Dr. Ashok Silwal

Curriculum Vitae

Center for Space Plasma and Aeronomic Research (CSPAR)
University of Alabama in Huntsville
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Education

2022–2025 **PhD, Space Science**, *University of Alabama in Huntsville*, Huntsville, Alabama, USA.
Dissertation: *Multipoint Observations of Energetic Particle Acceleration Associated with Corotating Interaction Regions*
Provide first detailed measurements of SIR-associated energetic particle events between 0.15 and 0.8 au using PSP/IS⊙IS observations, with coordinated observations from Solar Orbiter, STEREO-A, Wind, and ACE. My findings demonstrate that the turbulence properties within SIRs evolve with radial distance, and this evolution may directly influence the efficiency of particle scattering and acceleration in the inner heliosphere.

2022–2024 **MS, Space Science**, *University of Alabama in Huntsville*, Huntsville, Alabama, USA.

2017–2021 **MS, Physics**, *Patan Multiple Campus*, Patan Dhoka, Lalitpur, Nepal.
Dissertation: *Probing Geomagnetic Storm-Driven Magnetosphere-Ionosphere Dynamics via Propagation Characteristics of Radio Signals*

Work Experience

Postdoctoral Research Assistant III, Center for Space Plasma and Aeronomic Research (CSPAR), UAH

Jan 2026 - Present — Conducting independent and collaborative research on energetic particle transport and solar wind turbulence using data multi-spacecraft observations and numerical modeling. I also investigate the interaction between shock waves and solar wind turbulence in the heliosphere, with direct implications for energetic particle acceleration and solar-wind dynamics

Visiting Scholar, Theoretical Division, Los Alamos National Laboratory (LANL)

May 2025 - Present — Working as a visiting scholar in Associate Laboratory Directorate for Simulation, Computation, and Theory (ALDSCT) on the compressible solar wind turbulence in the near-Sun environment using simulation and observations

Graduate Research Assistant, Department of Space Science, UAH

May 2024 - Dec 2025 — Investigated multipoint observations to characterize turbulence within the corotating interaction regions and its effects on energetic particle acceleration

Graduate Teaching Assistant, Department of Department of Mathematical Science, UAH

Jan 2024 - Apr 2024 — Worked as a tutor in Student Success Center to help student engage in math courses, such as calculus, trigonometry, algebra and applications and build student skills through one-on-one and group sessions

Graduate Research Assistant, Department of Space Science, UAH

Aug 2023 - Dec 2023 — Conducted research on energetic particle and solar wind turbulence in the heliosphere.

Student Specialist V, Department of Department of Space Science, UAH

May 2023 - Jul 2023 — Assisted faculty-led research by processing scientific datasets and contributing to research presentations and reports.

Graduate Research Assistant, Department of Space Science, UAH

Jan 2022 - Apr 2023 Conducted research on energetic particle acceleration associated with Corotating Interaction Regions (CIRs) and Coronal Mass Ejections (CMEs)

Research Assistant, N. P. Chapagain's Research Lab, Tribhuvan University

Oct 2019 - Oct 2021 Ionospheric Total Electron Content (TEC) Variation During Geomagnetic Disturbances, Magnstesphere-Ionospohere Coupling, Galactic Cosmic Ray Modulation, Geomagnetically Induced Current (GIC) Hazard Prediction: From the Solar Winds to Power System Impacts

Research Interest

My research advances the understanding of energetic particle acceleration, interplanetary shocks, and solar wind turbulence in the heliosphere by integrating multi-spacecraft observations with theoretical and numerical modeling. I make extensive use of recent measurements from the Parker Solar Probe and Solar Orbiter to investigate energetic particle dynamics and the evolution of turbulence across heliocentric distances. Selected recent research activities in heliophysics are outlined below.

[1] Study the energetic particle acceleration associated with SIRs/CIRs in the inner heliosphere.

[2] Investigate the connection between solar wind turbulence and energetic particles accelerated at large scale structures, such as interplanetary coronal mass ejections (ICMEs), heliospheric current sheet (HCS) and CIRs.

[3] Investigate the physical mechanisms responsible for the generation of density fluctuations in the solar wind, as observed by Parker Solar Probe and Solar Orbiter.

[4] Study turbulence generation and transmission across interplanetary shocks in the heliosphere.

Awards

Aug 2024 **Future Investigators in NASA Earth and Space Science and Technology (FINESST) award: $50,000 per year and up to three years**.
Proposal Title: Multipoint observations to characterize turbulence within the corotating interaction regions and its effects on energetic particle acceleration

May 2024 **NSF Alabama EPSCoR Graduate Research Scholars Program (GRSP) award: $25,000**.
Proposal Title: Multi-spacecraft Study of Energetic Particle Behaviour in the Inner Heliosphere.

