Open House Guidelines for Observatory Staff and Docents

Our Open Houses are usually very well attended. By helping out at Open Houses, you are ensuring that we give the public a fun and unique experience. In general, you will be there to assist with the operations of the Open House (e.g. Controlling lights in the lecture hall, setting up telescopes, directing parking) and to answer any questions the public may have about Open House, our telescopes, or astronomy in general. Please remember that we run the Open House as a service to the public and we should do our best to be polite and patient with them. Many of them are very unfamiliar with how telescopes work or what astronomy is about.

Times

You need to arrive at the observatory about 15 ~ 20 minutes before the first lecture of the night for the pre-Open House strategy meeting for a quick dividing of tasks, to discuss possible weather/parking issues and what objects to try for in each of the telescopes.
April through October (during daylight savings time, summer): general Open Houses start at 9:00 PM; group reservations start at 8:00 PM.
November through March (during standard daylight time, winter): general Open Houses start at 8:00 PM; group reservations start at 7:00 PM.

You will be notified a few days in advance whether or not there will be a special group on the night of the Open House.

Parking

Two people are needed to direct traffic in the parking lot. There are flashlights available for both people. One of the traffic directors should move the traffic along and direct them to empty spaces while the other looks for and counts empty spaces. Fill in all the spaces that say "No Parking," except for the eastern most one closest to the entrance. Direct traffic to the overflow lot next to the dump once all the empty spaces have been filled. Make sure that parked cars do not block the entrance to the overflow lot. If there is a large early group, there is often a huge traffic flow. If people exiting the parking lot are blocked by people trying to come in for the public talk, direct them to leave through the overflow lot exit. The traffic directors should also take down license plate numbers and find the owners so they can move their cars if needed.

Lecture Hall

If you are working in the lecture hall for the Open House, your duties include interacting with the public and assisting the speaker for that evening. As the public enters the lecture hall, greet them politely and reassure them that they're in the correct place. Direct the ASTR100/101 students to their extra credit sign-up sheets. Answer questions about what happens at the Open House or about astronomy, whatever the public may ask. When the speaker arrives and Elizabeth is not in the lecture hall, please greet the speaker and help him or her set up. We will be having more speakers from Goddard and other places this year and we want them to feel welcome. As the talk begins, turn the lights off and on as the speaker requests and operate the TV and VCR if requested by the speaker. The TV needs to be set on Ch. 3. During the talk, take care of problems with the slide or overhead projectors. The overhead has a spare bulb in it that you can just slide over if the bulb burns out. If that happens, let Gretchen know so she will remember to change the spare. Extra bulbs for both the slide and overhead projectors are kept on the shelf under the slide projector. There are tools in the storage cabinet if needed. There is a pair of plastic tweezers next to the

slide projector that can be used to fish out jammed slides. If there is an early show, do not allow people for the second show come into the lecture hall early. Direct them to look through the telescopes before the show if the observatory is manned. There is also a sign available to put on the door of the lecture hall to direct early birds for the second show. Once the lecture is over, retrieve the speaker's slides and put AV equipment back in the closed and lock it. Coil the slide remote control cord and put it back on its hook. Lock the door behind you when you go to the telescopes.

The Observatory

After the public leaves, put the telescopes back in their home positions and shut them down. Put the computers back into the closet and close the roofs. Turn off the parking lights and bring the traffic cones back to the observatory and lock all doors.

Some definitions:

Refracting Telescope - A telescope in which the main light-collecting element is a lens.

Reflecting Telescope - A telescope in which the main light-collecting element is a mirror.

Radio Telescope - An instrument for the collection, detection and analysis of radio waves from any cosmic source. Because radio telescopes do not gather visible light they can be used during the daylight hours and during cloudy weather.

CCD (Charge-Coupled Device) - An electronic imaging device widely used in astronomy. When light from a source hits a silicon chip, pixels in the chip become charged. The pixels dump their charge when an image is complete and the charge is converted to a format that can be displayed.

Spectrometer - An instrument for observing a spectrum and measuring features in it by direct observation.

> **Spectrum -** The result of dispersing radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation or X-rays so that components with different wavelengths are separated in space. A good example: The rainbows that are produced by crystal prisms that people often hang in their windows.

Photometer - An instrument for measuring the intensity of light by indirect observation (the output is just a bunch of numbers).

Quick reference guide to the planets:

For an excellent review of current information known about each planet including the status on current number of moons, check http://sse.jpl.nasa.gov/features/planets/planetsfeat.html.

Mercury: 0.4 AU from Sun; 0.4 Earth diameters; mass is 0.06 Earth masses; surface gravity 0.28g; rotation 88 Earth days; revolution 116 Earth days

Venus: 0.7 AU from Sun; 0.95 Earth diameters; 0.81 Earth masses; retrograde rotation 224.7 E-days; 584 E-days revolution; brightest planet and 3rd brightest object in the sky (after the Sun and Moon), closest planet to Earth

Earth: distance: 1 AU (defined); 1 Earth mass defined 5.974e24 kg; inclination of axis = 23.5° (causes seasons) most other planetary data is given in terms of the Earth's data, such as mass and distance from the Sun.

