

Eric J. Zirnstien

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Curriculum Vitae

EDUCATION

Ph.D., Physics, University of Alabama in Huntsville, 2014

M.S., Physics, University of Alabama in Huntsville, 2012

B.S., Physics, University of Alabama in Huntsville, 2010

PROFESSIONAL CHRONOLOGY

Research Scholar, Princeton University, July 2021 – Present

Associate Research Scholar, Princeton University, Oct. 2016 – June 2021

Research Scientist, Southwest Research Institute, May 2016 – Sept. 2016

Postdoctoral Researcher, Southwest Research Institute, Sept. 2014 – May 2016

Research Assistant, University of Alabama in Huntsville, Aug. 2011 – Aug. 2014

Teaching Assistant, University of Alabama in Huntsville, Aug. 2010 – Aug. 2011

SUMMARY

Dr. Zirnstien is a research scientist specializing in the simulation and analysis of hydrogen energetic neutral atom (ENA) emission from the solar wind-local interstellar medium interaction. He received his B.S., M.S., and Ph.D. in Physics at the University of Alabama in Huntsville, specializing in Space Science. He developed a numerical code that computes hydrogen ENA fluxes at 1 au for NASA's *Interstellar Boundary Explorer (IBEX)* mission by post-processing 3D MHD-plasma/kinetic-neutral simulation results of the heliosphere, including the development of time-independent and -dependent algorithms, employing MPI and distributed/shared memory algorithms in C that run on multi-node computer clusters, and simulation/data analysis and visualization in IDL and Matlab. His current research continues the simulation and analysis of observations made by the *IBEX* mission, as well as supporting the analysis of *New Horizon's* Solar Wind Around Pluto (SWAP) instrument measurements at the Pluto plasma environment and in the solar wind. He is also lead data analyst for the Solar Wind And Pickup Ion (SWAPI) instrument and science team member for the *IMAP*-Hi instrument, both in development for the *Interstellar Mapping and Acceleration Probe (IMAP)* mission.

Dr. Zirnstien is actively involved with presenting talks/posters at conferences and meetings, convening conference sessions, and refereeing journal articles and NASA proposals. He is co-editor of *Heliosphere News*. As of July 2021, he has authored/co-authored 68 refereed publications (26 first author), with over 1700 citations and an h-index of 22 (Google Scholar).

PUBLICATIONS

2021

- Frisch, P. C., Berdyugin, A. B., Piirola, V., Heiles, C., Cole, A. A., Hill, K., Magalhães, A. M., Wiktorowicz, S. J., Bailey, J., Cotton, D. V., Kedziora-Chudczer, L., Schwadron, N. A.,

Bzowski, M., McComas, D. J., **Zirnstein, E. J.**, Funsten, H. O., Harlington, C., *Whence the Interstellar Magnetic Field Shaping the Heliosphere?*, ApJS, under review.

- **Zirnstein, E. J.**, Kumar, R., Bandyopadhyay, R., Dayeh, M. A., Heerikhuisen, J., McComas, D. J., *Turbulent Acceleration of Interstellar Pickup Ions at the Heliospheric Termination Shock Forms the Global ENA Spectrum*, ApJL, in press.
- Bagenal, F., McComas, D. J., Elliott, H. A., **Zirnstein, E. J.**, McNutt Jr., R. L., Lisse, C. M., Kollmann, P., Delamere, P. A., Barnes, N. P., *Solar Wind Interaction with the Pluto System*, in *The Pluto System After New Horizons*, pp. 379-392, doi:10.2458/azu_uapress_9780816540945-ch016, 2021.
- Fuselier, S. A., Galli, A., Richardson, J. D., Reisenfeld, D. B., **Zirnstein, E. J.**, Heerikhuisen, J., Dayeh, M. A., Schwadron, N. A., McComas, D. J., Elliott, H. A., Gomez, R. G., Starkey, M. J., Kornbleuth, M. Z., Opher, M., Dialynas, K., *Energetic Neutral Atom Fluxes from the Heliosheath: Constraints from in situ Measurements and Models*, ApJL, 915, L26, doi:10.3847/2041-8213/ac0d5c, 2021.
- Reisenfeld, D. B., Bzowski, M., Funsten, H. O., Heerikhuisen, J., Janzen, P. H., Kubiak, M. A., McComas, D. J., Schwadron, N. A., Sokół, J. M., Zimorino, A., **Zirnstein, E. J.**, *A Three-Dimensional Map of the Heliosphere from IBEX*, ApJS, 254, 40, doi:10.3847/1538-4365/abf658, 2021.
- Shrestha, B., L., **Zirnstein, E. J.**, Heerikhuisen, J., Zank, G. P., *Strength of the Termination Shock Inferred from the Globally Distributed Energetic Neutral Atom Flux from IBEX*, ApJS, 254, 32, doi:10.3847/1538-4365/abf659, 2021.
- McComas, D. J., Swaczyna, P., Szalay, J. R., **Zirnstein, E. J.**, Rankin, J. S., Elliott, H. A., Singer, K., Spencer, J., Stern, S. A., Weaver, H., *Interstellar Pickup Ion Observations Halfway to the Termination Shock*, ApJS, 254, 19, doi:10.3847/1538-4365/abee76, 2021.
- Swaczyna, P., Rahmanifard, F., **Zirnstein, E. J.**, McComas, D. J., Heerikhuisen, J., *Slowdown and Heating of Interstellar Neutral Helium by Elastic Collisions Beyond the Heliopause*, ApJL, 911, L36, doi:10.3847/2041-8213/abf436, 2021.
- **Zirnstein, E. J.**, Dayeh, M. A., Heerikhuisen, J., *Dependence of the IBEX Ribbon Geometry on Pitch Angle Scattering Outside the Heliopause*, ApJ, 908, 35, doi:10.3847/1538-4357/abd4e8, 2021.
- **Zirnstein, E. J.**, Dayeh, M. A., Heerikhuisen, J., McComas, D. J., Swaczyna, P., *Heliosheath Proton Distribution in the Plasma Reference Frame*, ApJS, 252, 26, doi:10.3847/1538-4365/abd092, 2021.

