

OBSERVATION OF SOLAR SYSTEM

Introduction

Winter nights have always been very advantageous for stargazing. During this time of year most of the brightest stars make their appearance in the sky. Among these bright stars some other glowing points of light, also lie that moves across the background of stars, change their position weekly, monthly when observed regularly. These objects are called planets. Taking this into account, a full night observation of the following celestial objects was done in Karachi.

- Jupiter and its four moons
- Uranus
- Saturn
- Venus
- Mercury

Jupiter

Jupiter is the largest planet of the solar system and easily observable with naked eye. With a small telescope we can even observe its four moons which are called Galilean moons. These were first observed by an Italian astronomer Galileo in 1761. Jupiter completes one revolution around the sun in 11.86 years.

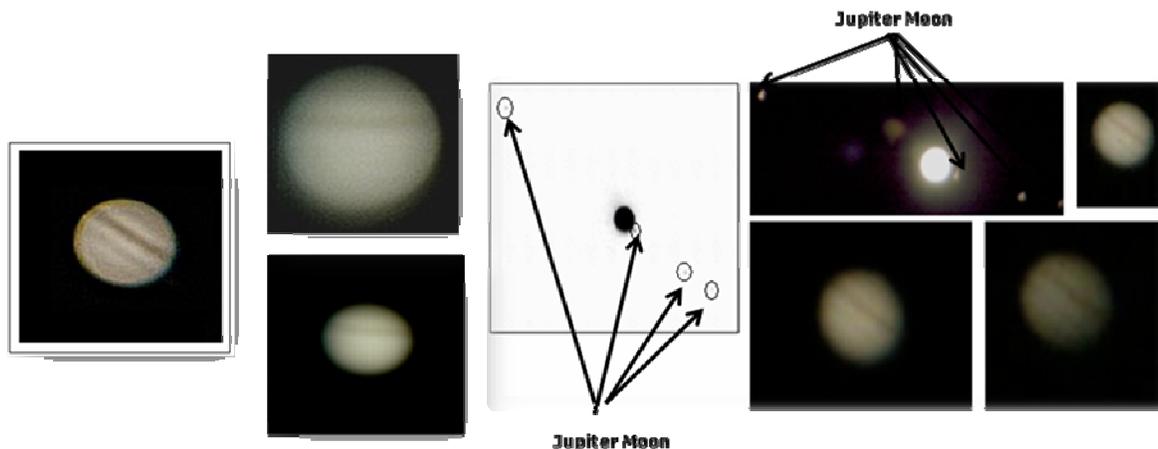


Figure 1: Jupiter and its four Galilean moons shown in first (inverted) image taken by Nikon coolpix p600; Images processed with Registx on 19 Jan 2011 at 22:17hrs PST

The Great Red Spot (GRS) is the most prominent feature of Jupiter and has been the attraction of astronomers for nearly 300 years. It was discovered by Cassini or Robert Hooke in the 17th century. The GRS is 12,000 by 25,000 kilometers and is wide enough to fit three Earths side by side. In addition to the GRS, there are similar smaller structures on the surface that act and behave in the same way.

The most remarkable and most visible feature of Jupiter is its atmosphere. We see belts of clouds in intricate patterns. The cloud patterns consist of:

- Polar regions
- Temperate regions
- Tropical regions
- Equatorial regions

Each region consists of:

- Belts - darker bands - falling gas - low pressure
- Zones - lighter bands - rising gas - high pressure

The belts and zones provide the swirling effects. The rotation of Jupiter is the engine that drives all of the motion as well as internal heat. Because of internal heating, the wind speeds can reach up to 500 km/h.

The first spacecraft to visit Jupiter was Pioneer 10 in 1973, followed by Pioneer 11, Voyager 1 & 2, and Ulysses. Currently, Galileo is in orbit with Jupiter and will be transmitting data back to Earth for study for a couple of years.

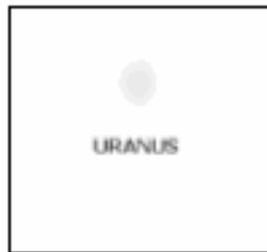


Figure 2: Jupiter showing bands of gases, two of such are visible photograph taken from SUPARCO, Karachi

Uranus

Uranus was observed below Jupiter at the same time. It is the first planet which was discovered with the help of a telescope by Sir William Herschel in 1781. It is the third largest planet with an equatorial diameter of 51,800 km and larger in diameter but smaller in mass than Neptune. Due to large distance from Earth, Uranus is not visible with naked eye, however it can be observed as a green spot in the sky with high power telescope. Its average distance from the sun is 2.871×10^9 km. The orbital period of Uranus around the sun is 84.099 Years. The planet has been visited by only one spacecraft, Voyager 2 on January 24, 1986. Uranus has twenty seven known moons, with a likely possibility of several undiscovered smaller ones in existence.

The atmosphere of Uranus is gaseous like Jupiter and Saturn, but contains a higher ratio of heavier elements. There is also a greater percentage of methane which absorbs longer wavelengths resulting in the bluish color. Like Jupiter and Saturn, Uranus rotates differentially; however, there are no clearly defined bands of clouds on Uranus. The wind speeds on Uranus are at high speed - near 700 km/h - but are in reverse at the equator (rotating to the west instead of east).



