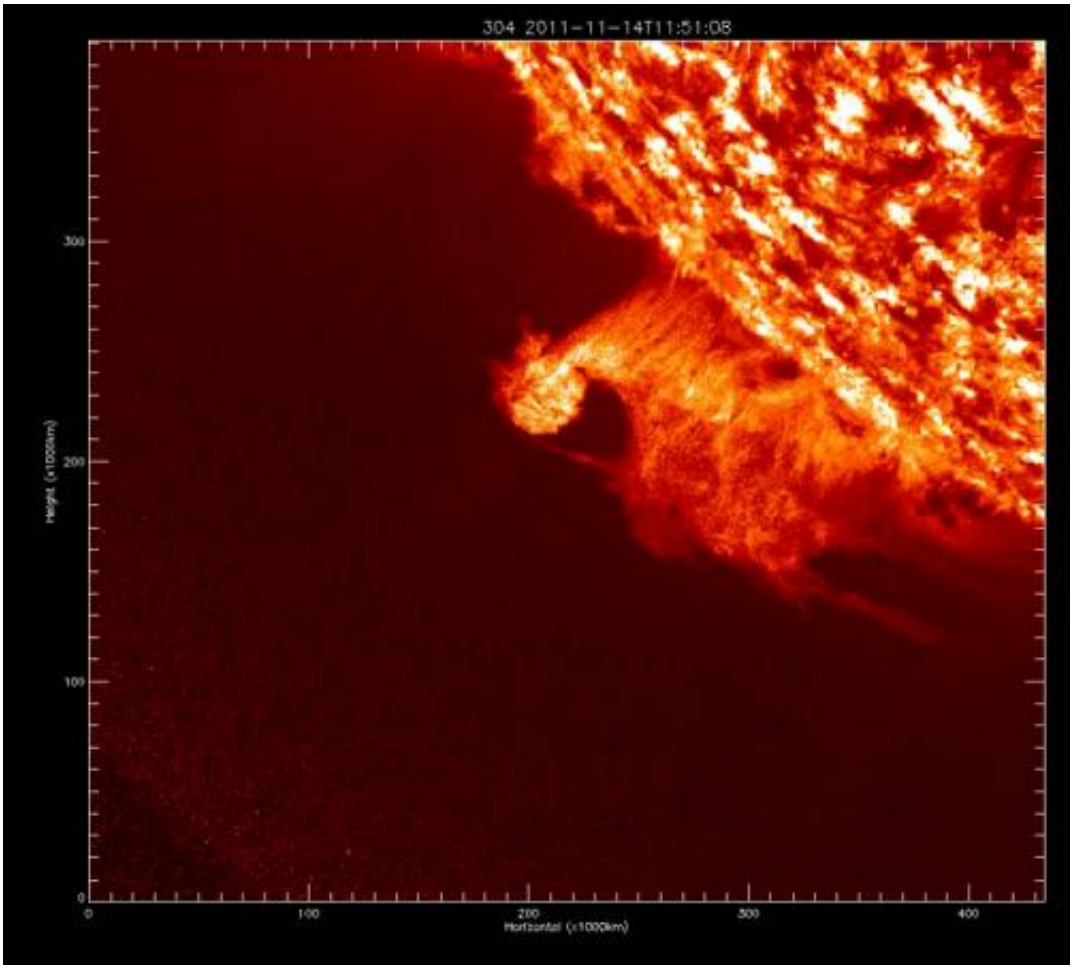
Solar prominences put on strange and beautiful show in the Sun's sky (w/ Video)

July 4 2013



Rotating disc motions. Credit: NASA/SDO/Li/Smith/Aberystwyth University

(Phys.org) —Cloud spotting seems to be growing in popularity as a hobby here on Earth. Now scientists studying the solar atmosphere are

building their own collection of fascinating moving features that they've spotted in the Sun's sky. The unusual solar prominences include a giant disc that rotates for several hours, feathery streamers as long as fifty Earths, a super-heated jet striking the top of a prominence and twisted ribbons flowing in opposite directions at a million kilometres per hour.

The features were discovered by Dr Xing Li and PhD student, Jeff Smith, of Aberystwyth University using the Atmospheric Imaging Assembly (AIA) telescope on board the Solar Dynamics Observatory (SDO) satellite. The findings have been presented at the RAS National Astronomy Meeting in St Andrews.

Prominences are – relatively – cold gaseous features, with temperatures around 5000 degrees Celsius compared to the surrounding the hot solar atmosphere of about 1-2 million degrees. They can be seen as towering features extending outwards from the Sun's surface, often in the shape of a loop. They are called filaments when viewed against the solar disc, appearing as dark stripes because the cold gases they contain absorb the light emitted from below. Solar prominences and filaments supply most of the material released in coronal mass ejections, vast eruptions from the Sun's atmosphere that can cause space weather and create geomagnetic storms on Earth.

Rotating discs in solar prominences were first observed decades ago, using ground-based telescopes, and have puzzled solar physicists since. The new SDO observations of a rotating disc reveal that the feature covers a temperature range from a few thousand to one million degrees Celsius. Li and Smith believe that the rotation is caused by turbulence produced at the interface of two gases of enormously different temperatures.

"We think the rotation is produced when hot gases enter a cold medium in an organised fashion. The magnetic field serves as a thermal barrier

between the two media. The resulting rotation can last hours," said Li.

The persistent horizontal motion of feathery streamers from a solar prominence was observed by SDO over a period of more than 15 hours. Li and Smith believe that the likely cause is a large-scale, slow restructuring of the magnetic field through a process called magnetic reconnection.

In a further observation, lasting around three hours, a jet of superheated gases as hot as 1.5 - 2 million degrees Celsius was sucked from the coronal cavity surrounding a prominence and spiralled up along a helical path to strike the top of prominence 50 000 km high.

"The feat of the jet hitting the top of the prominence, and the distances involved, is comparable to a ballistic missile hitting a satellite in geostationary orbit!" said Li.

Finally the SDO imagery showed counter-streaming flows at more than a million kilometres per hour along a filament channel consisting of many very thin threads.

"These fabulous motions suggest more complex magnetic structures of filaments/prominences than scientists previously thought," said Li.

Smith added: "These events are beautiful to observe and also set a fascinating challenge to get to the bottom of the physics involved."

Provided by Royal Astronomical Society