2020

- Swaczyna, P., McComas, D. J., **Zirnstein, E. J.**, Sokół, J. M., Elliott, H. A., Bzowski, M., Kubiak, M. A., Richardson, J. D., Kowalska-Leszczynska, I., Stern, S. A., Weaver, H. A., Olkin, C. B., Spencer, J., *Density of Neutral Hydrogen in the Sun's Interstellar Neighborhood*, ApJ, 903, 48, doi:10.3847/1538-4357/abb80a, 2020.
- Dayeh, M. A., Szalay, J. R., Ogasawara, K., Fuselier, S. A., McComas, D. J., Funsten, H. O., Petrinc, S. M., Schwadron, N. A., **Zirnstein, E. J.**, *First Global Images of Ion Energization in the Terrestrial Foreshock Region by the Interstellar Boundary Explorer (IBEX)*, GRL, 47, e2020GL088188, doi:10.1029/2020GL088188, 2020.
- **Zirnstein, E. J.**, Dayeh, M. A., McComas, D. J., Sokół, J. M., *Distance to the Energetic Neutral Hydrogen Source in the Heliotail*, ApJ, 897, 138, doi:10.3847/1538-4357/ab9605, 2020.
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Kowalska-Leszczynska, I., Kubiak, M. A., Schwadron, N. A., Sokół, J. M., Szalay, J. R., Tokumaru, M., **Zirnstein, E. J.**, *Solar Cycle of Imaging the Global Heliosphere: Interstellar Boundary Explorer (IBEX) Observations from 2009–2019*, *ApJS*, 248, 26, doi:10.3847/1538-4365/ab8dc2, 2020.

- Shrestha, B. L., **Zirnstein, E. J.**, Heerikhuisen, J., *Energetic Neutral Atom Flux from the Inner Heliosheath and its Connection to Termination Shock Properties*, *ApJ*, 894, 102, doi:10.3847/1538-4357/ab893b, 2020.
- **Zirnstein, E. J.**, Dayeh, M. A., McComas, D. J., Sokół, J. M., *Asymmetric Structure of the Solar Wind and Heliosphere from IBEX Observations*, *ApJ*, 894, 13, doi:10.3847/1538-4357/ab8470, 2020.
- **Zirnstein, E. J.**, Kim, T. K., Mostafavi, P., Heerikhuisen, J., McComas, D. J., Pogorelov, N. V., *Response of Pickup Ions in the Very Local Interstellar Medium to Solar Variations: Implications for the Evolution of the IBEX Ribbon and Interstellar Helium*, *ApJ*, 891, 56, doi:10.3847/1538-4357/ab744b, 2020.
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2019

- Swaczyna, P., McComas, D. J., **Zirnstein, E. J.**, Heerikhuisen, J., *Angular Scattering in Charge Exchange Collisions: Issues and Implications for Secondary Interstellar Hydrogen*, *ApJ*, 887, 223, doi:10.3847/1538-4357/ab5440, 2019.
- **Zirnstein, E. J.**, Swaczyna, P., McComas, D. J., Heerikhuisen, J., *Parallax of the IBEX Ribbon Indicates a Spatially Retained Source*, *ApJ*, 879, 106, doi:10.3847/1538-4357/ab2633, 2019.
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- **Zirnstein, E. J.**, McComas, D. J., Schwadron, N. A., Dayeh, M. A., Heerikhuisen, J., Swaczyna, P., *Strong Scattering of ~keV Pickup Ions in the Local Interstellar Magnetic Field Draped Around Our Heliosphere: Implications for the IBEX Ribbon's Source and IMAP*, *ApJ*, 876, 92, doi:10.3847/1538-4357/ab15d6, 2019.
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- Desai, M. I., Dayeh, M. A., Allegrini, F., McComas, D. J., Funsten, H., Heerikhuisen, J., Fuselier, S. A., Pogorelov, N. V., Schwadron, N. A., Zank, G. P., **Zirnstein, E. J.**, Sokół, J. M., Tokumaru, M., Bzowski, M., Kubiak, M. A., Reisenfeld, D. B., *Temporal Evolution of the Latitude and Energy Dependence of the Energetic Neutral Atom Spectral Indices Measured by the Interstellar Boundary Explorer (IBEX) Over the First Nine Years*, ApJ, 875, 91, doi:10.3847/1538-4357/ab0f37, 2019.
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- **Zirnstein, E. J.**, Kumar, R., Heerikhuisen, J., McComas, D. J., Galli, A., *Constraining the Evolution of the Proton Distribution Function in the Heliotail*, ApJ, 865, 150, doi:10.3847/1538-4357/aadb98, 2018.
- **Zirnstein, E. J.**, McComas, D. J., Kumar, R., Elliott, H. A., Szalay, J. R., Olkin, C. B., Spencer, J., Stern, S. A., Young, L. A., *In Situ Observations of Preferential Pickup Ion Heating at an Interplanetary Shock*, PRL, 121, 075102, doi:10.1103/PhysRevLett.121.075102, 2018.
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4357/aac3de, 2018.

