

ISSI International Team Proposal 2024 - Part B

Team leaders: Ryan Milligan & Louise Harra

The Impact of Solar Flare Irradiance on the Earth's Ionosphere

1. Value Added by ISSI

The study of the influence of solar flares on the processes occurring in the Earth's ionosphere and their possible effect on space weather, communication and navigation systems remains an important and urgent problem now. Modern research on this problem is carried out almost independently by the solar and ionospheric (aeronomy) scientific communities. This fact makes it difficult to carry out an interconnected detailed analysis of the physics of the ongoing processes at a high scientific level. Cooperative work of experts in the field of solar flare research and ionospheric physics will allow significant progress in the scientific interpretation and prediction of the response of ionospheric layers to variations in solar radiation.

The ISSI meetings provide a unique setting for extended discussions on a well-focused topic, that would be difficult to carry out remotely or during conferences or workshops, particularly given that the planetary atmosphere and solar flare/irradiance communities do not regularly attend the same meetings. Members of our team are involved in space missions (such as SDO/EVE, Solar-C/SoSpIM, PROBA2/LYRA) and have expertise across a wide range of the electromagnetic spectrum and particles. ISSI will allow us to gather a team of experts from the fields of heliophysics and aeronomy, from eight institutions in six different countries, that would not otherwise collaborate so closely and participate in face-to-face discussions. Space Weather is an important topic internationally and at ISSI and our results can be shared with the different interested communities. Several members of our team have taken part in prior ISSI International Teams and found that these meetings are extremely helpful, leading to significant progress. The format of the meetings (two five-day meetings) is also very suited to our project, which requires lengthy discussions, and sufficient time to work closely to compare observations with models and the cause and effect of different solar events.

2. The International Team

Our 12-person team comprises experts from the disparate but interconnected fields of heliophysics and ionospheric aeronomy. Solar flare experts shall establish the mechanisms and conditions behind increases in solar irradiance due to flares, while the aeronomy team members shall consider the atmospheric consequences at Earth. As well as having a good gender balance and representing six nations, our team comprises members who are at various stages of their career, including two Early Career Researchers, both of whom are current PhD students. The table below lists the team members and their affiliations, and areas of expertise.

Confirmed team members: Ryan Milligan (Team Leader; UK), Louise Harra (Co-leader, CH), Susanna Bekker (UK), Phillip Chamberlin (USA), Marie Dominique (BE), Graham Kerr (USA), Laura Hayes (NL), Nils Janitzek (CH), Liying Qian (USA), Kyoko Watanabe (JP), Aisling O'Hare (UK), Hannah Collier (CH).

Name	Gender	Affiliation	Country	Title/Career Stage (Years since PhD)	Expertise
Ryan Milligan (leader)	Male	Queen's University Belfast	UK	Senior Lecturer (18)	EUV and X-ray solar flare irradiance observations
Louise Harra (co-leader)	Female	PMOD/WRC & ETHZ	Switzerland	Senior Academic (31)	EUV spectral observations of solar flares
Susanna Bekker	Female	Queen's University Belfast	UK	Research Fellow (5)	Modelling of the ionosphere in response to solar flares
Phillip Chamberlin	Male	LASP, University of Colorado, Boulder	USA	Research Scientist (19)	EUV spectral irradiance observations and modelling
Marie Dominique	Female	Royal Observatory of Belgium	Belgium	Research Scientist (5)	EUV and X-ray flare response in the thermosphere
Graham Kerr	Male	Catholic University of America/NASA Goddard Space Flight Center	USA	Associate Research Scientist (7)	Radiative hydrodynamic modelling of solar flares (incl. EUV spectra).
Laura Hayes	Female	ESA/ESTEC	Netherlands	Postdoc (5)	X-ray observations of solar flares and thermospheric response
Nils Janitzek	Male	PMOD/WRC & ETHZ	Switzerland	Postdoc (3)	Properties of energetic particles from solar flares
Liyang Qian	Female	High Altitude Observatory	USA	Project Scientist (17)	Ionospheric/Thermospheric variability
Kyoko Watanabe	Female	National Defence Academy of Japan	Japan	Associate Professor (19)	Solar flare spectroscopy and modelling, and impact on the ionosphere
Aisling O'Hare	Female	Queen's University Belfast	UK	1 st year PhD student (ECR)	EUV observations of solar flares and thermospheric response
Hannah Collier	Female	FHNW & ETHZ	Switzerland	3 rd year PhD student (ECR)	Non-thermal energy distribution of solar flares

NAME, First Name: MILLIGAN, Ryan

Affiliation: Queen's University Belfast (QUB)

Role in the project: Team Leader. Expert in EUV and X-ray solar flare observations, including spectroscopy and irradiance measurements, as well as deriving nonthermal electron parameters from hard X-ray observations.