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Nikon coolpix p6000;

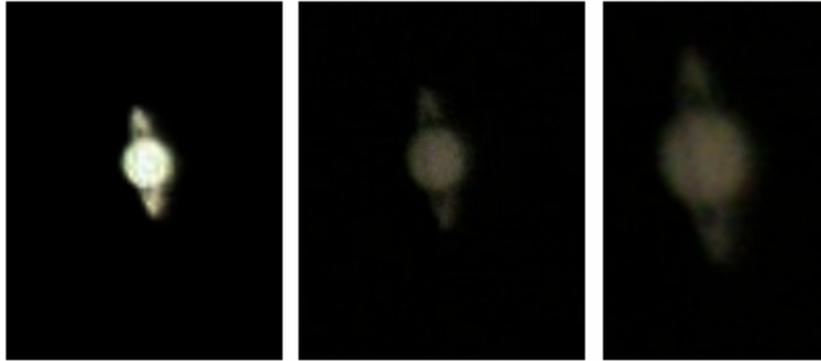
Figure 3: Uranus (inverted image); barely visible like a fuzzy spot

Saturn

Saturn has always been attractive for masses because of its rings (mostly consist of gas and dust particles). These days Saturn is in constellation Virgin, and is visible in eastward direction at midnight.

The chemical composition of Saturn is similar to Jupiter but with different quantities. Compare Saturn's 96.3% hydrogen to Jupiter's 86.2% hydrogen for example. Differential rotation occurs on both planets and it is believed that the same belt and zone patterns exist. Saturn is smaller than Jupiter but releases 25% more internal heat resulting in wind speeds reaching up to a phenomenal 1800 km/h near its equator. It has a huge magnetosphere and a stormy atmosphere. The orbital period of Saturn around the sun is 29.37 years. Saturn has 53 plus 9 awaiting official confirmation. Titan is the largest and bigger than the planet Mercury and our own moon. Titan is of particular interest to scientists because it is the only moon in the solar system with its own atmosphere.

Saturn's rings are among the most recognizable features in the solar system. They spread over hundreds of thousands of kilometers, yet they are extremely thin – perhaps only 10 meters (about 30 feet) thick. The rings consist of billions of individual particles of mostly water ice which create waves, wakes and other structures.



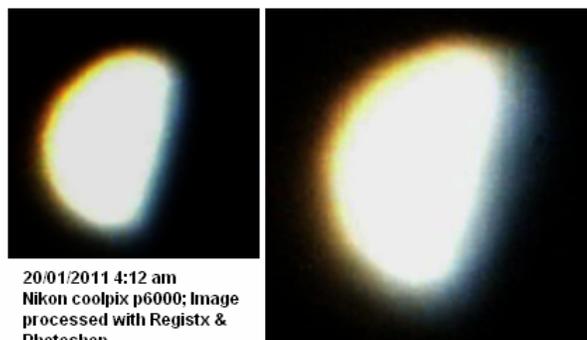
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Nikon coolpix p6000; Image processed with Registx

Figure 4: Saturn with its rings

Venus

The planet Venus can be observed around early morning in SE direction. It is the second brightest object after the moon. If observed through telescope, Venus also undergoes phases like our moon.

Venus is scorched with a surface temperature of about 482° C (900° F). This high temperature is primarily due to a runaway greenhouse effect caused by the heavy atmosphere of carbon dioxide. Sunlight passes through the atmosphere to heat the surface of the planet. Heat is radiated out, but is trapped by the dense atmosphere and not allowed to escape into space. This makes Venus hotter than Mercury. Venus rotates from east to west and completes one revolution around the sun in 243 days.



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Nikon coolpix p6000; Image processed with Registx & Photoshop

Figure 5: Venus; observed in Phases

Mercury

Mercury is the closet planet to the sun is the small and rocky surface, it speeds around the Sun in a wildly elliptical orbit that takes it as close as 47 million km and as far as 70 million km from the Sun. Mercury completes a orbit around the Sun every 88 days, speeding through space at nearly 50 km per second, faster than any other planet. Because it is so close to the Sun, temperatures on its surface can reach a scorching 467 degrees Celsius. But because the planet has hardly any atmosphere to keep it warm, nighttime temperatures can drop to a frigid -183 degrees Celsius. It can be seen during sunrise/sunset.

Like our Moon, Mercury has almost no atmosphere. What little atmosphere exists is made up of atoms blasted off its surface by the solar wind and has less than a million-billionth the pressure of Earth's atmosphere at sea level. It is composed of oxygen, sodium, and helium. Because of Mercury's extreme surface temperature, these atoms quickly escape into space and are constantly replenished. Mercury's surface very much resembles Earth's Moon, scarred by thousands of impact craters resulting from collisions with meteors. While there are areas of smooth terrain, there are also cliffs, some soaring up to a mile high, formed by ancient impacts.

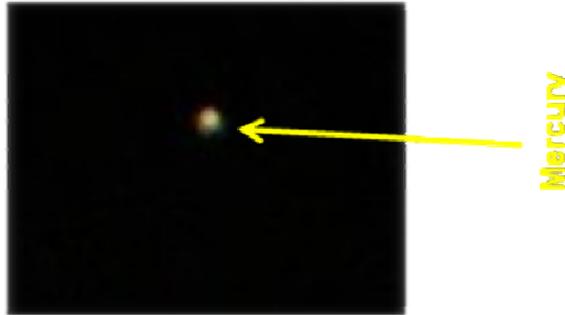


Figure 6: Photograph taken by Nikon coolpix p6000; Image processed with Registx & Photoshop on 20th Jan 2011 at 06:10 hrs PST