

## INTRODUCTION

# Alien Worlds Galore

WE KNEW THEY HAD TO BE THERE. ONCE PEOPLE REALIZED THAT THE SUN IS A STAR and that the planets travel around it, it was only natural to suspect that other stars had planets of their own. Confirmation, however, didn't come until the early 1990s, when astronomers found compelling signs of smaller bodies orbiting first pulsars and then normal main-sequence stars.

Today, it is estimated that our galaxy contains at least as many planets as stars. Almost 900 have been detected, and a few thousand others are under investigation. Observations have shown that planets are not only common but also extremely diverse, with our solar system being just one example of this diversity and perhaps even a rather unusual one. As described by Howard (p. 572), the most commonly observed class of planetary system so far consists of one or more planets one to three times the size of Earth, orbiting much closer to their star than Earth does to the Sun.

Over the next decade, astronomers plan to find and characterize habitable planets. William Borucki *et al.* (p. 587) have taken a step toward this goal by detecting two small planets (1.4 and 1.6 times the size of Earth) in the habitable zone of a star smaller and cooler than the Sun. In this Report, the habitable zone is defined as “the annulus around a star where a rocky planet with a CO<sub>2</sub>-H<sub>2</sub>O-N<sub>2</sub> atmosphere and sufficiently large water content (such as on Earth) can host liquid water on its solid surface.” Seager (p. 577) argues that the habitable zone concept needs to be expanded to include other possibilities such as hydrogen-rich atmospheres and reduced water inventories. Given the expected diversity of exoplanet atmospheres and interiors, she suggests that habitability must be considered on a case-by-case basis rather than as a one-size-fits-all definition if we are to increase our future chances of detecting chemical signatures of life. Finding these signatures will be difficult, however, and once they are detected, we may not be 100% certain that they were produced by life.

Meanwhile, in the field of planetary discovery itself, the signs of life could not be stronger. Every month, the orbiting Kepler telescope alone sights hundreds of new potential exoplanets in a patch of sky near the constellation Cygnus. Several more ground- and space-based missions are either in progress, in the works, or under consideration. To help nonexperts navigate this brave new world of world-finding, News writers Yudhijit Bhattacharjee and Daniel Clery (p. 566) survey some of the main techniques and research efforts in line for the next round of planetary discoveries, and Lizzie Wade (p. 570) presents a not-too-technical guide to exo-nomenclature. In the News Focus section (p. 542), Bhattacharjee profiles Kepler's creator, Borucki.

Now for the next step: finding things we *don't* know are there—discoveries that will quickly render this special section out of date.

— MARIA CRUZ AND ROBERT COONTZ

## Exoplanets

### CONTENTS

#### News

- 566 Gallery of Planet Hunters  
570 ... And a Glossary of Their Quarry

#### Reviews

- 572 Observed Properties of  
Extrasolar Planets  
*A. W. Howard*  
577 Exoplanetary Habitability  
*S. Seager*

See also News story p. 542, Report p. 587,  
Science Podcast, Planet Hunters slideshow,  
and more at [www.sciencemag.org/special/exoplanets](http://www.sciencemag.org/special/exoplanets)

# Science