

## What Am I? - KEY

The following are brief descriptions of each image. A website is given for most images if you (or your students) desire to do additional research about these objects. Nine of these objects are visible in (good quality) amateur telescopes (M57, M104, M20, M80, NGC 2392, M51, M42, and M87). Compare the telescopic view of one or more of these objects with the Hubble Telescope image. This will clearly demonstrate the value of a large telescope orbiting above Earth's atmosphere.

### **1 Saturn**

The Cassini-Huygens spacecraft returned this image of Saturn on May 16, 2004. Enceladus, one of Saturn's 31 known moons, appears near the south-pole at the bottom of the image. Cassini was then about 20 million kilometers (12.4 million miles) away from Saturn.

<http://saturn.jpl.nasa.gov/multimedia/images/saturn/index.cfm>

### **2 Ring Nebula, a planetary nebula**

Located in the constellation Lyra, the Ring Nebula (M57) is the best-known example of a planetary nebula, the glowing remains of a doomed star. The Hubble telescope images reveal that the "Ring" is actually a cylinder of gas seen almost end-on.

The Ring Nebula is about 2,000 light-years from Earth and has a diameter of about one light-year. The faint speck at its center was once a star of greater mass than our own Sun. Now, near the end of its life, it has ejected its outer layers into space, and the remnant is destined to die as a tiny white dwarf star, about the size of the Earth.

Two centuries ago, astronomers studying these round-shaped objects through small telescopes called them "planetary nebulae," because their circular disks resemble those of planets.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/1999/01/>

### **3 Sombrero Galaxy, a spiral galaxy**

The Sombrero galaxy (M104) is an edge-on spiral galaxy in the constellation Virgo. It is about 28 million light-years away. The photo reveals a myriad of stars in a pancake-shaped disk as well as a glowing central bulge of stars.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2003/28/>

### **4 Trifid Nebula**

The Trifid Nebula (M20) is a huge cloud of gas and dust, illuminated by the light from nearby stars. Astronomers believe stars are forming within the nebula (a group of recently formed, massive, bright stars is easily visible in the image). Three huge intersecting dark lanes of interstellar dust make the Trifid Nebula one of the most recognizable and striking nebulae in the night sky. This nebula lies within our own Milky Way Galaxy about 9,000 light-years from Earth, in the constellation Sagittarius.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2004/17/>

### **5 Globular Cluster**

This stellar swarm is M80, one of the densest of the 147 known globular star clusters in the Milky Way Galaxy. Located about 28,000 light-years from Earth, M80 contains hundreds of thousands of stars, all held together by their mutual gravitational attraction. Especially obvious are the bright red giants, which are stars similar to the Sun in mass that are nearing the ends of their lives.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/1999/26/>

## **6 Hair Dryer in visible light**

Is it on or off? How can we tell?

## **7 Hair Dryer in infrared light**

The infrared image shows the heat radiated by the hair dryer. Infrared is primarily heat radiation and is emitted by anything with a temperature - even objects that we think of as being cold. The scale shown to the right is the temperature in degrees Fahrenheit. For many more examples of infrared images and more information about the infrared, see:

*HTML version:* [http://coolcosmos.ipac.caltech.edu/main\\_html/index.html](http://coolcosmos.ipac.caltech.edu/main_html/index.html)

*FLASH version:* <http://coolcosmos.ipac.caltech.edu/index.html>

*Spanish version:* <http://www.spitzer.caltech.edu/espanol/edu/index.shtml>

## **8 Eskimo Nebula, a planetary nebula**

This planetary nebula (NGC 2392), is an intricate structure of shells and streamers of gas around a dying sun-like star 5,000 light-years away. It is dubbed the "Eskimo Nebula" because, as seen through ground-based telescopes, it resembles a face inside a furry parka. (See object #2 on the previous page for more about planetary nebula)

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2000/07/>

## **9 Earth**

Few people have seen this view of Earth. This photograph was taken from the Apollo 12 spacecraft on Nov. 14, 1969 while on its way to the Moon.

[http://images.jsc.nasa.gov/luceneweb/caption\\_direct.jsp?photoId=AS12-50-7362](http://images.jsc.nasa.gov/luceneweb/caption_direct.jsp?photoId=AS12-50-7362)

## **10 Whirlpool Galaxy, a spiral galaxy**

The Whirlpool galaxy (M51) is a face on spiral galaxy in the constellation Canes Venatici. Numerous clusters of bright, young stars [highlighted in red] can be seen in the galaxy's spiral arms. It is about 31 million light years away. The image is about 30,000 light years across in the horizontal direction.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2001/10/>

## **11 Star Clusters**

These two dazzling clusters of stars, called NGC 1850, are found in one of our neighboring galaxies, the Large Magellanic Cloud. (The Large Magellanic Cloud is not visible from Utah). The photo's centerpiece is a young, "globular-like" star cluster -- a type of object unknown in our own Milky Way Galaxy. The smaller second cluster is below and to the right of the main cluster. The stars are surrounded by diffuse gas [left], which scientists believe was created by the explosion of massive stars.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2001/25/>

## **12 Constellation, Ursa Major**

The brightest stars in Ursa Major form the asterism (star pattern) of the Big Dipper.

