

# Jordan Guerra Aguilera, Ph.D.

 [jordan.guerraaguilera@villanova.edu](mailto:jordan.guerraaguilera@villanova.edu)

 [@jorgueagui](https://twitter.com/jorgueagui)

 <http://jorgueagui.github.io>

 <https://www.linkedin.com/in/jordan-guerra-27a9a126/>



## Education

- 2010 – 2016  **Ph.D. in Physics, The Catholic University of America.** Washington DC.  
Thesis title: *Study of the photospheric magnetic field and coronal emission from solar active regions.* Advisor: Dr. Antti Pulkkinen (NASA)
- 2008 – 2010  **M.Sc. in Physics, Venezuelan Institute for Scientific Research.** Caracas, Venezuela.  
Master Thesis title: *Propagation and damping of MHD waves in solar coronal plumes.* Advisor: Dr. Leonardo Sigalotti.
- 2002 – 2007  **B.Sc. in Physics, University of Carabobo.** Valencia, Venezuela.

## Employment History

- Aug 2021 – …  **Assistant Research Professor.** Physics Department, Villanova University, PA.
- 2018 – …  **Adjunct Professor.** Physics Department, Villanova University, PA.
- 2018 – July 2021  **Postdoctoral Researcher.** Physics Department, Villanova University, PA. Supervisor: Prof. David Chuss.
- 2015 – 2017  **Postdoctoral Research Assistant.** School of Physics, Trinity College Dublin. Ireland. Supervisor: Prof. Peter Gallagher.
- 2010 – 2015  **Graduate Research Assistant.** NASA Goddard Space Flight Center, Greenbelt, MD.

## Research Experience

### • Observational:

1. Data reduction and analysis of far-infrared (FIR) dust polarimetric observations from the High-Resolution Airborne Wide-band Camera plus (HAWC+) onboard the Stratospheric Observatory for Infrared Astronomy (SOFIA) to study magnetized turbulence in astrophysical plasmas. In particular, the inference of the magnetic field strength in different targets (*i.e.*, molecular clouds, starburst galaxies, magnetized ring-like cloud) from the statistics of patterns in the polarization angles, and its influence on the ongoing physical processes (*e.g.*, star formation.)
2. Analysis of photospheric magnetic field maps (magnetograms) and extreme ultra-violet (EUV) maps from the Helioseismic and Magnetic Imager (HMI) and the Atmospheric Imaging Assembly (AIA) instruments onboard the Solar Dynamics Observatory (SDO) for understanding the process of solar eruptive phenomena (flares and coronal mass ejections, CMEs) and creating empirical models for their prediction.
3. Design and planning of observational strategies for HAWC+/SOFIA in order to survey dust polarimetric emission across several molecular clouds in the Gould Belt with the purpose of studying the effects of the magnetic field on the star-formation process in the local universe.

- **Numerical/Simulations:**

1. Construction and analysis of synthetic dust polarization observations (maps of Stokes parameters) from magnetohydrodynamic (MHD) numerical simulations of molecular clouds for comparison, validation, and calibration of observational results such as those related to magnetized turbulence.
2. Implementation of magnetic field extrapolation techniques (force-free and potential models) for magnetic field reconstruction using dust-polarimetric data. These methods help with the inference of magnetic field information at locations where direct measurements might not be available.
3. One- and two-dimensional numerical studies of MHD wave generation and propagation in magnetic structures of the solar atmosphere (*e.g.*, coronal loops and plumes), in order to understand the energy transport and dissipation in the context of the solar corona heating problem.
4. Implementation of advanced statistical and data-mining (*i.e.*, machine learning and deep learning) methods to large sets of astrophysical observations in order to uncover statistical relations and trends that can be used for predictive modelling.

- **Technical:**

1. Developing, testing, and implementation of software for the data-reduction pipeline of HAWC+/SOFIA observations and for data-analysis pipeline of SDO magnetograms for the autonomous forecasting of solar eruptions.
2. Deployment and maintenance of magnetogram-based, near-real-time solar flare prediction software to support the decision making process in space weather forecasting operations.
3. Development and implementation of multi-model ensemble modeling for flare prediction in space weather forecasting operations.

