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LIFE OUT THERE?

Ken Tapping, 13th September, 2016

Even the closest planets we have so far found beyond the Solar System are too far away to easily get to. With no prospects of a workable warp drive in the foreseeable future, sending a spacecraft to those planets involves travel times ranging from fifty years to tens of thousands of years, or longer. Moreover, we have no telescope that can show us any of them as visible discs we can examine and measure. Fortunately there are ways we can learn a lot, and we have Isaac Newton to thank.

Isaac Newton was a 17th Century scientist. It was he who came up with the concept of gravity and how it determines the orbits of the planets. He went on to develop the mathematical tools necessary to do those calculations, such as the calculus. He did not stop there. He made the first "reflecting telescope", where light is collected and an image formed using a concave mirror rather than a convex lens. His creation is the ancestor of large, modern astronomical telescopes such as the Gemini Telescopes, the Canada France Hawaii Telescope and even bigger instruments now being designed. He did not stop there. One day he passed sunlight through a glass prism and found that sunlight is in fact a mixture of many colours; we see them in the rainbow. Through the efforts of later scientists, this experiment led to the development of the spectroscope and the science of spectroscopy. This has made it possible to analyze the light from stars and distant places in the universe. We can deduce what atoms or molecules are making it, under what conditions, and how the sources of the light are moving. On its way to us, the light picks up information about the medium through which it is passing.

The only form of life we know to exist in the universe is the carbon-based life we have on Earth, and that is the only form of life we know how to look for. So for the time being we are searching for worlds where carbon-based life might be possible. That is what we mean when we refer to "life as we know it". Our planet's atmosphere contains about 20% oxygen and a small amount of methane and other hydrocarbons. Oxygen is highly reactive, and is rapidly removed from the atmosphere by reacting with minerals and other materials. The Earth has had its oxygen atmosphere for a billion years or so because something is replacing it – photosynthesis by plant life. Similarly, hydrocarbons are highly flammable, combining with oxygen to make water and carbon dioxide. They are only present in our atmosphere because they too are constantly being replaced. They are produced by rotting vegetation and animal flatulence, especially by cattle and other herbivores, but we all make our contributions.

Many of the planets orbiting other stars have been detected using reflecting telescopes. In some cases we deduced the presence of planets by the wobbling of their parent stars, like dancing with an invisible partner. Spectroscopes can tell us when the star is moving towards us and when it is moving away. Other planets have been found by detecting minute dimmings of starlight as they move between us and their stars. By the timings and sizes of the wobbles and dimmings we can deduce the sizes and orbits of the planets.

If a planet passes between us and its star we can learn a lot more. On its way to us, some of the starlight passes through the planet's atmosphere and in doing so picks up the signatures of the main gases present in that atmosphere. If we detect oxygen there are likely to be plants, or something like them, and if we can detect methane, we flatulent beings might not be alone in the universe. It seems that Isaac Newton was a fairly strait-laced individual. What would he think of the applications of his work to the detection of cosmic flatulence?

Mars and Saturn lie very low in the southwest after dark. Mars is on the left and Saturn on the right. The Moon will be Full on the 16th.

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