A new neptune-size exoplanet

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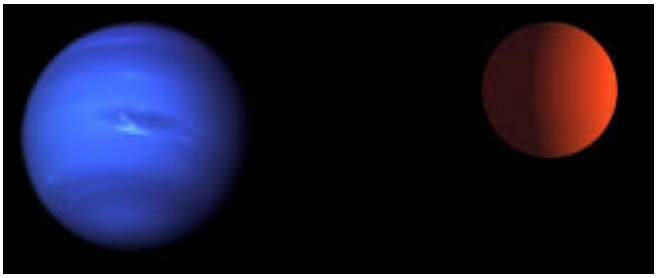

An image of Neptune taken by the Voyager spacecraft compared with an artist's conception of the exoplanet K2-263b. Credit: NASA; exoplanetkyoto.org

The remarkable exoplanet discoveries made by the Kepler and K2 missions have enabled astronomers to begin to piece together the history of the Earth and to understand how and why it differs from its diverse exoplanetary cousins. Two still outstanding puzzles include the differences between the formation and evolution of rocky versus non-rocky small planets, and why there seem to be a size gap with very few exoplanets at or about two Earth-radii in size (planets with smaller radii are likely to be rocky or Earth-like in their composition). In order to estimate an exoplanet's composition its density is needed, requiring a measurement of mass as well as size. While a radius can be estimated from the shape of the planet's transit curve as it blocks out its host star's light, a mass is more difficult to determine. In order to develop the emerging picture, however, precise and accurate masses are required for more planets that are similar in size to the Earth.

The K2 exoplanetary mission is the revived version of the Kepler exoplanetary discovery mission. Together they have discovered thousands of exoplanets, and uncovered a remarkable and unexpected diversity in the exoplanet population. K2 is sensitive only to short-period planets (it has only found a few with periods longer than 40 days). The exoplanet K2-263b orbits a star less massive than the sun (0.86 solar-masses) and located 536 light-years away as measured with the new Gaia satellite. This exoplanet has a radius of 2.41 Earth-radii (with a 5% uncertainty). CfA astronomers Maria Lopez-Morales, Dave Charbonneau, Raphaelle Haywood, John Johnson, Dave Latham, David Phillips, and Dimitar Sasselov and their colleagues used the HARPS-N high precision spectrometer on the Telescopio Nazionale Galileo in La Palma, Spain, to measure the periodic velocity of the exoplanet as it orbited and thus to derive its mass.

The HARPS-N velocity measurements were amazingly precise - uncertain to about a mere eleven miles an hour, about the speed of a slow bicyclist. From the orbital details the scientists obtained an exoplanet mass of 14.8 Earth-masses and a hence a density of about 5.6 grams per cubic centimeter (for comparison, the density of water is one gram per cubic centimeter, and the average density of the rocky Earth is 5.51 grams per cubic centimeter). The scientists conclude that K2-263b most likely contains an equivalent amount of ices compared to rocks, roughly consistent with current ideas about planet formation and the relative abundances in a circumstellar nebula of the building-block elements like iron, nickel, magnesium, silicon, oxygen, carbon and nitrogen.

More information: A Mortier et al. K2-263 b: a 50 d period sub-Neptune with a mass measurement using HARPS-N, *Monthly Notices of the Royal Astronomical Society* (2018). DOI: 10.1093/mnras/sty2360

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