Journal of Astrophysics & Aerospace Technology
ISSN: 2329-6542

Rauf et al., J Astrophys Aerospace Technol 2015, 3:2
DOI: 10.4172/2329-6542.1000120

Research Article Open Access

# Distribution of Moons in the Solar System

**Kani M Rauf, Hossien Hossieni*, Zher Arkan and Dana Sarkawt**

*Department of Physics, School of Science, University of Sulaimani, Iraq*

**Abstract**

This study explains the most important moons in solar system and their distribution in the planets. The research will also show the relationship between the mass of the planets, number of natural satellite of the planets and the distance of planets from the Sun. Furthermore, the study indicates the origin of moons and most interesting properties of the giant moons in Jupiter, Saturn, Uranus and Neptune System.

**Keywords:** Moons; Solar system; Jupiter; Saturn; Neptune; Uranus; Natural satellite

## Introduction

Our solar system has consisted of some celestial bodies in addition to a star (sun) and some planets. There are some celestial bodies which are rotate around the planets as moons. Some of the moons are large and some of them are very small. History of the moons has started by thinking and studying of humankind on our moon. Dawn of this history goes back to myths. Brightness and motion of the moon inspired wonder and weirdness. In Greek Mythology, Selene is the goddess of the moon; she was the driver of her chariot in the heavens [1]. But in Greek science, the scientific perspective of moon has been improved and in the middle centuries which were after the invention of telescope, it has been cleared that the moon is sphere. Furthermore, after discovering the moons of Jupiter by Galileo, it has been believed that moon is not the only celestial object that rotates around a planet [2]. Nowadays the number of the discovered moon is more than 180 [3]. The distribution of the moons in solar system may obey some rules. In the region of soil planet (Earth, Venus, Mars, Mercury) there are only three moons, and just one of them is large (the Earth's moon) while in the region of gaseous planets (Jupiter, Saturn, Uranus, Neptune and Plato) the number of moons is huge. The giant gaseous planets are in the outer part of solar system and most of the moons rotate around them. The size of some of the moons is comparable to the size of our moon (Lunar) but other moons are small and they made of rocky materials. Obviously in the outer region of the solar system, the bigger planets have more moons, because the sources of most of the moons are Kuiper belt and Oort cloud. After leaving these regions the moons have been absorbed by gravitational force of the planets. On the other hand, the large size moons have other sources. For example the moon of the earth separated from the earth when a collision occurred between the earth and a celestial body [4,5].

In this study we first explain the most important moons in solar system and then their distribution in solar system in another section.

## Most Important Moons in Solar System and their Sources

It has been mentioned previously that the number of moons in solar system is more than 180, but only nineteen of them hold enough mass to make a round body in the sky. Most of natural satellites came from Kuiper Belt and Oort cloud. Kuiper Belt is a disk region beyond the planets in solar system with a large number of celestial icy bodies and Oort cloud which is assumed as a spherical cloud with radius of about 2 ly that surrounded the solar system. These bodies with different velocities rotate around the sun [6]. Regularly some of the objects in Kuiper belt and Oort cloud with different velocities eject from their positions as asteroids or comets and enter the solar system. Depended on their velocities they absorbed by different planets of solar system and they named as natural satellites [7]. Both moons of Mars are asteroids which have fallen in Mars' gravitational fields [8]. Other types of moons have different origin such as our moon which is the second large satellite in solar system. The prevailing hypothesize of origin of the moon is that Erath-moon system is formed as a result of a huge celestial impact [9]. Galileo Galilee at 1610 discovered the four largest moons of Jupiter, known as Io, Europe, Ganymede, and Callisto [10]. Other small moons of Jupiter and giant gaseous planets are sometimes named as irregular moons because they might be asteroids that come from beyond Plato which is the boundary regions of the solar system [4]. Io is a volcanic moon of Jupiter and its surface covered with sulfur [11]. Other giant moon in Jupiter system is Europe, its surface covered by water ice and some evidences show the possibility of existing ocean of water under the surface of this moon. Callisto is the farthest of the four large Jupiter's moon and it holds the most heavily cratered celestial object in the solar system [12]. Moreover, Ganymede is the largest satellite in Jupiter and solar system. It is the only moon in our solar system that generate internal magnetic field similar to Earth [13]. Four Galilean satellites are among regular satellites and possibly formed from the gases and dusts of an early circum- Jovian disk [14]. Classification of the moons in other planets is similar to Jupiter system. For instance, in the Saturn system, Titan is the largest moon of the planet and it is slightly larger than planet Mercury. This moon covered by thick nitrogen atmosphere. Its atmosphere also contains hydrocarbons that shows similarity to Earth's atmosphere [15,16]. Another large moon in the Saturn system is Rhea. This moon is smallest body in the solar system which is in hydrostatic equilibrium [17]. Additionally, Uranus has five important moons, two of them, Titania and Oberon, has been discovered six years after discovering the planet by William Herschel and the other three moons, Ariel, Umbriel and Miranda, discovered after that. If these moons have been rotated around sun, they are considered as dwarf planet [18]. Another planet in

