Dr. Hazel Miller Bain

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Education

2006 - 2010	Ph.D., University of Glasgow Thesis : Hard X-ray and Radio Studies of Solar Flares
2002 - 2006	M.Sci. (Hons), Physics and Astronomy, University of Glasgow

Employment History

2021 - present	CIRES Science Lead at the Space Weather Prediction Center
2021 - present	Research Scientist III, CIRES, University of Colorado, Boulder
2017 - 2021	Research Scientist II, CIRES, University of Colorado, Boulder
2013 - 2017	Assistant Researcher, University of California, Berkeley
2010 - 2013	Postdoctoral Associate, University of California, Berkeley

Research Experience

I earned my doctorate from the University of Glasgow where my research focused on particle acceleration in solar flares. This research entailed X-ray imaging and spectroscopy from the Ramaty High Energy Solar Spectroscopic Imager (RHESSI), radio observations from the Nobeyama Radioheliograph (NoRH) and gyrosynchrotron modeling. After graduation I spent seven years at the Space Sciences Laboratory (SSL) at University of California, Berkeley as a team member of the NASA RHESSI spacecraft team, expanding my research to include particle acceleration in coronal mass ejections using observations of solar radio bursts. During this time I also became interested in solar energetic particle (SEP) events, in particular, an observers magnetic connectivity to the SEP source and the corresponding SEP event characteristics. While at SSL I was part of a team that designed and built the Gamma-Ray Imager Polarimeter for Solar flares (GRIPS) telescope which flew on a high-altitude balloon around Antarctica. As part of this project I led the development of the GRIPS Ground Support Equipment (GSE) software, incorporating telecommunications and commanding support for the balloon, in addition to on-the-ground data pipelines and processing. Now a CIRES research scientist at the University of Colorado Boulder and at NOAA's Space Weather Prediction Center, I develop models and tools for space weather forecasting. In particular, my research focuses on the impacts of solar radiation storms to human space exploration and the aviation industry. During my time at CIRES/SWPC I have validated and transitioned to operations the U.S. Federal Aviation Administration CARI-7 radiation dose model to support global space weather advisories for the International Civil Aviation Organization and have investigated machine learning approaches to SEP predictions.

Honors & Awards

2020	**Department of Commerce Gold Medal** awarded to the Space Weather Prediction Center For the planning, development, and implementation of a new space weather forecast service to support the International Civil Aviation Organization (ICAO)
2020	**CIRES Outstanding Performance Award** For building a critical system that serves the international commercial airline industry with enhanced space weather predictions and communications
2020	**CIRES Outstanding Performance Award** For creating a mentorship program at CIRES to boost workplace satisfaction and foster a more creative and productive research atmosphere
2013	NASA Group Achievement Award for RHESSI
2009	Royal Society of Edinburgh/Cormack Bequest Postgraduate Research Prize

Science Steering Committees

2021 - present	American Meteorological Society Space Weather program committee
2020 - 2023	National Space Weather Strategy and Action Plan Team Lead for Action 2.11.2
2019 - present	SHINE and COSPAR-ISWAT: Solar Energetic Particle Model Validation team co-lead
2019 - 2021	SHINE/GEM/CEDAR Machine Learning Exploratory Committee
2019 - 2020	Solar Dynamics Observatory Workshop Science Organizing Committee

2018 - present	CIRES Mentoring Program committee member/Vice Chair
2018 - 2022	Machine Learning in Heliophysics Science Organizing Commitee
2017 - 2021	National Solar Observatory Users Committee
2017 - present	Boulder Solar Day Science Steering Committee

Professional Affiliations

2010 - present	American Geophysical Union
2007 - 2017	American Astronomical Society Solar Physics Division
2006 - 2011	Institute of Physics (IoP), Associate Member
2006 - 2011	Fellow of the Royal Astronomical Society (FRAS).