Current position: Senior Lecturer in Astrophysics (QUB)

Former Position(s):

STFC Ernest Rutherford Fellow (QUB; Sep 2019-Aug 2022)

STFC Ernest Rutherford Fellow (University of Glasgow; Mar 2017-Aug 2019)

Visiting Research Fellow (QUB funded through NASA/LWS; Sept 2014-Feb 2017)

Leverhulme Trust Research Fellow (QUB; Jan 2014-Jul 2014)

Research Associate in Solar Physics (NASA/CUA; Jul 2013-Dec 2013)

Leverhulme Trust Research Fellow (QUB; Feb 2011-Jun 2013)

Research Associate for RHESSI mission (NASA/CUA; Aug 2009-Jan 2011)

NASA Postdoctoral Research Fellow (NASA/ORAU; Aug 2007-Jul 2009)

Research Associate for RHESSI mission (NASA/CUA; Jan 2007-Jul 2007)

Education:

Ph. D. in Solar Physics (QUB; Oct 2003-Dec 2006)

M. Sci in Physics and Applied Mathematics (QUB; Oct 1998-Oct 2003)

Services in National and/or International Committees (most recently):

NASA Solar Orbiter Guest Investigator Review Panel (Feb 2024)

Local Organising Committee (LOC) for 8th Solar Orbiter workshop (Sep 2022)

Member of Science Team for SoSpIM instrument on Solar-C (2022 onwards)

Scientific Organizing Committee (SOC) for upcoming 10th Anniversary Workshop for NASA's Solar Dynamics Observatory (SDO; Oct 2020)

NASA Heliophysics Guest Investigator Review Panel (Oct 2019)

Honors: NASA Group Achievement Award as part of the RHESSI Science and Data Analysis Team (2013)

Selected Publications (50 papers, 15 as first author, ~2000 citations, H-index=21):

Greatorex, H. J., **Milligan, R. O.**, & Chamberlin, P. C.

Observational Analysis of Lyman-alpha Emission in Equivalent Magnitude Solar Flares
Astrophysics Journal, 954, 120, (2023)

R. O. Milligan

Solar Irradiance Variability Due to Solar Flares Observed in Lyman-alpha Emission
Solar Physics, 296, 51, (2021)

R. O. Milligan, H. S. Hudson, P. C. Chamberlin & I. G. Hannah
Lyman-alpha Variability During Solar Flares Over Solar Cycle 24 Using GOES15/EUVS-E
Space Weather, 18, 02331, (2020)

P. J. A Simões, H. A. S. Reid, **R. O. Milligan**, & L. Fletcher
The spectral content of SDO/AIA 1600 and 1700 Å filters from flare and plage observations
Astrophysics Journal, 870, 114 (2019)

M. Machado, **R. O. Milligan**, & P. J. A Simões
Lyman Continuum Observations of Solar Flares Using SDO/EVE
Astrophysics Journal, 869, 63 (2018)

R. O. Milligan & J. Ireland
On the Performance of Multi-Instrument Solar Flare Observations During Solar Cycle 24
Solar Physics, 293, 18 (2018)

R. O. Milligan, B. Fleck, J. Ireland, L. Fletcher, & B. R. Dennis
Detection of Three-minute Oscillations in Full-disk Ly α Emission during a Solar Flare
Astrophysics Journal Letters, 848, 8 (2017)

R. O. Milligan & P. C. Chamberlin
The Anomalous Temporal Behaviour of Ly α Emission During Solar Flares Using SDO/EVE
Astronomy & Astrophysics Research Note, 587, 123 (2016)

R. O. Milligan
Extreme Ultra-Violet Spectroscopy of the Lower Solar Atmosphere During Solar Flares (Invited Review)
Solar Physics, 290, 3399 (2015)

R. O. Milligan, G. S. Kerr, B. R. Dennis, H. S. Hudson, L. Fletcher, J. C. Allred, P. C. Chamberlin, J. Ireland, M. Mathioudakis, & F. P. Keenan
The Radiated Energy Budget of Chromospheric Plasma In A Major Solar Flare Deduced From Multi- Wavelength Observations
Astrophysics Journal, 793, 70 (2014)

R. O. Milligan, P. C. Chamberlin, H. S. Hudson, T. N. Woods, M. Mathioudakis, L. Fletcher, A. F. Kowalski, & F. P. Keenan
Observations of Enhanced EUV Continua During an X-Class Solar Flare Using SDO/EVE
Astrophysics Journal Letters, 748, L14 (2012)

R. O. Milligan, M. Kennedy, M. Mathioudakis, & F. P. Keenan
Time-Dependent Density Diagnostics of Solar Flare Plasmas Using SDO/EVE
Astrophysics Journal Letters, 755, L16 (2012)

NAME, First Name: Harra, Louise

Affiliation: PMOD/WRC & ETHZ, Switzerland

Role in the project: Spectroscopic analysis of flares with Hinode EIS, IRIS, Solar Orbiter and SDO.

