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STUDY OF EXTRA SOLAR EXOPLANET SYSTEMS BY METHOD OF THE GEO-SPACE UNIVERSAL X – STRUCTURE

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ABSTRACT: *For some exoplanets within 50 light-years (15 pc) of the Earth by a method of the Geo-space universal X – structu re it is studied questions of the definition of the exoplanets parameters: density – diameter etc. I give also the Universal Geo – space X – structure theoretical Levels of the similarity of natural satellites of Solar system planets. From the theory in particularly follows the mystery similarity between the Mercury and the Earth's Moon*.

KEYWORDS: Geo-Space, Universal, X-Structure,

INTRODUCTION

There is a Galactic Winter on the Earth at present [1]. It's pretty quiet time when nobody when no major geological events does not occur except in the local area as it was 10,000 years ago with the isthmus connecting Asia with America (Bering Strait), in the formation of the Straits separating New Zealand, off the East coast of North America, etc. But sometimes comets fall into Jupiter. The attention of researchers of an outer space has attracted discovering exoplanets outside the Solar system [2]. For centuries philosophers and scientists supposed that extrasolar planets existed, but there was no way of detecting them or of knowing their frequency or how similar they might be to the planets of the Solar system. Various detection claims made in the nineteenth century were rejected by astronomers. The first confirmed detection came in 1992, with the discovery of several terrestrial-mass planets orbiting the pulsar PSR B1257+12 [2]. The first confirmation of an exoplanet orbiting a main-sequance star was made in 1995, when a giant planet was found in a four-day orbit around the nearby star 51 Pegasus. Some exoplanets have been imaged directly by telescopes, but the vast majority has been detected through indirect methods such as the transit method and the radial-velocity method. The first published discovery to receive subsequent confirmation was made in 1988 by the Canadian astronomers Bruce Campbell, G. A. H. Walker, and Stephenson Yang of the university of Victoria and the university of British Columbia [2]. Although they were cautious about claiming a planetary detection, their radial-velocity observations suggested that a planet orbits the star Gamma Cepheid. Partly because the observations were at the very limits of instrumental capabilities at the time, astronomers remained skeptical for several years about this and other similar observations. It was thought some of the apparent planets might instead have been brown dwarfs, objects intermediate in mass between planets and stars. In 1990 additional observations were published that supported the existence of the planet orbiting Gamma Cepheid but subsequent work in 1992 again raised serious doubts. Finally, in 2003, improved techniques allowed the planet's existence to be confirmed [2].

Initially, most known exoplanets were massive planets that orbited very close to their parent

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stars. Astronomers were surprised by these “hot Jupiter’s” , because theories of planetary formation had indicated that giant planets should only form at large distances from stars. But eventually more planets of other sorts were found, and it is now clear that hot Jupiter’s are a minority of exoplanets. In 1999, Upsilon Andromeda became the first main-sequence star known to have multiple planets. Others were found subsequently. As of 28 March 2015, a total of 1906 confirmed exoplanets are listed in the Extrasolar Planets Encyclopedia, including a few that were confirmations of controversial claims from the late 1980s. That count includes 1202 planetary systems, of which 480 are multiple planetary systems. Kepler-16 contains the first discovered planet that orbits around a binary main-sequence star system.

There are exoplanets that are much closer to their parent star than any planet in the Solar System is to the Sun, and there are also exoplanets that are much further from their star. Mercury, the closest planet to the Sun at 0.4 AU, takes 88 days for an orbit, but the smallest known orbits of exoplanets have orbital periods of only a few hours, e.g. Kepler-70b. The Kepler-11 system has five of its planets in smaller orbits than Mercury's. Neptune is 30 AU from the Sun and takes 165 years to orbit it, but there are exoplanets that are thousands of AU from their star and take tens of thousands of years to orbit, e.g. GU Piscium b.

The orbit of a planet is not centered on the star but on their common center of mass. For circular orbits, the semi-major axis is the distance between the planet and the center of mass of the system. For elliptical orbits, the planet–star distance varies over the course of the orbit, in which case the semi-major axis is the average of the largest and smallest distances between the planet and the center of mass of the system. If the sizes of the star and planet are relatively small compared to the size of the orbit and the orbit is nearly circular and the center of mass is not too far from the star's center, such as in the Earth–Sun system, then the distance from any point on the star to any point on the planet is approximately the same as the semi-major axis.

The radial-velocity and transit methods are most sensitive to planets with small orbits. The Kepler spacecraft has found planets with even shorter orbits of only a few hours, which places them within the star's upper atmosphere or corona, and these planets are Earth-sized or smaller. If a planet is detectable by both the radial-velocity and the transit methods, then both its true mass and its radius can be found. The planet's density can then be calculated. Planets with low density are inferred to be composed mainly of hydrogen and helium, whereas planets of intermediate density are inferred to have water as a major constituent. A planet of high density is inferred to be rocky, like Earth and the other terrestrial planets of the Solar System.

