Space tornadoes power the atmosphere of the Sun

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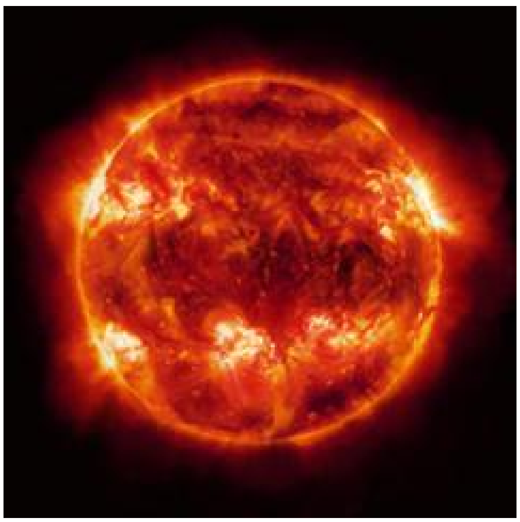

Mathematicians at the University of Sheffield, as part of an international team, have discovered tornadoes in space which could hold the key to power the atmosphere of the Sun to millions of kelvin.

The super tornadoes - which are thousands of times larger and more powerful than their earthly counterparts but which have a magnetic skeleton - spin at speeds of more than 6,000 mph at temperatures in millions of centigrade in the Sun's atmosphere.

They are more than 1,000 miles wide – hundreds of miles longer than the total distance between Land's End to John O'Groats. It is estimated that there are as many as 11,000 of these swirling events above the Sun's surface at any time.

Applied mathematicians from the University of Sheffield (Professor Robertus Erdélyi –senior author, and Dr Viktor Fedun) collaborating with the University of Oslo in Norway (Drs Sven Wedemeyer-Böhm – first author, Eamon Scullion – a Sheffield ex-postgraduate, Luc Rouppe van de Voort), Kiepenheuer Institute for Solar Physics of Freiburg, Germany (Dr Oskar Steiner), and Uppsala University in Sweden (Jaime de la Cruz Rodriguez), say the solar tornadoes carry the energy from the energy reservoir below the Sun's surface, called the convection zone, to the outer atmosphere in the form of magnetic waves.

Professor Robertus Erdélyi (a.k.a von Fáy-Siebenbürgen) Head of the Solar Physics and Space Plasma Research Centre (SP2RC) of the University of Sheffield's School of Mathematics and Statistics, said: "If we understand how nature heats up magnetised plasmas, like in the tornadoes observed in the Sun, one day we may be able to use this process to develop the necessary technology and build devices on Earth that produce free, clean, green energy. Because of our collaborative research it looks an essential leap forward is made towards unveiling the secrets about a great and exciting problem in plasma-astrophysics and we are getting closer and closer to find a solution.

"We report here the discovery of ubiquitous magnetic solar tornadoes and their signature in the hottest areas of the Sun's atmosphere where the temperature is a few millions of degree kelvin, about thousands of kilometres from the Sun's surface. This is a major step in the field."

The space tornadoes are very magnetic and they operate in plasma - Plasma is the forth known state of matter, beside solid, liquid and gas and makes around 99 per cent of the known matter of the Universe. The tornados act in a similar way to water does if you take the plug out of a full bath.

Professor Robertus Erdélyi added: "One of the major problems in modern astrophysics is why the atmosphere of a star, like our own Sun, is considerably hotter than its surface? Imagine, that you climb a mountain, e.g. a monroe in the Scottish highlands, and it becomes hotter as you go higher and higher. Many scientists are researching how to "heat" the atmosphere above the surface of the Sun, or any other star.

"It is understood that the energy originates from below the Sun's surface, but how this massive amount of energy travels up to the solar atmosphere surrounding it is a mystery. We believe we have found evidence in the form of rotating magnetic structures - solar tornadoes - that channel the necessary energy in the form of magnetic waves to heat the magnetised solar plasma. It is hoped that the process could be replicated here on Earth one day to energise plasma in tokamak that are believed to be a future device to produce completely clean energy."

Scientists viewed the solar tornadoes in the outer atmosphere of the Sun, stretching thousands of miles from the giant star's surface by using both satellite and ground-based telescopes. They then created 3D-layered seqence of images of the tornadoes and simulated their evolution with state-of-the-art numerical codes using the magnetic imprints detected by their high-resolution, cutting-edge telescopes.

Provided by University of Sheffield