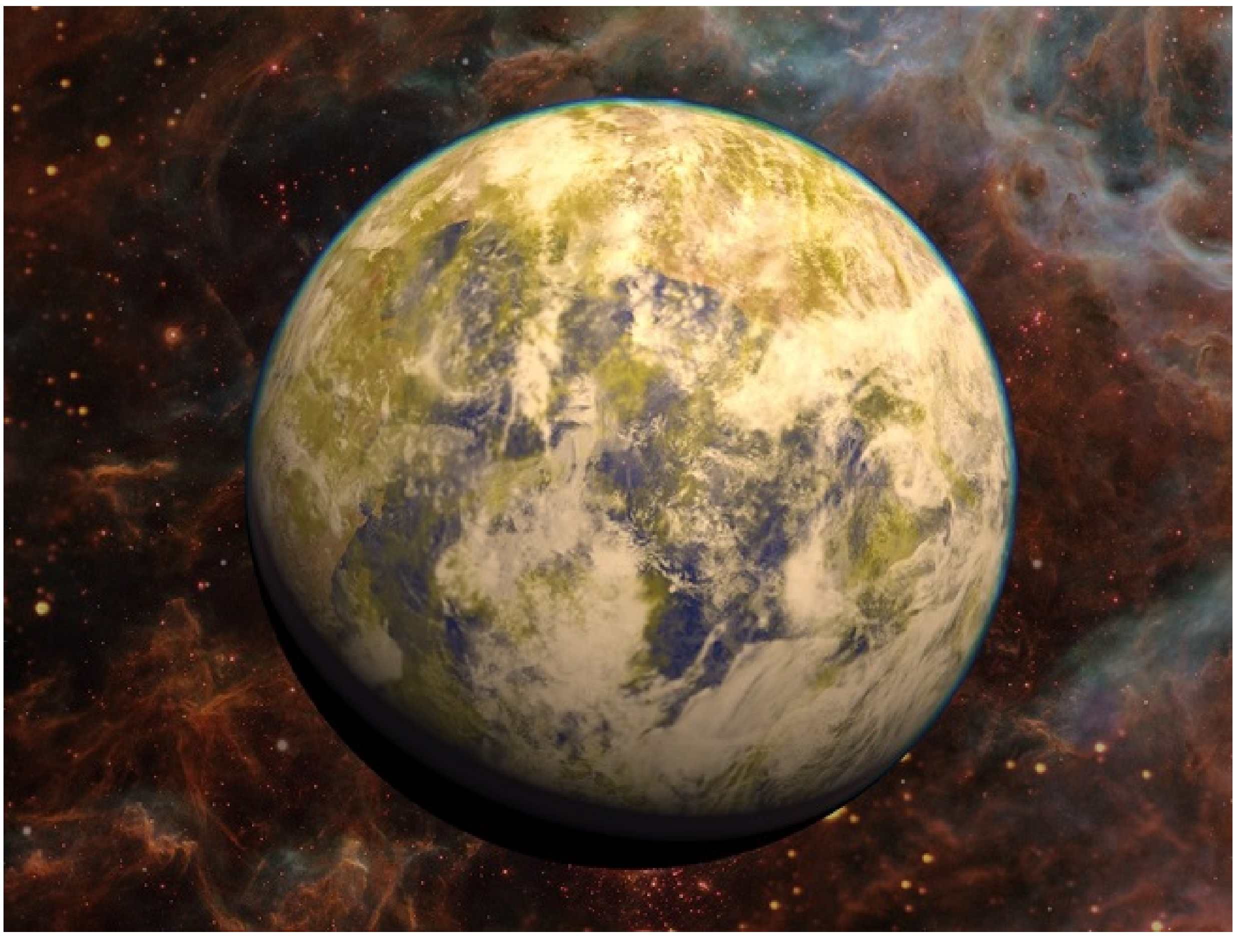
Earth-like planet may exist in a nearby star system

April 19 2016, by Tomasz Nowakowski



Artistic representation of the potentially habitable super-Earth Gliese 832c against a stellar nebula background. Credit: PHL @ UPR Arecibo, NASA Hubble, Stellarium.

