

# CURRICULUM VITAE

*Dr. Ryan O. Milligan*

## PERSONAL DETAILS

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Belfast, BT7 1NN	DOB: 24 November 1975
Northern Ireland	Nationality: Irish

## EMPLOYMENT

Feb 2011 – Present	Leverhulme Trust Research Fellow in Solar Physics, Queen's University Belfast.
Aug 2009 – Jan 2011	Research Associate in Solar Physics for the RHESSI Mission, Catholic University of America/NASA Goddard Space Flight Center.
Aug 2007 – Jul 2009	NASA Postdoctoral Research (NPP) Fellow, Oak Ridge Associated Universities/NASA Goddard Space Flight Center.
Jan 2007 – Jul 2007	Research Associate in Solar Physics for the RHESSI Mission, Catholic University of America/NASA Goddard Space Flight Center.

## EDUCATION

Oct 2003 – Dec 2006	Ph.D. in Solar Physics: <i>Multi-wavelength Observations of Chromospheric Evaporation During the Impulsive Phase of Solar Flares</i> Queen's University Belfast.
Oct 1998 – Oct 2003	M.Sci.(1ST CLASS HONS) in Physics and Applied Mathematics, Queen's University Belfast.

## RESEARCH INTERESTS

I am currently working as a postdoctoral researcher at Queen's University Belfast combining space-based observations of solar flares from the Ramaty High-Energy Solar Spectroscopic Imager (RHESSI) mission, a NASA Small Explorer designed to investigate energy release and particle acceleration during solar flares through X-ray and gamma-ray observations, with those from ground-based instruments such as ROSA (Rapid Oscillations in the Solar Atmosphere). I am also working on combining RHESSI observations with other space-based solar observatories (such as SOHO, TRACE, Hinode, STEREO and SDO) to investigate the consequences of this energy release. My current research includes the analysis of EUV data from the EVE instrument on SDO to investigate the driving mechanism behind geoeffective irradiance during solar flares; the statistical properties of X-ray flares using GOES observations from the past three solar cycles; investigating the process of chromospheric evaporation using the EIS instrument on Hinode; and the dynamics of plasmoid sources in coronal current sheets during CME initiation using STEREO data. I am also one of four Chief Observers for the Max Millennium Program for Solar Flare Research and I co-administer The Sun Today website which promotes awareness of solar activity and space weather to the general public.

## AWARDS AND STUDENTSHIPS

- NASA/LWS Targeted Research & Technology (TR&T) award (2011–2014; \$184k)
- American Astronomical Society/Solar Physics Division graduate student fellowship, May 2006
- Outstanding Student Paper Award from American Astronomical Society/Solar Physics Division, May 2005
- American Astronomical Society/Solar Physics Division studentship, May 2004
- Co-operative Award in Science and Technology (CAST) from NASA/GSFC, Oct 2003 (for 3 years)
- Nuffield Foundation Undergraduate Research Bursary, Jun 2002
- International Association for the Exchange of Students for Technical Experience (IAESTE) traineeship at Ricoh Inc, Yokohama, Japan, Jul–Sep 2001.