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- **Zirnstein, E. J.**, Heerikhuisen, J., McComas, D. J., Pogorelov, N. V., Reisenfeld, D. B., Szalay, J. R., *Simulation of the Solar Wind Dynamic Pressure Increase in 2014 and Its Effect on Energetic Neutral Atom Fluxes from the Heliosphere*, ApJ, 859, 104, doi:10.3847/1538-4357/aac016, 2018.
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2016

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HONORS & AWARDS

- NASA Group Achievement Award, *New Horizons* Team, 2016
- College of Science Outstanding GRA Award, University of Alabama in Huntsville, 2013-2014
- NASA Earth and Space Science Fellowship in Heliophysics, 2011-2014

RESEARCH GRANT SELECTIONS

- NASA ROSES Heliophysics Supporting Research Program: “Mapping the Heliospheric Termination Shock with IBEX Observations and Modeling” (**PI**, 2021-2024)
- NASA ROSES Outer Heliosphere Investigators Program: “Identifying the Origin of

- Energetic Neutral Atoms Measured by IBEX along the Voyager Directions” (**PI**, 2020-2023)
- NASA ROSES Outer Heliosphere Investigators Program: “Angular Scattering of Neutral Atoms: Observations and Interpretation from IBEX and Consequences for IMAP” (**Co-I**, 2020-2023)
- NASA ROSES Phase I DRIVE Program: “Our Heliospheric Shield” (**Co-I**, 2020-2021)
- NASA ROSES Heliophysics Supporting Research Program: “Helium and the Heliosphere” (**Co-I**, 2018-2021)
- NASA ROSES Heliophysics Supporting Research Program: “Understanding Pickup Ion Processes outside the Heliopause: Modeling and Analysis of the *IBEX* Ribbon Observables” (**PI**, 2017-2020)
- NASA ROSES Heliophysics Supporting Research Program: “Pick-Up Ions and Energetic Neutral Atoms: Implications for the Termination Shock” (**Co-I**, 2016-2019)

MISSION GUEST INVESTIGATOR

- *Interstellar Mapping and Acceleration Probe (IMAP)*, Outer Heliosphere Guest Investigators Program (2020-2023)
- *Interstellar Boundary Explorer (IBEX)*, Outer Heliosphere Guest Investigators Program (2020-2023)

IN THE PRESS

- APS *Physics* Feature, August 17, 2018: “Solar Wind Shockwave Gives Ions a Push” (<https://physics.aps.org/articles/v11/83>)
- NASA Feature, June 6, 2018: “As Solar Wind Blows, Our Heliosphere Balloons” (<https://www.nasa.gov/feature/goddard/2018/as-solar-wind-blows-our-heliosphere-balloons>)
- NASA’s Voyager Spacecraft 40th Anniversary Celebration, Panel Discussion, September 5, 2017 (<https://www.nasa.gov/press-release/nasa-and-ionic-museum-honor-voyager-spacecraft-40th-anniversary>)
- AAS NOVA Highlight, May 25, 2016: “Clues from Pluto’s Ions” (<http://aasnova.org/2016/05/25/clues-from-plutos-ions/>)
- NASA Feature, Feb. 26, 2016: “NASA’s IBEX Observations Pin Down Interstellar Magnetic Field” (<http://www.nasa.gov/feature/goddard/2016/nasa-s-ibex-observations-pin-down-interstellar-magnetic-field>)

INVITED CONFERENCE PRESENTATIONS

2020

- *Insights into the Heliospheric Energetic Neutral Atom Source with Modeling*, **Zirnstein, E. J.** (AGU, Oral, December 2020)

2019

- *Pickup Ions in the Outer Heliosphere: New Horizons, Voyager, IBEX, and the Upcoming IMAP Mission*, **Zirnstein, E. J.** (AGU, Oral, December 2019)

2018

- *Pickup Ions in the Outer Heliosphere: Revelations by IBEX and the Upcoming IMAP Mission*, **Zirnstein, E. J.** (AGU, Oral, December 2018)

