Bishwas L. Shrestha

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Address: 171 Broadmead, 200-G, Princeton, NJ 08544, USA
Space Physics @ Princeton
Department of Astrophysical Sciences, Princeton University
Phone: +1 (256) 527 8403
Email: bishwasls@princeton.edu

EDUCATION

2021 Ph.D. in Space Science — **Department of Space Science, The University of Alabama in Huntsville**
Huntsville AL, USA
Thesis: "Energetic Neutral Atom Flux from the Inner Heliosheath and its connection to the Termination Shock Properties"
Advisors: Prof. Gary P. Zank & Prof. Jacob Heerikhuisen

2018 M.S. in Space Science — **Department of Space Science, The University of Alabama in Huntsville**
Huntsville AL, USA

2013 M.Sc. in Physics — **Central Department of Physics, Tribhuvan University**
Kathmandu, Nepal

2009 B.Sc. in Physics — **Prithvi Narayan Campus, Tribhuvan University**
Pokhara, Nepal

RESEARCH AND TEACHING EXPERIENCE

Sep 2021 - Present — **Postdoctoral Research Associate**
Space Physics at Princeton
Department of Astrophysical Sciences, Princeton University, USA

Aug 2016 - July 2021 — **Graduate Research Assistant**
Department of Space Space Science, The University of Alabama in Huntsville, USA

Oct 2014 - Jun 2016 — **Lecturer of Physics**
Kantipur Engineering College, Lalitpur, Nepal
Course: Undergraduate Level Engineering Physics

May 2014 - Oct 2014 — **Lecturer of Physics**
Lalitpur Engineering College, Lalitpur, Nepal
Course: Undergraduate Level Engineering Physics

RESEARCH INTERESTS

- Pickup Ion acceleration at the Heliospheric Termination Shock, Interplanetary Shock, and Planetary Bow Shock
- Simulation and Analysis of Global Hydrogen Energetic Neutral Atom (ENA)
- Interaction of Solar Wind with Local Interstellar Medium Interaction
- Analysis of Pickup Ion, Solar Wind, & ENA data
- Computational Plasma Physics
- Scientific Algorithms development

PUBLICATIONS

Peer Reviewed (10 total, 4 first author, 2 second author)