***Corresponding author:** Hossien Hossieni, Department of Physics, School of Science, University of Sulaimani, Iraq, Tel: +9640748 060 6226; E-mail: hossien.hossieni@univsul.edu.iq

**Received** July 07, 2015; **Accepted** August 18, 2015; **Published** August 31, 2015

**Citation:** Rauf KM, Hossieni H, Arkan Z, Sarkawt D (2015) Distribution of Moons in the Solar System. J Astrophys Aerospace Technol 3: 120. doi:10.4172/2329-6542.1000120

**Copyright:** © 2015 Rauf KM, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Citation:** Rauf KM, Hossieni H, Arkan Z, Sarkawt D (2015) Distribution of Moons in the Solar System. J Astrophys Aerospace Technol 3: 120. doi:10.4172/2329-6542.1000120



solar system is Neptune. Fourteen moons around Neptune have been discovered until now and seven of them are large. Triton is the largest moon in Neptune system and is the only large moon in the solar system with a retrograde orbit [19].

## Results and Discussions

Distribution of the moons around each giant gaseous planet obeys the Titius–Bode law, which is an empirical law for distribution planets around the sun and it states each planet position should be approximately twice as far from the sun as the planet before[20]. This law is almost correct for most of the giant planet system. On the other hand, most of the moons in solar system have distributed around both Jupiter and Saturn.

Table 1 shows number of the moons around each planet in solar system, distance of each planet from the sun and mass of each planet. Here we consider distance of the earth from the Sun (AU) as a unit of Measurement [21].

Figure 1 shows the mass of the planets in terms of distance of them from the sun, the distances are expressed by AU and masses by Yotta (1024). It is clear that the position of Jupiter is on the top of the graph. This is corresponded to the maximum number of moon's location in the Solar system.

Figure 2 shows the number of moons for each planet. The larger planets have more moons than smaller planets. Every year scientists discover new bodies orbiting the gaseous giant planets. Many bodies of substantial size orbit in the asteroid belt, the Kuiper belt, or Oort cloud, and many sizable asteroids cross the orbits of planets as they make their way around the Sun. Some planets' moons are unstable and will in the near future (Geologically speaking) make new ring systems as they crash into their hosts. Many moons, like Neptune's giant Triton orbit their planets backward (clockwise when viewed from the North Pole, the opposite way that the planets orbit the Sun). Triton also has the coldest surface temperature of any Moon or planet, including Pluto, which is much farther from. This graph displays the number of moons of each planet versus the distance of the planet from the Sun. The figure clearly shows that the distribution of moons increase for the soil planets as we go further from the Sun while this distribution decrease for the gaseous planets with distance from the Sun.