2017

- *IBEX Observations and Simulations of the Ribbon: Implications for the Very Local Interstellar Medium*, **Zirnstein, E. J.** (AGU, Oral, December 2017)
- *What We've Learned from IBEX ENA Imaging of the Heliosheath*, **Zirnstein, E. J.** (AGU, Oral, December 2017)

2014

- *Distinguishing Tests of the Interstellar Boundary Explorer Ribbon through Numerical Modeling: Current Results and Future Prospects*, **Zirnstein, E. J.** (AGU, Oral, December 2014)

CONFERENCE/MEETING PRESENTATIONS

2020

- *The Impact of Helium on Simulations of the Heliosphere*, Heerikhuisen, J., Pogorelov, N. V., **Zirnstein, E. J.**, Bzowski, M., Moebius, E. (AGU, Poster, December 2020)
- *Higher Density of Interstellar Hydrogen from Pickup Ion Observations in the Outer Heliosphere*, Swaczyna, P., McComas, D. J., **Zirnstein, E. J.**, Sokół, J. M., Elliott, H. A., Bzowski, M., Kubiak, M. A., Richardson, J. D., Kowalska-Leszczynska, I., Stern, S. A., Weaver, H. A., Olkin, C., Singer, K. N., Spencer, J. R. (AGU, Oral, December 2020)
- *Inferring the IBEX ribbon shape from ENA temporal variations: A proof-of-concept for IMAP observations*, Dayeh, M. A., **Zirnstein, E. J.** (AGU, Oral, December 2020)
- *Strength of the Termination Shock Inferred from the Inner Heliosheath ENA Flux*, Shrestha, B. L., **Zirnstein, E. J.**, Heerikhuisen, J., Zank, G. P. (AGU, Poster, December 2020)
- *Building a 3-D Map of the Heliosphere with IBEX*, Reisenfeld, D. B., Bzowski, M., Funsten, H. O., Heerikhuisen, J., Janzen, P. H., Kubiak, M. A., McComas, D. J., Schwadron, N. A., Sokół, J. M., **Zirnstein, E. J.** (AGU, Poster, December 2020)

2019

- *Termination Shock Properties Inferred from the Inner Heliosheath ENA Flux*, Shrestha, B. L., Heerikhuisen, J., **Zirnstein, E. J.**, Zank, G. P. (AGU, Poster, December 2019)
- *Using Simulations to Understand the Impact of Physical Processes on the Global Heliosphere*, Heerikhuisen, J., **Zirnstein, E. J.**, Pogorelov, N. V., Shrestha, B. L., Zank, G. P., Desai, M. I., Bzowski, M. (AGU, Oral, December 2019)
- *Angular Scattering in Charge Exchange: Issues and Implications for Secondary Interstellar Hydrogen*, Swaczyna, P., McComas, D. J., **Zirnstein, E. J.**, Heerikhuisen, J. (AGU, Poster, December 2019)
- *First Global Images of Ion Energization in the Terrestrial Foreshock Region by the Interstellar Boundary Explorer (IBEX)*, Dayeh, M. A., Szalay, J. R., Ogasawara, K., Fuselier, S. A., McComas, D. J., Funsten, H. O., Petrinc, S. M., Schwadron, N., **Zirnstein, E. J.** (AGU, Oral, December 2019)
- *Properties of the Energetic Neutral Atom Emission from the Ribbon*, Funsten, H. O., Bzowski, M., Dayeh, M. A., Fernandes, P. A., Frisch, P. C., Janzen, P. H., McComas, D. J., Reisenfeld, D. B., Schwadron, N., Theiler, J. P., Zank, G. P., **Zirnstein, E. J.** (AGU, Oral, December 2019)
- *Parallax of the IBEX Ribbon Indicates a Spatially Retained Source*, **Zirnstein, E. J.**, Swaczyna, P., McComas, D. J., Heerikhuisen, J. (IBEX/IMAP SWT, Oral, June 2019)
- *Turbulence in the VLISM and the IBEX Ribbon*, **Zirnstein, E. J.**, Giacalone, J., Kumar, R., McComas, D. J., Dayeh, M. A., Heerikhuisen, J. (IBEX/IMAP SWT, Oral, June 2019)

- *The Solar Wind, Pickup Ion, Energetic Particle, Cosmic Ray, and Dust Space Environment at 2014 MU69 (Ultima Thule)*, Elliott, H. A., McComas, D. J., McNutt Jr., R. L., Horanyi, M., Gladstone, G. R., Bagenal, F., Hill, M. E., Kollmann, P., Bernardoni, E., Piquette, M., Young, L. A., **Zirnstein, E.**, Parker, J. W., Stern, S. A., Weaver, H. A., Spencer, J. R., Olkin, C. B., Verbiscer, A. (LPSC, Poster, March 2019)
- *Strong Scattering of ~keV Pickup Ions in the Interstellar Magnetic Field Draped Around Our Heliosphere: Implications for the IBEX Ribbon's Source and IMAP*, **Zirnstein, E. J.**, McComas, D. J., Schwadron, N. A., Dayeh, M. A., Heerikhuisen, J., Swaczyna, P. (AIAC, Oral, February 2019)

