Column

Explained in 60 Seconds: The Diversity of Distant Worlds

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To date, astronomers have discovered almost 4,000 exoplanets by observing stars and watching for a slight reduction in their brightness as a planet passes in front of them. Although planets are merely specs against their parent stars, we now have telescopes sensitive enough to detect them.

The diversity of the planets found outside the Solar System far exceeds that within it. Beyond our seven closest neighbours, there are all kinds of fascinating worlds.

There are planets orbiting dead stars and ocean worlds entirely enveloped by water. We see planets orbiting binary stars. On these worlds, if we could visit them, we would find two suns rising and setting. On other planets, where the host star is one of many in a gravitationally bound cluster, the night sky would be awash with bright stars. We see worlds with surfaces covered in molten lava and planets that orbit so close to their host star that they are disintegrating, boiling away like comets too close to the Sun and leaving a trail of material behind them.

Among this startling diversity, we also find many planets that resemble our own. These Earth-like planets are relatively small, rocky and much harder to detect. When a planet the size of Jupiter passes in front of its star, the observed dip in brightness is 1%. For an Earth-like planet this percentage plummets to 0.01%, a difference so minute it is very difficult to detect. It is the equivalent of looking up at a building 80 stories tall and noticing one person lowering their window blind by just a centimetre. This is the change we have to detect to find a planet like Earth.

Other than being rocky and small, it is the positioning of a planet in the habitable zone of its parent star that makes it Earth-like. This positioning has to be just right, not too close that liquid water will boil away and not too far that water is locked into ice. NASA's Kepler spacecraft has discovered almost five dozens of such Earth-like planets, but they are not all as similar as the name may suggest. Some of them are super-Earths, many times the size of ours, while others are covered in a thin layer of liquid water.

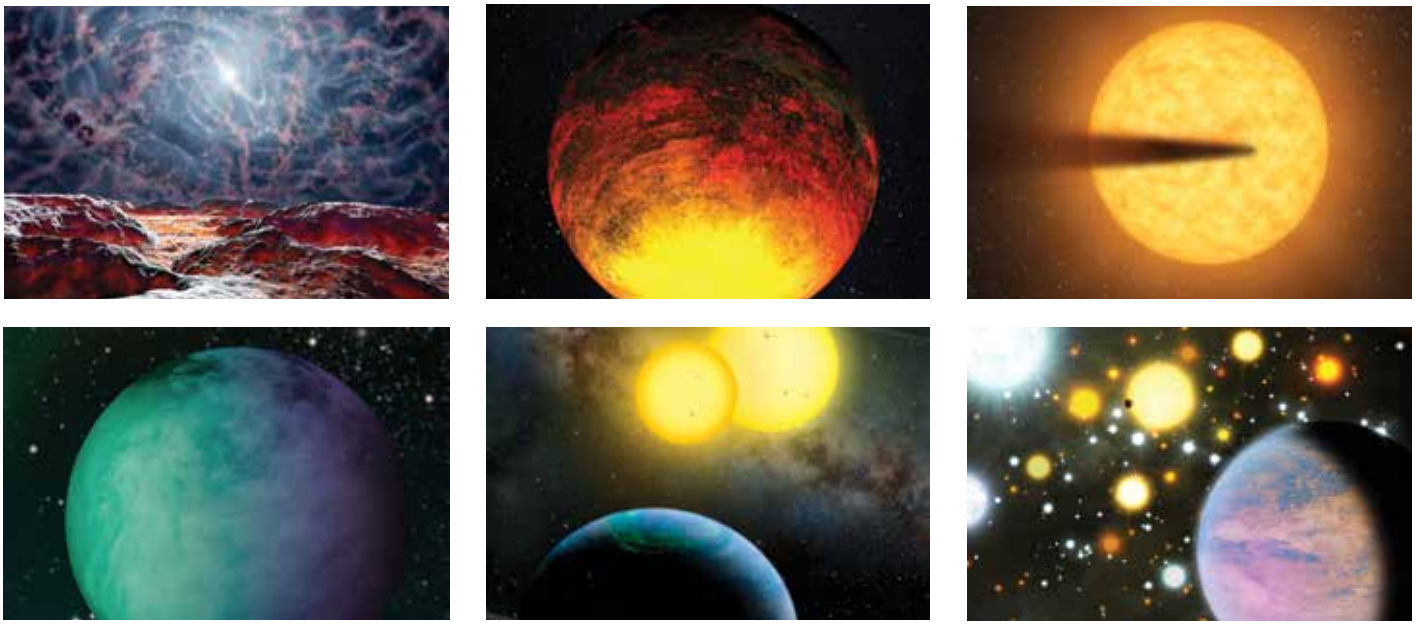

Figure 1. *(from left to right) Artist rendering of (a) dead planet, (b) lava world, (c) photo-disintegrate planet, (d) ocean worlds, (e) planet orbit binary stars and (f) planets in a star cluster. Credits: (a) David A. Hardy, (b) NASA/Kepler Mission/Dana Berry, (c) NASA/JPL-Caltech, (d) NASA, Jose-Luis Olivares/MIT, (e) Lynette Cook / extrasolar.spaceart.org, (f) Michael Bachofner.*