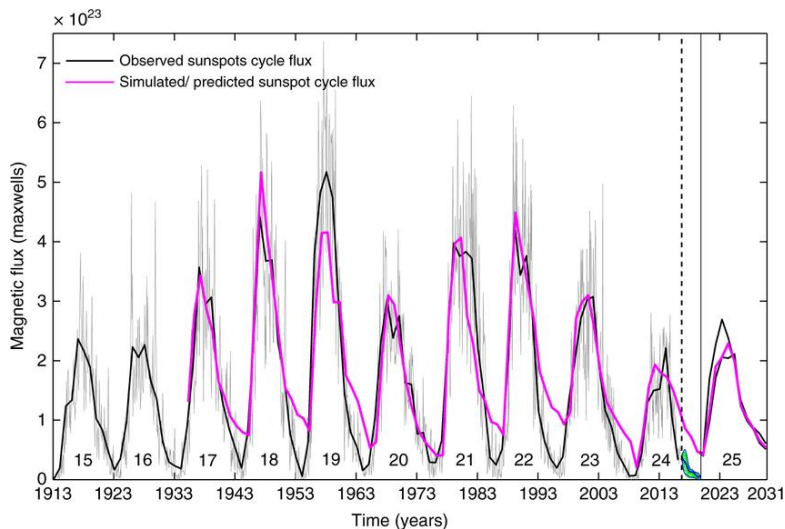


Carrington Events

If you recently tried to look out for the magnificent Aurora Borealis that appeared in our northern skies from Eastertown, you will probably have been disappointed. The light pollution from Weston is too strong. That said, many people in other southern areas of England and Wales were treated to a rare event at a time in the natural eleven-year solar cycle when sunspot activity is usually at a minimum.



The graph is taken from a freely available article in Nature Communications, which describes in detail the sun's activity and how it affects our atmosphere.

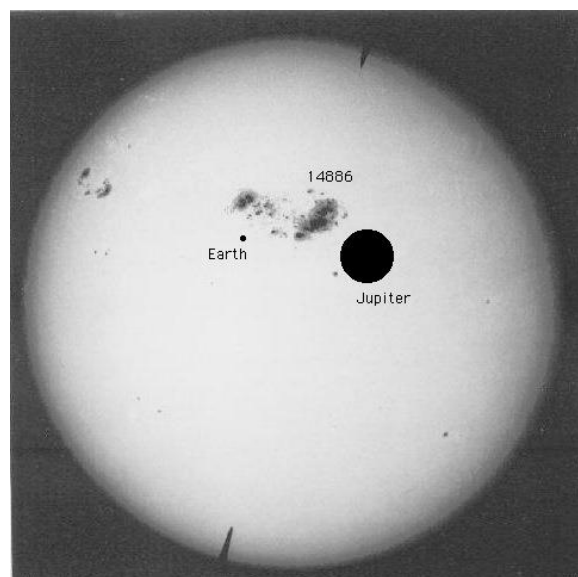
(The whole article is available as a pdf if you wish to read more. Just follow the link below the image. It is a bit technical but very interesting.)

<https://www.nature.com/articles/s41467-018-07690-0>

Sunspots have been known about since at least three hundred years before the common era. They were first commented upon by a Chinese astronomer Gan De in 364 BCE. In more recent times they were first observed with a telescope in 1610 by an English Astronomer called Thomas Harriot who lived and studied mathematics in Oxford. He was credited with describing the theories of refraction of light through glass and was the first man to make drawings of the moon in 1609, a few months before Galileo. Amongst other things he was an excellent navigator and accompanied Sir Walter Raleigh to the Americas, after helping to design the very ship they sailed in. Not only did he invent binary notation in arithmetic, his observations about the most efficient way to stack cannon balls also influenced the thinking of modern atomic theory by other scientists hundreds of years later. Added to that, he was probably the man who influenced the introduction of the potato to Europe and he was briefly implicated as a co-conspirator in the Gunpowder Plot! How is it that some people can be so brilliant and yet we have never heard of them?