2018

- *In Situ Observations of Preferential Pickup Ion Heating at an Interplanetary Shock*, **Zirnstein, E. J.**, McComas, D. J., Kumar, R., Elliott, H. A., Szalay, J. R., Olkin, C. B., Spencer, J., Stern, S. A., Young, L. A. (AGU, Poster, December 2018)
- *Energetic Neutral Atom Emission from the Heliospheric Nose*, Funsten, H. O., Bzowski, M., Fernandes, P. A., Frisch, P. C., Janzen, P. H., Larsen, B., McComas, D. J., Reisenfeld, D. B., Schwadron, N., Theiler, J. P., Zank, G. P., **Zirnstein, E. J.** (AGU, Poster, December 2018)
- *The Ionization State of the Local Interstellar Matter Revealed by IBEX Observations of Interstellar Neutral Atoms*, Bzowski, M., Czechowski, A., Frisch, P. C., Fuselier, S. A., Galli, A., Grygorczuk, J., Heerikhuisen, J., Kubiak, M. A., Kucharek, H., McComas, D. J., Moebius, E., Schwadron, N. A., Slavin, J. D., Sokół, J. M., Swaczyna, P., Wurz, P., **Zirnstein, E. J.** (AGU, Oral, December 2018)
- *Variations of the IBEX ENA Ribbon Properties and their Correlation with Solar Wind Observations*, Dayeh, M. A., **Zirnstein, E. J.**, Sokół, J. M., Desai, M. I., Fuselier, S. A., McComas, D. J., Schwadron, N. A., Szalay, J. R. (AGU, Oral, December 2018)
- *The Pickup Ion Mediated Solar Wind*, Zank, G. P., Zhao, L., Adhikari, L., Mostafavi, P., **Zirnstein, E. J.**, McComas, D. J. (AGU, Oral, December 2018)
- *Enhancement of Pickup Ion Pressure in the Inner Heliosheath and Possible Implications for Energetic Neutral Atom (ENA) Observations by IBEX*, Mostafavi, P., Zank, G. P., McComas, D. J., **Zirnstein, E. J.** (AGU, Poster, December 2018)
- *Population of He⁺ Ions Co-moving with the Solar Wind in the Outer Heliosphere*, Swaczyna, P., McComas, D. J., **Zirnstein, E. J.** (AGU, Poster, December 2018)
- *The Distribution Function of ISN He Outside and Inside the Heliopause*, Kubiak, M. A., Bzowski, M., Sokół, J. M., Heerikhuisen, J., **Zirnstein, E. J.** (AGU, Poster, December 2018)
- *Coupling suprathermal protons in the heliosheath to the plasma through charge-exchange with neutral hydrogen*, Heerikhuisen, J., **Zirnstein, E. J.**, Pogorelov, N. V., Zank, G. P., Desai, M. I., DeStefano, A. (AGU, Poster, December 2018)
- *ENA Flux from the Inner Heliosheath and its Connection to Termination Shock Properties*, Shrestha, B. L., Heerikhuisen, J., **Zirnstein, E. J.**, Pogorelov, N. V. (AGU, Poster, December 2018)
- *Stochastic Acceleration of Pickup Ions in the Heliotail*, **Zirnstein, E. J.**, Kumar, R., Heerikhuisen, J., McComas, D. J., Galli, A. (IBEX/IMAP STM, Oral, August 2018)
- *The Solar Wind Interaction with Pluto's Atmosphere as Observed by New Horizons*, Bagenal, F., McComas, D., McNutt, R., Elliott, H., Hill, M., **Zirnstein, E. J.**, Gladstone, R., Strobel, D., Stern, A., Weaver, H., Young, L., Olkin, C., Ennico, K. (COSPAR, Oral, July 2018)
- *Identifying Solar Wind Structures in the New Horizons Solar Wind Around Pluto (SWAP) Observations Between 20 and 40 AU*, Elliott, H., Valek, P., McComas, D., **Zirnstein, E. J.**

Bagenal, F., Stern, A., Weaver, H., Young, L., Olkin, C., Ennico, K. (COSPAR, Oral, July 2018)

- *The Role of Pickup Ion Dynamics Outside of the Heliopause in the Limit of Weak Pitch Angle Scattering: Implications for the Source of the IBEX Ribbon*, **Zirnstein, E. J.** (AIAC, Oral, March 2018)
- *Diagnosing the Local Interstellar Medium Using the Warm Breeze and IBEX Ribbon*, Bzowski, M., Kubiak, M. A., Heerikhuisen, J., Czechowski, A., Grygorczuk, J., Swaczyna, P., **Zirnstein, E.**, Sokół, J. M. (AIAC, Oral, March 2018)