1. **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)
2. P. C. Chamberlin, **R. O. Milligan**, & T. N. Woods  
*Thermal Evolution and Radiative Output of Solar Flares Observed by the EUV Variability Experiment (EVE)*  
Solar Physics, **tmp**, 74C, (2012)
3. M. S. Kirk, K. S. Balasubramaniam, J. Jackiewicz, R. T. J. McAteer, & **R. O. Milligan**  
*Physics of Sequential Chromospheric Brightenings and Associated Flare Ribbons*  
Astrophysics Journal, **750**, 145, (2012)
4. D. F. Ryan, **R. O. Milligan**, P. T. Gallagher, B. R. Dennis, A. K. Tolbert, R. A. Schwartz & C. A. Young  
*The Thermal Properties of Solar Flares Over Three Solar Cycles Using GOES X-ray Observations*  
Astrophysics Journal Supplements, *Accepted* (2012)
5. **R. O. Milligan**, M. Kennedy, M. Mathioudakis, & F. P. Keenan  
Time-Dependent Density Diagnostics of Solar Flare Plasmas Using SDO/EVE  
Astrophysics Journal Letters, *Submitted* (2012)
6. A. M. O'Flanagan, P. T. Gallagher, J. C. Brown, **R. O. Milligan**, & G. D. Holman  
*Downward-Moving Thick Target X-ray Emission Driven by Hardening in the Nonthermal Electron Spectrum*  
Astronomy & Astrophysics, *In Preparation* (2012)
7. D. Graham, I. G. Hannah, L. Fletcher, & **R. O. Milligan**  
Differential Emission Measures of Impulsive Phase Flare Footpoints  
Astronomy & Astrophysics, *In Preparation* (2012)
8. **R. O. Milligan**  
*Spatially-Resolved Nonthermal Line Broadening During the Impulsive Phase of a Solar Flare Using Hinode/EIS*  
Astrophysics Journal, **740**, 70 (2011)
9. L. Fletcher, B. R. Dennis, H. S. Hudson, S. Krucker, K. Phillips, A. Veronig, M. Battaglia, L. Bone, Q. Chen, P. T. Gallagher, P. Grigis, H. Ji, W. Liu, **R. O. Milligan** & M. Temmer  
*High-Energy Aspects of Solar Flares (RHESSI Book). Chapter 2: Observational Overview of Solar Flares*  
Springer Praxis Books (2011)
10. B. R. Dennis & **R. O. Milligan**  
*Solar Satellites*  
Scholarpedia, 5(7):6139 (2010)
11. **R. O. Milligan**, R. T. J. McAteer, B. R. Dennis, & C. A. Young  
*Evidence of a Plasmoid-Looptop Interaction During a Solar Flare/Coronal Mass Ejection Eruptive Event*  
Astrophysics Journal, **713**, 1292 (2010)
12. F. P. Keenan, **R. O. Milligan**, D. B. Jess, K. M. Aggarwal, M. Mathioudakis, R. J. Thomas & J. M. Davila  
*Emission lines of Fe XI in the 257–407Å wavelength region observed in solar spectra from EIS/Hinode and SERTS*  
Monthly Notices of the Royal Astronomical Society, **404**, 1617 (2010)
13. **R. O. Milligan** & B. R. Dennis  
*Velocity Characteristics of Evaporated Plasma Using Hinode/EIS*  
Astrophysics Journal, **699**, 968 (2009)

14. A. Warmuth, G. D. Holman, B. R. Dennis, G. Mann, H. Aurass & **R. O. Milligan**  
*Rapid Changes of Electron Acceleration Characteristics at the End of the Impulsive Phase of an X-class Solar Flare*  
Astrophysics Journal, **699**, 917 (2009)
15. C. L. Raftery, P. T. Gallagher, **R. O. Milligan** & J. A. Klimchuk  
*Multi-wavelength Observations and Modelling of a Canonical Solar Flare*  
Astronomy & Astrophysics, **494**, 1127 (2009)
16. **R. O. Milligan**  
*A Hot Microflare Observed With RHESSI And Hinode*  
Astrophysics Journal Letters, **680**, L157 (2008)
17. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis & F. P. Keenan  
*Observational Evidence for Gentle Chromospheric Evaporation during the Impulsive Phase of a Solar Flare*  
Astrophysics Journal Letters, **642**, L169 (2006)
18. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis, D. S. Bloomfield, F. P. Keenan & R. A. Schwartz  
*RHESSI and SOHO/CDS Observations of Explosive Chromospheric Evaporation*  
Astrophysical Journal Letters, **638**, L117 (2006)
19. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis, F. P. Keenan & D. S. Bloomfield  
*Plasma Diagnostics of Active Region Evolution and Implications for Coronal Heating*  
Monthly Notices of the Royal Astronomical Society, **363**, 259 (2005)
20. F. P. Keenan, K. M. Aggarwal, R. S. I. Ryans, **R. O. Milligan**, D. S. Bloomfield, J. W. Brosius, J. M. Davila & R. J. Thomas  
*Fe XI Emission Lines in a High-Resolution Extreme-Ultraviolet Active Region Spectrum Obtained by the Solar Extreme Ultraviolet Research Telescope and Spectrograph*  
Astrophysical Journal, **624**, 428 (2005)
21. F. P. Keenan, K. M. Aggarwal, **R. O. Milligan**, R. S. I. Ryans, D. S. Bloomfield, V. Sriganan, M. G. O'Mullane, K. D. Lawson, A. Z. Msezane, A. Z., J. W. Brosius, J. M. Davilla & R. J. Thomas  
*Emission lines of Fe XV in spectra obtained with the Solar Extreme-Ultraviolet Research Telescope and Spectrograph*  
Monthly Notices of the Royal Astronomical Society, **356**, 1592 (2005)