Figure 3 is a 3D graph that displays the relationship between the number of moons of the planets, mass of the planets and distance of them from the Sun. The figure shows that the number of the moons of the soil planets is directly proportional to their distance from the Sun but have no relation with their mass until we reach Jupiter. From Jupiter, the number of moons of the planets decreases with increasing their distance from the Sun and decreasing their mass. The middle of the graph is the Saddle point which is the Jupiter planet.

| Name of the planets | Planet Distance to the Sun | Mass of the planets x $10^{24}$ kg | Number of moons |
|---|---|---|---|
| Mercury | 0.387 | 3.302 | 0 |
| Venus | 0.723 | 48.69 | 0 |
| Earth | 1 | 59.94 | 1 |
| Mars | 1.524 | 6.41 | 2 |
| Jupiter | 5.203 | 18980 | 67 |
| Saturn | 9.523 | 5685 | 62 |
| Uranus | 19.208 | 868.4 | 27 |
| Neptune | 30.087 | 1024 | 13 |

**Table 1:** The table shows the number of moons for each planet and distance of each planet from the Sun and their mass. Mass of the planets ×$10^{24}$ kg.

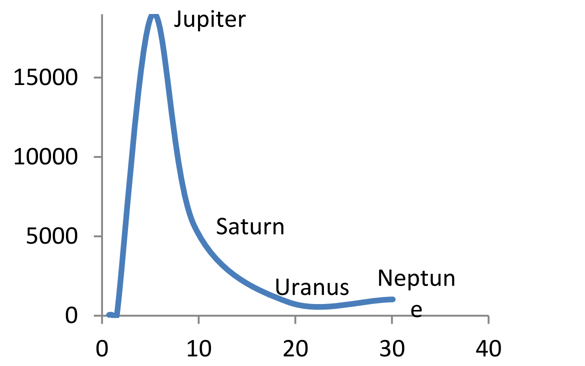


**Figure 1:** Distribution of the planets in solar system according to their mass and their distances from the Sun. The distances (X-axis) are in AU and masses (Y-axis) in Yotta (1024).

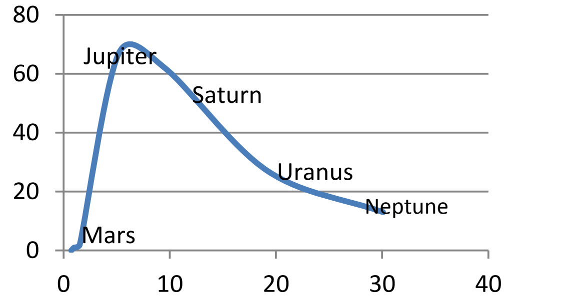


**Figure 2:** Distribution of moons in solar system. X-axis shows distance of the planets from the Sun and Y-axis shows number of moons for each planet.

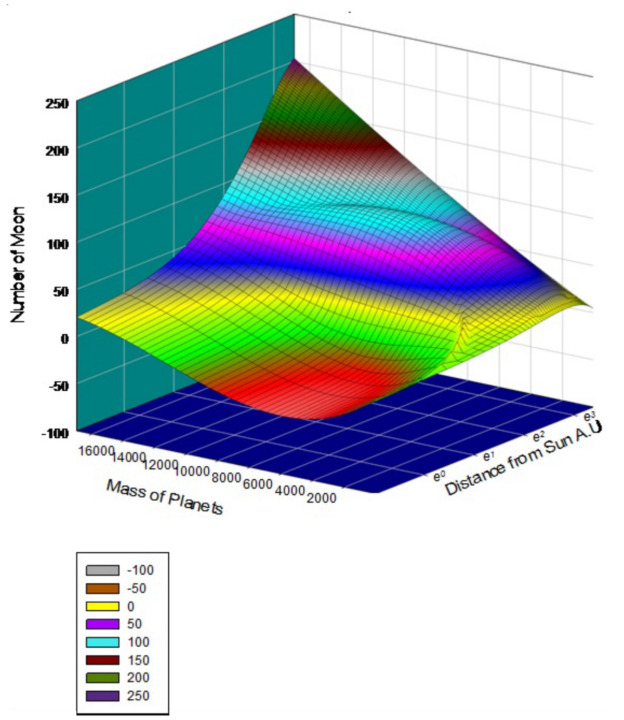


**Figure 3:** The 3 dimension figure shows the relationship between the number of moons of the planets, mass of the planets and distance of them from the Sun.