Current position: Director of PMOD/WRC and affiliated prof at ETHZ

Former Position(s): Prof. at UCL-MSSL, UK

Education: Queens University, Belfast, N.Ireland, Ph.D Physics, 1993

Services in National and/or International Committees (most recent nominations):

Member of the editorial board of RAS instruments and techniques

Member of scientific board of Congressi Stefano Franscini

Member of SNSF postdoc mobility committee

Secretary of Swiss Committee on Space Research

Chair of ESA Heliophysics User archive committee

Secretary of Swiss Committee of Space Research

Board of Davos Science City

Subject editor for Proceedings of the Royal Society A: Mathematical, Physical & Engineering Sciences

Co-chair of the Scientific Advisory Board of the MPS

Member of the Presidium of the Platform MAP (Mathematics, Astronomy, and Physics, map.scnat.ch) of the Swiss Academy of Sciences

Honors:

Awarded the IoP 2023 Cecilia Payne-Gaposchkin Medal and Prize

Vera Rubin colloquium, April 2020, at IAA, Granada (given remotely in November 2020)

Awarded the Robinson medal and lecture. November 2017

Awarded the Daiwa-Adrian prize for UK-Japan research collaboration, 2016.

Awarded the RAS group achievement award for the Hinode EIS team (2015)

Awarded the Sir Arthur C Clarke award in Space Achievement (Academic Study/Research) for her leadership in the UK and internationally of the exploitation

of data from the Japanese Hinode spacecraft and her leadership of the upcoming EUV telescope on Solar Orbiter, 2014

Awarded the RAS Chapman Medal, 2014

Selected Publications:

Harra, L. K., Sakao, T., Mandrini, C. H., Hara, H., Imada, S., Young, P. R., van Driel-Gesztelyi, L., Baker, D. 'Outflows at the Edges of Active Regions: Contribution to Solar Wind Formation?', *ApJ*, 2008, 676, 147.

Harra, L.K., Williams, D.R., Wallace, A.J., Magara, T., Hara, H., Tsuneta, S., Sterling, A. and Doschek, G.A., 'Coronal Nonthermal Velocity Following Helicity Injection Before an X-Class Flare', *ApJ*, 2009, 691, 99.

Harra, L.K., Sterling, A.C., Gömöry, P., Veronig, A Spectroscopic observations of a coronal Moreton wave, *ApJ Letters*, 2011, 737, 4.

Harra, L., Matthews, S., Culhane, J., Cheung, M, Kontar, E., Hara, H. , 'The Location of Non-thermal Velocity in the Early Phases of Large Flares Revealing Preeruption Flux Ropes, *ApJ*, 2013, 774, 122

Harra, L.K., Schrijver, C.~J., et al., 'The Characteristics of Solar X-Class Flares and CMEs: A Paradigm for Stellar Superflares and Eruptions?' 2016, *Sol Phys*, 291, 1761

Harra, L., Baker, D., Edwards, S.J., Hara, H., Howe, R., van Driel-Gesztelyi, L. 2015, 'A Study of the Coronal Non-thermal Velocity in Polar Regions During the Rise from Solar Minimum to Solar Maximum in Cycle 24', *Sol Phys*, 290, 3203.

Harra, Louise K., Hara, H., Doschek, G.A., Matthews, S.A., Warren, H., Culhane, J.L., Woods, M.M.

Measuring Velocities in the Early Stage of an Eruption: Using ?Overlappogram? Data from Hinode EIS

ApJ, 2017, 842, 58

Harra, L., Matthews, S., Long, D., Hasegawa, T., Lee, K.S., Reeves, K., Shimizu, T., Hara, H., Woods, M., 'Locating Hot Plasma in Small Flares using Spectroscopic Overlappogram Data from the Hinode EUV Imaging Spectrometer', *Solar Phys.*, 2020, 295, 34

Woods, M., Inoue, S., Harra, L., Matthews, S., Kusano, K., 'Serial Flaring in an Active Region: Exploring Why Only One Flare Is Eruptive', *ApJ*, 2020, 890, 84

Harra, L., Mandrini, C., Brooks, D.H., et al,' The source of unusual coronal upflows with photospheric abundance in a solar active region', 2023, *A&A*, 675, 20

Dr Susanna Bekker

Affiliation: Queen's University Belfast, Belfast, United Kingdom

Role in the project:

Photochemical modeling the response of the ionospheric D region to solar flares. Analysis of synchronous variations in solar radiation and ionospheric parameters (electron concentration; total electron content; amplitude and phase of very low frequency signals).