Peer-reviewed Publications

2022 Whitman, K. M. et al. *"Review of Solar Energetic Particle Models"*, Advances in Space Science (submitted)

2021 **Bain, H. M.**, Steenburgh, R. A., Onsager, T. G., Stitely, N., *"A Summary of NOAA Space Weather Prediction Center Proton Event Forecast Performance and Skill"*, https://doi.org/10.1029/2020SW002670

2019 Hughes, J. M., Hsu, V. W., Seaton, D. B., **Bain, H. M.** et al. *"Real-Time Solar Image Classification: Assessing Spectral, Pixel-Based Approaches"*, 2019JSWSC...9A..38H

2018 Luhmann, J. G., Mays, M. L., Li, Y., Lee, C. O., **Bain, H. M.** et al. *"Shock Connectivity and the Late Cycle 24 Solar Energetic Particle Events in July and September 2017"*, 2018SpWea..16..557L

2017 Luhmann, J. G., Mays, M. L., Odstrcil, D., Li, Y., **Bain, H. M.** et al. *"Modeling solar energetic particle events using ENLIL heliosphere simulations"*, 2017SpWea..15..934L

2017 Lario, D., Kwon, R.-Y., Richardson, I. G., Raouafi, N. E., Thompson,B. J. ,von Rosenvinge, T. T., Mays, M. L., Mäkelä, P. A., Xie, H., **Bain, H. M.** et al. *"The Solar Energetic Particle Event of 2010 August 14: Connectivity with the Solar Source Inferred from Multiple Spacecraft Observations and Modeling"*, 2017ApJ...838...51L

2016 Duncan, N., Saint-Hilaire, P., Shih, A., et al. *"First flight of the Gamma-Ray Imager/Polarimeter for Solar flares (GRIPS) instrument"*, 2016SPIE.9905E..2QD

2016 **H. M. Bain**, M. L. Mays, J. G. Luhmann, Y. Li, L. K. Jian, D. Odstrcil *"Shock Connectivity in the August 2010 and July 2012 Solar Energetic Particle Events Inferred from Observations and ENLIL Modeling"* 2016ApJ...825....1B

2014 J. C. Martinez-Oliveros, C. L. Raftery, **H. M. Bain** et al. *"STEREO-Wind Radio Positioning of an Unusually Slow Drifting Event"* 2015SoPh..290..891M

2014 J. P. Byrne, H. Morgan, D. B. Seaton, **H. M. Bain** and S. R. Habbal *"Bridging EUV and White-Light Observations to Inspect the Initiation Phase of a Two-Stage Solar Eruptive Event"* 2014SoPh..tmp..118B

2014 J. C. Martinez Oliveros, S. Krucker, H. S. Hudson, et al. *"Chromospheric and Coronal Observations of Solar Flares with the Helioseismic and Magnetic Imager"*, 2014ApJ...780L..28M

2014 **H. M. Bain**, S. Krucker, P. Saint-Hilaire and C. L. Raftery, *Radio imaging of a type IVM radio burst on the 14th of August 2010"*, 2014ApJ...782...43B

2013 Duncan, N., Shih, A., Hurford, G., et al. *"Detector and imaging systems for the gamma-ray imager/polarimeter for solar flares (GRIPS) instrument"*, 2013SPIE.8862E..0WD

2012 **H. M. Bain**, Krucker, S., Glesener, L. and Lin, R. P. *"Radio imaging of shock-accelerated electrons associated with an erupting plasmoid on the 3rd of November 2010"*, 2012ApJ...750...44B

2012 J. C. Martinez Oliveros, C. L. Raftery, **H. M. Bain**, Y. Liu, V. Krupar, S. Bale and S. Krucker. *"The 2010 August 1 Type II Burst: A CME-CME Interaction and its Radio and White-light Manifestations"*, 2012ApJ...748...66M

2012 Shih, A. Y., Lin, R. P., Hurford, G. J., et al. *"The Gamma-Ray Imager/Polarimeter for Solar flares (GRIPS)"*, 2012SPIE.8443E..4HS

2009 **H. M. Bain** and L. Fletcher, *"Hard X-ray emission from a flare-related jet"*, Astronomy and Astrophysics, Volume 508, Issue 3, 2009, pp.1443-1452

2008 **H. M. Bain** and L. Fletcher, *"Solar flare impulsive-phase footpoints in Extreme UV, Soft X-Rays and Hard X-Rays"*, Announcing First Results from Hinode ASP Conference Series, Vol. 397, Astronomical Society of the Pacific, 2008., p.157

2007 J. I. Khan, **H. M. Bain** and L. Fletcher, *"The relative timing of supra-arcade downflows in solar flares"*, Astronomy and Astrophysics, Volume 475, August 2007, pp.333-340