- Livadiotis, G., McComas, D.J., **Shrestha, B.L.**, Thermodynamics of Pickup Ions in the Heliosphere, **Submitted to ApJ**, (2024).
- Zirnstein, E. J., Kumar, R., Swaczyna, P., Dayeh, M.A., Heerikhuisen, J., **Shrestha, B. L.**, Szalay, J. R. (**2024**), Global Heliospheric Termination Shock Strength in the Solar-Interstellar Interaction, **Under Review, Nature Astronomy**, preprint
- **Shrestha, B. L.**, Zirnstein, E. J., McComas, D. J., Brandt, P., Stern A., Elliott, H. A., Poppe, A. R., Singer, K. N., Verbiscer, A. (**2023**), Suprathermal H^+ Pickup Ion Tails in the Outer Heliosphere, *The Astrophysical Journal*, *960 (1)*, *35*, doi: 10.3847/1538-4357/ad08b9.
- Adhikari, L., Zank, G. P., Wang, B.B., Zhao, L.-L, Telloni, D., Pinta, A., Opher, M., **Shrestha, B. L.**, McComas, D., Nykyri, K. (**2023**), Theory and Transport of Nearly Incompressible Magnetohydrodynamic Turbulence: High Plasma Beta Regime, *The Astrophysical Journal*, *953 (1)*, *44*, doi: 10.3847/1538-4357/acde57.
- Wang, B., Zank, G. P., **Shrestha, B. L.**, Kornbleuth, M., Opher, M. (**2023**), Relating Energetic Ion Spectra to Energetic Neutral Atoms, *The Astrophysical Journal*, *944(2)*, *198*, doi: 10.3847/1538-4357/acb437.
- **Shrestha, B. L.**, Zirnstein, E. J., and McComas, D. J. (**2023**), Tracking the Rapid Opening and Closing of Polar Coronal Holes through IBEX ENA Observations, *The Astrophysical Journal*, *943(1)*, *34*, doi: 10.3847/1538-4357/aca891.
- Zirnstein, E. J., **Shrestha, B. L.**, McComas, D. J., Dayeh, M. A., Heerikhuisen, J., Reisenfeld, D. B., Sokol, J. M., and Swaczyna, P. (**2022**), Oblique and Rippled Heliosphere Structures from the Interstellar Boundary Explorer, *Nature Astronomy*, **6**, 1398-1413, doi: 10.1038/s41550-022-01798-6
- McComas, D. J., **Shrestha, B. L.**, Swaczyna, P., Rankin, J. S., Weidner, S. E., Zirnstein, E. J., Elliott, H. A., Singer, K. N., Spencer, J., Stern, S. A., Weaver, H. A. (**2022**), First High-Resolution Observations of Interstellar Pickup Ion Mediated Shocks in the Outer Heliosphere, *The Astrophysical Journal*, *934(2)*, *147*, doi: 10.3847/1538-4357/ac7956.
- **Shrestha, B. L.**, Zirnstein, E. J., Heerikhuisen, J., and Zank, G. P. (**2021**), Strength of the Termination Shock Inferred from the Globally Distributed Energetic Neutral Atom Flux from IBEX, *The Astrophysical Journal Supplement Series*, *254(2)*, *32*, doi: 10.3847/1538-4365/abf659.
- **Shrestha, B. L.**, Zirnstein, E. J., and Heerikhuisen, J. (**2020**), Energetic Neutral Atom Flux from the Inner Heliosheath and Its Connection to Termination Shock Properties, *The Astrophysical Journal*, *894(2)*, *102*, doi: 10.3847/1538-4357/ab893b.

White Papers

- Swaczyna, P., Rankin, J. S., **Shrestha, B. L.**, Zirnstein, E. J., Kucharek, H., Mostafavi, P., Spitzer, S. A. (**2023**), Ubiquitous Nature of Pickup Ions in the Outer Heliosphere and Beyond, *Bulletin of the AAS*, doi: 10.3847/25c2cfeb.6085ff19.

Ph.D. Dissertation

- **Shrestha, B. L.** (**2021**), Energetic neutral atom flux from the inner heliosheath and its connection to termination shock properties, https://louis.uah.edu/uah-dissertations/250/.

MISSION EXPERIENCE

- IBEX - IBEX-Hi
- New Horizons - Solar Wind Around Pluto (SWAP)
- IMAP - Solar Wind and Pickup Ions (SWAPI), Algorithms Lead

CONFERENCE SESSION CONVENER

- Chaired the Afternoon session, 20th AIAC Meeting, Oct 31 - Nov 4, 2022, Santa Fe, New Mexico, USA.
- Chaired the Afternoon session, *Microphysics of ENA Sources*, IBEX/IMAP Science Team Meeting, June 15, 2022, Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland, USA.
- Chaired live online session, Over a Full Solar Cycle of Outer Heliosphere Observations, SH026, AGU Fall meeting 2020, 10 Dec 2020.