Current position: Research Fellow

Former Position(s):

Dec 2011 – Sept 2023 Sadovsky Institute of Geospheres Dynamics of Russian Academy of Sciences (IDG RAS), Moscow, Russia
Senior Researcher ← Researcher ← Junior Researcher ← Engineer

Education:

Moscow Institute of Physics and Technology (MIPT), Moscow, Russia
Department of Aerophysics and Space Research

2014 – 2018 Doctor of Philosophy, Atmosphere and Hydrosphere Physics
2012 – 2014 Master of Applied Mathematics and Physics
2008 – 2012 Bachelor of Applied Mathematics and Physics

Services in National and/or International Committees (most recent nominations):

Reviewer for the "Journal of Geophysical Research", "Advances in Space Research", and "Geomagnetism and aeronomy"

Selected Publications:

- **S.Z. Bekker**, J.A. Korsunskaya (2023). Influence of the Neutral Atmosphere Model on the Correctness of Simulation the Electron and Ion Concentrations in the Lower Ionosphere. *Journal of Geophysical Research: Space Physics*, 128(12), e2023JA032007.
- **S.Z. Bekker**, S.I. Kozlov, V.P. Kudryavcev (2022). Comparison and Verification of the Different Schemes for the Ionization-Recombination Cycle of the Ionospheric D-region. *Journal of Geophysical Research: Space Physics*, 127(10), e2022JA030579.
- **S.Z. Bekker** (2022). Verification of Plasma Chemical Models of the Ionospheric D Region of the According to Radiophysical Data from Mikhnevo Geophysical Observatory. *Geomagnetism and Aeronomy*, 62(3), 237–245.
- **S.Z. Bekker**, I.A. Ryakhovskiy, J.A. Korsunskaya (2021). Modeling of the Lower Ionosphere During Solar X-Ray Flares of Different Classes. *Journal of Geophysical Research: Space Physics*, 126(2), e2020JA028767.

Chamberlin, Phillip Clyde; Phil.Chamberlin@lasp.colorado.edu, 1.303.735.8165

Affiliation: University of Colorado, Laboratory for Atmospheric and Space Physics, 3665 Discovery Drive, Boulder, Colorado, USA (CU/LASP)

Role in the project: Provide the most accurate solar flare X-ray and UV irradiance measurements and models, identify range of specific solar events to study. Validate solar irradiance measurement/models with solar flare radiative models.

Current position: 2017-present: Research Scientist III. 2022-present: Assistant Director for Solar and Stellar Science.

Former Position(s): 2009-2017: Research Astrophysicists, Heliophysics Division, Solar Physics Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD 20771

2007-2009: Research Scientist II, CU/LASP

2005-2007: Research Scientist I (Post-Doc), CU/LASP

Education: 2005, Ph.D., Aerospace Engineering Sciences, University of Colorado, Boulder, CO

2003, M.S., Aerospace Engineering Sciences, University of Colorado, Boulder, CO

2001, B.A., Physics, Hanover College, Hanover, Indiana

Selected Publications:

Goncharenko, L. P., ... P. C Chamberlin, and 7 co-authors (2021), A New Model for Ionospheric Total Electron Content: The impact of Solar Flux Proxies and Indices, *J. Geophys. Res.*, 126(2), e28466, doi:10.1029/2020JA028466.

Chamberlin, P.C., and 9 co-authors (2020), The Flare Irradiance Spectral Model-Version 2 (FISM2), *Space Weather*, 18(12), doi: 10.1029/2020SW002588.

Chamberlin, P. C. (2016), Measuring Solar Doppler Velocities in the He ii 30.38 nm Emission Using the EUV Variability Experiment (EVE), *Sol. Phys.*, 291, 6, doi:10.1007/s11207-016-0931-0.

Chamberlin, P. C., R. O. Milligan, and T. N. Woods (2012), Thermal evolution and radiative output of solar flares observed by the EUV Variability Experiment (EVE), *Sol. Phys.*, 279, 1, doi:10.1007/s11207-012-9975-y.

Pesnell, W. D., B. J. Thompson, and P. C. Chamberlin (2012), The Solar Dynamics Observatory (SDO), *Sol. Phys.*, doi:10.1007/s11207-011-9841-3.

Woods, T. N., ... P. C Chamberlin, and 16 co-authors (2012), Extreme Ultraviolet Variability Experiment (EVE) on the Solar Dynamics Observatory (SDO): Overview of Science Objectives, Instrument Design, Data Products, and Model Developments, *Sol. Phys.*, 275(1-2), doi:10.1007/s11207-009-9487-6.

NAME, First Name: Collier, Hannah

Affiliation: Fachhochschule Nordwestschweiz, ETH Zürich

Role in the project: STIX instrument team member, solar flare and QPP researcher

Current position: PhD student

Former Position(s): Student

Education:

Masters in Space Science and Engineering, University College London, Distinction

BA in theoretical physics, Trinity College Dublin, 2.1

Services in National and/or International Committees (most recent nominations):

N/A

Honors:

Invited talk at EclipseSA conference, April 2024.

Best student paper award for paper titled “Energetic particle contamination in STIX during Solar Orbiter's passage through Earth's radiation belts and an interplanetary shock” at RADECS 2023.