Non-refereed

1. P. C. Chamberlin, T. N. Woods, C. J. Schrijver, H. P. Warren, **R. O. Milligan**, S. Christe, J. W. Brosius  
Solar flare impulsive phase observations from SDO and other observatories  
American Geophysical Union, Fall Meeting, SH23A-1832 (2010)
2. **R. O. Milligan**, R. T. J. McAteer, B. R. Dennis & C. A. Young  
Evidence of Enhanced Particle Acceleration During a Plasmoid-Loop-top Collision Observed with RHESSI  
American Geophysical Union, AAS Meeting, **216**, 404.26 (2010)
3. D. Ryan, P. T. Gallagher, **R. O. Milligan**, C. A. Young  
A Method to Calculate Background-Subtracted Flare Plasma Parameters Using GOES Over Three Solar Cycles  
American Astronomical Society, AAS Meeting **216**, 404.36 (2010)
4. **R. O. Milligan** & B. R. Dennis  
Velocity Characteristics of Evaporated Plasma Using Hinode/EIS  
American Astronomical Society, SPD Meeting, **41**, 868 (2009)
5. **R. O. Milligan**, R. T. J. McAteer & B. R. Dennis  
Observation Of Inflows And Collapsing X-point During CME Initiation Using STEREO And RHESSI  
American Astronomical Society, SPD meeting **41**, 856 (2009)

6. C. L. Raftery, P. T. Gallagher & **R. O. Milligan**  
Flare Cooling and Implications for Hinode/EIS  
Astronomical Society of the Pacific, **397**, 184 (2008)
7. C. L. Raftery, P. T. Gallagher & **R. O. Milligan**  
Hydrodynamics of Cooling Solar Flare Plasmas  
American Geophysical Union, Spring Meeting, SP51C-17 (2008)
8. **R. O. Milligan**  
A High-Temperature Microflare Observed With RHESSI and Hinode  
37th COSPAR Scientific Assembly. p.2044
9. **R. O. Milligan** & B. R. Dennis  
Imaging Spectroscopy Of Chromospheric Evaporation During An X-class Flare Using RHESSI And SOHO/CDS  
American Astronomical Society Meeting, **38**, 211
10. R. T. J. McAteer, J. Davilla, W. Thompson, O. St. Cyr & **R. O. Milligan**  
*Early SECCHI Observations of CME Initiation and Propagation*  
American Astronomical Society Meeting, **210**, 2811
11. **R. O. Milligan** & B. R. Dennis  
*Imagine Spectroscopy of Chromospheric Evaporation During an X-Class Flare Using RHESSI and SOHO/CDS*  
American Astronomical Society Meeting, **210**, 9302, (2007)
12. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis & F. P. Keenan  
*Observational Evidence of Gentle and Explosive Chromospheric Evaporation*  
SOHO-17, SP-617, P171 (2006)
13. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis & F. P. Keenan  
*Observational Evidence of Chromospheric Evaporation* American Astronomical Society Meeting, **37**, 0828, (2006)
14. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis & F. P. Keenan  
*Chromospheric Response to Non-Thermal Electrons During Flares Using RHESSI and SOHO/CDS*  
American Geophysical Union, Spring Meeting 2005, SP52A-04
15. **R. O. Milligan**, P. T. Gallagher, M. Mathioudakis, F. P. Keenan & D. S. Bloomfield  
*Plasma Diagnostics of Active Region Evolution and Implications for Coronal Heating*  
American Astronomical Society Meeting, **204**, 9803, (2004).