There are not all exoplanets parameters such as density and radius defines. In all this indeterminate cases it may be possible productive use of the Geo–space universal X – structure of the Solar system [1]. The X– structure constructed on basis of the theory [3] (see also ref. No 7 at [4]) as it tested in [5]. The binding structure is made in a standard way by setting a scale factor K equal to the relation of the diameter of the central star to the diameter of the Sun. It has been tested on the diameter of the rings of planets-Giants are Saturn, Jupiter and others: in all cases, the maximum diameter of the rings matches the 3 diameters of the planet in accordance with the known value of the boundaries of the zone of tidal destruction. In this way, managed to set the density of Saturn's rings. Within the small standard deviation of 25 mG · cm^{-3} it is the same as the density of ordinary ice, with minor additives in agreement with observed data measuring the rings coefficient of reflection.

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There are not any forms of a heavy ice.

By the beginning of 2015, astronomers have identified a total of 65 exoplanets within 50 light-years (15 pc) of the Earth, but the existence of at least another 35 unconfirmed exoplanets has been proposed. This corresponds to only 35 stars with confirmed planetary systems (and eleven with only unconfirmed exoplanets) of the around 1,400 stars that are estimated to be located within 50 light-years. Reports of planetary systems first came in 1996 for three stars located over 40 light-years away: 55 Chancre, Upsilon Andromeda and 47 Ursine Majors. Since 1999, more planets have been reported, including a total of five planets revolving around 55 Cancri, and four planets around Gliese 876 and Upsilon Andromeda. Eight star systems have three confirmed planetary partners, four others have only two planets, while the remaining 20 systems have only one confirmed planet. A total of seven planets has been suggested for Gliese 667 C (only two have been confirmed), six around HD 40307 (three confirmed).

Gliese 581 c or **Gl 581 c** is a planet orbiting the red dwarf Gliese 581. It is the second planet discovered in the system and the third in order from the star. With a mass at least 5.5 times that of the Earth it is classified as a super-Earth (a planet of 1 to 10 Earth masses). At the time of discovery, it was the smallest known extrasolar planet around a main-sequence star but on April 21, 2009, another planet orbiting Gliese 581, Gliese 581 e, with an approximate mass of 1.9 Earth masses, was announced. Gliese 581 c gained interest from astronomers because it was reported to be the first potentially Earth-like planet in the habitable zone of its star, with a temperature right for liquid water on its surface, and by extension, potentially capable of supporting extremophile forms of Earth-like life. However, further research casts doubt upon the planet's habitability. It is tidally locked (always faces the parent star with the same face) so if life had a chance to emerge, the best hope of survival would be "the twilight zone". In astronomical terms, the Gliese 581 system is relatively close to Earth, at 20.3 light years (192 trillion km or 119 trillion miles) in the direction of the constellation of Libra. The star Gliese 581 (see the list of open exoplanets for 2010 year) belongs to the spectral class G2V, more cold from 2000 to 3500° C, as the Sun is 5778 K. As suming that its mass and size of the Sun, you can calculate the density of the extrasolar planet Gliese 581 c, based on the universal Geo-space X-structure of Solar system [1, 5] on fig. 1.

Figure 1. Gliese 581 c.

The extrasolar planet Gliese 581 c of the orbits radius 10.5 million km should defend from its central luminaries to 3.15 km the reduced length. According to the fig. 1 of the universal Geo-space X-structure of the Solar system graph in axes density/semi-major axis of the orbit the Gliese 581 c position is precisely on the density exoplanets 3.6 $g \cdot cm^{-3}$ as icy or watery planet-ocean for its radius of about 2 Earth radii, whereas if it is a rocky planet with a large metal kernel, the density is much higher and its position in figure is not consistent. On these established here features an extrasolar planet similar to Europe-the Moon of Jupiter, only larger. Jupiter II and Jupiter III indicate the position of Jupiter in the second and third sheets of fig. 2 respectively.

The exact values of the density of the extrasolar planets are defined when you know their mass and radius. Only three exoplanets radii were measured by the transit method: Gliese 436 b - 0.365 RJ, 55 Cancri e - 0.178 RJ and GJ 1214 b - 0.238 RJ. In Fig. 2-4 these exoplanets are plotted on a graph of the universal Geospace X-structure of the Solar system [1].

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Figure 2. Gliese 436 b.

This exoplanet is far from the central star radius at 0.42 the radius of the Sun on 3.5 km the reduced semi-major axis of the orbit, expressed with the scale coefficient k = 0.42 reduction proportional to the radius of the star relative to the radius of the Sun. This factor to bind the x-scale structure is determined by the fact that the known limit of the zone of destructive deformation is proportional to the gravitational radius of central body. On the fig. 2 exoplanets point is exactly on the Geo-space X-structure graph. Jupiter II and Jupiter III indicate the position of Jupiter in the second and third sheets of fig. 2 respectively.

Figure 3. 55 Cancri e.