Awarded funding for EUI Guest Investigator Programme

Awarded funding for ESA Archival Research Visitors Programme

Award for the best master’s research project in cohort based on project on super resolution of Chandra X-ray images using Deep Learning

Team awarded the best science case and presentation at the Alpach Summer School 2019.

Selected Publications:

H. Collier, L. A. Hayes, A. F. Battaglia, L. K. Harra, S. Krucker. Characterising fast-time variations in the hard X-ray time profiles of solar flares using Solar Orbiter’s STIX, *A&A* 671 A79 (2023). DOI: 10.1051/0004-6361/202245293.

H. Collier et al., Energetic particle contamination in STIX during Solar Orbiter’s passage through Earth’s radiation belts and an interplanetary shock, in *IEEE Transactions on Nuclear Science*, DOI: 10.1109/TNS.2024.3355473.

H. Collier et al., Localising pulsations in the hard X-ray and microwave emission of an X-class flare (accepted, with editor) arXiv:2402.10546.

NAME, First Name: Dominique, Marie

Affiliation: Royal Observatory of Belgium

Role in the project: Core member. Dr. Marie Dominique is the PI of the solar UV-EUV radiometer LYRA, onboard the ESA satellite PROBA2. Her main field of expertise is solar flare observation and analysis, in particular in the soft X-rays to ultraviolet spectral range. She is also involved in the analysis of the Earth ionosphere composition based on solar measurements made in occultation, and of its evolution with solar activity.

Current position: Scientist at the Royal Observatory of Belgium (since 2009)

Former Position(s):

- 2004-2009: Instrument scientist position shared between the Royal Observatory of Belgium and the Royal Belgian Institute for Space Aeronomy.
- 2001-2003: Research engineer at the University of Liège

Education:

- PhD in Science (Astrophysics), 2019, KU Leuven (Belgium).
Thesis in solar physics entitled: “Solar flare studies with the LYRA instrument onboard PROBA2”.
- Post-master degree in Physics (Optics), 2003, University of Liège (Belgium)
- Master degree of Physics Engineering, 2001, University of Liège (Belgium)

Selected Publications:

- Dominique, M.; Zhukov, A. N. ; Heinzl, P. ; Dammasch, I. E. ; et al. *First Detection of Solar Flare Emission in Middle-Ultraviolet Balmer Continuum*. ApJL vol. 867, iss. 2 (2018).
- Thiemann, E. M. B. ; Eparvier, F. G. ; Bougher, S. W. ; Dominique, M. ; et al. *Mars Thermospheric Variability Revealed by MAVEN EUVM Solar Occultations: Structure at Aphelion and Perihelion, and Response to EUV Forcing*. Journal of Geophysical Research: Planets vol. 123 (2018).
- Thiemann, E.; Dominique, M.; Pilinski, M.; Eparvier, F. *Vertical Thermospheric Density Profiles from EUV Solar Occultations made by PROBA2 LYRA for Solar Cycle 24*. Space Weather, vol. 15, iss. 12 (2017)
- Slemzin, V.A.; Ulyanov, A.; Gaikovich, K.; Kuzin, S.V.; et al. *Validation of the Earth atmosphere models using the solar EUV solar occultation data from the CORONAS and PROBA 2 instruments*. Journal of Space Weather and Space Climate, Volume 6, id.A7 vol. 6 (2016).
- Kretschmar, M.; Dominique, M.; Dammasch, I.E. *Sun-as-a-Star Observation of Flares in Lyman alpha by the PROBA2/LYRA Radiometer*. Solar Physics, 286, pp.221-239 (2013)
- Dominique, M. ; Gillotay, D. ; Cessateur, G. ; Cabanas, C. ; et al. *The contribution of PROBA2-LYRA occultations to Earth atmosphere composition analysis*. New Horizons in Occultation Research: Studies in Atmosphere and Climate, pp. 285-293 (2009)

NAME, First Name: HAYES, Laura A.

Affiliation: European Space Agency, ESTEC, Noordwijk, Netherlands

Role in the project: X-ray observations of solar flares and thermospheric response

Current position: Research Fellow

Former Position(s):

- Postdoctoral researcher, DIAS, Ireland (Mar 2021-Sept 2021)
- NASA Postdoctoral Fellow, NASA GSFC (Mar 2019-Mar 2021)
- Research Assistant, Trinity College Dublin (Nov 2019-Feb 2020)
- Researcher, NASA Frontier Development Lab (Jun-Aug 2018)

Education:

- PhD Physics, Trinity College Dublin, Ireland, (2019)
- Postgraduate Diploma in Statistics, Trinity College Dublin, Ireland, (2017)
- B.A. (mod) Theoretical Physics, Trinity College Dublin, Ireland, (2014)

Services in National and/or International Committees (most recent nominations):

- Communications & Education lead for SunPy Project (sunpy.org)
- Maintain and contribute software to packages with the SunPy project.
- Reviewer ApJ, Science, JOSS journals.

