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## WINTER SOLSTICE, 2014

Ken Tapping, 16<sup>th</sup> December, 2014

At 6:03pm EST, 3:03pm PDT on 21 December the Sun will reach its southernmost point in its yearly travels, an event called the winter solstice. That will be the day with the smallest number of hours of daylight. From then on the days will start getting longer, at first slowly, and then faster and faster.

These days, with our heated houses, artificial light whenever we want it and food being brought from far away, the winter solstice does not have the significance it had for our ancestors. For them knowing that days would get longer and the warm weather would come again was really important. They had celebrations and ceremonies to remind the Sun to come back northward and to remind themselves that it would. The Romans celebrated the winter solstice as Saturnalia. When Christianity spread through Europe, pagan festivals were discouraged. However, the popularity of the winter solstice festival led to it being rededicated as a celebration of the birth of Jesus. Adjustments made to the calendar have led to the celebration moving to a few days after the solstice, to the date we use in the western world today.

The four seasons, together with the spring and autumn equinoxes and summer and winter solstices that separate them, are all due to one thing, the orientation of the Earth's axis of rotation. Imagine a straight line joining the Earth's North and South Poles, and extending into space. An analogy would be something like a knitting needle stuck through an orange. The Earth's axis stays pointed in one direction in space, towards Polaris, the North (or Pole) star. This means that as the Earth orbits the Sun, which takes a year, there is a point where our world's Northern Hemisphere is leaning directly towards the Sun, a point we call the summer solstice (around 21 June). Then, six months later, when the Earth is on the other side of the Sun, the Northern Hemisphere is leaning directly away from the Sun. This is the winter solstice (around 21 December). Exactly between these two points there are times when the Earth is

neither leaning toward the Sun nor away from it. These are the spring and autumn equinoxes, which fall around 21 March and 21 September respectively. The lean towards the Sun cycles smoothly between the solstices every year.

When the Earth is leaning toward the Sun, it appears higher in the sky and is above the horizon for longer, giving us warmer weather and more hours of daylight. On the other hand, when the Earth is leaning away, the Sun appears lower in the sky, and we have fewer hours of daylight. At the Earth's equator we don't experience much change in the hours of daylight over the year. However, as we travel towards the North or South Poles we see an increasing difference between the amount of daylight we get in summer and winter. If we are close enough to the Poles (within the Arctic or Antarctic Circles), there are periods of time in summer when the Sun does not set at all, and conversely, in winter when it does not come up.

If you have ever played with a spinning top, you will have noticed it is almost impossible for to position it so that it does not wobble. It will almost always end up with its spin axis describing a slow circle that is far slower than its rate of spin. This wobbling is known as precession. The Earth does this too, with one wobble taking about 26,000 years. In a couple of thousand years the Earth's axis will no longer be pointed at Polaris. Precession makes the solstices and equinoxes slip. The first sign of the zodiac was defined to be the constellation behind the Sun at the spring equinox. When the zodiac was set up that constellation was Aries. Now it's Pisces. However, in about 23,000 years it will be Aries again. What goes around comes around.

Jupiter rises around midnight. Mars lies very low in the sunset glow. Mercury lies very low in the dawn sky. The Moon will be New on the 22<sup>nd</sup>.

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