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Is our Sun falling silent?

By Rebecca Morelle Science reporter, BBC World Service

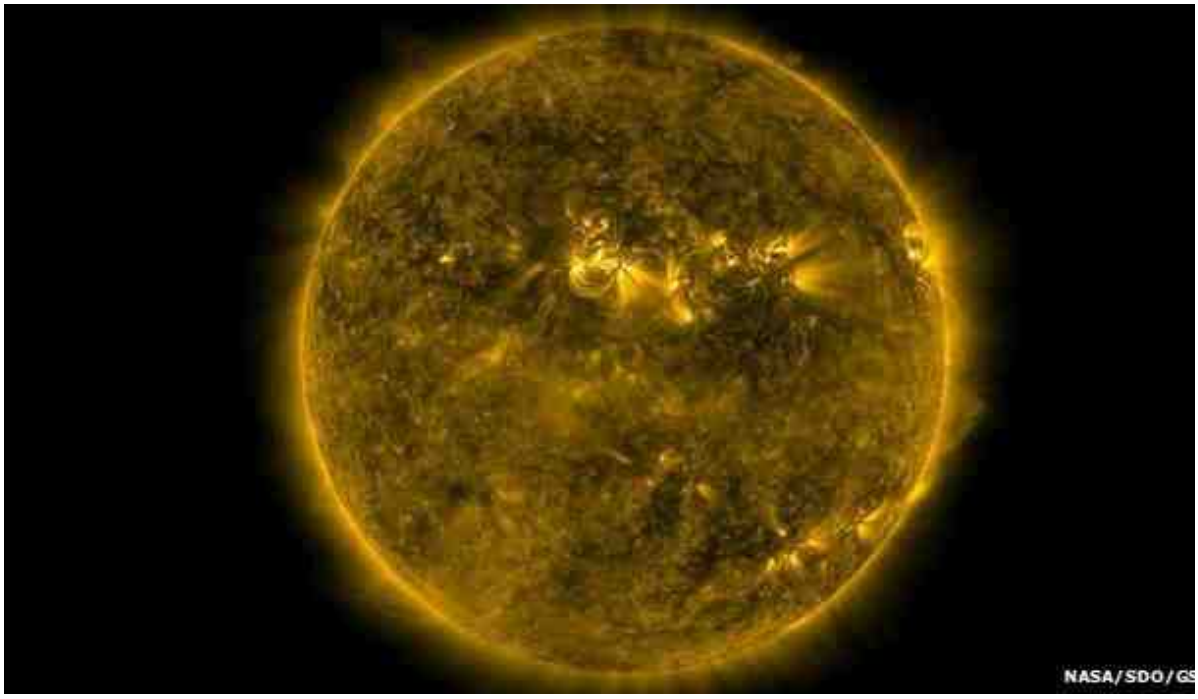
Rebecca Morelle reports for Newsnight on the solar lull that is baffling scientists

"I've been a solar physicist for 30 years, and I've never seen anything quite like this," says Richard Harrison, head of space physics at the Rutherford Appleton Laboratory in Oxfordshire.

He shows me recent footage captured by spacecraft that have their sights trained on our star. The Sun is revealed in exquisite detail, but its face is strangely featureless.

"If you want to go back to see when the Sun was this inactive... you've got to go back about 100 years," he says.

This solar lull is baffling scientists, because right now the Sun should be awash with activity.



The Sun's activity may be falling faster than at any time in 10,000 years
It has reached its solar maximum, the point in its 11-year cycle where activity is at a peak.

This giant ball of plasma should be peppered with sunspots, exploding with flares and spewing out huge clouds of charged particles into space in the form of coronal mass ejections.

The Sun should be at the peak of its activity - bursting with flares and coronal mass ejections
But apart from the odd event, like some recent solar flares, it has been very quiet. And this damp squib of a maximum follows a solar minimum - the period when the Sun's activity troughs - that was longer and lower than scientists expected.

"It's completely taken me and many other solar scientists by surprise," says Dr Lucie Green, from University College London's Mullard Space Science Laboratory.

The drop off in activity is happening surprisingly quickly, and scientists are now watching

closely to see if it will continue to plummet.

"It could mean a very, very inactive star, it would feel like the Sun is asleep... a very dormant ball of gas at the centre of our Solar System," explains Dr Green.

This, though, would certainly not be the first time this has happened.