> **The Moon** (sometimes called Luna) is the closest object to the Earth in space, and at night it is the brightest object in the sky. Through a phenomenon known as tidal locking, one side of the Moon always faces towards the Earth, and it is easily observed that the Moon moves through monthly phases from new to full and back again. The widespread "A man in the Moon" perception is caused by differences in the surface material on the Moon that make the "facial features" look darker and so stand out. Study of the two kinds of surface material in the Moon and its craters have helped to suggest its age, which is estimated at 4.5 billion years.

Mars: 1.5 AU from Sun, diameter half that of the Earth, rotation is nearly identical to Earth's - 25 hours; axial tilt is also similar, 25.19°, named for the god of war, Mars has 2 satellites Phobos and Deimos (Fear and Terror). This planet has been the subject of the debate over ET life for over a century.

Jupiter: 5.2 AU, 318 Earth masses, surface gravity 2.4g; largest planet of the solar system; has 99% of the mass outside of the Sun! Jupiter rotates in less than 10 hours, which causes its striking cloud patterns. Storms are common in Jupiter's atmosphere: the famous Great Red Spot has lasted more than 300 years and is larger than the Earth itself. 39 satellites, the largest 4 of which are called the Galilean satellites, because they were some of the first objects discovered by Galileo with his telescope in 1610. Revolution is 11 Earth years, and a tenuous ring was discovered by the Voyager spacecraft.

the Galilean satellites of Jupiter

> **Io:** this is the only geologically active object in the solar system besides the Earth. Heated internally by gravitational interaction with Jupiter, Io volcanoes erupt sulphurous gases and slush, which coat Io's surface, giving it a mottled surface of red, yellow, and black colors.
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> **Europa:** this may be the only object in the solar system to have oceans besides the Earth. Europa's surface is coated with ice, below which may be an ocean of liquid water, methane, and other compounds may cover the satellite. There is evidence of past tectonic activity in the pattern of linear cracks in the ice, but relatively few craters.
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> **Ganymede:** this is the largest moon in the solar system, larger than the planets Pluto and Mercury. There is evidence of past geological activity on the moon, in that the moon's impact craters have been smoothed over.
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> **Callisto:** this is the most heavily cratered of the Galilean satellites, indicating that there are few tectonic processes at work to replace the surface with fresh material. It is the most distant from Jupiter of the large satellites.

Saturn: 9.5 AU, 9.4 Earth diameters, 95 Earth masses, surface gravity 0.92g, rev. 29.4 years most distant planet known to the ancients. The rings of Saturn are its most famous features, and the large Cassini division is easily visible. Saturn has at least 30 satellites, the largest of which is Titan, one of only two moons in the solar system that have atmospheres.

> **Titan:** this is the second-largest moon in the solar system (after Ganymede) and one of only 2 known to have atmospheres. An opaque, smoggy atmosphere that is composed primarily of

methane and nitrogen shrouds Titan. The surface temperature is thought to be about 90 degrees Kelvin, with the atmospheric pressure approximately 60% greater than that of the Earth.

Uranus: 19.1 AU, 4 Earth diameters, 14.5 Earth masses, rotation 18 hours retrograde; 1st planet to be discovered in modern times: found by W. Herschel in 1781; planet's axis is tilted more than 90° w/ respect to orbital plane, the ring that encircles this planet is also tilted over. Uranus has 20 known satellites, many of which are named after Shakespearean characters, mostly the heroines!

Neptune: 30 AU, 3.8 Earth diameters, 17 Earth masses, rotation 19.2 hours; discovered in 1846 after astronomers were unable to account for small irregularities found in the orbit of Uranus. This planet has 8 known moons, the largest of which is Triton (the other planetary moon to have an atmosphere besides Titan).

Pluto: 40 AU, .2 Earth diameters, 0.0022 Earth masses, rotation 6 Earth days retrograde; discovered in 1930 by Clyde Tombaugh, Pluto has 1 moon called Charon; Due to its very small size and differences from the other planets, it is debated whether or not Pluto should be classified as an actual planet of the Sun, or an escaped satellite of Neptune, a large comet, or perhaps some other kind of object. The revolution of Pluto around the Sun takes 248 Earth years.

Open House Favorites:

The Orion Nebula (M42): (late fall, winter)

The Orion Nebula is one of the most famous nebulae in the night sky, located in the sword of the constellation Orion and at a distance of 1,500 light years. Visible with the naked eye as a slightly fuzzy-looking star, it is actually a huge collection of bright young stars, glowing clouds of gas, and lanes of dust. Viewed close up in a small telescope, the nebula can be seen to have two distinct parts, a pink-red region composed of hydrogen gas being ionized by ultraviolet light from the tremendously hot stars embedded in the nebula (or an emission nebula), and another blue region of dust glowing in reflected light from a few other bright stars (or a reflection nebula). In the late 1700's, the Orion Nebula was catalogued by the French astronomer Charles Messier in his catalogue of fuzzy objects as object number 42.

