PAPER PLATE UPDATE

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Abstract: Innovative GLPA members contributed the displayed activities for a Paper Plate Astronomy compilation. More ideas are being sought.

An effort is underway to compile and to distribute astronomy activities that can be done with inexpensive materials such as paper plates. On display at the poster are some samples contributed by innovative GLPA members. The suggested grade levels for the submitted activities as well as previously published activities range from pre-K to 12. Please submit *your* creation.

The method of disseminating the compilation is not decided. To be discussed at the conference are ways to make the activities readily available through multiple formats, such as the Web, video, CD, or booklet. Yet to be solicited are complementary materials to support the activities.

Many activities, ranging from designing a NASA mission patch to plotting globular clusters, are omitted due to "space and time" limitations. The excerpts below are brief descriptions of the material displayed on the poster:

Paper Moon

Cut out phases of the Moon from paper plates and stack in the following order: whole black plate, crescent, quarter, gibbous, and whole white plate. Secure the stack with a paper fastener. Rotate through the plates, inverting the stack to show the remainder of the phases.

Cosmic Hat

Draw colorful space art on an inverted paper bowl. Secure it to the top of one's head with a large rubber band that goes under the chin, like a traditional birthday party hat.

Deep Field Art

Smear dark blue Rose Art 3-in-1 Activity Paint with your finger so the paint covers the entire flat portion of a foam plate. This type of paint interacts with the foam so that when dry the plate looks like a rich starfield against a dark sky. Imagine this is the view through a space telescope.

Moon Mask

Press a six-inch rubber stamp depicting a stylized moon face onto a paper plate. Punch out two large eyeholes. Decorate the mask with crayons, sparkles, etc. Secure the mask to one's face with a large rubber band.

Navigating with Polaris

In this more elaborate design, the northern hemisphere student makes a dial that shows the correlation between the observed altitude of Polaris and the observer's latitude. To use it, move the "Boat" dial around the Earth to an unknown latitude. Align the "North" dial parallel to the north celestial pole. Determine the latitude by reading the elevation of Polaris, or the Horizon-to-Boat-to-North angle.

Photographic Plate

Secure two plates with a paper fastener in the center. Position the upper plate, which has holes punched out corresponding to the circumpolar stars, so it corresponds to the current night sky. (To mass produce top plates, place one plate with the stars drawn on it on top of an unopened package of plates. Then drill through each star on the top plate and through the stack below as well.)

Place a pen tip in one star hole and rotate the top plate an angular amount that corresponds to the time of a long duration camera exposure. For example, to simulate a two-hour photograph, rotate the top plate counterclockwise 30 degrees while sweeping out the arc with the pen. Return the plate to the starting position and repeat for each of the stars. Remove the top plate to view the predicted star trails of your long duration exposure.

Plotting Satellite Passes

In this activity, the user creates a device that depicts the path of visible satellites that night. On the inside of a foam bowl, which will later be held over one's head, label cardinal points and draw 360 degrees of local horizon features in their respective positions. (Note: Hefty® foam bowls have scalloped edges that conveniently are 10 degrees apart. Label the azimuth in 10-degree increments.) From the edge of the bowl to the center, subdivide and label zero- to 90-degrees of azimuth.

From the GSOC at http://www.heavens-above.com, obtain current predictions on satellite passes for your location. Plot the predicted track (or point, for Iridium flares) across the bowl and label each line with time and satellite name.

Dynamic Scale of the Orbits

Give each team one half of a paper plate that is folded over so it looks like a quarter plate. Each team opens their half-plate to see the name of the planet they're supposed to depict. Each team then colors a paper plate front and back to look like their planet. Provide some posters or images of planets they can refer to as well (real color, not false color). The ringed planets have rings cut into them. Comets are two plates: one plate whole with a nucleus and the other plate cut in a double spiral for the tail (yellow dust tail and blue gas tail).

Discuss with students their existing knowledge or convictions about the planets and concepts like rotation, poles, equator, and revolution/year length. Take the students outside with planet plates in hand. Establish a scale by creating a story. For example, suggest a cosmic giant can step from the Sun to the Earth in one step (1 A.U.). Pace off the planet distances from the Sun with each team of students, starting with Pluto and leaving the teacher back with the other students. As each team reaches its distance from the Sun, the students stop, turn to face the Sun and hold their planet plate up high.

Note how far apart the outer solar system planets really are (or, conversely, how close the inner ones are), and why it takes spacecraft so long to get from one to the next. Comets are last. They start at the very outer edges of the solar system, race toward the Sun as their tails lengthen, and hurtle back out again.

Serving Up the Solar System

Color the entire bottom side of the plate to represent the Sun and label it so. Decorate the fluted edges of the plate to resemble solar flares ("flames").

On the top side, write the names of the planets. You can write them in order from the Sun, if you want the students to practice that skill, or you can write the names scattered around, the way the real planets are in different places around the Sun. Next to each planet's name, glue the seed that represents its size:

Mercury – sesame seed
Venus – small dried pea
Earth – large dried pea
Mars – barley seed
Jupiter – walnut
Saturn – filbert (hazelnut)
Uranus – dried garbanzo bean
Neptune – dried garbanzo bean
Pluto – radish seed

The Vanishing Spacecraft and Planet

Draw a small planet and a spacecraft on the paper plate about 6 cm (2 1/4 inches) apart. Use the *right* eye to make the *spacecraft* vanish. Position the ringed planet in front of the right eye at arm's length. Close the left eye. Concentrate your vision from your right eye on the planet and slowly move the paper plate to your face. As the planet approaches, note when the spacecraft disappears.

