

Dr. Graham S. Kerr

NASA Postdoctoral Program Fellow

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Research Interests: My research interests are in the field of solar flares, particularly in the energy and radiation transport through the solar atmosphere during flares. I have expertise of image and spectroscopic data analysis from the Hinode, IRIS & SDO satellites. In addition I use the numerical radiation hydrodynamics code RADYN, and the radiation transport code RH to model physical processes during solar flares, with a focus on understanding the formation of optically thick radiation.

Education

- 2012–2016 **PhD Solar Physics**, University of Glasgow, U.K.
Supervisor: Prof. Lyndsay Fletcher
Topic: Observations and Modelling of the Chromosphere During Solar Flares
- Funded by College of Science and Engineering Research Scholarship.
 - Included Research visit to Montana State University June-August 2014
 - Thesis submitted in Sept '16, Viva passed Dec '16, and PhD awarded Feb '17.
- 2007–2012 **MSci.(1st Class Hons.) Physics and Astronomy**, University of Glasgow, U.K.

Career History (Research)

- Apr 2017 – **NASA Postdoctoral Program (NPP) Fellow**, Goddard Space Flight Centre, NASA, Maryland, USA,
Proposal: Understanding the Flaring Chromosphere (advisor: Dr. J. Allred) .
- Investigating the formation properties of the Mg II resonance and subordinate lines, the C II resonance lines and the continuum during solar flares, in an effort to better understand observations of the flaring chromosphere, in particular from the IRIS and *Hinode* spacecraft.
- Jan – April 2017 **Affiliate Staff Member**, University of Glasgow, Glasgow, UK.
- Investigated the formation of the optical continuum and the Mg II h & k lines during solar flares.
- Oct–Dec 2016 **F-CHROMA Postdoctoral Research Assistant**, University of Glasgow, Glasgow, UK.
- Investigated the formation of the optical continuum and the Mg II h & k lines during solar flares.
 - Worked on modifications to RH in order to more realistically model solar flares.
- Oct 2012 – **PhD Research**, University of Glasgow, Glasgow, UK.
Sept 2016 *Observations and modelling of the chromosphere during solar flares* (Sup: Prof. L. Fletcher).
- Performed imaging and spectroscopic analysis of flare observations at optical and Near-UV wavelengths.
 - Investigated optically thick line formation using radiation hydrodynamic (RADYN) and radiation transfer (RH) numerical simulations.
 - Experimented with alternative forms of flare energy transport in flare simulations using the RADYN code.
- Jun–Aug 2011 **High Altitude Observatory Solar Physics REU Program**, Boulder CO, USA.
Global 2D Axisymmetric MHD Simulations of Coronal Streamers (Sup: Dr Y. Fan).
- Testing a new numerical code of the solar corona, analysing the validity of solutions.
- Jun–Aug 2010 **Montana State University Solar Physics REU Program**, Bozeman MT, USA.
HXR and UV Observations of a Two-Ribbon Solar Flare (Sup: Prof J. Qiu).
- Investigated the evolution and correlation of HXR & UV emissions, and reconnection rates.

Publications

Refereed

- Kerr, G.S., Fletcher, L., Russell, A.J.B, & Allred, J. (2016), *Simulations of the Mg II k and Ca II 8542 lines from an Alfvén Wave-heated flare chromosphere*. The Astrophysical Journal, 827(2), 101.
- Kerr, G.S., Simoes, P.J.A., Qiu, J, & Fletcher, L. (2015), *IRIS Observations of the Mg II h & k Lines During a Solar Flare*. Astronomy & Astrophysics, 582, (A50).
- Milligan, R.O., Kerr, G.S., Dennis, B.R., Hudson, H.S., Fletcher, L., Allred, J.C., Chamberlin, P.C., Ireland, J., Mathioudakis, M. & Keenan, F.P. (2014), *The Radiated Energy Budget of Chromospheric Plasma in a Major Solar Flare Deduced from Multi-Wavelength Observations*. The Astrophysical Journal 793(2), 70.

- **Kerr, G.S.** & Fletcher, L. (2014), *Physical Properties of White-Light Sources in the 2011 Feb 15 Solar Flare*. The Astrophysical Journal 783(2), 98.
- Cheng, J. X., **Kerr, G** & Qiu, J. (2012), *Hard X-ray and ultraviolet observations of the 2005 January 15 two-ribbon flare*. The Astrophysical Journal 744(1), 48.

Conference Proceedings

- Simoes, P.J.A., Fletcher, L., Labrosse, N., & **Kerr, G.S.** (2016), *Observations and Modelling of Helium Lines in Solar Flares*. In: 'Ground-based Solar Observations in the Space Instrumentation Era', Coimbra Portugal. ASP Conf. Series, Vol. 504.

