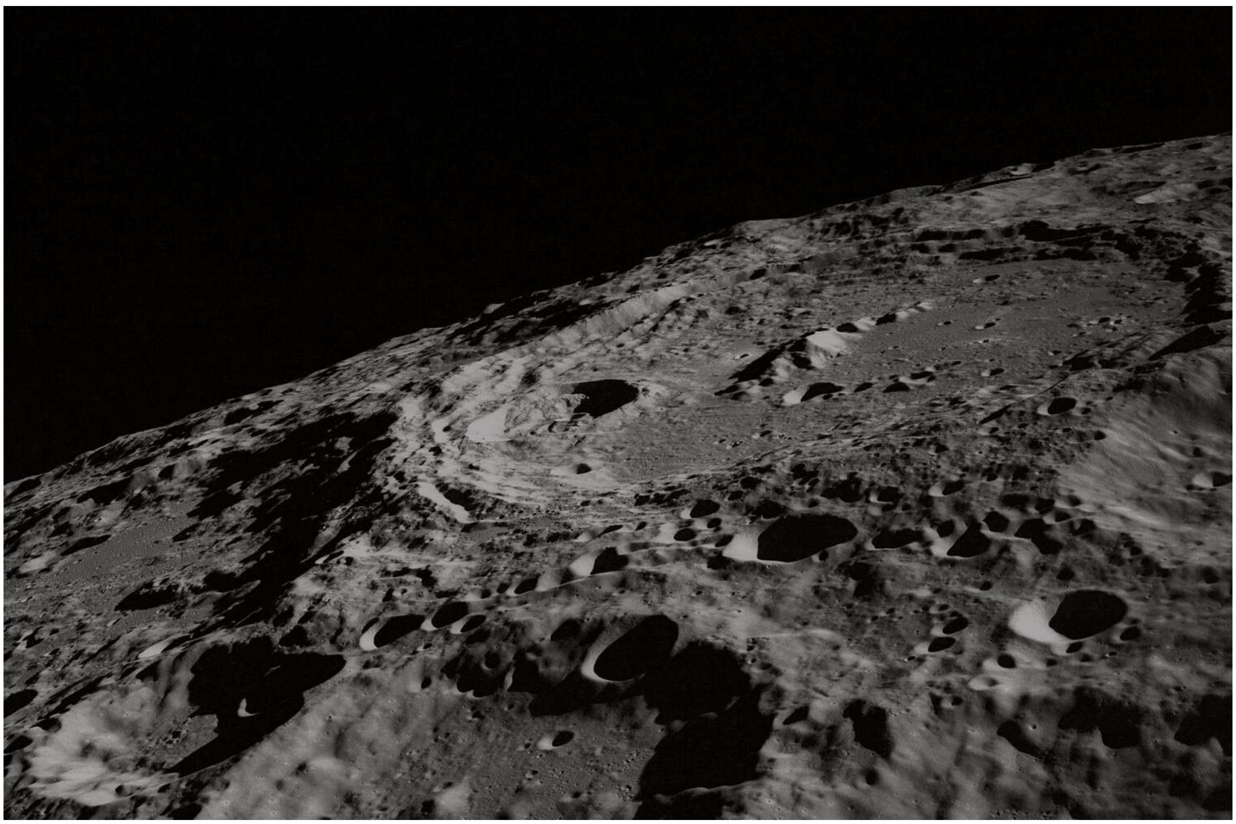
Unconfirmed exomoon could be unlike any of those in our solar system

October 25 2017, by Bob Yirka



Credit: CC0 Public Domain

René Heller, a space scientist with the Maxx Planck Institute for Solar System Research has uploaded a paper to the *arXiv* preprint server offering possible attributes for the still-unconfirmed exomoon Kepler

1625 b-i. He suggests that if the exomoon does truly exist, it is probably unlike any of the moons in our solar system, which suggests that theories about the origins of moons might have to be expanded.

Back in July, a team of researchers led by Alex Teachey and David Kipping of Columbia University announced that they had found possible evidence of a moon circling a planet outside of our solar system. If the exomoon turns out to be real, it would mark the first time that one has ever been discovered. News of a possible exomoon sighting has set off speculation regarding what it might be like.

In his paper, Heller describes the research he has conducted studying the Kepler data that suggests the possible exomoon. He notes the data is not strong enough to pin down a size for the moon, suggesting it could be anywhere from approximately the size of the Earth to the size of Saturn. He does not suggest the data proves the existence of an exomoon, but does offer a wild guess on the size of the exomoon if it is there—approximately the size of Neptune.

A moon that size does not exist in our own solar system, of course, which suggests that if one that large does exist elsewhere, it likely formed in ways that are not described by one of the three main moon creation theories—something impacting a planet, assimilation of material orbiting a planet, or a passing object captured by a planet's gravity. This means that if the exomoon is confirmed and its size and makeup can be determined, it is likely that there will be a race between space groups around the world to find a theory explaining its existence.

Teachey and Kipping have been vocal about their view that researchers should wait to see if the exomoon exists before conducting research or creating theories, lest it all be in vain. They have their sights set firmly on this weekend, when the Hubble Space Telescope will be aimed at the system, possibly confirming or ruling out its existence.

More information: The nature of the giant exomoon candidate Kepler-1625 b-i, arxiv.org/abs/1710.06209

Abstract

The recent announcement of a Neptune-sized exomoon candidate around the transiting Jupiter-sized object Kepler-1625 b could indicate the presence of a hitherto unknown kind of gas giant moons, if confirmed. Three transits have been observed, allowing radius estimates of both objects. Here we investigate possible mass regimes of the transiting system that could produce the observed signatures and study them in the context of moon formation in the solar system, i.e. via impacts, capture, or in-situ accretion. The radius of Kepler-1625 b suggests it could be anything from a gas giant planet somewhat more massive than Saturn (0.4 M_Jup) to a brown dwarf (BD) (up to 75 M_Jup) or even a very-low-mass star (VLMS) (112 M_Jup ~ 0.11 M_sun). The proposed companion would certainly have a planetary mass. Possible extreme scenarios range from a highly inflated Earth-mass gas satellite to an atmosphere-free water-rock companion of about 180 M_Ear. Furthermore, the planet-moon dynamics during the transits suggest a total system mass of 17.6_{-12.6}^{+19.2} M_Jup. A Neptune-mass exomoon around a giant planet or low-mass BD would not be compatible with the common mass scaling relation of the solar system moons about gas giants. The case of a mini-Neptune around a high-mass BD or a VLMS, however, would be located in a similar region of the satellite-to-host mass ratio diagram as Proxima b, the TRAPPIST-1 system, and LHS 1140 b. The capture of a Neptune-mass object around a 10 M_Jup planet during a close binary encounter is possible in principle. The ejected object, however, would have had to be a super-Earth object, raising further questions of how such a system could have formed. In summary, this exomoon candidate is barely compatible with established moon formation theories. If it can be validated as orbiting a super-Jovian planet, then it would pose an exquisite riddle for formation theorists to solve.