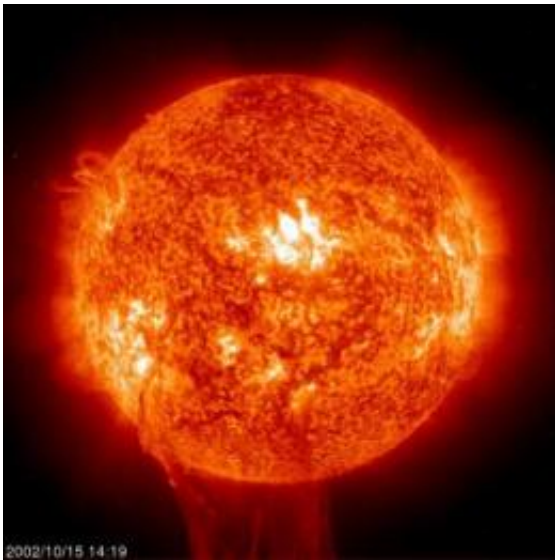


Solar experts detect waves in giant magnetic holes the size of the UK

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This shows the chromosphere of the solar atmosphere. Bright patches correspond to concentrated magnetic flux. Credit: SOHO

Massive waves in giant magnetic holes on the surface of the Sun have been discovered for the first time by solar scientists from the University of Sheffield and Queen's University Belfast, something that will bring experts a step closer to unlocking the secrets of the Sun.

The Sun is interwoven by a complex network of [magnetic field lines](#) that are responsible for a large variety of fascinating features that can be seen in the solar atmosphere. Large, dark regions, which look like holes on

the Sun's surface, mark out areas where the magnetic field breaks through from the Sun's deep, boiling interior and rises into the very hot solar atmosphere, which is over a million degrees. The largest of these dark regions are often called sunspots and have been studied since their discovery from as early as 364 BC.

Led by Professor Robertus von Fay-Siebenburgen, Head of the [Solar Physics](#) and Space Plasma Research Centre (SP2RC) at the University of Sheffield, the team studied a magnetic region of the Sun much smaller than a sunspot, however its size was still many times greater than the size of the UK.

Their research, which was published this week in [Astrophysical Journal](#), has shown that the magnetic hole they observed, which is also known as a pore, is able to channel energy generated deep inside the Sun, along the magnetic field to the Sun's [upper atmosphere](#). The magnetic field emerging through the pore is over 1,000 times stronger than the magnetic field of the Earth.

The energy being transported is in the form of a very special form of waves, known as 'sausage waves' which the scientists were able to observe using a UK-built solar imager known as ROSA (Rapid Oscillations of the [Solar Atmosphere](#)), which was designed by Queen's University Belfast and is in operation at the Dunn Solar Telescope, Sacramento Peak, USA. This is the first direct observation of 'sausage waves' at the solar surface. The magnetic hole is seen to increase and decrease in size periodically which is a characteristic feature of the 'sausage wave.'

The team of experts, including Dr Richard Morton from the University of Sheffield, as well as Professor Mihalis Mathioudakis and Dr David Jess from Queen's University Belfast, hope these giant magnetic holes will play an important role in unveiling the longstanding secrets behind

solar coronal heating.

This is because the solar surface has a temperature of a few thousand degrees but the solar corona - the outermost, mysterious, and least understood layer of the Sun's atmosphere - is heated to temperatures often a thousand times hotter than the surface. Why the temperature of the Sun's atmosphere increases as we move further away from the centre of energy production, which lies under the surface, is a great mystery of astrophysics. The findings, which demonstrate the transfer of energy on a massive scale, offer a new explanation for this puzzle.

The team now hope to use further similar solar images from ROSA to understand the fine substructure of these massive magnetic holes by reconstructing the images to view what is inside the holes.

Professor Robertus von Fay-Siebenburgen, said: "This is a fascinating new discovery in line with a number of discoveries made in recent years by the team. It is the first time that 'sausage waves' have been detected in the Sun with such detail. Analysing these waves may bring us closer to understanding the physical mechanisms in the atmosphere of a star.

"I am very proud that such talented young researchers like Richard and Dave have shown such a serious commitment in bringing us closer to unveiling the secrets of the Sun. We're also very pleased that Professor Keenan and the Queen's University Belfast solar team were able to build such a wonderful instrument that allows us to make unprecedented observations with relatively low costs."

The news comes as part of the University of Sheffield's unique venture entitled Project Sunshine, led by the Faculty of Science. SP2RC plays a key role in Project Sunshine, which aims to unite scientists across the traditional boundaries in both the pure and applied sciences to harness the power of the Sun and tackle the biggest challenge facing the world

today: meeting the increasing food and energy needs of the world's population in the context of an uncertain climate and global environment change.

More information: To view the research paper entitled 'Observations of Sausage Modes in Magnetic Pores' visit:
iopscience.iop.org/2041-8205/729/2/L18

Provided by University of Sheffield

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