Use the *left* eye to make the *planet* vanish. Position the spacecraft in front of your left eye at arm's length. Close your right eye. Stare at the spacecraft while slowly moving the paper to your face. Note when the planet disappears and reappears. You have discovered the blind spot in each eye. Why don't we have a blind spot(s) in our vision when we use both eyes?

Core Sample

Build a 3-D model of the planets to depict the interiors of each. Punch a hole in a paper plate and spin it on a phonographic record player at 77 rpm. With different colored markers, draw the layers of the planet to correspond in scale to the planet's interior. For example, for a simplified Earth draw to scale a core, a mantle, and a crust. Repeat this on both sides of three plates. (On some turntables, an upside down plate will override the rotating section. To get a plate to spin upside down, first place a spare plate right-side-up on the player, then place the upside down plate on that.)

Cut and combine the plates so the three of them intersect perpendicular to each other on an X-, a Y-, and a Z-axis. To do this, cut a slit halfway across two plates and intertwine them. Cut a third plate in half. On each half cut a slit from the cut edge (what was formerly the center of the plate) halfway outward. Cut partial slits on the combined plates to accommodate the two halves. Hang and shebang.

As The World Turns

On a 6-inch circle of paper, draw and color two pictures. Color a day scene on half of the circle and a night scene on the other half. Cut a window out of a paper plate (retaining a central tab) and affix the circle to the back side of the plate with a paper fastener. Rotate the plate to show day and night segueing into each other.

Sub-Solar Cup

Throughout the year, this simple device will indicate where the Sun is currently overhead. Drill a small hole out of the bottom of a dark plastic cup. On the top of the cup secure two pieces of thread to make a set of cross hairs. Cut out a viewing window on the side of the cup.

Secure the globe on its side so that a figure standing at the observer's location is upright on the globe and the figure's line of longitude is aligned with the north-south meridian. That is, a tangent at the observer's location is parallel to the ground. Position the cup upside down on the globe so that sunlight goes through the small hole and is centered over the cross hairs. That location is the current sub-solar point.

View the location of the Sun at local noon throughout the year to track the Sun's annual migration between the tropics.

Alien Platecraft

Place a paper plate with a small hole cut out of its center onto a phonographic record player (remember them?). With the plate spinning at 77 rpm, have the student hold a marker on the plate and move it across the surface. Repeat with colored markers on both sides of the plate.

Fold the edge of the plate under, and give it a very stiff crease so it holds the shape of a Frisbee®. You will be surprised to see how far your alien platecraft will fly compared to an unadulterated paper plate. Heavy stock plates work best.

Observing Plates

Before you go out at night for a public observing session, compile background information on scheduled viewing targets. Draw or paste items of interest, such as positions of Jupiter's moons, constellation outlines, or lunar features, on individual plates. Punch a hole in the top of each plate and secure them together with a string. Save plates through the year and build an observing collection. For items that you wish to mark repeatedly, cover the data plate with a clear plate and mark on it.

Orbit by Elongation

Determine the orbits of the inferior planets using the values of their greatest elongations. On the perimeter of a plate, which defines the orbit of Earth, label the months of the year. At the center mark the Sun. Make a card, as shown on the poster, that indicates the position of the planet relative to the Earth and Sun. Given the greatest elongation values for the inferior planets for a few years, mark the positions of the respective planets as seen from the Earth on the given dates.

Impact Game

On a large plate or pizza tray, draw the orbits of the planets around the Sun. Fasten cups of appropriate sizes on the orbits to represent the planets. On a piece of string secure a bead to represent space debris. Repeatedly flip the bead onto the solar system plate or tray and note which planets receive the most "impacts." Assign point values or create game legend.

Ricehenge

Make Rice Krispies Treats® and arrange them on a plate akin to Stonehenge. Eat and enjoy.

Ptolemaic Polemic

Attach a medium-sized circle on the bottom of a plate with a paper fastener, which serves as the Earth. On the edge of this circle, which serves as a deferent, attach a second smaller circle. On the edge of the second circle, which serves as an epicycle, mark a planet. Label the parts accordingly. Draw lines of sight from Earth outward through the planet as it revolves on its deferent and epicycle, respectively, to the edge of the plate. With practice you will be able to demonstrate Ptolemy's argument to explain retrograde motion.

Slide Tray Index

Cut from the center of a paper plate a circle just slightly larger than the slide tray locking ring. Label the individual slides, program name, or available free space on the crinkled edge of the plate. Cover the slide tray with the new index and secure with locking ring before storing the tray.

I thank the following people whose contributed material was displayed on the poster:

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To see additional detailed paper plate write-ups, refer to the following issues of the *GLPA Conference Proceedings:*

1992, St. Louis, MO, pp.
1993, Dayton, OH, pp. 34-38 and pg. 51
1994, Wheeling, WV, pp. 31-33
1995, Grand Rapids, MI, pp. 44-46
1996, Minneapolis, MN, pp. 47-50
1997, Cleveland, OH, pg. 155
1998, Nashville, IN, pp. 110-112