#### CONFERENCES AND PRESENTATIONS

1. Spectroscopy of the Dynamic Sun, London, UK. April 2012. Contributed Talk.
2. National Astronomy Meeting/UK Solar Physics Meeting, Manchester, UK, Mar 2012. Contributed Talk.
3. University of Glasgow, Glasgow, November 2011. Invited Talk.
4. 11th RHESSI Workshop, Glasgow, Scotland, April 2011. Contributed Talk. (Workgroup leader)
5. ISSI Meeting on Chromospheric Flares, Bern, Switzerland, March 2011. Invited Talk.
6. American Geophysical Union Meeting, San Francisco, California, USA, Dec 2010.
7. Hinode 4 Science Meeting, Palermo, Sicily, October 2010. Poster.
8. 10th RHESSI Workshop, Annapolis, Maryland, USA, Aug 2010. Contributed Talk. (SOC/LOC/Workgroup leader)
9. Hinode/XRT Team Meeting, Bozeman, Montana, USA, Jun 2010. Invited Talk.
10. ISSI Meeting on Chromospheric Flares, Bern, Switzerland, Jun 2010. Invited Talk.
11. American Astronomical Society/Solar Physics Division, Miami, Florida, USA, May 2010. Poster.

12. 3rd Hinode Science Meeting, Tokyo, Japan, Dec 2009. Poster.
13. ISSI Meeting on Chromospheric Flares, Bern, Switzerland, Nov 2009. Invited Talk.
14. 9th RHESSI Workshop, Genoa, Italy, Aug 2009. Contributed Talk.
15. Hinode/EIS Team Meeting, London, UK, Jul 2009. Invited Talk.
16. Solar Physics Division Meeting, Boulder, Colorado, USA, Jun 2009. Poster.
17. Solar Activity During the Onset of Cycle 24, Napa, California, USA, Dec 2008. Contributed and Invited Talks, and Posters.
18. Solar Image Processing Workshop IV, Baltimore, Maryland, USA, Oct 2008. (LOC)
19. 2nd Hinode Science Meeting, Boulder, Colorado, USA, Oct 2008.
20. 8th RHESSI Workshop, Potsdam, Germany, Sep 2008. Contributed Talk.
21. COSPAR Meeting, Montreal, Canada, Jul 2008. Contributed Talk.
22. National Astronomy Meeting/UK Solar Physics Meeting, Belfast, Northern Ireland, Apr 2008. Contributed Talk.
23. American Geophysical Union Meeting, San Francisco, California, USA, Dec 2007.
24. 1st Hinode Science Meeting, Dublin, Ireland, Aug 2007.
25. 7th RHESSI Workshop, Santa Cruz, California, USA, Jun 2007.
26. American Astronomical Society/Solar Physics Division, Honolulu, Hawaii, USA, May 2007. Poster.
27. Space Weather Enterprise Forum, Washington DC, USA, Apr 2007.
28. Solar Physics Division meeting, Durham, New Hampshire, USA, Jun 2006. Poster.
29. Second Solar Physics Division summer school - High Energy Solar Physics, Durham, New Hampshire, USA, Jun 2006. Poster.
30. Post-graduate seminar series, Queen's University Belfast, Belfast, Northern Ireland, May 2006. Invited Seminar.
31. SOHO-17: 10 Years of SOHO and Beyond, Giardini Naxos, Sicily (Italy), May 2006. Poster.
32. 6th RHESSI Workshop, Paris, France, Apr 2006.
33. Royal Astronomical Society meeting: Dynamics of the Solar Atmosphere, London, UK, Feb 2006. Contributed Talk.
34. Solar Physics Division Meeting, New Orleans, Louisiana, USA, May 2005. Contributed Talk.
35. RHESSI/SOHO/TRACE Workshop, Sonoma, California, USA, Dec 2004. Contributed Talk.
36. Solar Image Processing Workshop II, Annapolis Maryland, USA, Nov 2004.
37. RHESSI Data Analysis Workshop, Berkeley, California, USA, Oct 2004.
38. PPARC Advanced Summer School in Solar Physics, Egham, UK, Sep 2004. Contributed Talk.
39. Solar Physics Division Meeting, Denver, Colorado, USA, May 2004. Poster.
40. Solar Magnetic Phenomena Summer School and Workshop, Kanzelhöhe Solar Observatory, Austria, Aug 2003.
41. National Astronomy Meeting/UK Solar Physics Meeting, Dublin, Ireland, Apr 2003. Poster.