2017

- *Spectral Properties of ENAs in the Presence of Multiple PUI Populations*, Shrestha, B. L., Heerikhuisen, J., **Zirnstein, E.** (AGU, Poster, December 2017)
- *Reduced Solar Wind Speeds at New Horizons Beyond 30 AU*, Elliott, H. A., McComas, D. J., **Zirnstein, E.**, Delamere, P. A., Bagenal, F., Stern, A., Weaver, H. A. Jr., Young, L. A., Ennico, K., Olkin C., and New Horizons Plasma and Particles Theme Team (AGU, Poster, December 2017)
- *Observational Evidence for The Comet-Like Heliosphere*, Bzowski, M., Czechowski, A., Funsten, H. O., Grygorczuk, J., Heerikhuisen, J., Kubiak, M. A., Moebius, E., McComas, D. J., Schwadron, N., Sokół, J. M., Swaczyna, P., **Zirnstein, E.** (AGU, Oral, December 2017)
- *Spatial, temporal, and circularity variations of the ENA ribbon over seven years of IBEX observations*, Dayeh, M. A., **Zirnstein, E.**, Funsten, H. O., Fuselier, S. A., McComas, D. J., Schwadron, N. A., Szalay, J. R. (AGU, Poster, December 2017)
- *How does the presence of suprathermal protons impact the heliosheath on global scales?*, Heerikhuisen, J., **Zirnstein, E.**, Zank, G. P., Pogorelov, N. V., Desai, M. I. (AGU, Poster, December 2017)
- *Observations of the Very Local Interstellar Medium with the IBEX and Voyager Spacecraft*, **Zirnstein, E. J.** (TeVPA, Oral, August 2017)
- *Imprint of the Sun's Evolving Polar Winds on IBEX ENA All-Sky Maps*, **Zirnstein, E. J.**, Dayeh, M. A., McComas, D. J., Sokół, J. M. (IBEX STM, Oral, June 2017)
- *Structure of the Heliotail from IBEX Observations: Implications for the 11 Year Solar Cycle and Pickup Ions in the Heliosheath*, **Zirnstein, E. J.**, Heerikhuisen, J., Zank, G. P., Pogorelov, N. V., Funsten, H. O., McComas, D. J., Reisenfeld, D. B., Schwadron, N. A. (AIAC, Oral, March 2017)

2016

- *Multi-Fluid MHD study of the solar wind interaction with Pluto*, Dong, C., Ma, Y., McComas, D. J., Bhattacharjee, A., **Zirnstein, E.**, Toth, G., Luhmann, J. G., Wang, L. (AGU, Poster, December 2016)
- *Structure and Dynamics of the IBEX Ribbon of Enhanced ENA Emission: The Role of ENA Transport in the Interstellar Medium*, Funsten, H. O., Demajistre, R., Fernandes, P. A., Frisch, P. C., Heerikhuisen, J., Janzen, P. H., McComas, D. J., Pittman, K. T., Reisenfeld, D. B., Schwadron, N., Theiler, J. P., **Zirnstein, E.**, Larsen, B. (AGU, December 2016)
- *Neutral atom distributions in the direction of the ribbon from global simulations*, Heerikhuisen, J., Gamayunov, K. V., **Zirnstein, E.**, Pogorelov, N. (AGU, December 2016)
- *Structure of the Heliotail from Interstellar Boundary Explorer (IBEX) Observations: Implications for the 11 Year Solar Cycle and Pickup Ions in the Heliosheath*, **Zirnstein, E.**, Heerikhuisen, J., Zank, G. P., Pogorelov, N., Funsten, H. O., McComas, D. J.,

Reisenfeld, D. B., Schwadron, N. (AGU, Poster, December 2016)

- *Evolution of heliospheric energetic neutral atom emissions over seven years of IBEX observations*, Dayeh, M. A., Desai, M. I., Fuselier, S. A., Heerikhuisen, J., McComas, D. J., Schwadron, N., Szalay, J., **Zirnstein, E.** (AGU, December 2016)
- *Structure and Characteristics of the Heliotail from ENAs*, **Zirnstein, E. J.**, Funsten, H. O., Heerikhuisen, J., McComas, D. J., Pogorelov, N. V., Reisenfeld, D. B., Schwadron, N. A., Zank, G. P. (IBEX STM, Oral, August 2016)
- *Local Interstellar Magnetic Field Determined from the IBEX Ribbon*, **Zirnstein, E. J.**, Heerikhuisen, J., Funsten, H. O., Livadiotis, G., McComas, D. J., Pogorelov, N. V. (AIAC, Oral, April 2016)