## Conclusion

This research has focused on moons which are 180 moons in our solar system. Then, It has also described the moons in solar system including our moon and the important moons particularly. Next, this research has explained the origin of moons formation and origin place of moons either they come from outer space or exist in solar system itself. On the other hand, the research has explored the effects of gravity in general and also showed the relationship between the distance of the planets from the sun, the number of their moons and the mass of the planets. The result is the number of moons increase for the soil planets as we go further from the Sun while this number decrease for the gaseous planets with distance from the Sun which means that the distribution of moons of the soil planets is directly proportional to their distance from the Sun but have no relation with their mass whereas for the gaseous planets, the number of moons of the planets decreases with increasing their distance from the Sun and decreasing their mass. Finally, it has also explained that the moons come from outer space and each planet captures its moons according to their gravitational force and mass.

### References

1. Graham D (2013) Science before Socrates: Parmenides, Anaxagoras, and the New Astronomy. Oxford University Press, UK.
2. Stevenson, David J (2001) Jupiter and its moons. Science.
3. Black C (2012) The moons of the Solar System.
4. Perryman M (2011) The Origin of the Solar System.
5. Weidenschilling SJ (1997) The Origin of Comets in the Solar Nebula: A Unified Model. Icarus 127: 290–306.
6. Weissman PR (1990) The Oort cloud. Nature 344: 825-830.
7. Stern SA (2003) The evolution of comets in the Oort cloud and Kuiper belt. Nature 424: 639-642
8. Rosenblatt P (2011) The origin of the Martian moons revisited. Astron Astrophys Rev.
9. Cameron AGW, Benz W (1991) The origin of the moon and the single impact hypothesis IV. Icarus. 92: 204-216.
10. Lawson AE (2002) What does Galileo's discovery of Jupiter's moons tell us about the process of scientific discovery? Science and Education 11: 1-24.
11. McEwen AS (1998) High-temperature silicate volcanism on Jupiter's moon Io. Science 281: 87-90.
12. Zimmer C, Khurana KK, Kivelson MG (2000) Subsurface oceans on Europa and Calisto: Constraints from Galileo magnetometer observations. Icarus 147: 329-347.
13. Kiveslson MG, Khurana KK, Russell CT, Walker RJ, Warnecke J, et al.(1996) Discovery of Ganymede's magnetic field by the Galileo spacecraft. Nature 384: 537-541.
14. Coradini A, Magni G, Turrini D (2010) From Gas to Satellitesimals: Disk Formation and Evolution. Space Science Reviews 153: 411-429.
15. Zebker HA, Stiles B, Hensley S, Lorenz R, Kirk RL, et al. (2009) Size and Shape of Saturn's Moon Titan. Science 324: 921-923.
16. Hueso R, Sánchez-Lavega A (2006) Methane storms on Saturn's moon Titan. Nature 442: 428-431.
17. Anderson JD, Schubert G (2007) Saturn's satellite Rhea is a homogeneous mix of rock and ice. Geophysical Research Letters.
18. Johnson TV, Brown RH, Soderblom LA (1987) The moons of Uranus. Scientific American 256: 48-60.
19. Cruikshank DP (1995) Neptune and Triton. The University Arizona press.
20. Rouan D (2011) Titius–Bode Law. Encyclopedia of Astrobiology.
21. (2015) Solar System Exploration, NASA.