



Jul 07, 2017 12:17 BST

## Shining a light on solar flares and particles

**Researchers at Northumbria are helping increase understanding of the spectacular space phenomenon known as solar flares and their potential impact on the Earth.**

A team of astronomers, led by Northumbria University PhD researcher Malcolm Druett, have taken a step forward in understanding a 30-year-old mystery in the formation of solar flares. The researcher presented the team's findings on Monday 3 July at the National Astronomy Meeting in Hull, to coincide with the publication of a paper in *Nature Communications*.

Solar flares are large explosions on the surface of the Sun, associated with

the eruption of large amounts of matter. These coronal mass ejections can cause adverse 'space weather', disrupting communications and even electrical power supplies. Scientists use a variety of techniques to study the Sun, including looking at the so-called 'H-alpha line' in the solar spectrum, associated with the hydrogen gas that makes up the bulk of our nearest star. The observed wavelength of this line changes as a result of the Doppler effect, where light emitted from gas is slightly bluer if the gas is moving towards us (blueshifted) and slightly redder if it is moving away from us (redshifted).

For 30 years there has been a mystery surrounding the H-alpha emission associated with solar flares, specifically why it is observed from the ground to be strongly redshifted, but when observed by space probes such as the Solar Dynamics Observatory, it is seen blue-shifted. Northumbria's team, led by Malcolm Druett and supervised by Professor Valentina Zharkova in collaboration with Dr Eamon Scullion, have for the first time created a model to explain this effect. The approach uses radiative transfer (transfer of electromagnetic radiation, including visible light) and hydrodynamic modelling (understanding fluid flow).

Druett and his team found that short, 10 second injections of super-energetic electrons, so-called solar energetic particles (SEPs) could be responsible for the redshift in H-alpha and the formation of solar flares. This will help forecasters predict future adverse space weather events, allowing agencies on Earth to take protect systems before it hits.

Professor Zharkova said: "Solar flares are magnificent energetic phenomena releasing huge amounts of energy in the form of particles, radiation, coronal mass ejections and interplanetary shocks into the atmospheres of all the planets, including the Earth."

"A greater understanding of how a solar flare can occur and how much energy they eject into the Sun and heliosphere is a major priority for the space industry and space weather forecasts. Our paper sheds significant light on the main factors, which are able to account for the observations associated with these phenomena both in the Sun and in the heliosphere."

The team now hope that the research will advance the whole field of solar flare dynamics, allowing a better understanding of the process of flare formation and disruptive space weather.

Alongside Northumbria's team, a number of other international academics collaborated on this discovery. These included Dr Sarah Matthews (Mullard Space Science Laboratory/University College London) – a specialist in solar flare investigation, Dr Sergei Zharkov (Department of Physics and Mathematics, Hull University), a specialist in helioseismology, white light and magnetic field variations in solar flares and Dr Luc Rouppe Van der Voort (SST developer and observer) (Institute of Theoretical Astrophysics, University of Oslo, Norway).

Northumbria is a specialist in the multidisciplinary research theme Extreme Environments. Academics working in this area explore research questions in environments where life is under threat from the most extreme conditions, from the ice of Antarctica to the surface of the Sun. For more information about research into Extreme Environments click [here](#). Northumbria offers a range of courses in Mathematics, Physics and Electrical Engineering. To find out more about studying at the University go to: [www.northumbria.ac.uk](http://www.northumbria.ac.uk) or sign up for one of our upcoming Open Days [here](#).

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## Contacts



### **Rik Kendall**

Press Contact

PR and Media Manager

Business and Law / Arts, Design & Social Sciences

[rik.kendall@northumbria.ac.uk](mailto:rik.kendall@northumbria.ac.uk)

07923 382339



**Andrea Slowey**

Press Contact

PR and Media Manager

Engineering and Environment / Health and Life Sciences

[andrea.slowey@northumbria.ac.uk](mailto:andrea.slowey@northumbria.ac.uk)

07708 509436



**Rachael Barwick**

Press Contact

PR and Media Manager

[rachael.barwick@northumbria.ac.uk](mailto:rachael.barwick@northumbria.ac.uk)

07377422415



**James Fox**

Press Contact

Student Communications Manager

[james2.fox@northumbria.ac.uk](mailto:james2.fox@northumbria.ac.uk)



**Kelly Elliott**

Press Contact

PR and Media Officer

[kelly2.elliott@northumbria.ac.uk](mailto:kelly2.elliott@northumbria.ac.uk)



**Gemma Brown**

Press Contact

PR and Media Officer

[gemma6.brown@northumbria.ac.uk](mailto:gemma6.brown@northumbria.ac.uk)