Impact Factor: 1.75, Citations: 4.**
 14. Multi-Instrument Observations of MSTIDs and Source Determination; Ross Dinsmore, J. D. Mathews, Anthea Coster, and **S. Sarkhel**, 2018 2nd URSI Atlantic Radio Science Meeting (AT-RASC), Gran Canaria, Spain, 2018, pp. 1-4, *IEEE Xplore*, doi:10.23919/URSI-AT-RASC.2018.8471550, 2018. **Citations: 1.**
 13. The ionospheric impact of a CME driven sheath region over Indian and American sectors in the absence of a typical geomagnetic storm; Diptiranjana Rout, D. Chakrabarty, **S. Sarkhel**,

- R. Sekar, B. G. Fejer, G. D. Reeves, Atul S. Kulkarni, Nestor Aponte, Mike Sulzer, John D. Mathews, Robert B. Kerr, and John Noto, *Journal of Geophysical Research: Space Physics*, 123, 4298–4308, doi:10.1029/2018JA025334, 2018. **Impact Factor: 3.42, Citations: 8.**
12. Erratum to: Dependence of mesospheric Na and Fe distributions on electron density at Arecibo; Shikha Raizada, Craig Tepley, Qihou Zhou, **S. Sarkhel**, John Mathews, Nestor Aponte, Ilgin Seker, Robert Kerr, Edvier Cabassa, *Earth Planets Space*, 67:202, doi:10.1186/s40623-015-0371-3, 2015. **Impact Factor: 1.87, Citations: 0.**
 11. Dependence of mesospheric Na and Fe distributions on electron density at Arecibo; Shikha Raizada, Craig Tepley, Qihou Zhou, **S. Sarkhel**, John Mathews, Nestor Aponte, Ilgin Seker, Robert Kerr, Edvier Cabassa, *Earth Planets Space*, 67:146, doi: 10.1186/s40623-015-0322-z, 2015. **Impact Factor: 1.87, Citations: 7.**
 10. Erratum to: A case study on occurrence of an unusual structure in the sodium layer over Gadanki, India; **S. Sarkhel**, Mathews JD, Shikha R, Ramanathan S, Dibyendu C, Amitava G, Geonhwa J, Jeong-Han K, Kerr RB, Geetha R, Sundararajan S, Qian W, Mlynczak MG, Russell JM, *Earth Planets Space*, 67:145, doi:10.1186/s40623-015-0276-1, 2015. **Impact Factor: 1.87, Citations: 4.**
 9. A case study on occurrence of an unusual structure in the sodium layer over Gadanki, India; **S. Sarkhel**, John D. Mathews, Shikha Raizada, R Sekar, D. Chakrabarty, A. Guharay, Geonhwa Jee, Jeong-Han Kim, Robert B. Kerr, Geetha Ramkumar, S. Sridharan, Qian Wu, Martin G. Mlynczak, and James M. Russell III, *Earth, Planets and Space*, 67:19, doi:10.1186/s40623-015-0183-5, 2015. **Impact Factor: 1.87, Citations: 10.**
 8. Investigation of the intraseasonal oscillations over a Brazilian equatorial station: a case study; A Guharay, P. P. Batista, B. R. Clemesha, **S. Sarkhel**, and R. A. Buriti, *Earth, Planets and Space*, 66:145, doi:10.1186/s40623-014-0145-3, 2014. **Impact Factor: 1.33, Citations: 8.**
 7. Response of the extra-tropical middle atmosphere to the September 2002 major stratospheric sudden warming; A. Guharay, P. P. Batista, B. R. Clemesha, **S. Sarkhel**, *Adv. Space Res.*, 53, 257–265, doi:10.1016/j.asr.2013.11.002, 2014. **Impact Factor: 1.36, Citations: 5.**
 6. On the variability of the terdiurnal tide over a Brazilian equatorial station using meteor radar observations; A. Guharay, P. P. Batista, B. R. Clemesha, **S. Sarkhel**, R. A. Buriti, *J. Atmos. Sol. Terr. Phys.*, 104, 87–95, doi:10.1016/j.jastp.2013.08.021, 2013. **Impact Factor: 1.47, Citations: 13.**
 5. Identification of large scale billows-like structure in the neutral Na layer over Arecibo, **S. Sarkhel**, S. Raizada, J. D. Mathews, S. M. Smith, C. A. Tepley, F. J. Rivera, S. A. Gonzalez, *J. Geophys. Res.*, 117, A10301, doi:10.1029/2012JA017891, 2012. **Impact Factor: 3.17, Citations: 17.**
 4. Investigation on Mesospheric Gravity Waves over Indian Low Latitude Stations using Sodium Airglow Observations and A Few Case Studies Based on Thermal and Wind Structures; **S. Sarkhel**, R. Sekar, D. Chakrabarty, and A. Guharay, *J. Atmos. Sol. Terr. Phys.*, 86, 41–50, doi:10.1016/j.jastp.2012.06.008, 2012. **Impact Factor: 1.42, Citations: 9.**

