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WORLDS LIKE OURS?

Ken Tapping, 27th January, 2015

Finding out whether we are alone in the universe is one of the big quests of modern science. The chemistry upon which the Earth's life is based uses ingredients we see in the dust and gas clouds filling ours and other galaxies. What happened here some 3.5 or so billion years ago could easily have happened on other planets too.

On Earth there are creatures that live in near-boiling, acidic water, or in sub-zero ice or in dark, cold lakes way below the Antarctic ice cap. There are living things in the deepest parts of the oceans and in rocks kilometres below the Earth's surface. There are animals like the "water bear" that can survive in a vacuum, extreme temperatures and lethal levels of radiation. They just go dormant until conditions improve. They can also go years without eating. We also know of common terrestrial bacteria that survived for years on the surface of the Moon. The sheer adaptability of life on Earth makes it difficult to decide what other worlds might harbour some form of life.

One way we have been searching for life for decades has been through looking for alien radio signals. This is limited to finding civilizations that are using high-power radio transmitters and are pointing their antennas in our direction, at radio frequencies we are tuned to, using transmission methods we can identify. The time interval over which civilizations do this might be limited. For example, a decade or two ago we used high power transmitters for broadcasting and communication; now we use networks of low-power systems, such as cell phone networks and WiFi. The sum of lots of these signals from a whole planet would look very much like the hissing we get from stars or the Milky Way. It would be nice to know there are intelligent civilizations on planets orbiting other stars, but since signals would take decades or centuries to get from sender to recipient, not much of a dialogue will be feasible. More fundamentally, is there is any life "out there" at all? Our experience on Earth shows living creatures can thrive under a wide range of conditions. Comfort for some creatures means instant death for others. However, if we don't draw some guidelines we won't know what to do or where to start.

We now know of about 1900 planets orbiting other stars. In almost all cases their existence has been proven by firm but indirect evidence; in a few instances we have actually seen planets as faint points of light orbiting other stars, but that is it. However, we can estimate how big a planet is and how far it is from its parent star. That will give us an idea of its surface temperature. So we can look for planets that are roughly Earth-size and at the right temperature for liquid water to exist on their surfaces. On Earth all known forms of life depend on liquid water, so that's a guideline we can use.

When a planet passes in front of its star, the starlight passing through the planet's atmosphere – if it has one – will pick up the signatures of molecules. We have instruments that can pick up those signatures. The atmospheres of stars are usually far too hot for molecules to exist, so if we detect them, they are in the planet's atmosphere. We have found watery planets. We can go further. Life on Earth really got going when early plants filled its atmosphere with oxygen. This element is highly reactive, which is why it is so good for processing our food and producing energy. It also means that in a planet's atmosphere it will rapidly be removed by reacting with something. It has to be continually replaced, which is what plants on land and in the oceans are doing for us all the time. If we find oxygen in the atmospheres of other worlds, there has to be at least plant life, and probably more than that.

Look for Venus low in the southwest after sunset, with Mars a bit higher. Jupiter dominates the southern sky overnight and Saturn rises around 4am. The Moon will be Full on the 3rd.

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