ORAL PRESENTATIONS

- **Shrestha, B. L.**, Zirnstein, E. J., McComas, D. J., New Horizons Team, Suprathermal Pickup Ion Tails in the Outer Heliosphere, SH53A, AGU Fall Meeting 2023, 15 December 2023, San Francisco, CA, USA.
- **Shrestha, B. L.**, Zirnstein, E. J., McComas, D. J., Brandt, P., Stern A., Elliott, H. A., Poppe, A. R., Singer, K. N., Verbiscer, A., Evolution of Proton Pickup Ion Tails in the Outer Heliosphere, New Horizons STM 54, 25-27 October 2023, Boston University, Boston, MA, USA.
- Zirnstein, E. J., **Shrestha, B. L.**, McComas, D. J., Dayeh, M. A., Heerikhuisen, Reisenfeld, D. B., Sokół, J. M., Swaczyna, P.Oblique and Rippled Heliosphere Structures from the Interstellar Boundary Explorer, AGU Fall Meeting 2022, 12 - 17 Dec 2022, Chicago, IL, USA.
- **Shrestha, B. L.**, Zirnstein, E. J., McComas, D. J., Evolution of Polar Coronal Holes Observed by IBEX, 20th Annual International Astrophysics Conference, 31 Oct - 4 Nov, 2022, Santa Fe, NM, USA.
- **Shrestha, B. L.**, Zirnstein, E. J., Szalay, J. R., McComas, D. J., Opening and Closing of Polar Coronal Holes Observed by IBEX, IBEX/IMAP Science Team Meeting, 14-15 June 2022, Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland, USA.
- Zirnstein, E. J., **Shrestha, B. L.**, McComas, D. J., Dayeh, M. A., Heerikhuisen, J., Reisenfeld, D. B., Sokol, J. M., and Swaczyna, P., High-resolution Helioaphere Boundary Structures from IBEX, IBEX/IMAP Science Team Meeting, 14-15 June, 2022, Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland, USA.
- **Shrestha, B. L.**, Zank, G. P., Zirnstein, E. J., Heerikhuisen, J., Giacalone, J., and McComas, D. J., Pickup Ion Spectrum Downstream of the Termination Shock Inferred from IBEX ENA observations and Comparison with Kinetic Simulations, SH22A, AGU Fall Meeting 2021, 13 - 17 Dec 2021, New Orleans, LA, USA.
- **Shrestha, B. L.**, Zirnstein, E. J., Heerikhuisen, J., and Zank, G. P., Strength of the Termination Shock Inferred from the Globally Distributed Energetic Neutral Atom Flux from IBEX, 43rd COSPAR Scientific Assembly, 28 Jan - 4 Feb 2021, Sydney, Australia (Online Oral Presentation).
- Heerikhuisen, J., Zirnstein, E. J., Pogorelov, N. V., Zank, G. P., **Shrestha, B. L.**, The Interaction between Neutral Atoms and PUIs in the Heliosphere and LISM, 43rd COSPAR Scientific Assembly, 28 Jan - 4 Feb 2021, Sydney, Australia (Online Oral Presentation).
- **Shrestha, B. L.**, Zirnstein, E. J., and Heerikhuisen, J., Energetic Neutral Atom Flux from the Inner Heliosheath and its Connection to Termination Shock Properties, 19th Annual International Astrophysics Conference, 9 - 13 March 2020, Santa Fe, NM, USA.
- Heerikhuisen, J., Zirnstein, E. J., Pogorelov, N. V., **Shrestha, B. L.**, Zank, G. P., Desai, M. I., and Bzowski, M., Using Simulations to Understand the Impact of Physical Processes on the Global Heliosphere, AGU Fall Meeting 2019, 9 - 13 Dec 2019, San Francisco, CA, USA.
- **Shrestha, B. L.**, Heerikhuisen, J., and Zirnstein, E. J., Simulated Heliosphere Projected into All-sky Map, 22^{nd} IBEX/ 1^{st} IMAP Science Working Team Meeting, 28 - 29 Aug 2018, Princeton University, Princeton, NJ, USA.

POSTER PRESENTATIONS

- Zirnstein, E. J., Kumar, R., Swaczyna, P., Dayeh, M.A., Heerikhuisen, J., **Shrestha, B. L.**, Szalay, J. R., Global Heliospheric Termination Shock Strength in the Solar-Interstellar Interaction, SH51D-2648, AGU Fall Meeting 2023, 11-17 Dec 2023, San Francisco, CA, USA.

