

CURRICULUM VITAE

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Personal Data

Nationality: Indian

Gender: Male

Birth Place: Santiniketan, India

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 (<i>affiliated to</i> Mohan Lal Sukhadia University, Udaipur, India)	2011	—	<i>Science with specialization in Upper Atmospheric 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 Mathemat- ics 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

RESEARCH 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: **(October, 2010).**

AWARD DATE: **(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 working with **Prof. John D. Mathews** 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).**
- Assistant Professor, **Indian Institute of Technology Roorkee, Roorkee, India (August, 2014–Present).**

Teaching Experience

- **Plasma Physics**, Integrated M.Sc. (3rd Year), Autumn Semester 2014-15 & 2015-16, **IIT Roorkee, India**.
- **Electromagnetic Theory**, B.Tech. (1st Year), Spring Semester 2014-15, **IIT Roorkee, India**.
- **Space Science and Technology**, B.Tech. (3rd Year), Spring Semester 2015-16, **IIT Roorkee, India**.

Thesis Supervised

- Master 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.

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)** 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

- “Identification of large scale billow-like structures in the neutral sodium layer over Arecibo” on **January, 2012** in **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 **February, 2014** in **Physical Research Laboratory, Ahmedabad, India**.
- “Upper atmospheric investigation using active and passive remote sensing techniques” on **May, 2014** in **Chungnam National University, Daejeon, South Korea**.
- “Physics in the Upper Atmosphere (Active and Passive Remote Sensing Techniques)” on **October, 2014** in **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 **July, 2015** in **Indian Institute of Astrophysics, 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**, R. Sekar, D. Chakrabarty, R. Narayanan and Y. Bhavani Kumar.
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**, R. Sekar, D. Chakrabarty, R. Narayanan, and S. Sridharan.
in **16th National Space Science Symposium (NSSS 2010)**, **Rajkot, India**.
- Presented a paper entitled “Sodium Airglow Observations from India”
by **S. Sarkhel**, R. Sekar, D. Chakrabarty, R. Narayanan, and S. Sridharan.
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**, R. Sekar, D. Chakrabarty, and R. Narayanan.
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**, Shikha Raizada, Craig A. Tepley, Sixto Gonzalez, and John D. Mathews.
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**, John D. Mathews, Shikha Raizada, and Craig A. Tepley.
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**, Shikha Raizada, John D. Mathews, Steve Smith, Craig A. Tepley, Francisco J. Rivera, and Sixto A. Gonzalez.
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**, 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.
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, 2015**, **Physical Research Laboratory, Ahmedabad, India**.

List of Publications

Papers Submitted/Under Preparation

1. How collisional quenching plays a crucial role in Na airglow emission: A review based on simultaneous observation of Na airglow and Na lidar from India; R. Sekar, **S. Sarkhel**, and D. Chakrabarty, *to be submitted to Earth, Planets and Space*, 2016.

Papers Published in Refereed Journals

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.

9. 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.
10. 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.
11. 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.
12. 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.

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, Bremen, Germany, 2010.
4. Observations of the Intra-seasonal oscillations in the tropical MLT and lower atmosphere; A Guharay, **S. Sarkhel**, PP Batista, AGU Fall Meeting Abstracts 1, 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 in Mysore, India, 14-22 July, 2012.

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.
- 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.
- Impact on mesospheric chemistry during ionospheric modification experiment using High Frequency (HF) heater.
- Understanding the role of secondary suprathermal electrons generated during HF heating experiment in the F region on artificial airglow.

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 and analyzing near-real time raw images. An image processing module has been developed to process those raw 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, 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 for posting those process data is also designed. The processed data products are openly available online (<http://allsky.ee.psu.edu>) to all users in near real-time. The web interface allows user to choose to view/download movies/keograms at any filter.
- Experience in handling Na resonance lidar and analyzing raw data to derive Na atom concentration.
- Can work in both Windows and UNIX environments.
- Knowledge in MATLAB programming.

- Brief knowledge in PERL and SHELL script.
- Conversant in LaTeX.
- Conversant in several menu-driven graphics softwares like SIGMAPLOT, TABLECURVE, ORIGIN, etc.

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

Date: January 12, 2016

Sumanta Sarkhel

Place: Roorkee, India