This planet is from the central star radius 1.15 of the Sun's radius to 1 km of the reduced semi-major axis of the orbit, without recalculation of the rate of reduction as to the order of 1 in proportion to the radius of the star relative to the radius of the Sun. On the fig. 3 the exoplanet's point position is satisfactorily on the Geo-space X-structure graph within the permissible deviation of the length. And, finally, - the third planet GJ 1214 b, extends from the Earth to 42 light years. This planet is far from the central star radius 0.2 of the Sun's radius on 3.6 km the reduced semi-major axis of the orbit in terms of reduction coefficient K = 0.2 is proportional to the radius of the star relative to the radius of the Sun. On the fig. 4 exoplanet's point is exactly on graph of the Geo-space X-structure within the permissible deviation of the length despite of a fairly high density. As can be seen in all three cases, parametric exoplanets points on scheme well consistent with the universal Geo-space structure [1] for various radii of the central star.

Figure 4. GJ 1214 b.

The 82 Eridani star system weight 0.70 the Sun's mass and radius of the Sun's radius distant 0.92 19.7 light years from Earth discovered and supposed three exoplanets 82 G. Eridani b, c, d. From the measured albedo 0.3, the surface temperature of exoplanets 115° C is allowed this stellar system top grade of habitability. The major semi axis of orbits in a way binding on the radius of the central star (scaling factor K = 0.92 order 1) identified as 6.58 ± 0.1, 11.1 ± 0.16, 19.0 ± 0.32 km for extrasolar pla nets b, c, d respectively. Real these values can be defined on the upper scale fig. 5, which shows that all parametric points of extrasolar planets extremely well on the theoretical curve X-structure with all the uncertainty values of density, because large half-orbit exactly coincided with the features (jumps) of density of the X-structure. The range of density values of extrasolar planets b, c, d respectively their masses [2] (2.52 ± 0.3) M_{Earth}, 2.52 ± 0.3) M_{Earth} and (4.7 ± 0.6) M_{Earth} are exactly corresponded to the weight jumps diapasons of the X-structure. In this field within the spread the Universal Geo-space X-structure of the planets in the Solar system gives the following values for the radii of extrasolar planets b, c, d 82 Eridani-10880 km, 9860 km and 10720 km respectively.

Figure 5. 82 G. Eridani b, c, d.

In the latter two cases, the theory gives the valid interval radii values exoplanets from 9470 km up to 10250 km and from 10270 km to 1170 km. Important when comparing theory with observed three exoplanets orbit parameters 82 Eridani is the largest major axes all three exoplanets are exactly at the boundary set theory. The density closest to the 82 Eridani extrasolar planet is additional fixed by the largest plateau of the first peak fig. 2 due to the

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small offset to the left. However, the theory is valid and the interval of less than 3 $G \cdot cm^{-3}$, while the more distant orbits, one of which coincided with the orbit of Mercury, the theoretically permission interval of density is small and coincided with the experimental dispersion. Because the values of the density less than 1 $G \cdot cm^{-3}$ an extrasolar planet is a gas balloon (not discussed), theoretical limits on the density of the confirmed exoplanets 82 Eridani b would be:

$1.4\, R_{Earth} < R_{exo} < 2.2\, R_{Earth}$

If the density is more than 6 $G \cdot cm^{-3}$, it can be said with certainty about the existence of heavy chemical elements.

Universal Geo – space X – structure Levels

Figure 6.

There are the following parameters similarities on planets: Mercury-Moon, Venus-Uranus, Jupiter-Rhea (Saturn) Mercury-Proteus (Neptune), Earth-Ganymede (Jupiter).

DISCUSSION

Mercury and the Moon on the Geo-space universal X-structure as related to structural levels of the reduced semi-major axis of the orbit 18 km. So their property could theoretically be very close. The following is a list of the similarities.

- Mercury's diameter-4878 km at 3476 km from the Moon;
- «… It was thought that Mercury rotates synchronousl y and it always faces to the Sun by one hemisphere, just as the Moon made by one side to the Earth» [6];
- Mercury's albedo 0.106 to 0.12 at the Moon;
- “The measurement showed that spectrophotometric p roperties of surface rocks of Mercury's many areas of mainland rocks resemble the Moon, though somewhat lighter than their” ([6], p. 7);
- “Chapter 2. LUNAR LANDSCAPES of Mercury” [6];
- Mercury and the Moon, related to meteorite age [7], close to the geological structure.

Should be mentioned that a list of similarities only applies to border on the surface. While theoretically the power of the crust - 40 km of the Moon and 46 km from the Jupiter’s sea in the area of Mercury [5] the differences are substantial (see also [6]). Recent measurements of the Moon's crust power give 37 km (data website: Wikipedia) that is within the permissible variation in theory [5].

With the help of computer calculations was simulated the process of planetary formation of clouds of protoplanetary bodies, and it was shown that patterns of structure of the solar system, such as the separation of the planets on the two big groups, consistently observed in the majority of cases ([6], p. 37).

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CONCLUSION

1. Sum of similarities on density reaches over 50% of the number of natural satellites.
2. The sum of the diameters of the similarities is not much less than the sum of similarities in density.
3. The highest sum is the sum of similarities on albedo, almost equal to the number of satellites. This means that the structural levels of the Geo-space X-structure of the Solar system are grouped directly observable way.
4. There are similarities and geological structures of the satellites (see e.g. [7]).

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