## Journal Articles

### Principal Author (Contribution to work and text $\geq 50\%$ )

- 1 **Guerra, J. A.**, Lopez-Rodriguez, E., Butterfield, N., Chuss, D. T., & Schmelz, J. T. (2022). The Sheared Magnetic Field in the Circum-Nuclear Disk. *To be submitted to ApJ*.
- 2 Lopez-Rodriguez, E., **Guerra, J. A.**, Asgari-Targhi, M., & Schmelz, J. T. (2021). The Strength and Structure of the Magnetic Field in the Galactic Outflow of Messier 82., *914*(1), 24.  doi:10.3847/1538-4357/abf934
- 3 **Guerra, J. A.**, Chuss, D. T., Dowell, C. D., Houde, M., Michail, J. M., Siah, J., & Wollack, E. J. (2021). Maps of Magnetic Field Strength in the OMC-1 Using HAWC+ FIR Polarimetric Data., *908*(1), 98.  doi:10.3847/1538-4357/abd6f0. arXiv: 2007.04923 [astro-ph.GA]
- 4 **Guerra, J. A.**, Murray, S. A., Shaun Bloomfield, D., & Gallagher, P. T. (2020). Ensemble forecasting of major solar flares: methods for combining models. *Journal of Space Weather and Space Climate*, *10*, 38.  doi:10.1051/swsc/2020042. arXiv: 2008.00382 [physics.space-ph]
- 5 **Guerra, J. A.**, Murray, S. A., & Doornbos, E. (2020). The Use of Ensembles in Space Weather Forecasting. *Space Weather*, *18*(2), e02443.  doi:10.1029/2020SW002443
- 6 Murray, S. A., **Guerra, J. A.**, Zucca, P., Park, S.-H., Carley, E. P., Gallagher, P. T., ... Bothmer, V. (2018). Connecting Coronal Mass Ejections to Their Solar Active Region Sources: Combining Results from the HELCATS and FLARECAST Projects., *293*(4), 60.  doi:10.1007/s11207-018-1287-4. arXiv: 1803.06529 [astro-ph.SR]
- 7 **Guerra, J. A.**, Park, S. ..H., Gallagher, P. T., Kontogiannis, I., Georgoulis, M. K., & Bloomfield, D. S. (2018). Active Region Photospheric Magnetic Properties Derived from Line-of-Sight and Radial Fields., *293*(1), 9.  doi:10.1007/s11207-017-1231-z. arXiv: 1712.06902 [astro-ph.SR]
- 8 **Guerra, J. A.**, Pulkkinen, A., & Uritsky, V. M. (2015). Ensemble forecasting of major solar flares: First results. *Space Weather*, *13*(10), 626–642.  doi:10.1002/2015SW001195. arXiv: 1504.04571 [physics.space-ph]

- 9 Guerra, J. A., Pulkkinen, A., Uritsky, V. M., & Yashiro, S. (2015). Spatio-Temporal Scaling of Turbulent Photospheric Line-of-Sight Magnetic Field in Active Region NOAA 11158., *290*(2), 335–350. doi:10.1007/s11207-014-0636-1. arXiv: 1402.5934 [astro-ph.SR]
- 10 Sigalotti, L. D. G., Guerra, J. A., & Mendoza-Briceño, C. A. (2009). Propagation and Damping of a Localized Impulsive Longitudinal Perturbation in Coronal Loops., *254*(1), 127–144. doi:10.1007/s11207-008-9279-4

