



Title: JÚPITER, KING OF THE MOON.

Authors: Elena Alcacera Pérez (tutor responsible for the group), Luis Fernández Codeseda (10 years), Fidel Martínez García (10 years), Elia Sufuentes Arija (11 years).

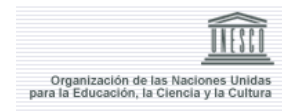
School: CEIP “Salvador de Madariaga”. Daganzo (Madrid), CP: 28814

E-mail: elen_alcacera@hotmail.com



INDEX:

- Abstract**
- Summary**
- Development**
- Practical activities.**
- References**



Abstract

Our project is based on exhaustive research of the planet Jupiter and the four major Galilean satellites. To carry out this job the students have researched, as far as possible, about Jupiter discovering its features and peculiarities and making a direct observation of the star and its satellites in the astronomical Observatory of Bonilla in Cuenca (Spain) where they made photographs thanks to powerful telescopes that this observatory has. Also it has been made a study of Jupiter compared to our planet Earth, showing similarities and differences, evaluating, in addition, important data about the past and the future of star investigated.

On the other hand, in addition to the direct observation and research, students have developed a mobile of Jupiter and the four satellites and 3D mural have been presented at school. In turn, they have

made a power point presentation to disseminate what they have learned and make all students and teachers at the school participants in this research project.

Jupiter is the fifth planet in the solar system and it is part of the outer or gaseous planets. The Romans named the planet after the Roman god. It is, in addition, after the Sun, the largest and most massive planet in our solar system. Jupiter's rotation is the fastest of all the Solar System's planets. Its atmosphere is permanently covered with clouds and is consisted of mainly hydrogen and helium. The main satellites of Jupiter were discovered by Galileo Galilei in 1610, the four most important moons of Jupiter are: Io, Europa, Ganymede and Callisto.

DEVELOPMENT:

Jupiter is the fifth planet of the Solar System. Form leaves from denominated outer or gaseous planets. It receives his name of the Roman God Jupiter.

It is also after the Sun, the largest celestial body in the Solar System. It is a colossus over 142,000 miles in diameter and 318 times the mass of Earth, about 2.48 times of the sum of the masses of all the other planets combined; Jupiter can comfortably accommodate over 1000 planets the size of the Earth. Jupiter's volume is equal to 1,317 Earth. To get an idea of the magnitude of the Jupiter's size, just to say that if Jupiter were a basketball, the Earth would be a ping-pong ball.

If we were to Jupiter in a spaceship, having travelled a distance of 750 million kilometres, we will arrive at a huge word that show a multi-coloured gaseous layer, full of clouds and 67 satellites, and a very narrow ring of "dirty dust" that includes in its equatorial plane.

Jupiter spins faster than any other planet, taking a little under 10 hours to complete a turn on its axis. Jupiter has the fastest rotation of all the planets in the Solar System. Jupiter's equator rotates a bit faster than its polar regions at a speed of 450,494 miles/minute (about 725.000 kilometres / minute). The rapid rotation causes the planet's equator to bulge out. Instead of being a perfect sphere, Jupiter looks more like a squashed ball.

Jupiter is made mostly of hydrogen (87%) and helium (13%), and also contains methane, water vapour, ammonia and hydrogen sulphide. Its composition is more like a star than a planet.

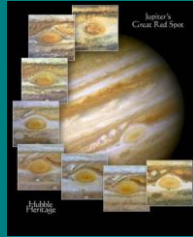
- A first layer, underneath its dense cloud cover, in which hydrogen and helium form a molecular liquid due to the high pressures and temperatures.
- An intermediate layer, about 18,000 kilometres beneath the clouds.
- A rock solid core, composed of metals and silicates, with a temperature of 30,000 C

So, we could say that Jupiter is like a liquid planet which has a rocky core and an outer layer of gases.

All components of Jupiter's atmosphere play an important role in the formation of clouds and the thermal structure of the atmosphere. Even some, especially derivatives of phosphorus and sulphur, may be the main cause of the diversity of colours seen on this planet.

Among the atmospheric details stand out the Great Red Spot (GRS) also called "The Eye of Jupiter". The Great Red Spot is shown in the South Tropical Zone and was discovered by Robert Hooke in 1664. Its current size is between 10,000 and 12,000 km by 25,000 and 30,000 km.

The Great Red Spot has been seen for more than 300 years and the winds are even faster than expected (more than 400 mph). Usually it is reddish, although, sometimes, it pales to turn pink.