In Preparation

- **Kerr, G.S.**, Fletcher, L. & Allred, J.C. (2017), *Formation Properties of the Mg II h & k Lines During Solar Flares* (In Prep.)

Conferences, Meetings and Talks

Invited Presentations

- Jan 2017 **ISSI Team Meeting: Flare Heating Mechanisms** - Bern, Switzerland
- April 2014 **Mullard Space Science Lab Seminar** - Guildford, UK
- April 2014 **ISSI Team Meeting: Chromospheric Flares** - Bern, Switzerland
- Jan 2013 **ISSI Team Meeting: Chromospheric Flares** - Bern, Switzerland

Oral Presentations

- Nov 2016 **F-CHROMA Consortium Meeting** - Belfast, U.K.
- Dec 2015 **F-CHROMA Flare Modelling Meeting** - Oslo, Norway
- Nov 2015 **SUPA/Cormack Meeting** - Edinburgh, U.K
- May 2015 **IRIS-4 Workshop** - Boulder, USA
- Apr 2015 **TESS/Solar Physics Division Meeting** - Indianapolis, USA
- Apr 2015 **Glasgow-Cambridge Flare Workshop** - Glasgow, U.K
- Jan 2015 **F-CHROMA Flare Modelling Meeting** - Prague, Czech Republic
- Jan 2015 **RAS Discussion Meeting: Results from the IRIS mission**
- July 2014 **Montana State University Solar Group Seminar** - Bozeman, USA
- May 2014 **University of Glasgow A&A Seminar** - Glasgow, UK
- April 2013 **RAS Discussion Meeting: Solar flares of the lower chromosphere**

Poster Presentations

- Sept 2014 **European Solar Physics Meeting** - Dublin, Ireland (Poster Presentation)
- Nov 2013 **Hinode-7 Conference** - Takayama, Japan (Poster presentation)
- July 2013 **National Astronomy Meeting** - St. Andrews, U.K (Poster presentation)
- Nov 2012 **SUPA Cormack Astronomy Meeting (SCAM)** - Edinburgh, U.K. (Poster presentation)

Tutorials

- Nov 2016 **F-CHROMA Workshop: IRIS Data Analysis Tutorial** - Wroclaw, Poland

Awards

- Oct 2012 **College of Science and Engineering, Univ. of Glasgow, Research Scholarship:** competitive scholarship that awarded full tuition and maintenance for PhD study. Total value approx £61,000.
- Nov 2013 **Hinode-7 LOC,** ¥100,000 travel support to to attend the Hinode-7 conference.
- Nov 2013 **Royal Astronomical Society,** £700 travel support to attend the Hinode-7 conference.
- Feb 2014 **College of Science and Engineering, Univ. of Glasgow, Mobility Scholarship,** £2300 to support a research visit to Montana State University.
- Mar 2014 **School of Physics and Astronomy, Univ. of Glasgow, Lord Kelvin Postgraduate Award,** £720 to attend ESPM14.
- Jan 2015 **Solar Physics Division, AAS, Zirin Studentship,** \$900 to attend the 2015 TESS Meeting.
- Feb 2015 **European Space Agency,** €1000 to attend the IRIS-4 Workshop.
- Mar 2015 **Royal Astronomical Society,** £550 Travel support to attend the 2015 TESS Meeting.

April 2015 **School of Physics and Astronomy, Univ. of Glasgow**, *Lord Kelvin Postgraduate Award*, £470 to attend the IRIS-4 Workshop.

Prizes

Rolls-Royce **2nd Place in the Rolls-Royce Science Prize (2016)**: Team award for a year-long outreach project, from 2000 initial entrants and 6 finalists.

U of Glasgow (postgrad) **Hunter-Cumming Prize (2016)**: Prize awarded in recognition of outstanding science outreach activities
• **Post Graduate Thomson Experimental Prize (2015)**: 3 prizes awarded for excellence in research during 2nd year of PhD out of ~ 30 candidates • **Hunter-Cumming Prize (2014)**: Awarded for best 1st year PhD Report, of ~ 30 candidates

U of Glasgow (undergrad) **Archibald McAulay Memorial Prize (2012)** • **Tannahill Bequest (2012)** • **MacKay-Smith Prize (2011)** • **Lang Scholarship (2010)** • **Tannahill Bequest (2010)** • **Lanfine Bursary (2009)** • **Cleland Prize (2009)** • **Astronomy 2 (2009)**

Teaching (University of Glasgow)

Jan–April 2013, '14 & '15 **Astronomy 3/4 (Honours) Laboratory Demonstrator**: Supervised undergraduate students working on small research projects • Helped develop a new project for the 2015 students.