(Phys.org)—An Earth-like planet may be lurking in a star system located just 16 light years away, according to a new research. The star, named Gliese 832, was recently investigated by a team of astronomers searching for additional exoplanets that may be residing between the two currently known alien worlds in this system. A paper detailing the finding was published online on Apr. 15 in the *arXiv* journal.

Gliese 832 is a red dwarf and has just under half the mass and radius of our sun. The star is orbited by a giant Jupiter-like exoplanet designated Gliese 832b and by a super-Earth mass planet Gliese 832c. The gas giant, with a mass of 0.64 Jupiter masses, is orbiting the star at a distance of 3.53 AU, while the other planet is potentially a rocky world, around five times more massive than the Earth, residing very close its host star—about 0.16 AU.

Now, a team of astronomers, led by Suman Satyal of the University of Texas at Arlington, has reanalyzed the available data on this nearby planetary system hoping to find more extrasolar worlds that may be located in a vast space between the two known planets. The researchers have conducted numerical simulations to check the possibility of existence of other celestial bodies around the red dwarf.

Gliese 832b and Gliese 832c were discovered by the radial velocity technique, from which the scientists extracted the orbital parameters by using the best-fit solutions. These parameters were used as the initial conditions for starting their simulations.

"We also used the integrated data from the time evolution of orbital parameters to generate the synthetic radial velocity curves of the known and the Earth-like planets in the system. Moreover, based on the maximum amplitude of the radial velocity curve obtained from the observation of the inner planet, the approximate mass and distance from the star for the Earth-like planet were computed using the radial velocity signature of the Keplerian motion," the researchers wrote in the paper.

The team's computations revealed that an additional Earth-like planet with a dynamically stable configuration may be residing at a distance ranging from 0.25 to 2.0 AU from the star. According to the measurements, this hypothetical alien world would probably be more massive than our planet with a mass between one to 15 Earth's masses.

"We obtained several radial velocity curves for varying masses and distances for the middle planet," the astronomers noted.

For instance, if the planet is located around one AU from the star, it has an upper mass limit of ten Earth masses and a generated radial velocity signal of 1.4 m/s. A planet with about the mass of the Earth at the same location would have radial velocity signal of only 0.14 m/s, thus much smaller.

In general, the existence of this possible planet is supported by long-term orbital stability of the system, orbital dynamics and the synthetic radial velocity signal analysis.

The scientists emphasized that their main goal was to provide a general idea to the observers of where and what to look for in this system. They concluded that a significantly large number of radial velocity observations, transit method studies, as well as the direct imaging are still needed to confirm the presence of possible new planets in the Gliese 832 system.

More information: An Earth-Like Planet in GJ 832 System, arXiv:1604.04544 [astro-ph.EP] arxiv.org/abs/1604.04544

Abstract
Stability of planetary orbits around GJ 832 star system, which contains

inner (GJ 832c) and outer (GJ 832b) planets, is investigated numerically and the detailed phase-space analysis are performed. The stability of the system is defined in terms of its lifetime, which is its survival time during the orbital integration period, and the maximum eccentricity, emax attained by the orbits during the evolution processes. A special emphasis is given to the existence of stable orbits for an Earth-like planet that is injected between the inner and outer planets. Thus, numerical simulations are performed for three and four bodies in elliptical orbits (or circular for special cases), and a large number of initial conditions that covers the whole phase-space of the existing bodies are used. The results presented in the phase-space maps for GJ 832c indicates the least deviation of the eccentricity from its nominal value, which is then used to determine its inclination regime. Also, the Earth-like planet displays stable orbital configurations for at least one billion years. Then, the radial velocity curves based on the signature from the Keplerian motion are generated for the Earth-like planet to estimate its distance from the star and its mass-limit. The synthetic RV signal suggests that an additional planet (1M? ? mass ? 15M?) with dynamically stable configuration may be residing between 0.25 - 2.0 AU from the star. We have provided an estimated number of RV observations for the additional planet for further observational verification.