## **13 Galaxy Cluster**

This is a massive cluster of galaxies called Abell 2218, which acts like a giant zoom lens in space. The gravitational field of the cluster bends and magnifies the light of more distant galaxies far behind it, producing the arcs of light seen in the image. The galaxy cluster is about 2 billion light years away in the constellation Draco.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2000/07/>

## **14 Horsehead Nebula** [12](#)

The Horsehead nebula is a cold, dark cloud of gas and dust, silhouetted against a bright gas cloud, nebula IC 434. The bright area at the top left edge is a young star still embedded in its nursery of gas and dust, but radiation from this hot star is eroding the stellar nursery. The Horsehead nebula is about 1600 light years away in the constellation of Orion. The Horsehead nebula is visible in amateur telescopes, but it does require a large telescope and a very dark sky.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2001/12/>

## **15 Jupiter and Io**

This true-color image was taken on Dec. 12, 2000 by NASA's Cassini spacecraft. It shows Jupiter's moon Io and Io's shadow in against the disk of Jupiter. Io is one of Jupiter's four largest satellites, discovered by Galileo Galilei in 1610. An observer within Io's shadow (the black circle), would experience a total solar eclipse.

<http://saturn.jpl.nasa.gov/multimedia/images/jupiter-flyby/index.cfm>

## **16 Ant Nebula, a planetary nebula**

The glowing remains of this dying, Sun-like star resemble the head and thorax of a garden variety ant. The star has expelled its outer layers to make the lobes of gas seen in this image. The so-called "ant nebula" is about 3000 light years away in the constellation Norma. It is about 1.6 light years long. (Norma is not easily seen from Utah.)

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2001/05/>

## **17 Microorganisms**

Left - *Cryptosporidium parvum* oocysts.

[http://www.epa.gov/nerlcwww/cpt\\_seq1.htm](http://www.epa.gov/nerlcwww/cpt_seq1.htm)

Right - *Giardia lamblia* cysts

[http://www.epa.gov/nerlcwww/gda\\_seq1.htm](http://www.epa.gov/nerlcwww/gda_seq1.htm)

Scale bar is 10 microns (micrometers).

## **18 Orion Nebula in visible (left) and infrared light (right)**

The Orion nebula (M42) is a glowing cloud of gas and dust, about 1,500 light-years from Earth. The four brightest stars near the center are known as the Trapezium. (The Orion Nebula and the Trapezium are easily visible in amateur telescopes). Appearing like glistening precious stones surrounding a setting of sparkling diamonds, more than 300 fledgling stars and brown dwarfs surround the brightest, most massive stars in Hubble's view of the Trapezium cluster's central region. Infrared light can penetrate dust clouds better than visible light, giving astronomers a more detailed view of this stellar nursery.

### **What are brown dwarfs?**

A Brown dwarf is a gaseous object, much larger than a planet, that has too low a mass for nuclear fusion to begin in its core.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2000/19/>

## **19 Moon (from the side)**

This color image of the Moon was taken by the Galileo spacecraft on Dec. 9, 1990, at a distance of about 350,000 miles. The near side of the Moon (the side always facing Earth) is to the right, the far side (the side always facing away from Earth) to the left. The concentric, circular Orientale basin, 600 miles across, is near the center. At the upper right is the large, dark Oceanus Procellarum; below it is the smaller Mare Humorum.

[http://nssdc.gsfc.nasa.gov/photo\\_gallery/photogallery-moon.html](http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-moon.html)

## **20 M87, an elliptical galaxy**

Streaming out from the center of the galaxy M87 like a cosmic searchlight is one of nature's most amazing phenomena, a black-hole-powered jet of electrons and other sub-atomic particles traveling at nearly the speed of light. In this Hubble telescope image, the blue jet contrasts with the yellow glow from the combined light of billions of unseen stars and the yellow, point-like clusters of stars that make up this galaxy. Lying at the center of M87, the monstrous black hole has swallowed up matter equal to 2 billion times our Sun's mass. M87 is 50 million light-years from Earth in the constellation Virgo.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2000/20/20>

## **21 Solar Spectrum**

This is light from the Sun spread out over all visible wavelengths. Elements present in the Sun's atmosphere absorb particular wavelengths of the light, resulting in the dark lines. For a more detailed solar spectrum, and links to the spectra of two other stars, Procyon and Arcturus, see: [http://www.noao.edu/image\\_gallery/html/im0600.html](http://www.noao.edu/image_gallery/html/im0600.html)

## **22 Venus transit of the Sun, 8 June 2004**

A transit of the Sun is a passage of a planet across the face of the Sun. Observers on Earth can only witness solar transits of Mercury and Venus. Currently, transits of Venus occur in pairs eight years apart, separated by more than 100 years. The next Venus transit will occur in the year 2012, and then not again until 2117, and 2125. This image of Venus (dark circle near the bottom) passing in front of the Sun, was taken from the Swedish 1-m Solar Telescope (SST) in La Palma. <http://vt-2004.solarphysics.kva.se/>

## **23 Comet**

A comet is a small body that is part of the solar system. It has a solid nucleus (usually around 1-10 kilometers across) made mostly of ices, dust and rock. Many comets move in large elliptical orbits around the Sun. As a comet approaches the Sun, heat from the Sun causes the ices to vaporize, venting outwards from the nucleus, carrying along various atoms and molecules that make up the different ices, dust and rock in the comet. This creates a temporary (and extremely thin) atmosphere around the nucleus called the coma. Dust and gas pushed away from the coma by light and particles from the Sun forms the comet's tails.

This is a picture of Comet Halley, taken on March 8, 1986 by W. Liller from Easter Island, part of the International Halley Watch.

[http://nssdc.gsfc.nasa.gov/photo\\_gallery/photogallery-comets.html](http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-comets.html)

## **24 Waxing gibbous moon**