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Earth 2.0

The hunt is on for a distant planet similar to our own. Astronomers should decide just how similar it needs to be, before the candidates start pouring in.

The search for a second Earth has long enthralled readers of science fiction. What rich and varied life could it contain? What would such a discovery mean for humanity's own place in the Universe? How many similar planets are out there? The question is more than a philosophical puzzle, and it comes with a hard scientific edge that should be considered sooner rather than later. As the search for planets beyond the Solar System widens and public interest in the quest grows, at which point should astronomers declare the hunt for another Earth a success?

Hundreds of candidate planets have been identified, and some have been profiled, if not as a second Earth, then as signs that the search is heading in the right direction. Last month, NASA announced the discovery of the smallest extrasolar planet yet: Kepler-10b, which has 1.4 times the diameter and 4.6 times the mass of Earth, and was discovered by NASA's Kepler spacecraft (see page 24). Although the planet orbits too close to its star to support life, the news was heralded by some media outlets as a landmark in the search for a new Earth, particularly because Kepler-10b is the first exoplanet with a dense and rocky core.

Attention on Kepler's mission will intensify again this week, as NASA publicly releases a batch of its data (see page 53). The satellite focuses on a single point in the sky, where it can keep track of some 150,000 stars. Kepler observes the decrease in the brightness of these stars as planets pass in front of, or 'transit', them, and the findings are used to target telescopes on the ground.

It takes three to four such confirmed transits before astronomers are confident that they have found a planet, which makes it too soon to be sure whether Kepler has found a world truly similar to Earth. (By definition, Earth-like planets orbiting a star similar to the Sun pass in front of their stars about once a year, and Kepler has only been in place for about 18 months). All exoplanets confirmed to date orbit much closer to their stars than does Earth; they are too close for conditions to allow the existence of liquid water, which is what defines a star's 'habitable zone'.

As more data are analysed, they will probably produce a string of reports of ever-smaller planets, until we get an Earth-sized example. Many of these small planets are likely to orbit M-dwarfs, by far the most numerous type of star in the Universe (see page 27). The habitable zone around these stars is very narrow, but Kepler may find a rocky planet there. Would that be the first Earth-like planet? Probably not if, as seems likely, it were to be tidally locked, so that one side faced permanently towards the star.

What about planets that orbit larger stars? Does a first Earth-like planet have to orbit in the habitable zone of a G2-type star, similar to the Sun? If so, must the planet be Earth-sized? And is the focus on a habitable zone defined in terms of liquid water appropriate? As the Universe reveals its secrets, we discover it to be a more diverse and stranger place than we had anticipated. Would it be so odd to conceive of life on a dry or frozen world? Must the first Earth-like planet be capable of supporting life, or human life in particular?

The answers to these questions are important because the public-relations rewards of planet-hunting — and planet-finding — are great. The temptation to hype each discovery is equally large, but so is the scope for confusion and public scorn, especially given the rabid response on some blogs to NASA announcements. Set the bar for 'Earth-like' planets too low, and a string of repeated discoveries could be overwhelming. Set the bar too high, and a planet that meets the strict criteria may not emerge at all. If that were to happen, the Kepler mission would risk being viewed as a failure — which it most certainly is not.

> ***"As more data are analysed, they will produce a string of reports of planets."***

Amid the excitement of exploring a new frontier, astronomers should pause to consider the public reaction to their work. Then they should decide how a standard should be set. Perhaps a reasonable starting point would be to define an Earth-like planet as one of similar size to Earth, orbiting in the habitable zone of any star, and not tidally locked. More important than the details of the definition is that the relevant criteria are established before the claims start to pile up. To announce the discovery of the first Earth-like planet would be a stunning success. To announce it more than once could look like carelessness. ■

Preserve the past

Historic scientific collections deserve better than to gather dust.

When the celebrated anatomist Antonio Scarpa died in 1832, he left an extensive collection of anatomical preparations to his university in Pavia, Italy. The collection includes his own head which, pickled, now presides grimly over his legacy in a protected museum.

Across Europe, a distressingly high number of historic scientific collections — from herbaria to minerals — are being lost or left to rot in universities. As many are autonomous institutions, they can't be told what to do by governments, they are mostly poorly funded and they tend to be oriented to the future, not the past. Historic collections have to compete for space and resources with active researchers, and are rarely prioritized.

Germany may have come up with a way to break out of this dilemma. Earlier this week, the Wissenschaftsrat, the nation's influential science council, issued a detailed list of recommendations that declares that scientific collections of potential research value should be handled as