"It's an unusually rapid decline"

Prof Mike Lockwood University of Reading
During the latter half of the 17th Century, the Sun went through an extremely quiet phase - a period called the Maunder Minimum.

Historical records reveal that sunspots virtually disappeared during this time.

Dr Green says: "There is a very strong hint that the Sun is acting in the same way now as it did in the run-up to the Maunder Minimum."

Mike Lockwood, professor of space environment physics, from the University of Reading, thinks there is a significant chance that the Sun could become increasingly quiet.

An analysis of ice-cores, which hold a long-term record of solar activity, suggests the decline in activity is the fastest that has been seen in 10,000 years.

"It's an unusually rapid decline," explains Prof Lockwood.

Londoners enjoyed frost fairs on the Thames in the 17th Century
"We estimate that within about 40 years or so there is a 10% to 20% - nearer 20% - probability that we'll be back in Maunder Minimum conditions."

The era of solar inactivity in the 17th Century coincided with a period of bitterly cold winters in Europe.

Londoners enjoyed frost fairs on the Thames after it froze over, snow cover across the continent increased, the Baltic Sea iced over - the conditions were so harsh, some describe it as a mini-Ice Age.

And Prof Lockwood believes that this regional effect could have been in part driven by the

dearth of activity on the Sun, and may happen again if our star continues to wane.

"It's a very active research topic at the present time, but we do think there is a mechanism in Europe where we should expect more cold winters when solar activity is low," he says.

He believes this local effect happens because the amount of ultraviolet light radiating from the Sun dips when solar activity is low.

This means that less UV radiation hits the stratosphere - the layer of air that sits high above the Earth. And this in turn feeds into the jet stream - the fast-flowing air current in the upper atmosphere that can drive the weather.

The results of this are dominantly felt above Europe, says Prof Lockwood.

Cold, snowy winters could become the norm for Europe

"These are large meanders in the jet stream, and they're called blocking events because they block off the normal moist, mild winds we get from the Atlantic, and instead we get cold air being dragged down from the Arctic and from Russia," he says.

"These are what we call a cold snap... a series of three or four cold snaps in a row adds up to a cold winter. And that's quite likely what we'll see as solar activity declines."

So could this regional change in Europe have a knock-on effect on for the rest of the world's climate? And what are the implications for global warming?

In a recent report by the UN's climate panel, scientists concluded that they were 95% certain that humans were the "dominant cause" of global warming since the 1950s, and if greenhouse gases continue to rise at their current rate, then the global mean temperature could rise by as much as 4.8C.

"This feels like a period where it's very strange... but also it stresses that we don't really understand the star that we live with"

Prof Richard Harrison Rutherford Appleton Laboratory

And while some have argued that ebbs and flows in the Sun's activity are driving the climate - overriding the effect of greenhouse gas emissions, the Intergovernmental Panel on Climate Change concludes that solar variation only makes a small contribution to the Earth's climate.

Prof Lockwood says that while UV light varies with solar activity, other forms of radiation from the Sun that penetrate the troposphere (the lower layer of air that sits above the Earth) do not change that much.

He explains: "If we take all the science that we know relating to how the Sun emits heat and light and how that heat and light powers our climate system, and we look at the climate system globally, the difference that it makes even going back into Maunder Minimum conditions is very small.

"I've done a number of studies that show at the very most it might buy you about five years before you reach a certain global average temperature level. But that's not to say, on a more regional basis there aren't changes to the patterns of our weather that we'll have to get used to."


Polar lights - one manifestation of solar activity in the Earth's magnetosphere - may dim

But this weather would not be the only consequence of a drawn out period of inactivity, says Dr Green.

"If the Sun were to get very quiet, one of the few things that would happen is that we'd have very few displays of the northern lights. They are driven by solar activity, and we'd miss out on this beautiful natural phenomenon," she explains.

However, there could be positive effects too.

"Solar activity drives a whole range of space weather, and these are ultimately effects on the electricity networks, on satellites, on radio communications and GPS on your sat-nav," she explains.

And while scientists cannot discount that the random bursts of activity may still occur, calmer periods of space weather would help to maintain the technological infrastructure that we rely so heavily on.

While the full consequences of a quietening Sun are not fully understood, one thing scientists are certain about is that our star is unpredictable, and anything could happen next.

"This feels like a period where it's very strange... but also it stresses that we don't really understand the star that we live with." says Prof Harrison.

"Because it's complicated - it's a complex beast."

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