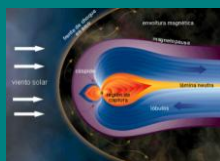
Picture taken from: <http://www.cielosboreales.com/index.php/2009/03/11/que-le-ocurre-a-la-gran-mancha-roja-de-jupiter/>

Júpiter and the Great Red Spor.

English fan A.S. Williams made the first systematic study on the atmosphere of Jupiter in 1896. The Jupiter atmosphere is divided in dark belts called Bands and clear regions called Zones, all of them in the direction of the parallels and alternating light and dark colours. The "zones" are caused by strong gas extraction and consist of white ammonia clouds and white matter reaching high altitudes and low temperatures. In belts, the ammonium hydrosulphide clouds are darker, less dense and reach lower altitude than the zones.

Although very different from those surrounding Saturn, Jupiter also has a ring. It is unobservable from Earth even with the most powerful optical of the best observatories, due to its proximity to the planet, its small thickness (a few centimetres smaller) and a low intensity. For that reason, no one knew about it until he was photographed by Voyager I in March 1979 against solar backlighting; in other words, using the sun as a bright background to reveal the existence of the rings. The ring has a width of about 6,000 km and its thickness (in profile) does not exceed the thirty kilometres. Like the rings of Saturn, it is composed of ice crystals mixed with dust and small rocks.

Jupiter has the strongest magnetosphere (region dominated by magnetic field) of the planets in the solar system except the Sun itself, forming a magnetic tail extending in the antisolar direction, extending over several million kilometres. The origin of this magnetic field could be the huge electrical currents inside the liquid metal ocean. This field varies with the rotation of the planet, carrying with it a gas of ionized atoms and electrons captured by some intense radiation belt. Jupiter auroras are thousands of times more intense than anything here on Earth.



Picture taken from:
http://www.windows2universe.org/jupiter/upper_atmosphere.html&lang=sp

Jupiter's Magnetosphere



Jupiter's main ring picture taken by Voyager 2..

Jupiter's ring

Life exists on Planet Earth but...are there any possibilities of life on Jupiter?...

As regards we can say that as might be expected, the poisonous gases of Jupiter make this huge world an inhospitable place where is not possible to conceive existence of life as we know it. However, let us remember that those same components and energy resources (ultraviolet radiation, electric shock) possibly, were those which presided and led in a remote past, to the origin of life on planet Earth.



Compared to Jupiter to Earth, you can set a number of similarities and differences between the two planets, as we have said before, Jupiter is 318 times more massive than Earth, able to comfortably accommodate more than 1,000 planets the size of Earth. But we have tried to look for more comparative data for presentation in this table:

DATA	JÚPITER	EARTH
Size: equatorial radius	71.492 Km.	6.378 km.
Mean distance from Sun	778.330.000 km.	149.600.000 km.
Minimum distance to Earth	591.000.000 km.	---
Maximum distance to Earth	965.000.000 km.	---
Siderial period	11 years	1 year
Rotation period	9 hours 55 minutes	23 hours 56 minutes
Inclination of equator to orbit	03° 12'	23° 27'
Orbital speed (km/s)	13	30
Rotational speed (km/s)	12,5720	0,4651
Scape velocity (km/s)	59,54	11,18
Diameter equatorial	142.984 km.	12.756 km.
Mass	318	1
Surface gravity	2,55	1
Mean surface temperature	-120° C	15° C
Known number of satellites	57	1
Albedo	0,52	0,367

Earth-Jupiter encounters happen every 13 months when the Earth laps Jupiter in their race around the sun. But because Earth and Jupiter do not orbit the sun in perfect circles, they are not always the same distance apart when Earth passes by.

Of the sixteen most important satellites orbiting Jupiter, it should be noted the four largest, discovered by the great astronomer Galileo Galilei in 1610, which are called "Galilean" in

honour of the astronomer. These four major moons of the giant planet are: Io, Europa, Ganymede and Callisto.

Io: is the closest to the giant Jupiter. It is 262,000 miles from Jupiter. It has a diameter of 2,258 miles. It orbits Jupiter once every 42, 5 hours. Its orbit is affected by the magnetic field of Jupiter and the proximity to Europa and Ganymede. It is rocky and permanently maintains intense volcanic eruptions, is the most volcanically active body in the Solar System. The massive volcanic eruptions over the past million years are the cause of the satellite is found permanently covered by a 10 meter thick layer of sulphurous lava. The temperature of Io's surface is about -148 C, but there are many "hot spots" on Io's surface that reach up to +25 C.