Honors:

- Outstanding Student Paper Award, AGU Fall Meeting (2018)
- Unexpected Discovery Award, NASA Frontier Development Lab (2018)

Selected Publications:

- **Hayes, L.A.** and Gallagher, P.T., **2022**. *A Significant Sudden Ionospheric Disturbance Associated with Gamma-Ray Burst GRB 221009A*. Research Notes of the AAS, 6(10), p.222. [DOI: [10.3847/2515-5172/ac9d2f](https://doi.org/10.3847/2515-5172/ac9d2f)]
- **Hayes, L.A.**, O'Hara, O.S., Murray, S.A. and Gallagher, P.T., **2021**. *Solar flare effects on the earth's lower ionosphere*. Solar Physics, 296(11), p.157. [DOI: [10.1007/s11207-021-01898-y](https://doi.org/10.1007/s11207-021-01898-y)]
- **Hayes, L.A.**, Gallagher, P.T., McCauley, J., Dennis, B.R., Ireland, J. and Inglis, A., 2017. *Pulsations in the Earth's lower ionosphere synchronized with solar flare emission*. Journal of Geophysical Research: Space Physics, 122(10), pp.9841-9847. [DOI: [10.1002/2017JA024647](https://doi.org/10.1002/2017JA024647)]
- Collier, H., **Hayes, L.A.**, Battaglia, A.F., Harra, L.K. and Krucker, S., **2023**. *Characterising fast-time variations in the hard X-ray time profiles of solar flares using Solar Orbiter's STIX*. Astronomy & Astrophysics, 671, A79 [DOI: [10.1051/0004-6361/202245293](https://doi.org/10.1051/0004-6361/202245293)]
- **Hayes, L.A.**, Inglis, A.R., Christe, S., Dennis, B. and Gallagher, P.T., **2020**. *Statistical study of GOES X-ray quasi-periodic pulsations in solar flares*. The Astrophysical Journal, 895(1), p.50. [DOI: [10.3847/1538-4357/ab8d40](https://doi.org/10.3847/1538-4357/ab8d40)]

NAME, First Name: Janitzek, Nils

Affiliation: Physical-Meteorological Observatory Davos (PMOD) and ETH Zürich

Role in the project: Early Career Researcher with expertise in the linkage of solar remote-sensing data and solar wind in-situ measurements, space weather

Current position (since 11/2022): Instrument Scientist for Solar Orbiter (EUI, SPICE instruments) and Solar-C (SoSpIM instrument) with main responsibilities:

- Science operations, data analysis, and software development for EUI and SPICE
- Preparation of science operations for SoSpIM
- Research in solar physics based on remote-sensing and in-situ data

Former Position (11/2019–10/2022): Internal ESA Research Fellow at the European Space Astronomy Centre (ESAC), Madrid, with main responsibilities:

- Research in solar physics and space weather based on data from Solar Orbiter and other space missions

Education:

01/2021 PhD in Solar Physics, CAU Kiel

02/2015 MSc. in Physics, CAU Kiel

10/2010 BSc. In Physics, CAU Kiel

Services in National and/or International Committees: -

Honors: Selected for the Guest Investigator Program 2024 by the Royal Observatory of Belgium (ROB), Outstanding Student Paper Award, AGU Fall Meeting 2016

Selected Publications:

- 1) *A Space Weather Mission Concept: Observatories of the Solar Corona and Active Regions (OSCAR)*, Strugarek, A.; Janitzek, N.; Lee, A.; Löschl, P.; Seifert, B, 2015, J. Space Weather, Space Clim., 5, A4
- 2) *High-Time Resolution Measurements of Solar Wind Heavy Ions with SOHO/CELIAS/CTOF*, Janitzek, N.; Taut, A.; Berger, L.; Bochsler, P.; Drews, C., 2016, Proc. Sol. Wind 14 , 1720 , 040006
- 3) *First Year of Energetic Particle Measurements in the Inner Heliosphere with Solar Orbiter's Energetic Particle Detector*, Wimmer-Schweingruber, R.; Janitzek, N.; Pacheco, D.; Cernuda, I., Espinosa, F., 2021, A&A, 656,A22
- 4) *Slow Solar Wind Sources. High-Resolution Observations with a Quadrature View*, Barczynski, K.; Harra, L.; Schwanitz, C.; Janitzek, N.; Berghmans, D., 2023, A&A, 673A, 74
- 5) *Linking Solar Flare Observations to a Series of Impulsive Solar Energetic Particle Events Measured with Solar Orbiter at 0.5 AU*, Janitzek, N.; Roco, M.; Harra, L. K. A.; Berger, L.; Barczynski, K., in prep. (to be submitted to A&A in 03/2024)

Kerr, Graham S.

The Catholic University of America / NASA Goddard Space Flight Center (GSFC)

Role in the project Solar flare modelling, focusing on detailed NLTE radiation transfer to forward model EUV flare spectra including Ly α and He II 304. Comparisons between physics-based models (e.g. RADYN) and empirical models (e.g. FISM).