2015

- *Observational Constraints on a Pluto Torus of Circumsolar Neutral Gas*, Hill, M. E., Kollmann, P., McNutt, R. L., Jr., Smith, H. T., Bagenal, F., Brown, L. E., Elliott, H. A., Haggerty, D. K., Horanyi, M., Krimigis, S. M., Kusterer, M. B., Lisse, C. M., McComas, D. J., Piquette, M. R., Sidrow, E. J., Strobel, D. F., Szalay, J., Vandegriff, J. D., **Zirnstein, E.**, Ennico Smith, K., Olkin, C., Weaver, H. A., Jr., Young, L. A., Stern, S. A. (AGU, December 2015)
- *Escape of Pluto's Atmosphere: In Situ Measurements from New Horizons and Remote Observations from Chandra*, McNutt, R. L., Jr., Hill, M. E., Kollmann, P., Krimigis, S. M., Brown, L. E., Kusterer, M. B., Lisse, C. M., Mitchell, D. G., Vandegriff, J. D., McComas, D. J., Bagenal, F., Elliott, H. A., Ennico Smith, K., Horanyi, M., Olkin, C., Piquette, M. R., Stern, A., Strobel, D. F., Szalay, J., Valek, P. W., Weaver, H. A., Jr., Weidner, S., Young, L. A., **Zirnstein, E.**, Wolk, S. J. (AGU, December 2015)
- *Energetic Particles in the far and near Environment of Pluto*, Kollmann, P., Hill, M. E., McNutt, R. L., Jr., Brown, L. E., Kusterer, M. B., Vandegriff, J. D., Smith, H. T., Mitchell, D. G., Haggerty, D. K., Bagenal, F., Krimigis, S. M., Lisse, C. M., Delamere, P. A., Elliott, H. A., Horanyi, M., McComas, D. J., Piquette, M. R., Poppe, A. R., Sidrow, E. J., Strobel, D. F., Szalay, J., Valek, P. W., Weidner, S., **Zirnstein, E.**, Ennico Smith, K., Olkin, C., Weaver, H. A., Jr., Young, L. A., Stern, A. (AGU, December 2015)
- *Properties of ENA Source Regions Outside the Heliopause*, Heerikhuisen, J., **Zirnstein, E.**, Gamayunov, K. V., Pogorelov, N., Funsten, H. O., Florinski, V., Ernst, A. E. (AGU, December 2015)
- *The Local Interstellar Magnetic Field Determined from the IBEX Ribbon*, **Zirnstein, E.**, Funsten, H. O., Heerikhuisen, J., Livadiotis, G., McComas, D. J., Pogorelov, N. V. (AGU, December 2015)
- *Spectral Modulation of the IBEX Ribbon Flux by the Dynamic Draping of the Interstellar Medium over the Heliosphere*, Funsten, H. O., Pittman, K. T., Frisch, P. C., Heerikhuisen, J., Janzen, P. H., McComas, D. J., Reisenfeld, D. B., Schwadron, N., **Zirnstein, E.** (AGU, December 2015)
- *Pluto, Near and Far: PEPSSI Measurements of Energetic Particles During the New Horizons Flyby and Investigating a Pluto Torus of Circumsolar Neutral Gas*, Hill, M. E., Kollmann, P., McNutt, R. L., Smith, H. T., Bagenal, F., Brown, L. E., Elliott, H. A., Haggerty, D. K., Horanyi, M., Krimigis, S. M., Kusterer, M., Lisse, C. M., McComas, D. J., Piquette, M., Strobel, D., Szalay, J., Vandegriff, J., **Zirnstein, E.**, Ennico, K., Olkin, C. B., Weaver, H. A., Young, L. A., Stern, S. A. (DPS, November 2015)
- *First Results on Pluto's Energetic Particle Environment from the PEPSSI Instrument*,

Kollmann, P., Hill, M. E., McNutt, R., Smith, H. T., Vandegriff, J., Kusterer, M., Brown, L., Haggerty, D. K., Lisse, C. M., Elliott, H. A., Strobel, D., Bagenal, F., Sidrow, E., McComas, D. J., Horanyi, M., **Zirnstein, E.**, Krimigis, S. M., Ennico, K., Young, L. A., Weaver, H. A., Olkin, C. B., Stern, S. A. (DPS, November 2015)

- *The Local Interstellar Magnetic Field Determined from the IBEX Ribbon*, **Zirnstein, E. J.**, McComas, D. J., Livadiotis, G., Heerikhuisen, J., Pogorelov, N. V., Funsten, H. O. (IBEX SWT, Oral, August 2015)
- *The Effects of Slow, Intermediate, and Fast SW Speeds on the IBEX Ribbon*, **Zirnstein, E. J.**, Funsten, H. O., Heerikhuisen, J., McComas, D. J. (AIAC, March 2015)

2014

- *How Do κ -Distributed Protons in the Heliosheath Affect Energetic Neutral Atoms*, Heerikhuisen, J., **Zirnstein, E. J.**, Pogorelov, N. V. (AGU, December 2014)
- *Simulating a Dynamic Solar Cycle and Its Effects on the Interstellar Boundary Explorer Ribbon*, **Zirnstein, E. J.**, Heerikhuisen, J., Pogorelov, N. V., McComas, D. J., Dayeh, M. A. (AGU, Poster, December 2014)
- *Heliospheric Structure: The Bow Wave and the Hydrogen Wall*, Zank, G. P., Heerikhuisen, J., Wood, B. E., Pogorelov, N. V., **Zirnstein, E.**, McComas, D. J. (ASPC, May 2014)
- *Global Properties of the Heliospheric Termination Shock as inferred from Energetic Neutral Atoms measured by the Interstellar Boundary Explorer (IBEX)*, Desai, M., Heerikhuisen, J., McComas, D., Pogorelov, N., Zank, G., Dayeh, M., Schwadron, N., Allegrini, F., **Zirnstein, E.** (COSPAR, Oral, August 2014)
- *Latest Modeling Results from the Alabama Group*, **Zirnstein, E. J.**, Heerikhuisen, J., Pogorelov, N. V., Zank, G. P. (IBEX SWT, Oral, August 2014)
- *A Time-Dependent Simulation of the IBEX Ribbon Flux*, **Zirnstein, E. J.**, Heerikhuisen, J., Pogorelov, N. V. (AIAC, Oral, March 2014)