Jul 2022 **Graduate Research Assistant through the Central Education, Recruitment, and Impact Fund (CERIF), FTPP: $25,000 per year**.
Proposal Title: Turbulence, Magnetic Reconnection and Interplanetary Shocks.

Selected Publications

2026 [1] X. Zhu, L. Yang, L. Zhao, G. P. Zank, C. Hou, **A. Silwal**, N. S. M. Subashchandar. *Proton acceleration during the interaction of a coronal-mass-ejection-driven shock and a current sheet*. Accepted by **Astronomy & Astrophysics.**

2025 [2] **A. Silwal**, L. Zhao, X. Zhu, L. S.-Valvo, L. Z. Hadid, G. P. Zank, H. Li, S. T. Badman, Y. M. Rivera, S. P. Gautam, M. Karki, J. G. A. Guzman, N. S. M. Subashchandar, Z. Jin. *Evolution of Solar Wind Turbulence during Radial Alignment of Parker Solar Probe and Solar Orbiter in December 2022*. **The Astrophysical Journal Supplement Series**, 278(2), 40.

2025 [3] M. Karki, G. P. Zank, L. Adhikari, **A. Silwal**, S. P. Gautam, P. Baruwal, P. Baruwal, I. Tasnim, L. Zhao, A. Pitňa. *Investigation of Turbulent Fluctuations in the Fast and Alfvénic Slow Solar Wind at 1 au*. **The Astrophysical Journal**, 995(2), 212.

2025 [4] L. Zhao, V. Florinski, G. P. Zank, M. Opher, J. Richardson, W. S. Kurth, **A. Silwal**, X. Zhu, N. S. M. Subashchandar, J. G. Alonso Guzman, Z. Jin. *Magnetic Turbulence Intermittency and Compressibility in the Inner Heliosheath and Very Local Interstellar Medium*. **The Astrophysical Journal Letters**, 992(1), L4.

2025 [5] N. S. Subashchandar, L. Zhao, A. Shalchi, G. P. Zank, J. Le Roux, H. Li, X. Zhu, **A. Silwal**, J .G. A. Guzman. *Parallel and perpendicular diffusion of energetic particles in the near-Sun solar wind observed by Parker Solar Probe*. **The Astrophysical Journal Letters**, 991(2), p.L30.

2025 [6] S. P. Gautam, G. P. Zank, A. Pitňa, L. Adhikari, L. Zhao, **A. Silwal**, P. Baruwal, P. Baruwal, M. Karki and I. Tasnim. *Characterization of the Transmission and Generation of Turbulence at Interplanetary Shocks*. **The Astrophysical Journal**, 989(1), 82.

2025 [7] S. P. Gautam, G. P. Zank, L. Adhikari, A. Pitňa, **A. Silwal**. *Influence of Solar Cycle on Magnetohydrodynamic Turbulent Modes at 1 au*. **The Astrophysical Journal**, 989(1), 62.

2025 [8] L. Zhao, X. Zhu, **A. Silwal**, G. P. Zank and A. Pitňa. *Theory and observations of the interaction between magnetohydrodynamic waves and shocks*. **Proceedings of the National Academy of Sciences of the United States of America**, 122(20), e2425668122.

2025 [9] L. Zhao, **A. Silwal**, X. Zhu, H. Li and G. P. Zank. *Transonic Turbulence and Density Fluctuations in the near-Sun Solar Wind*. **The Astrophysical Journal Letters**, 974, L4.

2025 [10] J. G. Alonso Guzmán, K. Ghanbari, V. A. Florinski, R. A. Leske, L. Zhao, X. Zhu, **A. Silwal** and N. S. M. Subashchandar. *Superposed Epoch Analysis of Stream Interaction Regions at 1 au during Solar Minimum with Turbulence Geometry Decomposition: Implications for Galactic Cosmic Ray Transport*. **Journal of Geophysical Research: Space Physics**, 130(3), e2024JA033567.

2025 [11] S. K. Saurav, **A. Silwal**, S. P. Gautam, B. Adhikari, M. Karki, L. A. Magrini, E. Echer, O. M. Magrini and M. O. Domingues. *Investigation of Pc5 pulsations and their correlation with solar wind parameters during intense geomagnetic storms*. **Journal of Atmospheric and Solar-Terrestrial Physics**, 106534.

2025 [12] X. Zhu, G. P. Zank, L. Zhao, L. Adhikari and **A. Silwal**. *Radial Evolution of MHD Turbulence Anisotropy in Low Mach Number Solar Wind*. **The Astrophysical Journal Letters**, 978(2), L34.

2024 [13] **A. Silwal**, L. Zhao, G. P. Zank, B. Wang, A. Pitňa, S. P. Gautam, B. Park, M. Nakanotani and X. Zhu. *Multispecies Energetic Particle Acceleration Associated with CIR and ICME-driven Shocks*. **The Astrophysical Journal**, 972(2), 168.