Current position Research Scientist, *April 2020 – present*

Former Positions

- NASA Postdoctoral Program Fellow. *April 2017 – April 2020*, NASA GSFC, USA
- Postdoctoral Research Assistant (PDRA). *2016 – 2016*, University of Glasgow, UK

Education

- PhD *2012-2016 (conferred Feb 2017)*, University of Glasgow, UK.
Thesis: “Observations and Modelling of Chromospheric Solar Flares”
- MSci (hons 1st class) Physics and Astronomy, *2007-2012*, University of Glasgow, UK.

Services in National and/or International Committees

- American Astronomical Society Solar Physics Division Public Policy Committee
- Co-leader of ISSI Team: Interrogating Field Aligned Solar Flare Models (2019-2022)

Selected Publications (full list: <https://grahamkerr.github.io/publications.html>)

- **Kerr, G.S.**, Kowalski, A.F., Allred, J.C., *et al* (2024). *An Optically Thin View of the Flaring Chromosphere: Nonthermal line widths in a chromospheric condensation during an X-class Solar Flare*. MNRAS, 527(2).
- **Kerr, G.S.**, Allred, J.C., Kowalski, A.F., Milligan, R.O., *et al* (2023), *Prospects of Detecting Non-thermal protons in Solar Flares via Lyman Line Spectroscopy: Revisiting the Orrall-Zirker Effect*. ApJ 945(2).
- McLaughlin, S.A., Milligan, R.O., **Kerr, G.S.** *et al* (2023), *Formation of the Lyman Continuum During Solar Flares*. ApJ, 944(2).
- **Kerr, G.S.**, (2023). *Interrogating Solar Flare Loop Models with IRIS Observations, 2: Plasma Properties, Energy Transport and Future Directions*. FrASS, 9 (1060862).
- **Kerr, G.S.**, Xu, Y., Allred, J.C. *et al* (2021). *He I 10830Å Dimming During Solar Flares, 1: The crucial role of nonthermal collisional ionisations*. ApJ 912.
- **Kerr, G.S.**, Allred, J.C. & Polito, V. (2020). *Solar Flare Arcade Modelling: Bridging the Gap from 1D to 3D Simulations of Optically thin Radiation*. ApJ 900(1).
- **Kerr, G.S.**, Carlsson, M., Allred, J.C., *et al* (2019). *Si IV Resonance Line Emission During Solar Flares: Non-LTE, Non-equilibrium Radiation Transfer Simulations*. ApJ, 871(1).
- Brown, S.A., Fletcher, L., **Kerr, G.S.**, *et al.* (2018). *Modelling the Hydrogen Lyman Lines in Solar Flares*. ApJ 862(1).
- **Kerr, G.S.**, Fletcher, L., Russell, A.J.B. & Allred, J.C. (2016). *Simulations of the Mg II k & Ca II 8542 Lines from an Alfvén Wave-Heated Flare Chromosphere*. ApJ 872(2).
- **Kerr, G.S.**, Simões, P.J.A., Qiu, J. & Fletcher, L. (2015). *IRIS Observations of the Mg II h & k Lines During a Solar Flare*. A&A, 582.
- **Kerr, G.S.** & Fletcher, L. (2014). *Physical Properties of White-Light Sources in the 2011 Feb 15 Solar Flare*. ApJ, 783(2).

NAME, First Name: O'HARE, Aisling Niamh

Affiliation: Queen's University, Belfast (QUB)

Role in the project: EUV observations of solar flares and ionospheric response

Current position: 1st Year PhD Candidate

Former Position(s): N/A

Education:

- MSc Physics and Applied Mathematics, 1st Class Honors (QUB; Sept 2019-Sept 2023)
- Solar and Solar-Terrestrial Summer School (St. Andrews, August 2023)

Services in National and/or International Committees (most recent nominations):
N/A

Honors:

- Awarded funding for ESA Archival Research Visitor Programme (ESTEC, Netherlands; May-June 2024)
- Selected for poster presentation at EclipseSA conference (April 2024)

Selected Publications:

- Poster at RAS Specialist Meeting: Investigating the Dynamic Solar Atmosphere in the Age of Solar Orbiter (February 2024)

Qian, Liying:

Affiliation: National Center for Atmospheric Research (NCAR), USA

Role in the project: Studying ionospheric and thermospheric variability due to solar flares

Current position: Project Scientist III, High Altitude Observatory, NCAR

Former Positions:

2013–2020 Project Scientist II, High Altitude Observatory (HAO), National Center for Atmospheric Research (NCAR), Boulder, Colorado
2010–2013 Project Scientist I, HAO, NCAR Boulder, Colorado
2007–2010 Associate Scientist III, HAO, NCAR, Boulder, Colorado

Education

2007	Ph.D., Meteorology	Pennsylvania State University
1998	M.E., Computer Sciences & Engineering	Pennsylvania State University
1991	M.S., Atmospheric Sciences,	Chinese Academy of Science, China
1988	B.S., Atmospheric Sciences	Nanjing University, China

