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THE BIG FLIP

Ken Tapping, 26th November, 2013

Every 10-13 years, the Sun's magnetic field flips. As far as we can deduce, this is a normal event in the solar activity cycle, which has been going on for millions of years. The next flip should take place in the next few months.

For most of our history, the Sun has been seen as a deity or at least something moving around in the heavens, and therefore perfect – an unblemished, shining sphere. Therefore, when in the 17th Century, Galileo, Scheiner and others discovered spots on the Sun, they ran into a fair amount of religious opposition. However, it was impossible to deny the existence of something that anyone with the right equipment could see for themselves.

Observers were soon making careful sketches showing the structures and positions of sunspots. From the day-to-day changes in sunspot positions on the Sun's disc they deduced that the Sun rotates on its axis every 27 days or so. As the observations continued, more fascinating things were discovered. First of all the number of sunspots rose and fell over a cycle ranging in duration from ten to thirteen years, with the sunspot number ranging from a minimum value close to zero to a maximum that might be in the hundreds, and then back to almost zero again. This originally became known as the “sunspot cycle”, although really this was only part of something much more complicated: the solar magnetic activity cycle.

As the sunspot watchers collected more data, they saw another odd thing. When the first sunspots in the new cycle appeared, they were always at high latitudes, close to the Sun's north and south poles. Then, as the cycle proceeded, the numbers of sunspots increased and they turned up at lower and lower latitudes, closer to the Sun's equator. The last few spots at the end of the cycle emerged close to the equator. Interestingly, the first spots of the next cycle appeared at high latitudes while there were still spots belonging to the old cycle near the equator. This repeating, large-scale

pattern suggests there is a big, organized, and probably complex machine running inside the Sun.

The next strange thing turned up when we became able to measure solar magnetic fields. During each solar cycle, the magnetic fields in the sunspots are arranged in opposite ways between the northern and southern hemispheres, and then, in the next cycle, this is reversed, so the northern spots are arranged the way the southern spots were in the last cycle, and vice versa. If we say a cycle has to end with things exactly the way they were at the beginning, it is not a 10-13 year cycle, it is really a 20-26 year cycle. These magnetic reversals that turn up every 10-13 years are the “magnetic flips”. Over the last few years it has become possible to model all the complex motions and circulations we believe to be taking place in the Sun, and end up with a simulated Sun that has cycles and flips.

This time round we are keeping a special eye on this magnetic flip. The last minimum of activity was so long some were wondering if there was going to be a new cycle at all. Then, when the new cycle started, it was the weakest we have seen in decades. So we are eager to see what the next cycle is going to be like. Is it going to be weird, weirder, or back to “normal” behaviour?

On the whole, the Sun has looked after us pretty well for millions of years. However, as we became more numerous and more demanding of our planet's environment and resources, and increasingly dependent upon a complex, global infrastructure, we also become more sensitive to the Sun's behaviour than ever before. This is why we are monitoring the Sun very carefully.

Venus shines brightly, low in the southwest after sunset. Jupiter and Mars rise around 8pm and 2am respectively. Look for Mercury low in the southeast before dawn, close to Saturn. The Moon will be New on the 2nd.

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