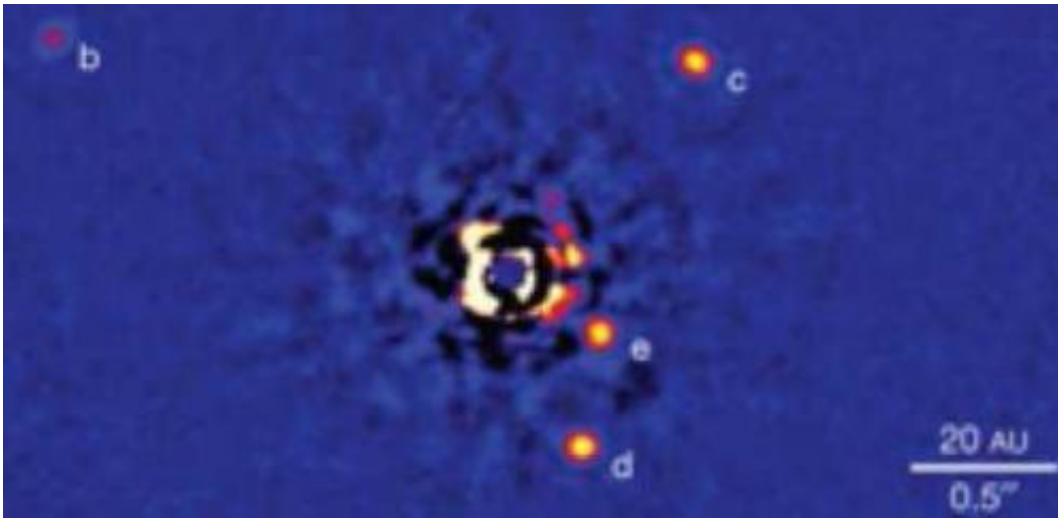


Coming to a solar system near you... super-Earth!

August 8 2011, By Tammy Plotner



Planetary system of HR 8799 imaged by Marois et al (2010). The central star is of spectral type A with a mass of 1.5 solar-masses at a distance of 128 light-years from the Sun. The planets have the masses of $M_b = 7M_J$, $M_c = M_d = 10M_J$, and $M_e = (7-10)M_J$, with semimajor axes of 68, 38, 24, and 14.5 AU, respectively. Figure with the permission of NPG.

It is our general understanding of solar system composition that planets fall into two categories: gas giants like Jupiter, Saturn, Neptune and Uranus... and rocky bodies that support some type of atmosphere like Earth, Mars and Venus. However, as we reach further into space we're beginning to realize the Solar System is pretty unique because it doesn't have a planetary structure which meets in the middle. But just because

we don't have one doesn't mean they don't exist. As a matter of fact, astronomers have found more than 30 of them and they call this new class of planet a "Super-Earth."

"Super-Earths, a class of planetary bodies with masses ranging from a few Earth-masses to slightly smaller than [Uranus](#), have recently found a special place in the exoplanetary science." says Nader Haghighipour of the Institute for Astronomy and NASA Astrobiology Institute, University of Hawaii. "Being slightly larger than a typical terrestrial planet, super-Earths may have physical and dynamical characteristics similar to those of Earth whereas unlike terrestrial planets, they are relatively easier to detect."

Having a super-Earth in the neighborhood opens the avenue towards habitability. Chances are planets of this type have a dynamic core and are able to maintain a type of atmosphere. When combined with being within the [habitable zone](#) of a host star, this raises the bar towards possible life on other planets.

"It is important to note that the notion of habitability is defined based on the life as we know it. Since Earth is the only habitable planet known to humankind, the orbital and physical characteristics of Earth are used to define a habitable planet." says Haghighipour. "In other words, habitability is the characteristic of an environment which has similar properties as those of Earth, and the capability of developing and sustaining Earthly life."

But being a super-Earth means that there is a lot more going on than just being in the zone. To qualify it must meet three requirements: its composition, the manifestation of plate tectonics, and the presence of a magnetic field. For the first, the presence of liquid water is a high priority. In order to determine this possibility the values of its mass and radius have to be known. To date, two super-Earth planets for which

these values have been determined – CoRoT-7b and GJ 1214b – have given us fascinating numerical modeling to help us better understand their composition. Plate tectonics also plays a role through geophysical evolution – just as the presence of a magnetic field has been considered essential for habitability.

“Whether and how magnetic fields are developed around super-Earths is an active topic of research.” notes Haghhighipour. “In general, in order for a [magnetic field](#) to be in place around an Earth-like planet, a dynamo action has to exist in the planet’s core.”

Last, but not least, comes an atmosphere – the “presence of which has profound effects on its capability in developing and maintaining life.” From its chemical properties we can derive the “planet’s possible biosignatures” as well as the chemicals which formed it. Atmosphere means environment and all of this leads back to being within a habitable zone and of sufficient gravity to keep atmospheric molecules from escaping. Says Haghhighipour, “It would not be unrealistic to assume that super-Earths carry gaseous envelopes. Around low-mass stars, some of such atmosphere-bearing super-Earths may even have stable orbits in the habitable zones of their host stars.”

Has a super-Earth been detected? You betcha’... and studied right down to its spectral signature. “The recently detected super-Earth GL 581 g with its possible atmospheric circulation in the habitable zone of its host star may in fact be one of such [planets](#).” says Haghhighipour. “More advanced telescopes are needed to identify the biosignatures of these bodies and the physical and compositional characteristics of their atmospheres.”

Source: [Universe Today](#)

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