Europa is the second nearest of the four large moons discovered around Jupiter, it has a diameter of 3,130 km (1,940 miles), which makes it a little smaller than Earth's Moon. It orbits Jupiter at a distance of about 671,000 km. Europa orbits Jupiter in around three-and-a-half days. Europe has the distinction of being the brightest body in the solar system and the body surface with fewer accidents. On its surface there is a thick layer of ice several kilometres thick with fractures of up to 300 km in length, the ice sheet is not uniform but is cracked in many places. The Galileo spacecraft passed within 1,500 Km (932 miles) of the icy surface of Europa which scientists theorized that an ocean of liquid water exists below the surface.

Ganymede is the largest moon in the Solar System. It is 3,278 miles (5.275 km) wide. It takes Ganymede exactly 7 days, 3 hours, and 42 minutes to complete one orbit around Jupiter. He seems to have a rocky core, a mantle of ice water and a crust of rock and ice, with mountains, valleys, craters and lava flows. It is in a distance of 1.070.000 km from Jupiter. This large satellite has an atmosphere almost negligible, probably consisting of a mixture of methane and water vapour, resulting from occasional leaks arising from its low geologic activity.

Calisto: is 1,882,000 miles from Jupiter and orbits it in 16.75 days. A diameter of almost 4,900 km Callisto becomes the third largest moon in the Solar System, after Ganymede and Titan. It is composed of approximately equal amounts of rock and ices. The surface is a record of an intense meteorite bombardment. We cannot talk about Calisto's atmosphere, because it lacks. We can say that it is quite similar to Ganymede, although its icy surface is dirty by rocky meteorite dust. Just before sunrise, the temperature can reach -180° C.



Picture taken by students on March 10, 2012 from the observatory of Bonilla.



NASA image.

Jupiter and satellites Io, Europa, Ganymede and Callisto.

Jupiter and satellites Io, Europa, Ganymede and Callisto.

Regarding to the past and future of our star we can start from its name, it is not known exactly why the ancient Greeks called this planet Zeus, in honour of the most important God for them. In this case as well, the Romans adopted the name, he was named patron of their empire and called it Jupiter.

Until the early 17th Century, the dominant theory was that the Earth was the centre of all things and everything else was "in orbit around the Earth" and its position in the sky. In 1610, the famous Italian scientist Galileo Galilei, turned his newly invented telescope towards Jupiter. It was from then when he began to know a host of new issues on that "wandering star".

Thanks to Jupiter and its four main satellites, Galileo was able to discover that not all heavenly bodies revolve around the Earth. This great astronomer checked with his primitive telescope (that barely gave 30x) how around the planet four faint stars remained aligned and...moved around it! Because of this evidence, the heliocentric theory of Nicolaus Copernicus definitely gained strength to prevail. This discovery was extremely importance to science and to the understanding of the Universe.

In the 60s, astronomers discovered that Jupiter radiates twice as much energy as it receives from the sun and then came the theory, now largely accepted, that Jupiter is halfway between a planet and a star. The shining origin of Jupiter seemed to indicate that it could be a star to compete with the Sun. However, during its formation did not get enough mass that would have led to thermonuclear reactions that would have made it to shine in its own right. So, sometimes, referring to Jupiter often said to be "the star that could not be". As a curiosity, the energy that Jupiter released every second is equivalent to that developed in the explosion of 1 million tons of TNT.

The missions Pioneer 10 and Pioneer 11 conducted a preliminary exploration of the planet flybys. Pioneer 10 space probe flew by Jupiter for the first time in history in December 1973. The probe Pioneer 11 followed just a year later. It was taken the first close-up pictures of Jupiter and the Galilean satellites, it was studied its atmosphere, its magnetic field was detected and was studied its radiation belts.

With the evolution of the telescopes was gradually gaining a more realistic picture of the planet. However, it was not until the early eighties when Humanity finally had a clear and real image of the largest brothers on Earth. It was in May and September 1979 when the Voyager satellite series carried out a thorough examination of Jupiter, sending us numerous and unpublished photographs as well as a huge amount of data, which came to upgrade the knowledge that until then, they had on the planet. The Voyager got 30,000 images of Jupiter and its moons.

A unique event, witnessed by millions of astronomers worldwide, was the collision of different fragments of Comet Shoemaker-Levy 9 into Jupiter, which occurred between 16 and 22 July 1994. The powerful impacts vanished in Jupiter's cloud layers after having caused a huge hole in them. It could also be observed the disruptive effects of the shock waves, under the appearance of waves that occur in a pond that has been thrown a stone. The dark marks generated by this impact were visible for several months.

