Hi this is Steve Nerlich from Cheap Astronomy www.cheapastro.com and this is *What's in a day?*

Ok so there's 365 days of astronomy in 2009, just like 3 out of 4 of any other year, right? And a day is 24 hours long, right? So, quick question, how long does it take the Earth to spin once on its axis? If you said 23 hours and 56 minutes, this probably isn't the first astronomy podcast you've listened to.

It's this 4 minute discrepancy that makes astronomy the constantly fascinating business that it is. Every night if you go out into the backyard and look up you'll find the great celestial sphere returns to the same orientation it was at the night before – four minutes earlier than the night before.

After a week, it's 28 minutes earlier. After a month, it's 2 hours earlier. After 6 months it's 12 hours earlier and you will find yourself looking at a very different night sky. After 12 months, well that's 24 hours which means it's that one day of the year when everything is exactly the same again. Get it?

What's happening is that every day the apparent movement of the sun across the sky from east to west, due to the Earth's rotation, is counteracted by a tiny apparent shift of the sun from west to east due to the Earth progressing slightly through its annual orbit around the Sun.

I say apparent shift because it's the Earth's spin and its solar orbit that is making the Sun appear to move the way it does. Being the daylight-orientated species that we are we developed our time-keeping system on the basis of the appearance of the Sun in the day rather than the appearance of the other stars at night. In fact those 365.25 days we experience every solar obit are the result of 366.24 spins of our planet around its axis.

But so what, there's a 4 minutes difference between the Earth's spin and what we call a 'day' – being the period of time from one sunrise to the next. Big deal.

Well, if you really think this is just splitting hairs, let's look at Mercury. It takes about 59 Earth days for Mercury to spin once on its axis and about 88 Earth days for it to orbit the Sun. From the surface of Mercury, the Sun still rises in the east and sets in the west. But the proportional shift of the Sun from west to east, due to the Mercury's progression in its orbit around the Sun, is enormous.

This means the time from one sunrise to the next is 176 Earth days, the longest day in the solar system. This also means that one Mercurian year (88 Earth days) is only half a Mercurian day.

Things get even stranger on Venus. Venus takes about 225 Earth days to orbit the sun and it has the slowest spin of any planet, 243 Earth days. If you've been following this story so far, you might be wondering how come Venus doesn't hold the record for the longest day in the solar system. The answer is that it spins the wrong way.

If you look down on the solar system from the northern sky, you will see every planet orbiting the Sun in an anti-clockwise direction – and, apart from Venus and Uranus, every planet is spinning on its axis in an anti-clockwise direction. The Sun itself also spins in an anti-clockwise direction once every 28 days.

So, all this suggests that the primordial gas cloud that became our solar system began to spin in an anti-clockwise direction when it began to collapse in on itself about 5 billion years ago. It's that spin that flattened the cloud down into a flat disk of planets, asteroids and other stuff we see today – although about 99.9% of the original cloud material got sucked into the gi-normous gravity well that today is the Sun.

Anyway, it's hypothesised that sometime in the early stages of the solar system's formation, both Venus and Uranus got whacked by some other large body – knocking a still spinning Uranus onto its side and sending Venus spinning around the wrong way.

So what's a day like on Venus? Unlike most planets, the Sun rises in the west – but, like most planets Venus' orbit around the Sun produces an additional apparent motion west to east. This all means that a Venusian day is actually much shorter than the time it takes for Venus to spin once on its axis – which was 243 Earth days. It turns out that a day on Venus is about 117 Earth days.

Since a Venusian year is 225 Earth days there will only be two short podcasts required for Venus's International Year of Astronomy and only half a podcast for Mercury's. And of course the Venusian ones will have to be played backwards.

If you like lots of podcasts, Mars is worth considering. It has a similar spin to Earth's at 24 hours and 37 minutes – but because it takes nearly twice as long as the Earth to orbit the Sun – its day length from sunrise to sunrise (24 hours and 39 minutes) is only 2 minutes longer than its spin. So, with its solar orbit taking 1.8 Earth years, that's a 668 (and a bit) days of astronomy podcast.

Jupiter is even better. It takes under 10 Earth hours to spin one on its axis. It takes nearly 12 Earth years to orbit the Sun. That long duration orbit and very rapid spin means the west to east creep of the Sun in Jupiter's sky, due to the progress of Jupiter in its orbit around the Sun is negligible. So you are looking at more than 10,000 podcasts for Jupiter's International Year of Astronomy.

Saturn with a similar spin but a nearly 30 Earth year solar orbit will need around 25,000 podcasts. For Uranus, with a 17 hour spin and an 84 Earth year orbit, that's over 42,000 podcasts, although the sound will only play through one channel. Neptune with its 18 hour spin and 165 Earth year orbit will need almost 80,000 podcasts.

I hope I've managed to demonstrate that it's not always right to assume the spin of a planet and the length of its day, from one sunrise to the next, are the same. In fact the close congruence of these two parameters on Earth is just a coincidence that keeps life interesting for astronomers.

But this coincidence won't last. The Earth's spin is slowly decreasing as more and more of its angular momentum is transferred to the Moon. And that means less days to fit into one year. Our slowing spin will be adding over 2 seconds to our day within the next 100,000 years. In a mere few million years from now we may have to do an International Year of Astronomy with only 364 podcasts – or neuron-injected multisensual holocasts, as they will be known.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, www.cheapastro.com. Cheap Astronomy offers an educational website for beginning astronomers, just in case there's ever some kind of a global financial crisis. Bye.