### Contributing Author (Contribution to work and text < 50%)

- 1 Tram, L. N., Bonne, L., Hu, Y., Lopez-Rodriguez, E., Guerra, J. A., Lesaffre, P., ... Gordon, M. (2022). SOFIA observations of 30 Doradus: II – Magnetic fields and large scale gas kinematics. arXiv: 2205.12084 [astro-ph.GA]
- 2 Butterfield, N., Chuss, D. T., Guerra, J. A., Morris, M., Dowell, C. D., Watkins, M., & Zweibel, E. (2022). SOFIA/HAWC+ Far-Infrared Polarimetric Large Area CMZ Emission (FIRPLACE) Survey I: General Results from the Pilot Program and Detection of a Magnetized Dust Ring. *To be submitted to ApJ*.
- 3 Morris, M., Chuss, D. T., Dowell, C. D., Guerra, J. A., Hensley, B. S., & Hankins, M. J. (2022). Magnetic Sculpting of the Sickle HII Region: 53  $\mu$ m Polarimetry with HAWC+ on SOFIA. *In preparation*.
- 4 Georgoulis, M. K., Bloomfield, D. S., Piana, M., Massone, A. M., Soldati, M., Gallagher, P. T., ... Worsfold, M. (2021). The flare likelihood and region eruption forecasting (FLARECAST) project: flare forecasting in the big data & machine learning era. doi:10.1051/swsc/2021023. arXiv: 2105.05993 [astro-ph.SR]
- 5 Michail, J. M., Ashton, P. C., Berthoud, M. G., Chuss, D. T., Dowell, C. D., Guerra, J. A., ... Wollack, E. J. (2021). Far-infrared Polarization Spectrum of the OMC-1 Star-forming Region. doi:10.3847/1538-4357/abd090. arXiv: 2008.00310 [astro-ph.GA]
- 6 Kontogiannis, I., Georgoulis, M. K., Guerra, J. A., Park, S.-H., & Bloomfield, D. S. (2019). Which Photospheric Characteristics Are Most Relevant to Active-Region Coronal Mass Ejections? doi:10.1007/s11207-019-1523-6. arXiv: 1909.06088 [astro-ph.SR]
- 7 Chuss, D. T., Andersson, B. -G., Bally, J., Dotson, J. L., Dowell, C. D., Guerra, J. A., ... HAWC + Science Team. (2019). HAWC+/SOFIA Multiwavelength Polarimetric Observations of OMC-1. doi:10.3847/1538-4357/aafd37. arXiv: 1810.08233 [astro-ph.GA]
- 8 Park, S.-H., Guerra, J. A., Gallagher, P. T., Georgoulis, M. K., & Bloomfield, D. S. (2018). Photospheric Shear Flows in Solar Active Regions and Their Relation to Flare Occurrence. doi:10.1007/s11207-018-1336-z. arXiv: 1807.07714 [astro-ph.SR]
- 9 Kontogiannis, I., Georgoulis, M. K., Park, S.-H., & Guerra, J. A. (2018). Testing and Improving a Set of Morphological Predictors of Flaring Activity. doi:10.1007/s11207-018-1317-2. arXiv: 1807.06371 [astro-ph.SR]
- 10 Florios, K., Kontogiannis, I., Park, S.-H., Guerra, J. A., Benvenuto, F., Bloomfield, D. S., & Georgoulis, M. K. (2018). Forecasting Solar Flares Using Magnetogram-based Predictors and Machine Learning. doi:10.1007/s11207-018-1250-4. arXiv: 1801.05744 [astro-ph.SR]
- 11 Harper, D. A., Runyan, M. C., Dowell, C. D., Wirth, C. J., Amato, M., Ames, T., ... Wollack, E. J. (2018). HAWC+, the Far-Infrared Camera and Polarimeter for SOFIA. doi:10.1142/S2251171718400081
- 12 Kontogiannis, I., Georgoulis, M. K., Park, S.-H., & Guerra, J. A. (2017). Non-neutralized Electric Currents in Solar Active Regions and Flare Productivity. doi:10.1007/s11207-017-1185-1. arXiv: 1708.07087 [astro-ph.SR]

### Presentations/Talks

- 1 Guerra, J., Lopez-Rodriguez, E., Chuss, D., Butterfield, N., & Schmelz, J. T. (2022). Effect of the Shear Flow in the Magnetic Field of the CND (Poster). In *American astronomical society meeting #240*.

- 2 **Guerra, J.** (2022). What the polarimetric data can tell us: magnetized turbulence (Invited Talk). In *Sofia school 2022: Understanding the mid and far-infrared*.
- 3 **Guerra, J.** (2021). Unraveling Astrophysical Magnetic Fields with SOFIA/HAWC+ (Talk). In *Green bank observatory lunch talks*.
- 4 **Guerra, J.**, Lopez-Rodriguez, E., Asgari-Targhi, M., & Schmelz, J. T. (2021a). Magnetic Field in the Starburst Galaxy M82 (Talk). In *International astronomical union symposium: Astropol 2020*. Retrieved from [🔗 https://astropol2020-iau.jp/](https://astropol2020-iau.jp/)
- 5 **Guerra, J.**, Lopez-Rodriguez, E., Asgari-Targhi, M., & Schmelz, J. T. (2021b). Magnetic Field in the Starburst Galaxy M82 (Talk). In *American astronomical society meeting #237* (Vol. 234, p. 316.05).
- 6 **Guerra, J.**, Lopez-Rodriguez, E., Asgari-Targhi, M., & Schmelz, J. T. (2021c). Magnetic Highway: Channeling the M82 Super Wind (Press Conference). In *American astronomical society meeting #237*. Retrieved from [🔗 https://www.youtube.com/watch?v=KjAlRbaMBbw](https://www.youtube.com/watch?v=KjAlRbaMBbw)
- 7 **Guerra, J. A.**, Chuss, D. T., Dowell, C. D., Houde, M., Michail, J. M., & Siah, J. (2020). Maps of Magnetic Field Strength in the OMC-1 Region (Poster). In *American astronomical society meeting #235*.
- 8 **Guerra, J. A.**, Chuss, D. T., Houde, M., Michail, J. M., & Siah, J. (2019). Magnetic Field and Turbulence in the OMC-1 Region (Talk). In *American astronomical society meeting #233*.
- 9 **Guerra, J. A.**, Murray, S. A., Bloomfield, D., & Gallagher, P. T. (2018). Modeling Ensemble Forecasting of Solar Flares (Talk). In *Agu fall meeting abstracts*.
- 10 **Guerra, J. A.**, Murray, S. A., Bloomfield, D., & Gallagher, P. T. (2017). Modeling Ensemble Forecasting of Solar Flares (Poster). In *International astronomical union symposium 335: Space weather on the heliosphere: Processes and forecasts*.