In 1995 the Galileo mission, which consisted of a probe and an orbiter, launched an exploratory mission planet for seven years. Although the mission had major problems with the main antenna relaying data to Earth, it was able to send information with unprecedented quality of the satellites of Jupiter, discovering evidence of a liquid ocean underneath Europa's surface and several examples of active volcanism on Io. The mission concluded launching an orbiter against the planet itself to avoid a future collision with Europe that could contaminate their ice.

In late February 2007, the planet Jupiter was visited by the New Horizons probe on its journey to Pluto.

In August 2011, the spacecraft Juno lifted off to begin a five-year journey to the planet Jupiter and in September of that year were first identified two new moons by Magellan-Baade telescope at Las Campanas Observatory in Chile. At present there are already 67 moons discovered around Jupiter.

Missions are under study dedicated to the observation of Jupiter and its satellite Europa by the space agencies NASA and ESA.

PRACTICAL ACTIVITIES:

1st BONILLA OBSERVATORY VISIT AND MAKING PICTURES:

On 10 of March 2012 we visited the Bonilla observatory facilities (Cuenca) to make a direct observation and take pictures of Jupiter and its four main satellites.




The Astronomical Association of Madrid has in the astronomical observation area of Bonilla (Cuenca) an astronomical observatory. This observatory, partly still in development, currently has two buildings equipped with individual telescopes. The main building has a motorized telescope on fork mount for astronomical studies, while the service building offers a tool Dobson large type. The data from the telescopes that students could use in Bonilla were:

Telescope that took the photos: Brand: Meade-Model: LX200 – clear aperture: 25 cm – Focal length: 2,500 mm-focal ratio: f/10 (used to determine if the instrument is bright or not. The lower the number, the brighter the instrument - Optical system: Schmidt-Cassegrain-Frame: Fork.

Telescope with which the star was observed: Brand: Meade - Model: Lightbridge – clear aperture: 40 cm – Focal length: 2,000 mm - focal ratio: f / 5 - Optical system: Newton – Frame: Dobson - Ocular: Hyperion 26mm Wide Angle Deluxe 2" eyepiece, giving a 55.56 x increases (to obtain it we need just to divide the telescope focal length by the eyepiece).

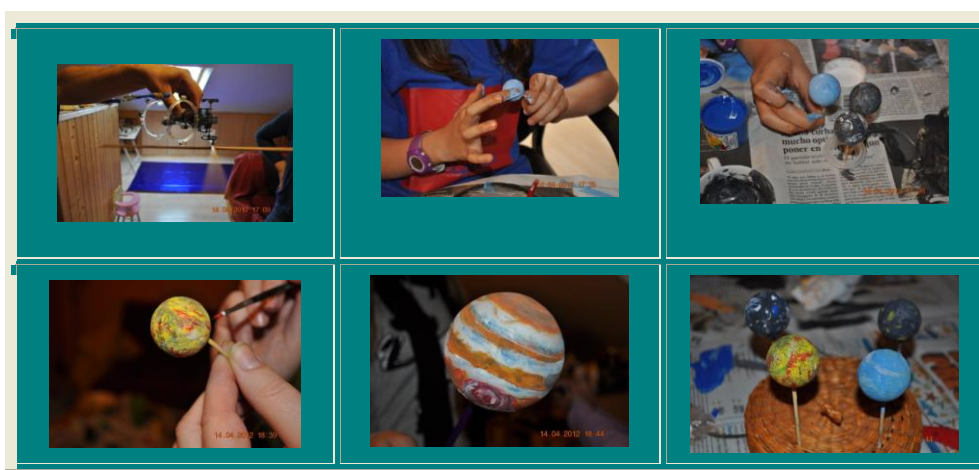


The visit took place during the month of March as during this month could be seen a spectacular astronomical event, a planetary conjunction between Jupiter and Venus, this phenomenon will not occur until June 2015. Also during the 25th, 26th and 27th of March the Moon showed up, escorting these two planets in the evening sky.

		 <p>Imagen: cortesía Pedro Arrano y César González (del libro El Cielo a tu Alcance)</p>
<p>Picture taken by students in Bonilla observatory where you can see Jupiter.</p>	<p>Picture taken by Alejandro Mendiagoitia Pauly from Bonilla observatory. Underneath you can see the Moon and Venus. At the top in the left you can see Jupiter.</p>	<p>Picture taken from: http://www.planetmad.es/saber/2012CONJUNCIÓN.html</p>

