Evidence found of magnetic reconnection generating spicules on the sun

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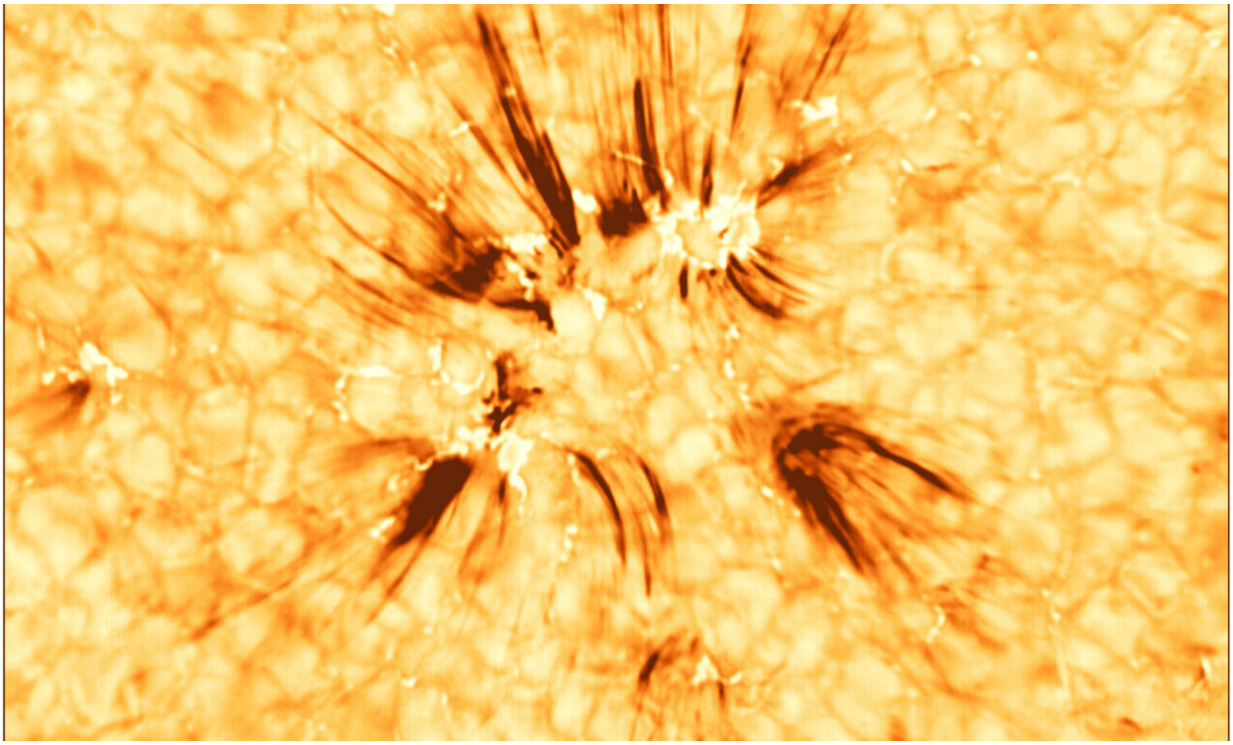

The background image is a coronal image in the 17.1 nm passband taken by the AIA instrument on board the SDO spacecraft. The overlain layered images show the photospheric magnetic field as well as emission from the photosphere, chromosphere and corona in the region indicated by the black box. Credit: T. Samanta, GST & SDO

An international team of researchers has found evidence that magnetic

reconnection is the source of spicule generation on the surface of the sun. In their paper published in the journal *Science*, the group describes their study of the sun and what they learned about it.

Scientists have known about spicule generation on the surface of the sun since 1877, but despite much research, their origin has remained a mystery. In this new effort, the researchers believe they may have at long last found the answer, thanks to the Goode Solar Telescope; a new, very high-resolution solar telescope.

Spicules are small jets of solar plasma that erupt all over the surface of the sun. Each lasts just a few minutes, making it very difficult to study them. Solar scientists have been wondering for some time if they may hold the key to the mystery of why the sun's corona is so much hotter than its surface. To find some possible answers, the researchers used the Goode Solar Telescope to get the best possible look at them. They found something not previously observed—just before a spicule erupted, a patch formed on the sun's surface in the same place that had a magnetic field that was reversed from the area around it. Such a finding suggested that spicules might form due to magnetic reconnection, in which clashes occur between regions with oppositely arranged magnetic field lines. In such clashes, magnetic energy is converted to kinetic energy and heat. On the sun, that heat and energy could be responsible for forming spicules.

Curious as to whether spicule eruptions might be part or all of the reason that the corona is so much hotter than the surface, the researchers turned to data from the Solar Dynamics Observatory—an Earth-orbiting satellite equipped with solar observation equipment. When comparing data from the Goode Telescope showing the same part of the sun at the same moment, the spicule being studied erupted—the researchers observed a glow from charged iron atoms appearing directly over the spicule location. They note that such a glow indicates that the plasma in

the spicule had reached at least a temperature of 1 million degrees centigrade.

More information: Tanmoy Samanta et al. Generation of solar spicules and subsequent atmospheric heating, *Science* (2019). DOI: 10.1126/science.aaw2796 , science.sciencemag.org/content/366/6467/890

Press release