- **Shrestha, B. L.**, Zirnstein, E. J., McComas D. J., Szalay, J. R., Evolution of Polar Coronal Holes Observed by IBEX, SH45E-2386, AGU Fall Meeting 2022, 12-17 Dec 2022, Chicago, IL, USA.
- **Shrestha, B. L.**, Zirnstein, E. J., Szalay, J. R., McComas, D. J., Tracking the Evolution of Polar Coronal Holes using IBEX ENA Observations, SHINE 2022, June 27 - July 01, 2022, Honolulu, HI, USA, https://helioshine.org/tracking-the-evolution-of-polar-coronal-holes-using-ibex-ena-observations/.
- **Shrestha, B. L.**, Zirnstein, E. J., Heerikhuisen, J., and Zank, G. P., Strength of the Termination Shock Inferred from the Inner Heliosheath ENA Flux, SH023-0006, AGU Fall Meeting 2020, 01 - 17 Dec 2020 (Online Poster Presentation).
- **Shrestha, B. L.**, Heerikhuisen, J., Zirnstein, E. J., and Zank, G. P., Termination Shock Properties Inferred from the Inner Heliosheath ENA Flux, SH51C-3338, AGU Fall Meeting 2019, 09 - 13 Dec 2019, San Francisco, CA, USA.
- **Shrestha, B. L.**, Heerikhuisen, J., and Zirnstein, E. J., ENA Flux from the Inner Heliosheath and its Connection to Termination Shock Properties, P122, SHINE 2019, 05 - 09 Aug 2019, Boulder, CO, USA.
- **Shrestha, B. L.**, Heerikhuisen, J., Zirnstein, E. J., and Pogorelov, N. V., ENA Flux from the Inner Heliosheath and its Connection to Termination Shock Properties, SH13C-2971, AGU Fall Meeting 2018, 10 - 14 Dec 2018, Washington, DC, USA.
- **Shrestha, B. L.**, Heerikhuisen, J., and Zirnstein, E. J., Spectral Properties of ENAs in the Presence of Multiple PUI Populations, SH23C-2662, AGU Fall Meeting 2017, 11 - 15 Dec 2017, New Orleans, LA, USA.

JOURNAL REVIEWER

- The Astrophysical Journal ($\times$ 2), The Astrophysical Journal Supplement Series ($\times$ 1)

AWARDS AND HONORS

- First Place, CSPAR and SPA Graduate Student Flash Talk Contest 2021, International Space Weather Camp 2021, June 15, 2021
- Departmental Scholarship, Department of Space Science, UAH, Fall 2016 - Spring 2017

OTHER ACTIVITIES

- Judge for the Princeton Research Day 2023, May 11, 2023, Princeton, NJ
- Outstanding Student Presentation Award (OSPA) Judge, AGU Fall Meeting 2022, Dec 12 - 16 2022, Chicago, IL, USA
- Judge for the SHINE 2022 Poster Contest, June 27 - July 01, 2022, Honolulu, HI, USA
- Volunteer Judge for Alabama Science and Engineering Fair (ASEF), Junior (2018, 2019) and Senior (2017) Physical Science category

WORKSHOP AND SUMMER SCHOOLS ATTENDED

- Joint Space Weather Summer Camp 2017, June 24 - July 8 (UAH, Huntsville, AL), July 9 - July 22 (SANSA, Hermanus, South Africa)
- Workshop on Plasma Physics and Introduction of Plasma Experiments at University Courses, December 17, 2012, Kathmandu University, Dhulikhel, Nepal
- Eleventh International School on Astronomy and Space Science, October 1 - 10, 2012, Kathmandu, Nepal
- Fourth International Conference on the Frontiers of Plasma Physics and Technology (FPPT- 4), April 6 - 10, 2009, Kathmandu, Nepal

TECHNICAL SKILLS

Simulations:	Test Particle Simulation, and Fluid/MHD Simulation
Programming Languages:	C/C++, MATLAB, IDL, Bash, LaTeX, and Mathematica
Parallel Programming:	MPI and OpenMP
Version Control:	Git and GitHub
Operating Systems:	Linux, MacOS, and Microsoft Windows.

PROFESSIONAL SOCIETIES MEMBERSHIP

- American Geophysical Union (July 2017 to present)
- American Physical Society (September 2020 to August 2021)
- Association of Nepali Physicists in America (July 2020 to present)
- Nepal Physical Society (Life member)