## TEACHING AND ADVISING EXPERIENCE

- Project designer and co-supervisor for a Masters level student at Queen's University Belfast.
- Co-supervisor for three students from Trinity College Dublin undertaking research in solar flare physics, at both graduate and under-graduate level. Each student has spent several months visiting NASA/GSFC to work with myself and other members of the RHESSI team. I also provide continued guidance and support while they are at their home institution, as well as advise on funding sources, fellowships and post-doctoral job applications.
- Under the Researcher In Residence program, I volunteered to assist teachers at Glenlola Colligate Grammar School, Bangor, Northern Ireland, in preparing and supervising astronomy experiments, including tracking near-Earth objects. Some findings were later published at the Minor Planet Center.

## ONLINE SCIENCE ARTICLES

1. RHESSI Science Nugget: Flare Observations of the EUV Continua  
<http://tinyurl.com/milligan-eve-continua-nugget>
2. EIS Science Nugget: Velocity Characteristics of Evaporated Plasma  
<http://msslxr.mssl.ucl.ac.uk:8080/SolarB/nuggets/nugget%5Fjun01.jsp>
3. RHESSI Science Nugget: Particle Acceleration Due to a Plasmoid-Looptop Collision  
<http://tinyurl.com/milligan-rhessi-nugget>
4. Solarpedia: Solar Satellites  
<http://www.solarpedia.org/article/Solar%5FSatellites>
5. NASA Press Release from NAM 2008  
<http://www.nasa.gov/centers/goddard/news/topstory/2008/focused%5Fflares.html>
6. RHESSI Science Nugget: The Evaporating Sun  
<http://sprg.ssl.berkeley.edu/%7Etohban/nuggets/?page=article&article%5Fid=55>

## PROFESSIONAL MEMBERSHIPS AND SERVICES

- Fellow of the Royal Astronomical Society (FRAS).
- Associate Member of the Institute of Physics (AMInstP).
- Member of the American Geophysical Union (AGU).
- Affiliate Member of the American Astronomical Society/Solar Physics Division (AAS/SPD).
- Referee for Astrophysics Journal.
- Referee for Astronomy & Astrophysics Journal.
- Referee for Solar Physics Journal
- Have served on NASA Scientific Review panels
- Chief Observer for the Max Millennium Program of Solar Flare Research  
(<http://solar.physics.montana.edu/max%5Fmillennium>).
- Member of International Space Science Institute (ISSI) Workgroup on Chromospheric Flares  
(<http://www.issibern.ch/teams/solarflares>)
- Member of the Irish Low Frequency Array (I-LOFAR; <http://www.lofar.ie/>) consortium.