2013

- *Spectral properties of ~ 0.03 -6 keV Energetic Neutral Atoms Measured by the Interstellar Boundary Explorer (IBEX) Along the Lines-of-Sight of Voyager*, Desai, M. I., Allegrini, F., Dayeh, M. A., Funsten, H. O., Heerikhuisen, J., McComas, D. J., Pogorelov, N. V., Schwadron, N. A., Fuselier, S. A., Zank, G. P., **Zirnstein, E. J.** (AGU, Oral, December 2013)
- *Spectral Properties of Energetic Neutral Atoms Measured by the Interstellar Boundary Explorer (IBEX) Along the Lines-of-Sight of Voyager*, Desai, M.; McComas, D., Fuselier, S., Dayeh, M., Funsten, H., Heerikhuisen, J., **Zirnstein, E.**, Pogorelov, N., Zank, G. (EGU, Oral, April 2013)
- *Numerical Simulations of the Compton-Getting Effect for H ENAs*, **Zirnstein E. J.**, Heerikhuisen, J. (IBEX SWT, Oral, March 2013)

2012

- *Global Modeling of the Heliosphere and the IBEX Ribbon*, Heerikhuisen, J., **Zirnstein, E. J.**, Pogorelov, N. V., Zank, G. P. (AGU, Poster, December 2012)
- *Numerical Simulations of Primary and Secondary Hydrogen ENA Fluxes at 1 AU*, **Zirnstein, E. J.**, Heerikhuisen, J., Pogorelov, N. V. (AGU, Poster, December 2012)
- *Numerical Simulations of Primary and Secondary Hydrogen ENA Fluxes at 1 AU*, **Zirnstein, E. J.**, Heerikhuisen, J., Pogorelov, N. V. (AIAC, Oral, March 2012)

2011

- *Numerical simulations of hydrogen ENAs from 1 AU to the heliopause*, **Zirnstein, E. J.**,

Heerikhuisen, J., Pogorelov, N. V. (AGU, Poster, December 2011)

2010

- *Simulations of Energetic Neutral Hydrogen Within the Heliosphere: Creation, Transport, and Loss*, **Zirnstein, E. J.**, Heerikhuisen, J., Pogorelov, N. V. (AGU, Poster, December 2010)

COMMITTEES

- Ph.D. Committee for Graduate Student Bishwas Lal Shrestha, University of Alabama in Huntsville, Spring 2019-Present

SEMINARS & COLLOQUIA

2017

- *IBEX Observations and Simulations of Energetic Neutral Hydrogen from the Heliosphere*, **Zirnstein, E. J.** (Los Alamos National Lab, Theory Seminar, August 2017)

2016

- *IBEX Observations and Simulations of Energetic Neutral Hydrogen from the Heliosphere*, **Zirnstein, E. J.** (Princeton University, Astroplasmas Seminar, December 2016)

2015

- *The IBEX Ribbon and the Local Interstellar Magnetic Field*, **Zirnstein, E. J.** (Southwest Research Institute, Space Science Seminar, June 2015)

2014

- *Simulating Hydrogen Energetic Neutral Atom Flux Measurements for NASA's IBEX Mission*, **Zirnstein, E. J.** (Los Alamos National Lab, Theory Seminar, June 2014)
- *Interpretation of Hydrogen Energetic Neutral Atom Emission Observed by NASA's IBEX Mission*, **Zirnstein, E. J.** (Southwest Research Institute, Space Science Seminar, August 2014)

WORKSHOPS

2021

- *Topical Questions for "Low Energy ENA" Science (<10 keV)*, **Zirnstein, E. J.** (Heliophysics 2050 Workshop, "Outer Heliosphere and Local Interstellar Medium" Session, May 2021)
- *Pickup Ions and Energetic Neutrals: New Horizons' SWAP and IBEX (and then IMAP)*, **Zirnstein, E. J.** (International Space Science Institute, "The Heliosphere in the Local Interstellar Medium 2.020", Team Workshop, February 2021)

2018

- *Modeling the IBEX Ribbon in the 3D Heliosphere: An Update*, **Zirnstein, E. J.** (International Space Science Institute, "The Physics of the Very Local Interstellar Medium and its Interaction with the Heliosphere", Team Workshop, September 2018)

2017

- *IBEX Observations and Simulations of the Ribbon: Implications for the VLISM*, **Zirnstein, E. J.** (International Space Science Institute, "The Physics of the Very Local Interstellar Medium and its Interaction with the Heliosphere", Team Workshop, May 2017)

JOURNAL/PROPOSAL REVIEWER

- *The Astrophysical Journal, Space Science Reviews, Geoscience Letters, Journal of Physics: Conference Series, NASA ROSES – Heliophysics, NASA NESSF – Heliophysics*

MEMBERSHIPS

American Geophysical Union (AGU), American Astronomical Society (AAS), Sigma Pi Sigma
Physics Honor Society