Services in National and/or International Committees

2024 Decadal Survey Steering Committee for Solar and Space Physics (Heliophysics)

SELECTED Publications

- Qian, L., Yu, W., Pedatella, N., Yue, J., & Wang, W. (2023). Hemispheric asymmetry of the annual and semiannual variation of thermospheric composition. *Journal of Geophysical Research: Space Physics*, 128, e2022JA031077. <https://doi.org/10.1029/2022JA031077>
- Qian, L., Gan, Q., Wang, W., Cai, X., Eastes, R., & Yue, J. (2022). Seasonal variation of thermospheric composition observed by NASA GOLD. *Journal of Geophysical Research: Space Physics*, 127, e2022JA030496. <https://doi.org/10.1029/2022JA030496>
- Qian, L., Wang, W., Burns, A. G., Chamberlin, P. C., & Solomon, S. C. (2020). Responses of the thermosphere and ionosphere system to concurrent solar flares and geomagnetic storms. *Journal of Geophysical Research: Space Physics*, 125, e2019JA027431. <https://doi.org/10.1029/2019JA027431>
- Qian, L., T. N. Woods (2019), Solar Flare Effects on the Thermosphere and Ionosphere, *Space Physics and Aeronomy Collection Volume 4: Upper Atmosphere Dynamics and Energetics, Geophysical Monograph 261*, First Edition, DOI: 10.1002/9781119815631.ch14
- Qian, L., Wang, W., Burns, A. G., Chamberlin, P. C., Coster, A., Zhang, S.-R., & Solomon, S. C. (2019). Solar flare and geomagnetic storm effects on the thermosphere and ionosphere during 6–11 September 2017. *Journal of Geophysical Research: Space Physics*, 124, <https://doi.org/10.1029/2018JA026175>.
- Qian, L., A. G. Burns, B. A. Emery, B. Foster, G. Lu, et al. (2014), The NCAR TIE-GCM: A community model of the coupled thermosphere/ionosphere system, in *Modeling the Ionosphere-Thermosphere System*, AGU Geophysical Monographs.
- Qian, L., A. G. Burns, S. C. Solomon, and P. C. Chamberlin (2012), Solar flare impacts on ionospheric electrodyamics, *Geophys. Res. Lett.*, 39, L06101, doi:10.1029/2012GL051102.
- Qian, L and S. C. Solomon (2011), Thermospheric Density: An Overview of Temporal and Spatial Variations, *Space Science Reviews*, doi:10.1007/s11214-011-9810-z.

NAME, First Name: WATANABE, Kyoko

Affiliation: National Defense Academy of Japan
1-10-20 Hashirimizu, Yokosuka 239-8686, Japan

Role in the project:

Analysis and modeling of solar flare spectroscopy and impact on the ionosphere

Current position: Professor

Former Position(s):

Oct 2018 – Mar 2024 Associate professor @National Defense Academy of Japan
Oct 2015 – Sep 2018 Lecturer @ National Defense Academy of Japan
Apr 2015 – Sep 2015 Research Fellow of the NAOJ @ NAOJ
Apr 2012 – Mar 2015 Research Fellow of the JSPS @ ISAS/JAXA
Apr 2008 – Mar 2012 JAXA Project Research Scientist @ ISAS/JAXA
Apr 2006 – Mar 2008 JSPS Postdoctoral Fellowships for Research Abroad@
Space Sciences Laboratory, UC Berkeley
Apr 2004 – Mar 2006 Research Fellow of the JSPS @ STE Lab., Nagoya Univ.

Education:

Mar 2005 Ph.D. in Science, Graduate School of Science, Nagoya University, Japan
Mar 2002 Master of Science, Graduate School of Science, Nagoya University,
Japan
Mar 2000 Bachelor of Science, School of Science, Nagoya University, Japan

Services in National and/or International Committees (most recent nominations):

Apr 2024 - Representative of Space and Planetary Sciences section of Japan
Geoscience Union

Honors:

Sep 2004 Student Presentation Award (Aurora Medal) at 116th SGEPS Meeting
Mar 2006 6th Cosmic-ray Physics Incentive Award of ICRR (Institute for Cosmic
Ray Research, University of Tokyo)
Jul 2013 2013 NASA group achievement award (RHESSI science and data
analysis team)

Selected Publications:

1. Nishimoto, S., Watanabe, K., Jin, H., et al., Earth, Planets and Space, Vol.75, article id.30, pp.1-15 (2023.3)(Corresponding author)
2. Watanabe, K., Jin, H., Nishimoto, S., et al., Earth, Planets and Space, Vol.73, article id.96, pp.1-10 (2021.4)
3. Watanabe, K., and Imada, S., The Astrophysical Journal, Vol.891, No.1, article id.88, pp.1-8 (2020.3)