The Ring Nebula (M57): (summer)

Located in the constellation Lyra, the Ring Nebula is a well known planetary nebula. Actually having nothing to do with planets, planetary nebulae are created when a Sun-like star evolves into a red giant star and then gently ejects gaseous matter from its outer envelope, which expands at speeds of about 10~20 kilometers per second. The spherical shell of gas appears like a ring around the star, which eventually evolves into a white dwarf. The Ring Nebula is about 2,150 light years from Earth and is also referred to by the Messier designation of M57.

The Andromeda Galaxy (M31): (fall)

Also known as the Great Galaxy in Andromeda, this galaxy is famous for being the most distant object visible with the naked eye from Earth. It was also once thought to be the closest galaxy to the Milky Way, but in more recent times, at least three other galaxies were determined to be closer to the Earth, and indeed, satellite galaxies to our own. These satellite galaxies include the Large and Small Magellanic Clouds visible in the southern hemisphere. The Andromeda Galaxy appears as a fuzzy oval of light in the center of a square of bright stars between the constellations

of Pegasus and Andromeda. It is estimated to be about two million light years distant from the Milky Way, and is also known as M31.

Globular Clusters:

Globular clusters are groups of stars whose members are gravitationally bound to one another. Unlike most objects in the galaxy, they are located outside the plane of our galaxy. These groups of stars are believed to be very old and may by older than most objects in our galaxy. The bright clusters are visible with the naked eye and appear to be fuzzy stars from the Earth.

M15: This globular star cluster is one of the brightest visible from the Earth (6th mag.) and located in the constellation of Pegasus. (late fall, early winter)

M13: Located in the constellation of Hercules, this is the brightest globular cluster visible in the Northern Hemisphere. To the naked eye, the cluster appears as a slightly fuzzy star in the constellation, the light of all the stars it contains (~ 300,000) combining to appear at about 5th magnitude. (late spring, summer)

M5: This globular cluster is in the constellation of Serpens, located at about 26,000 light years from Earth.

Open Clusters:

Open Clusters are star clusters where the stars are born in the same cloud and are not gravitationally bounded to each other. These clusters are generally young in age because the members do move apart over time and as the stars evolve.

M41: In the constellation Canis Major (the Large Dog), M41 is a large, bright open star cluster. It contains about fifty low-magnitude stars, but together they appear as a single 6-magnitude star. (winter)

M35: This cluster is at a distance of about 2,8000 light years and located in the constellation of Gemini. It appears as a 5th-magnitude fuzzy star-like object. (winter)

The Pleiades (M45): Probably the most famous of open clusters, it is also named the "Seven Sisters" located in the constellation Taurus. The mythology surrounding this cluster mentions that one of the Sisters was struck by a lightning bolt and killed, which may explain why only six stars of the cluster are visible to the naked eye. The cluster contains hundreds of stars altogether, nine of which are named for the seven mythological sisters and their parents. In other legends, the sisters are said to be chased around the sky by both the bright star Aldebaran and the hero Orion, both of which are closely behind the cluster in the sky. The cluster is about 415 light years away. (late fall)

Meteor Showers:

Meteor showers are usually caused by the leftover remnants of comets that have swept through the Solar System and crossed the path of the Earth's orbit. The comet leaves behind a track of dust grains and larger particles in space, and when the Earth reaches that area of space in its orbit the particles are attracted by the Earth's gravity and run into the atmosphere. They incinerate in the upper atmosphere and produce the bright streaks of light known as meteors. There are several yearly meteor showers (named for the constellation in which they are observed), created when, each year, the Earth intersects the path of debris left behind by the "parent" comet.

the Perseids: This is the most famous meteor shower, and emanates from the constellation Perseus. The shower reaches its peak around the night of August 12-13, with an hourly rate of meteors 80 or higher. The parent comet of the Perseids is Swift-Tuttle, with a period of 120 years.

the Leonids: This meteor shower (in the constellation Leo) occurs in November, with the peak night around the 17th. The number of meteors per hour shows a strong cycle: since the shower occurs from the debris left by the Tempel-Tuttle comet having a period of 33 years, the brilliance of the shower also has a 33-year cycle. During the best years, hourly rates can be as high as several thousand per hour, and average rates are around ten to fifteen.

the Geminids: This meteor shower is most active in December, on the night of 12-13. The meteors emanate from between the two brightest stars in the constellation (Gemini), and often reach a rate of 80 per hour. Surprisingly, this shower is not caused by cometary debris, but from the orbit of an Earth-approaching asteroid named 3200 Phaethon, discovered in October 1983.

the [Eta] Aquarids: The Aquarids are strongest about the night of May 5th each year.

the [Delta] Aquarids: reaches a maximum of about twenty meteors per hour on or near the night of July 28.

the Taurids: Actually two separate showers, the Taurids peak on November 4-7 (northern branch) and October 30-November 7 (southern branch).