2024 [14] S. P. Gautam, L. Adhikari, G. P. Zank, **A. Silwal** and L. Zhao. *Solar Cycle Dependence of the Turbulence Cascade Rate at 1 au*. **The Astrophysical Journal**, 968(1), 12.

2024 [15] C. I. Uga, S. P. Gautam, B. Adhikari, **A. Silwal**, A. Giri. *Relationship between cosmic ray intensity and Earth's magnetic field: Cross-wavelet analysis during intense and moderate geomagnetic storms*. **Physics of Plasmas**, 31(9).

2024 [16] S. P. Gautam, A. M. Tilahun, **A. Silwal**, B. Adhikari, Y. G. Ejigu. *Ionospheric response to the 08 April 2024 total solar eclipse over United States: a case study*. **Astrophysics and Space Science**, 369(10), 1-12.

2024 [17] B. Adhikari, V. Klausner, C. M. N. Cândido, P. Poudel, H. M. Gimenes, **A. Silwal**, S. P. Gautam, A. Calabia, and Munawar Shah. *Lithosphere–atmosphere–ionosphere coupling during the September 2015 Coquimbo earthquake*. **Journal of Earth System Science**, 133(1), 35.

2024 [18] B. Park, A. Pitňa, J. Šafránková, Z. Němeček, O. Krupařová, V. Krupař, L. Zhao and **A. Silwal**. *Change of Spectral Properties of Magnetic Field Fluctuations across Different Types of Interplanetary Shocks*. **The Astrophysical Journal Letters**, 954(2): L51.

2023 [19] R. Baral, B. Adhikari, A. Calabia, M. Shah, R. K. Mishra, **A. Silwal**, S. Bohara, R. Manandhar, L. D. Peral & M. D. R. Frías. *Spectral Features of Forbush Decreases during Geomagnetic Storms*. **Journal of Atmospheric and Solar-Terrestrial Physics**, 242: 105981.

2022 [20] T. Thapa, **A. Silwal**, B. Adhikari, S. P. Gautam, P. Baruwal & A. Panthi. *Variability of relativistic electron flux (E >2 MeV) during geo-magnetically quiet and disturbed days: a case study*. **Astrophysics and Space Science**, 367(11), 114.

2022 [21] S. Dahal, B. Adhikari, A. K. Khadka, **A. Silwal**, S. K. Gupta & N. P. Chapagain. *Ionospheric signatures during G2, G3 and G4 storms in mid-latitude*. **Radio Science**, 57(5), 1-22

2022 [22] S. P. Gautam, **A. Silwal**, A. Bashyal, K. Chaudhary, M. Khanal, B. Ale, B. Adhikari, P. Poudel, M. Karki & N. P. Chapagain. *Tracking IMF Fluctuations Nearby Sun Using Wavelet Analysis: Parker Solar Probe First Encounter Data*. **Geomagnetism and Aeronomy**, 62(1), 138-150.

2022 [23] R. K. Mishra, **A. Silwal**, R. Baral, B. Adhikari, C. R. Braga, S. P. Gautam, P. K. Das & Y. Migoya-Oure. *Wavelet Analysis of Forbush Decreases at High-Latitude Stations During Geomagnetic Disturbances*. **Solar Physics**, 297, 26.

2022 [24] B. D. Ghimire, A. Silwal, N. P. Chapagain, S. P. Gautam, P. Poudel,and B. Khadka. *GPS observations of ionospheric TEC variations over Nepal during 22 July 2009 solar eclipse*, **EUREKA: Physics and Engineering**, (2), 3-14.

2021 [25] **A. Silwal**, S. P. Gautam, P. Poudel, M. Karki, B. Adhikari, N. P. Chapagain, R. K. Mishra & B.D. Ghimire. *GPS Observations of Ionospheric TEC Variations during the 15th Jan 2010 and 21st June 2020 Solar Eclipse*. **Radio Science**, 56 (5), 1-20.

2021 [26] **A. Silwal**, S. P. Gautam, K. Chaudhary, M. Khanal, S. Joshi, S. Dangaura & B. Adhikari. *Study of Solar Wind Parameters During Geomagnetic Storm of 26th August 2018 and 28th September 2017*. **Thai Journal of Physics**, 38(2), 54-68.

2021 [27] **A. Silwal**, S. P. Gautam, N. P. Chapagain, M. Karki, P. Poudel, B. D. Ghimire, R. K. Mishra, and B. Adhikari. *Ionospheric response over Nepal during the 26 December 2019 solar eclipse*. **Journal of Nepal Physical Society**, 7(1), 25-30.

