Exploring Unknown Worlds

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Materials:

1 8-inch or larger Styrofoam or polystyrene ball
String to hang the ball from the ceiling, door, etc.
Materials to "decorate" the ball to emulate a planet/moon
Toilet paper tubes (enough to have one for each participant)
Clear plastic sandwich bags or plastic wrap
Rubber bands (1 for each toilet paper tube)
Flashlight
Cell phones with cameras or small digital cameras

Procedure:

Before the activity, make a planet-like model. Use color and add some landforms with Play-Doh or modeling clay and make "craters" and valleys. If you use polystyrene, you may need to use glue to hold the clay to the ball.

Suspend the ball so that it is at about eye level (for your participants). The ball should be as far as possible from where the participants will initially stand and there should be room to be able to walk around it.

Girl Scout adult leaders observing the unknown world from the Earth. The sandwhich bags represent the Earth's atmosphere.

Girl Scout adult leaders flying by an unknown world.

Cover one end of the toilet paper tubes with sandwich bags or plastic wrap, holding the covering on the tubes with the rubber bands.

With the room dark, remove the cover from the ball and shine the flashlight on the ball, spinning it slowly.

Have the participants use the toilet paper tube "telescopes" to observe the object. Have them discuss their observations and interpretations, including the significance of the bag/wrap (the atmosphere).

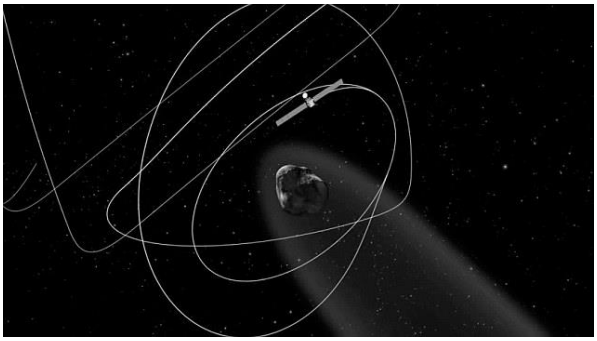
Have the participants observe the object without the plastic bag/wrap. Have them discuss their observations and interpretations and the significance of removing the plastic bag/wrap (a telescope in space).

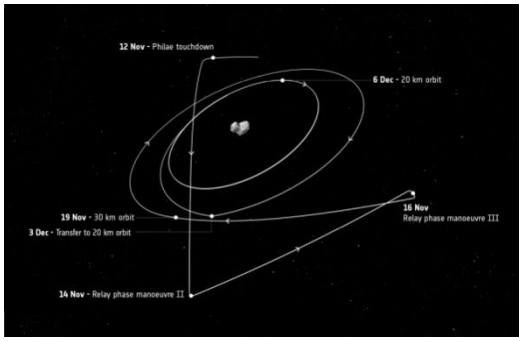
Ask the participants to discuss the next step for observing a newly discovered object. They should come up with the idea of flying by the object, a fly-by mission. Have several of the participants fly by the ball without stopping. Make sure to shine the light on the object and keep it rotating (they may not be able to see all sides of the object as they fly by). Have the participants use the toilet paper telescopes. Also, if they have cell phones, have one or two students take pictures of the object. When they return to Earth (fly-bys do not return to Earth they just send back their pictures), have them discuss what they saw, show their pictures, and what may have limited what they saw (not enough time to see the whole object in sunlight and, when using a telescope, may be difficult to see all of the object in focus).

Discuss the next step: flying in tandem (low-gravity objects) or an orbital mission. Have several (different) participants repeat the previous step, but this time they can "orbit" the new object.

Note: For small objects, the gravity is very low and a spacecraft has to be fairly close before it can orbit the object. For several recent missions, the spacecraft, as it approaches the object, will slow down and match the speed of the object without actually orbiting the object. It will fly in tandem with the object. Here is an example of the path of the Rosetta spacecraft around Comet 67P/Churyumov-Gerasimenk. Here is a recent animation of Rosetta's path.

http://www.esa.int/spaceinvideos/Videos/2016/08/Rosetta_s_journey_around_the_comet





Now, have the participants who made the previous two missions discuss where they would like to land on the object. Things to consider should be based on scientific interest and also safety issues (do not land on the top of a mountain, especially if it looks like an active volcano, for example).

Send one or two participants to land on the object. They may be stuck in one spot or be able to "rove" around a short distance. Discuss what was seen and the limitations of having to land and study one location.

Finally, send out a sample return mission. Discuss the limitations of such a mission (only a very small sample can be picked up and returned since you have to land and be able to get off the object again, as it does have gravity!).

Closure:
Discuss the advantages and disadvantages of each type of observation and mission. Discuss, in particular, the value of taking pictures of what was observe.