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There's Something Special About the Sun: It's a Bit Boring

The sun seems a little less active than hundreds of similar stars in our galaxy, which could play a role in why life exists in our solar system.

By Adam Mann

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The sun, like all stars, is a blazing ball of fusion-powered plasma. From its surface emerge magnetic field lines that can cause dark patches known as sunspots. Turn up the activity of these magnetic whorls, and you get more solar storms flinging deadly charged particles and radiation throughout our solar system. If enough of these punishing waves hit a rocky planet, that planet might end up microwaved into a dreary condition where nothing could live.

So how is it that we're alive? A study released Thursday in the journal Science suggests that our sun is rather tame compared with its stellar siblings, and that hundreds of other sun-like stars in our galaxy have on average five times more magnetic activity than our parent star. In other words, the sun is a bit humdrum, which might be good for life here on Earth.

Astronomers have been tracking the appearance of sunspots since the time of Galileo, providing a proxy for solar activity stretching back four centuries. Some previous studies also implied that the sun was quieter than other similar stars. But competing evidence has also found the sun's activity level is normal for stars of its size.

“This triggered the question: ‘Is the sun a real sun-like star?’” said Timo Reinhold, an astrophysicist at the Max Planck Institute for Solar System Research in Göttingen, Germany, and co-author of the paper.

Dr. Reinhold and colleagues looked at data collected by NASA’s retired Kepler space telescope, which continuously monitored approximately 150,000 stars in the Milky Way for four years to find exoplanets, and was capable of observing brightness variations from activity such as the appearance and disappearance of starspots.

The researchers selected stars with masses, temperatures, ages, chemical compositions and rotation periods comparable to our sun’s. They eventually found 369 stars for comparison, the largest such sample to date.

Stars like the sun go through regular cycles during which spots cross their surfaces with greater or less frequency. During times of peak magnetic activity, when spots pop out all over the surface, a star will dim. Our sun’s cycle lasts about 11 Earth years.

For the sun, this dimming is negligible. Data from the past 140 years indicates that its brightness changes by less than a tenth of a percent over the course of its cycle. But for the stars studied by Kepler, the variability could be up to 12 times that amount.

The team has come up with two rather different potential explanations for what this means.

The first is that the sun is in a period of unusual torpor, and will one day wake up and become more like its kin. Evidence for this idea comes from significant swings in the sun’s activity levels during recorded history. Between 1645 and 1715, an era known as the Maunder Minimum, astronomers observed few to no sunspots. More than a century later, in 1859, the sun released one of the largest electromagnetic storms ever recorded, the Carrington Event, which knocked out telegraph lines and generated auroras as far south as the Caribbean.

But Natalie Krivova, a co-author and also an astrophysicist at Max Planck said that data from ice cores, which contain chemical indicators of solar activity stretching back 9,000 years, don't suggest that the sun was any more raucous in the geologically recent past. Then again, nine millenniums is a blip compared to the sun's 4-billion-year life span.

The second idea, Dr. Krivova said, is that the magnetic dynamo inside the sun, which powers its colossal magnetic field, is reaching the end of its high-powered stage, and is currently transitioning into a period of reduced activity. Stars older than the sun show marked decreases in magnetic activity, and the sun is just about getting to the age when this shift should occur.

Some stellar scientists believe that the sun's magnetic dynamo might be "reaching its end state, or almost its death," said Ricky Egeland, a solar physicist at the National Center for Atmospheric Research in Boulder, Colo.

The 369 sun-like stars observed by Kepler might simply be in an earlier stage of evolution than the sun, these scientists say. Or perhaps something particular about the sun is causing an early transition. Dr. Reinhold's team doesn't favor one explanation over the other.

In either case, a quiet sun has benefited our species. When the sun flares up, its energetic emissions do harm to astronauts and satellites in orbit, and especially powerful outbursts can affect power grids down on the ground. Radiation from such events is not particularly conducive to the existence of living organisms.

Models indicate that when the sun was younger, perhaps half a billion or a billion years old, it had greater magnetic activity than today, Dr. Egeland said.

"I always wonder what effect this variability had on the development of life," he said. "It may be no coincidence that we live around a very inactive star."