## COMMUNITY ENGAGEMENT AND PUBLIC OUTREACH

- I was invited to South Eastern Regional College (formerly East Down Institute for Further Education where I completed my A-levels) to be the guest speaker at their Student Excellence Award ceremony at the Downpatrick campus in February 2012.
- BBC Radio Ulster organised the A Night Under The Stars live outside broadcast at Delamont Park in Killyleagh, Northern Ireland. I was on hand to answer questions about the Sun and solar activity.
- I assisted in the Jupiter Watch night at Queen's University Belfast which was organised by the Irish Astronomical Association as part of BBC's Stargazing Live week (January 2012).
- The Irish Astronomical Association invited me to give a talk on "Exploring the Current

Rise in Solar Activity” as part of their monthly lecture series in Belfast, December 2011 (<http://irishastro.org.uk/index1112.html>).

- I was invited onto BBC Radio Ulster’s Good Morning Ulster program to discuss the effects of solar activity on climate. November 2011.
- In March 2011 I gave talks to primary school children at three different schools on my experience at school, university and NASA as part of the Adopt A School program from the Business in the Community initiative in conjunction with Queen’s University Belfast (<http://www.bitc.org.uk/media%5Fcentre/bitc%5Fnews%5Fpress%5Freleases/spacemans%5Fvision.html>).
- From 2007–2011 I worked closely with the Solar Dynamics Observatory (SDO) Education and Public Outreach (EPO) team to promote the excitement and relevance of solar science and space weather to the public, and increase awareness of the broad spectrum of careers available in science. Specific events that I have been involved in are:
  - *A Day at Goddard* where I gave talks on the impacts of space weather, and why we study it at Goddard, to high school physics students (2–3 events per year).
  - At *Family Science Night* I was able to share my passion and enthusiasm for science with parents and their children (once per year).
  - *Educators Night* is an evening at Goddard where teachers are invited to ask scientists and engineers about their work and what influence them as students (two events).
  - I was chosen as a featured scientist for the *Scientist Like Me* program where I was interviewed about my research, how I got into science and what inspired me as a student.
- Oak Ridge Associated Universities, who administer the NASA Postdoctoral Program, initially interviewed me for a featured spot on their website (<http://nasa.orau.org/postdoc/about-fellows/milligan.htm>) and eventually funded a short video to be made about me and my experience working at NASA in order to promote the program to a wider audience (<http://www.youtube.com/watch?v=lMauZUeLcBk>).
- I am a co-administrator of The Sun Today website ([www.thesuntoday.org](http://www.thesuntoday.org)), a portal for the general public to access information related to solar activity over the rise of the current solar cycle. We also utilize social media tools such as Facebook, YouTube and Twitter to put out regular, real-time updates on solar activity, and any possible effects on the Earth, as well as general facts about the Sun ([www.facebook.com/thesuntoday](http://www.facebook.com/thesuntoday), [www.youtube.com/thesuntoday](http://www.youtube.com/thesuntoday), [www.twitter.com/thesuntoday](http://www.twitter.com/thesuntoday)).
- The Northern Ireland Bureau in Washington, DC wrote a featured article about me for their Summer 2010 newsletter and the Washington Ireland Program (WIP; <http://www.nibureau.com/index/about-the-bureau/newsletter.htm>).
- The Launch of the Solar Dynamics Observatory (SDO), Feb 2010, is an online article written for the Sun-Trek website about my personal experience of the launch of SDO (<http://www.thesuntoday.org/historical-sun/the-launch-of-the-solar-dynamics-observatory-part-1/>).
- In Jun 2008, the annual Smithsonian Folklife Festival in Washington, DC showcased NASA as one of its main exhibits. I spent a few days at the Heliophysics Science Division tent, showing pictures and movies of solar flares to the public and answering questions on space weather.
- I volunteered to give a talk on “Solar Flares and Space Weather” to the East Antrim Astronomical Society, an amateur astronomy group in Belfast, Northern Ireland in October 2006.
- I gave a talk entitled “A Journey Through the Solar Atmosphere” at Glenlola Colligate Grammar School, in Bangor, Northern Ireland in Oct 2005 as part of the Researcher in Residence program.

REFEREES

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