3. A Case Study on the Possible Altitude-Dependent Effects of Collisions on Sodium Airglow Emission; **S. Sarkhel**, R. Sekar, D. Chakrabarty, and S. Sridharan, *J. Geophys. Res.*, 115, A10306, doi:10.1029/2010JA015251, 2010. **Impact Factor: 3.30, Citations: 10.**
2. Simultaneous sodium airglow and lidar measurements over India: a case study; **S. Sarkhel**, R. Sekar, D. Chakrabarty, R. Narayanan, and S. Sridharan, *J. Geophys. Res.*, 114, A10317, doi:10.1029/2009JA014379, 2009. **Impact Factor: 3.08, Citations: 16.**
1. Identifications of active fossil bubbles based on coordinated VHF radar and airglow measurements; R. Sekar, D. Chakrabarty, **S. Sarkhel**, A. K. Patra, C. V. Devasia and M. C. Kelley, *Ann. Geophys.*, 25, 2099–2102, doi:10.5194/angeo-25-2099-2007, 2007. **Impact Factor: 1.43, Citations: 37.**

Other Publications

1. The Coordinated Sodium Airglow and Lidar Observations over India; **S. Sarkhel**, R. Sekar, D. Chakrabarty, R. Narayanan, and S. Sridharan, Abstract # SA33A-02, *American Geophysical Union*, Spring Meeting, 2009.
2. Sodium Airglow Emission from Terrestrial Mesosphere; **Sumanta Sarkhel**, *PRL News*, Volume 25, Issue 1, July 2010.
3. Mesospheric Gravity Waves over Indian Regions using Sodium Airglow Measurements; **S. Sarkhel**, R. Sekar, D. Chakrabarty, R. Narayanan, 38th COSPAR Scientific Assembly. Held 18-15 July 2010, in Bremen, Germany, p.5, 2010.
4. Observations of the Intra-seasonal oscillations in the tropical MLT and lower atmosphere; A Guharay, **S. Sarkhel**, PP Batista, AGU Fall Meeting 2011, abstract id. A51A-0205, 2011.
5. Lidar observations of mesospheric metals and electron densities over Arecibo; S Raizada, B Williams, J Friedman, **S. Sarkhel**, C Tepley, Q Zhou, N Aponte, 39th COSPAR Scientific Assembly. Held 14-22 July 2012, in Mysore, India. Abstract F3.1-5-12, p.1557, 2012.
6. Characteristics of Mesospheric Na Distribution over Arecibo, Puerto Rico, S Raizada, E Garcia, C Garnett Marques Brum, **S Sarkhel**, E Cabassa-Miranda, Q Zhou, CA Tepley, AGU Fall Meeting 2013, abstract id.SA11B-1927, 2013
7. Influence of Sporadic E layers on Mesospheric Na and Fe Layers over Arecibo; S Raizada, CA Tepley, Q Zhou, **S Sarkhel**, JD Mathews, N Aponte, R Kerr, AGU Fall Meeting 2014, abstract id.SA41A-4049, 2014.

Research Interests

My research interest encompasses the investigations of upper atmosphere using mainly ground-based nighttime airglow photometer and imager. The airglow data are supplemented by data from VHF radar, Na resonant lidar and satellite borne measurements.