This photo of a sunspot taken over 70 years ago, has the sizes of the Earth and the planet Jupiter superimposed to give you a sense of their scale. The recent solar storm that caused the exciting light show in our night skies was associated with a spot at least 15 times the diameter of our planet.

Sunspots are the visible signs of reduced surface temperature due to changes in magnetic flux within the sun.

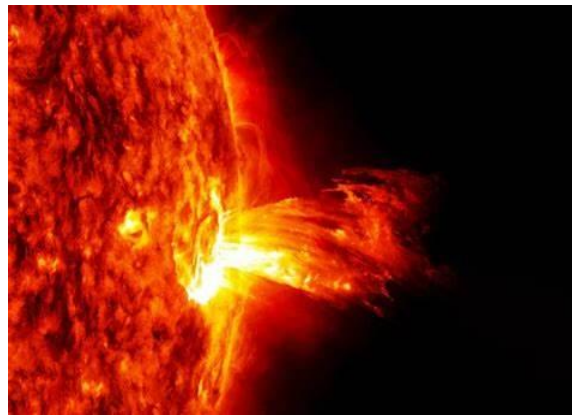


In the early 19th Century, William Herschel, who lived for a while in nearby Bath, was one of the first to equate sunspots with heating and cooling on Earth and believed that certain features of sunspots would indicate increased heating on Earth.

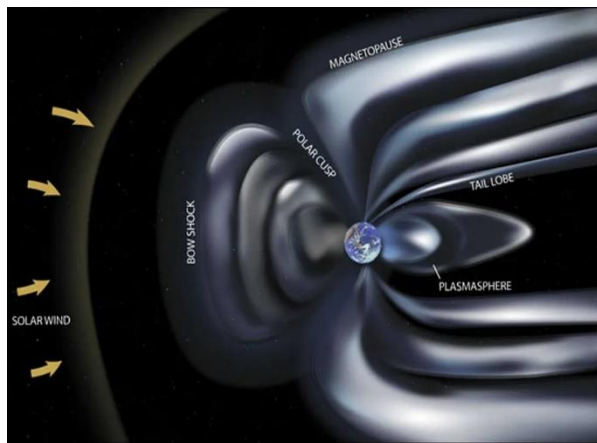
Another amateur astronomer called Richard Carrington was destined to enter the Church but became enthused by lectures about the universe that he heard at Cambridge University. After a period in Durham Observatory, he moved to Redhill in Surrey and began his own work. From there he demonstrated the existence of solar flares and suggested that they influenced the appearance of the Aurorae in the northern skies.

The Carrington Event was the most intense geomagnetic storm in recorded history, peaking from 1–2 September 1859. It created strong auroral displays that were reported globally and caused sparking and even fires in multiple telegraph stations.

The image here is one taken by the modern NASA Solar Dynamics Observatory. The sun's magnetic field lines had become twisted and then released a massive burst of pent-up energy in the form of light and electromagnetic radiation and particles. These are sometimes referred to as "solar wind".



If the flare occurs in the direction of the earth the stream of energy and particles arrives a few minutes later and is then attracted to our polar regions by the Earth's own magnetic field.



This field is fortunate for us and all life on Earth, as without it we would have lost most of our atmosphere. This is what scientists now believe may have happened to Mars, which lacks similar protection.

It is not a perfect defence even though most of the harmful radiation is contained at a safe distance in our twin doughnut shaped Van Allen Belts at each pole. Solar wind variations can disturb it, leading to "space weather".

Aside from enhancing auroras, large solar storms are potentially hazardous to technologically driven lifestyles, since they can interrupt GPS signals, damage satellites, pose health risks to orbiting astronauts, and even carry the potential to knock out power grids. As the atmosphere swells with the heating effect, low orbiting satellites can be slowed down and begin to descend and re-enter, burning up as they fall.

Scientists are still trying to assess the effect of this most recent Carrington-like event. At the moment it does not seem to have been as bad as predicted and our technology may be more robust now, so we have not lost communications and GPS in a bad way. However, it does serve to remind us of the spectacular power of the sun.