Opening extract from

Really, Really Big Questions About Space and Time

Written by

Prof. Mark L. Brake

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HOW ON EARTH CAN WE DESCRIBE THE UNIVERSE FROM HERE?

The simple answer is: by stargazing.

People have always looked upwards. In ancient times folk used to judge the seasons, and the rotation of crops for food, based on the movements of the sky. And for centuries, people used the stars to navigate their ships.

Stargazing was an important part of life. And it still is.

When we watch the night sky, everything seems to revolve around the Earth. By night – stars, planets and galaxies rise in the east, then set in the west. By day – the Sun rises in the east, and sets in the west. So it's easy to get the idea that we are at the centre of everything!

Aha! But then we found out it's just an illusion, down to the fact that the Earth turns around on its axis as it travels around the Sun.

Astronomy – the scientific study of the Universe – has taught us that Earth is not at the centre of the Universe. Nor is it likely to be the only object of its kind, made of materials only to be found on Earth. Not even the Sun is that special. It is not at the centre of the Universe, nor is it the only star with planets around it, and now we know that it will not keep burning away in the sky for ever.

So, how about the Milky Way, our Galaxy..? No! That's not at the centre, either. It's just one of a hundred billion other galaxies, all adrift in an ever-expanding Universe, that we have discovered using our telescopes. Heck! There may even be other universes. Who's to say this is the only one?

It's amazing, when you think about it, that all these discoveries have been made from this one point in space – planet Earth – which is an extremely tiny component in the grand scheme of Everything.

ARE THERE ALIENS IN OUR SOLAR SYSTEM?

Today's space missions to Mars look for water, among other things. For where there is water, there might be life. In 2007, caves were discovered on Mars – so future missions may go there to search for Martian life under the ground... But the robotic explorers will be looking for tiny bugs, not bug-eyed monsters!

Another possible home for alien life is Europa, one of Jupiter's biggest moons. Europa is smooth: completely covered by an icy crust. *Underneath* that ice, the giant moon may be hiding a vast underground ocean – and tiny microbes, similar to those in Earth's oceans, may be lurking in those subterranean seas.

ARE THERE OTHER EARTHS?

A very important book was published, in 1543, written by a Polish astronomer called Nicholas Copernicus. This book suggested that the Sun, not the Earth, was at the centre of our small solar system. Before Copernicus, the Earth hadn't been a planet, it had been...

!!!BIG FANFARE!!! – !!!THE CENTRE OF EVERYTHING IN THE UNIVERSE!!!

Ever since Copernicus, astronomers have been wondering about other planets like ours. Since the19th century, we've known that most stars in the sky are like our Sun, and that many of them have planets in orbit around them. Such planets are called 'extrasolar' planets.

It was only in the 1990s that we found the first official example. But today, we know of more than 300.

We've not found another Earth-like planet yet. But space is *gargantuan*. There are more stars in the sky than grains of sand on all the Earth's beaches. And many of those billions of stars will have planets in orbit about them. Surely, there must be another place like Earth out there somewhere...

DO ALIENS LOOK LIKE ME?

Here's the thing: if Earth's not the only planet out there, and there are life forms on other planets, then Earth's not so special after all. It's just another place where life is possible.

And here's another thing: biologists like Charles Darwin started thinking about how creatures on Earth change over time – how they evolve. But his ideas on evolution don't just work for creatures on Earth. They work for aliens, too. Creatures on other planets would also need to change and evolve, to suit the environment in which they lived.

Since the vast majority of extrasolar planets are nothing like Earth, it makes sense that aliens wouldn't look like humans. It'd be very spooky indeed if there were another you, out there in space!