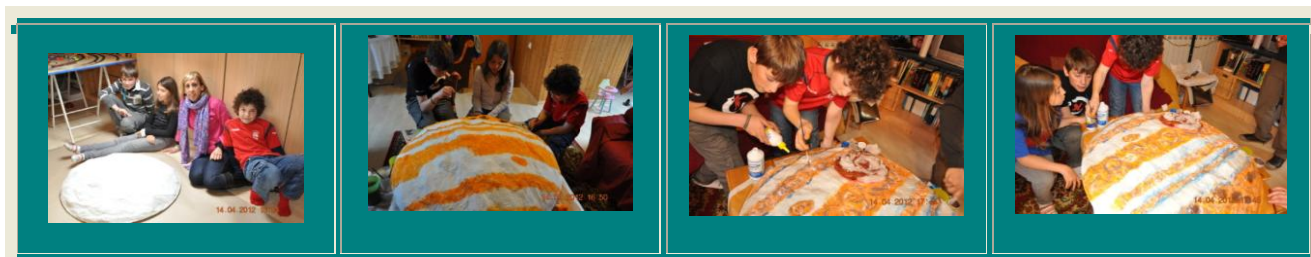
2nd MAKING A MOBILE MODEL OF JUPITER

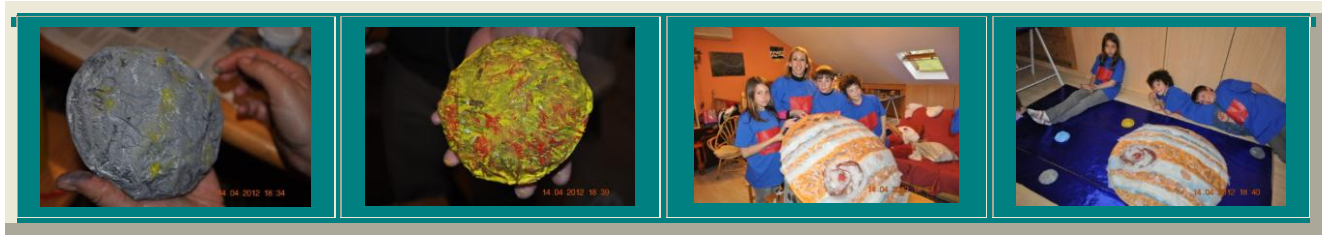
Using large amount of materials such as wax, tempera, polystyrene balls, cotton, thread and a small motor, students have made a mobile model in which we wanted to represent Jupiter and its four largest satellites, also we have added to this model a motor for rotating the satellites around Jupiter.



3rd DEVELOPMENT OF A 3D MURAL:

To continue with practical activities we have developed a 3D mural using wide range of materials the same as in the mobile model. The mural has been exposed in the school so that all students can enjoy and observe certain characteristics of Jupiter.





4th EXPOSURE AND DISCLOSURE OF INFORMATION COLLECTED ABOUT JUPITER IN POWERPOINT.

To complete this project we developed a powerpoint which reflected all activities undertaken in the project, from the visit to the Bonilla observatory to the completion of all practical activities, showing everything we have learned about Jupiter and its satellites and highlighting and publicizing this job and all the information to the students at the school.



References

- Pedro Arranz García y Alex Mendiolagoitia Pauli. “Conocer y observar el Sistema Solar”. Agrupación Astronómica de Madrid, 2003.
- Guinness World Records 2012. Sumérgete en el asombroso mundo de los récords. Editorial Planeta, 2011.
- “El Espacio”. Los exploradores de Nacional Geographic. Autor Alan Dyer. Ed. Círculo de Lectores. 2002.
- “El Universo”. Enciclopedia Visual de las preguntas. El País. Ed. Santillana.2009.
- “El Sistema Solar”. Colección Biblioteca del Estudiante-Genios. 2002.

- <http://www.redicecreations.com/solarsystem.html>
- [http://es.wikipedia.org/wiki/J%C3%BApiter_\(planeta\)](http://es.wikipedia.org/wiki/J%C3%BApiter_(planeta))
- http://es.wikipedia.org/wiki/Anillos_de_J%C3%BApiter
- <http://es.wikipedia.org/wiki/Albedo>
- <http://www.xtec.es/~rmolins1/solar/es/jupiter.htm>
- <http://www.astrored.net/nueveplanetas/solarsystem/jupiter.html>
- <http://www.todoelsistemasolar.com.ar/jupiter.htm>
- <http://www.solarviews.com/span/jupiter.htm>
- <http://www.astromia.com/solar/jupiter.htm>
- <http://www.astroyciencia.com/2007/12/17/los-satelites-de-los-planetas/>
- http://ciencia.nasa.gov/ciencias-especiales/09aug_juno3/
- <http://celestia.albacete.org/celestia/celestia/solar/jupite9.htm>