2020 [28] P. Poudel, N. Parajuli, A. Gautam, D. Sapkota, H. Adhikari, B. Adhikari, **A. Silwal**, S. P. Gautam, M. Karki, and R. K. Mishra. *Wavelet and cross-correlation analysis of relativistic electron flux with sunspot number, solar flux, and solar wind parameters*. **Journal of Nepal Physical Society**, 6(2), 104-112.

Computer skills

Programming Languages: Python, PyTorch, C++, MATLAB

Memberships

2025-Present Member, American Physical Society (APS)

2021-Present Member, American Geophysical Union (AGU)

Position of Responsibility

2025-Present Associate Editor, Frontiers in Astronomy and Space Sciences

2021-Present Reviewer, The Astrophysical Journal (ApJ, ApJL), Scientific Reports, and JGR: Space Physics.

Jul 2025 Lead Mentor, South Asian Astrophysics Summer School 2025 (Heliophysics group)

Community Service

2022-Present Actively co-mentored undergraduate students in space physics research with Dr. Lingling Zhao under the Research Experiences for Undergraduates (REU) program at UAH since 2022

2022, 2023 Volunteered as a judge for the North Alabama Regional Science and Engineering Fair (NARSEF) in 2022 and 2023, evaluating middle and high school student projects and engaging with participants.

Workshops and Schools Attended

Aug 12 - 20, 2025 **NASA Heliophysics Summer School 2025**, *organized by NASA's Living With a Star program and UCAR/CPAESS, Boulder, Colorado*.
Project Title: **SHARP – Switchback Hunting with an Automated Logistic Regression Pipeline.**
Developed a machine learning pipeline using logistic regression to automatically detect solar wind 'switchback' events from Parker Solar Probe data. Combined physics-based seed labels with scalable training and validation, enabling consistent event catalogs for large-scale statistical studies and real-time detection.

May 22 - 26, 2023 **SHIELD Summer School**, *organized by The NASA SHIELD DRIVE Science Center at Boston University, Boston, Massachusetts*.
Project Title: **Turbulence in the Outer Heliosphere**

June 1 - 23, 2022 **International Space Weather Camp - 2022**, *organized by joint collaboration between The University of Alabama in Huntsville, NSF EPSCoR, CPU2AL, The German Aerospace Center (DLR) and The South African National Space Agency (SANSA)*.
Project Title: **Analysis of Interplanetary shocks in the Heliosphere.**
Conducted data-driven analysis of interplanetary magnetohydrodynamic (MHD) shocks in the solar wind, focusing on their formation, evolution, quantitative determination of shock parameters, and their role in energetic particle acceleration.

Invited Talks, Conferences and Seminars Attended

July 24, 2025 **South Asian Astrophysics Summer School 2025**.
Invited Talk: Understanding the Solar Wind from In-Situ Measurements.

Sep 26, 2025 **The Clyde W. Tombaugh Lecture Series**.
Invited Talk: From Sun to Earth and Beyond: The Story of the Solar Wind.

Apr 7 – 11, 2025 **22nd Annual International Astrophysics Conference - Physics of the Solar Wind and Local Interstellar Medium**, *Santiago de Compostela, Spain*.
Oral Presentation: Evolution of Solar Wind Turbulence during Parker Solar Probe - Solar Orbiter Radial Alignment.

Aug 12 – 16, 2024 **Solar Heliospheric and INterplanetary Environment (SHINE) Meeting 2024**, *Juneau, Alaska, USA*.
Poster Presentation: Evolution of solar wind turbulence during radial alignment of PSP with Solar Orbiter in December 2022.

Dec 9 – 13, 2024 **American Geophysical Union (AGU) Fall Meeting 2024**, *Washington, D.C., USA*.
Poster Presentation: Multi-Spacecraft Study of Energetic Particle Acceleration Associated with Corotating Interaction Regions.

Dec 11 - 15, 2023 **AGU Fall Meeting 2023**, *San Francisco, CA, USA*.
Poster Presentation: Low-Energy Elemental Flux Ratios Observed at 1 AU: Implications for Galactic Cosmic Ray Propagation.

Dec 12 - 16, 2022 **AGU Fall Meeting 2022**, *Chicago, USA*.
Poster Presentation: Turbulence Evolution and Particle Acceleration across the Interplanetary Shocks.

Dec 13 - 17, 2021 **AGU Fall Meeting 2021**, *New Orleans, LA, USA*.
Virtual iPoster Presentation: Study of Field Aligned Currents During the 22 July 2009 and 21 June 2020 Solar Eclipse.

Referees

Dr. Lingling Zhao
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University of Alabama in Huntsville
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Dr. Gary P Zank
Distinguished Professor, Department of Space Science
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Dr. Hui Li
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Nuclear, Particle Physics, Astrophysics and & Cosmology
Los Alamos National Laboratory
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