- To measure the Na D₂/D₁ airglow intensity ratio, investigate its variability and its impact on sodium airglow emission process.
- To measure the Earth's airglow emissions onboard Indian twin satellites: **D**isturbed and quiet time **I**onosphere-thermosphere **S**ystem at **H**igh **A**ltitudes (DISHA-H & DISHA-L).
- Investigating planetary airglow emissions using ground based astronomical optical telescope.
- Investigating the generation of ubiquitous omnipresent Medium Scale Travelling Ionospheric Disturbances (MSTIDs) using airglow imager.
- Investigation of meteoroid ablation processes and associated phenomena using the airglow imager at different wavelengths.
- Investigation of breaking of gravity waves near mesopause region using multi-wavelength airglow imager and satellite borne measurements and characterize secondary waves.
- Investigation of neutral instability processes at mesosphere lower thermospheric region using resonance lidars.

Other Proficiencies

- Was an active member of a team which has the experience to conceptualize and design different state-of-the-art optical instruments such as nighttime airglow photometers and spectrometers. An automatic multi-wavelength airglow imager is also designed and fabricated at Physical Research Laboratory (PRL), Ahmedabad, India in order to characterize mesospheric gravity waves in three dimensions along with Na lidar at Gadanki. It consists of several achromatic lens systems, a programmable motorized filter wheel with five filter slots and a cooled CCD detector. The fish-eye lens being an essential part of the lens system decides the field-of-view and the rays are channelled through a field lens decreasing the divergence. A collimating lens further reduces the divergence of the rays in order to pass through the interference filter. The interference filter selects the desired wavelength of emission and the filtered signals are further focused on the high sensitive CCD pixels using camera lens. The whole imaging system is completely automatic and the interfacing between the motorized filter wheel and the CCD camera was carried out in our laboratory. The imager is equipped with the capability of capturing signals at different wavelengths with different exposure times using a software program made in-house.
- Experience in operating airglow imagers at the Arecibo Observatory (18.35° N, 66.75° W), Puerto Rico, USA operated by Penn State University, Pennsylvania, USA and analyzing near-real time raw images. An image processing module has been developed to process those raw images into geographically calibrated unwarped images. This image processing module consists of several MATLAB subroutines developed specifically for processing those images which are designed for geographical calibration of images using standard star catalogue at 557.7 nm and 630.0 nm, and 777.4 nm wavelength. In addition, the module also calculates north-south and east-west keograms and movies for each filter. As a part of developing the image processing module, a web interface has also been designed for posting those process data online that can

be accessed online to all users in near real-time. The web interface allows users to choose to view/download movies/keograms at any filter.

Also has significant experience of processing raw images of another airglow imager at the King Sejong Station, Antarctica (62.22° S, 58.78° W) that is operated by Korea Polar Research Institute, South Korea.

- Recently, we have installed an allsky multi-wavelength imaging system (557.7 and 630.0 nm filters) for the investigation of Earth's upper atmosphere at the Indian Astronomical Observatory (IAO), Hanle, Leh Ladakh (32.78° N, 78.96° E). The observatory is operated by the Indian Institute of Astrophysics, Bengaluru which is situated at 4200 meter altitude from mean sea level (at ~ 600 mb pressure level). The imaging system was procured under DST-SERB project (EMR/2016/000247). The purpose of the allsky imaging system is to understand the optical emissions from the Earth's upper atmosphere and its connection with the plasma irregularities at the ionosphere over the Himalayan region. The imager is installed inside a small ($3\text{ m} \times 2\text{ m} \times 2\text{ m}$) weather proof PUF container which was also constructed during installation of the imager. We have named of the building as "High Altitude Optical Aeronomy Observatory". We got the first light on 12 June, 2018 evening. The imaging system is fully automatic and will keep on taking observation during nighttime. ***This is the first of its kind of instrument that is ever installed at such an altitude in India.*** A web interface has been developed (<https://allsky.iitr.ac.in>) that allows users to view quick-look image data for both the filters for any given observational night.
- Experience in handling Na resonance lidar at Arecibo Observatory, Puerto Rico, USA and analyzing raw data to derive neutral Na atom concentration.
- Can work in both Windows and UNIX environments.
- Knowledge in MATLAB programming. Brief knowledge in PERL and SHELL script.

I hereby declare that the above information is correct to the best of my knowledge.

Date: November 30, 2023

Sumanta Sarkhel

Place: Roorkee, India