Sept–Dec 2013 & 2014 **Astronomy 1 Tutor**: Assisted with class tutorials, helping to develop first year student's problem solving skills • Graded assignments and provided feedback.

Sept–Dec 2013 **Physics 1 Laboratory Demonstrator**: Worked in the first year labs, teaching techniques and critical analysis of experiments • Marked and provided feedback on records and reports.

Sept 2013 & 2014 **Physics 3 Skills Revolution Demonstrator**: Worked with honours physics students to develop their communication, team working and leadership skills.

June 2013 **Physics summer school**: Taught at a pre-university school for students entering 1st year.

Memberships

Jan 2017 – **International Space Science Institute (ISSI)**: Young Scientist member of Dr. H. Tian's ISSI team on *Diagnosing Heating Mechanisms in Solar Flares Through Spectroscopic Observations*.

Sept 2012 – April 2014 **International Space Science Institute (ISSI)**: Young Scientist member of Prof. L. Fletcher's ISSI team on *Observations and Modelling of Flare Chromospheres*.

2012 – 2017 **Royal Astronomical Society**

2012 – **Stemnet Ambassador**: Public outreach in the Glasgow & west of Scotland area.

Technical Skills

Programming IDL • Fortran • Matlab • python (beginner) • Shell Scripting (basic) • L^AT_EX

Operating Systems Mac OSX • LINUX • Windows

Community Involvement

Editing & Reviewing

- **Astrophysical Journal** - I have refereed articles for the Astrophysical Journal since June 2015.
- **The GIST** - I have volunteered as a Specialist Editor, and a Copy Editor, for the Glasgow Insight into Science and Technology magazine & website. This is a student-led magazine for a general science audience.

Conference Planning

- **STFC Intro. Solar System Plasma School 2015** - member of the local organising committee, supporting the running of the summer school.

Scientific Outreach

- **Rolls Royce Science Prize** - Team member of the St Vincent's Primary School's entry to the Rolls Royce Science prize 2015/16, led by Danielle Timmons. We were awarded 2nd place in the prize, working on a year long program of space & astronomy themed activities for the full school (ages 5-11). My involvement has included advising on the purchase of specialist equipment, helping to guide the after school activities, assisting with stargazing evenings and developing a session on spectroscopy: The Colors of the Sun.
- **STEMNET Ambassador** - I have taken part in various STEMNET activities in Glasgow, including careers events for

high school students, and delivering a 'Science of Star Wars' talk

- **Glasgow University Astronomy and Astrophysics group (2010-present)** - Assisted with various outreach activities. Past events include delivering talks at the *Pint of Science* and *Seven Minutes of Science* events, public solar observing, Stargazing live themed events, transit of venus open evening, delivering many planetarium shows and schools sessions, and a Glasgow Film Theatre Q&A.
- **Glasgow Science Centre** - Meet the expert/Explore Your Universe program (Sept 2013, 2014), *Space Station 3D* movie introduction and Q&A session, and 2015 *Exploration*.
- **Glasgow University Public Engagement Internship** - Development and delivery of a new supernovae outreach project for the Glasgow Science Festival (June 2013).
- **Glasgow University / RAS** - Demonstrator for RAS Physics Masterclasses 2013, 2014.
- **Stars Over Yellowstone** - Demonstrator at a star party held in Yellowstone National Park (July 2010), where I helped the public use telescopes, find astronomical objects and answered questions about astrophysics.

Career History (non-research)

- Jun – Aug 2012 **Head of Waterfront, Head of Swimming, Senior Counselor.**
Jun – Aug '08,'09 **Head of Woodcraft, Senior Counselor, Camp Greenbrier for Boys, Alderson WV, USA.**
Jun '06 – Jun '08 **Customer Assistant, Homebase Ltd., East Kilbride, UK.**

Voluntary Work

- British Red Cross** **Event First Aid volunteer, (2008-2017)**, I volunteer with the first aid team at various public events in the Glasgow area · Requires excellent team working sometimes under high pressured situations · Trained to an advanced level of first aid.
- Volunteer Council Member, (2013-2017)**, Elected member of the Glasgow and Renfrewshire Volunteer Council, representing volunteers views at quarterly meetings.
- Glasgow University Red Cross, (2008-2013)**, I was a leading member of GURC · elected Humanitarian Coordinator (2012/13), Secretary (2011/12), Humanitarian Action Coordinator (2010/11), Ordinary Board Member (2009/10) · Developed, organised and ran activities, events and meetings in humanitarian action, fundraising and first aid training/awareness on the Glasgow University campus · GURC was awarded a BRC Excellence Award.
- The Scout Association** **Cub Scout Leader, (2006-2017)**, Assist in the planning, organisation and delivery of weekly group nights, as well as camps and other weekend activities, and the training of Young Leaders.