## Grants

- 1 PI: **Guerra, J. A.** (2021a). *Statistical Study of the Magnetic Field Structure in Molecular Clouds of the Gould Belt*. Award: USD 296,000.: Funding agency: NASA/SOFIA.
- 2 PI: **Guerra, J. A.** (2021b). *Mapping Large-Scale Magnetic Fields in Molecular Clouds of the Gould Belt*. Award: 28 hours of observations; up to USD 150,000.: Funding agency: NASA/SOFIA.
- 3 PI: **Guerra, J. A.** (2019). *Ensembles in Space Weather: Science and Operations – Workshop*. Award: USD 10,000.: Funding agency: US Airforce Research Lab.

## Teaching Experience

- **PHY1100**-General Physics I. Algebra-based introductory mechanics course for science majors.
- **PHY1101**-General Physics Lab I. Mechanics experiments for science majors
- **PHY1103**-General Physics Lab II. E&M and Modern Physics experiments for science majors.
- **PHY2400**-University Physics I: Mechanics. Calculus-based introductory mechanics course for engineering majors.
- **PHY2403**-Physics Lab for Engineering. Combined mechanics and E&M experiments for engineering majors.
- **PHY2411**-Mechanics Lab. Mechanics experiments for Physics and Astrophysics majors.

## Skills

- Languages      ■ Strong reading, writing and speaking competencies for English and Spanish.
- Coding          ■ Strong competency in Python, IDL, & L<sup>A</sup>T<sub>E</sub>X. Familiarity with Fortran, Github, & JIRA.

## Miscellaneous Experience

### Service

- **National Science Foundation.** AAG Panelist.
- **National Science Foundation.** CSSI *Ad hoc* reviewer.
- Reviewer for journals: Solar Physics, the Astrophysical journal, and Space Weather.

### Leadership

- 2022      ■ **COSPAR ISWAT Workign Meeting 2022**, (Acting) Cluster Leader for S3: Solar Eruptions. <https://www.iswat-cospar.org/wm2022>
- 2020      ■ **Inaugural Meeting of the COSPAR International Space Weather Action Teams.**, Team Leader for S3-03: Ensembles in Space Weather. <https://www.iswat-cospar.org/iswat-cospar>
- 2019      ■ **Ensemble Forecasts in Space Weather: Science and Operations (Workshop)**. The Lorentz Center (The Netherlands). Organizer.

### Mentoring

- 2022      ■ Kathryn Karpovich (junior, Physics), Villanova University. Project: Reduction of Dust Polarimetric Observations.
- Aryan Chawda (freshmen, Astrophysics), Villanova University. Project: Statistics of EUV maps in solar Active Regions.
- 2018      ■ Rahul Tapha (freshmen, Astrophysics & Comp. Science), Villanova University. Project: Analysis of HAWC+ Polarimetric Data for OMC-1.
- 2017      ■ Sean Healy (senior, Physics), Trinity College Dublin. Project: Co-temporal Analysis of SDO/HMI and AIA data.

## References

### Prof. David Chuss

Professor, Dept. Chairman  
Villanova University,  
Physics Department, 850 E Lancaster Ave, Villanova  
PA.  
[david.chuss@villanova.edu](mailto:david.chuss@villanova.edu)

### Dr. Enrique Lopez-Rodriguez

Research Professor  
Kavli Institute for Particle Astrophysics and Cosmology.  
Stanford University.  
[elopezrodriguez@stanford.edu](mailto:elopezrodriguez@stanford.edu)

### Dr. Natalie Butterfield

Assistant Scientist  
National Radio Astronomy Observatory,  
NRAO Headquarters. 520 Edgemont Road,  
Charlottesville, VA 22903.  
[nbutterf@nrao.edu](mailto:nbutterf@nrao.edu)