

Workshop: Comet Activities

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Abstract:

Two workshops at the 2013 Annual Conference of the Great Lakes Planetarium Association (GLPA) in Peoria, IL, featured comet-related activities for educators. The presentations paralleled the author's recent experiences at all-school assemblies in South Bend, IN, which is having a Comet Festival to celebrate the uncertain outcome of Comet ISON. The GLPA workshops concluded with each participant making a dry ice comet (<http://www.nightwise.org/blog/make-comet/>). This paper offers a sample outline for public or school or group demonstrations, with links and resources within www.cometfestival.com. **[Image: Goins-venting.jpg]**

Text:

With the approach of Comet ISON and its Thanksgiving Day encounter with the sun, the South Bend, IN, community is hosting a Comet Festival (www.cometfestival.com) to celebrate ISON's uncertain outcome. Each of 29 primary and secondary education centers in the South Bend Community School Corporation (SBCSC) conducted an all-school assembly about comets, with all students scheduled to create comet-themed art for a community art exhibition (<http://cometfestival.com/index.php/events/comets-schools/>). Two workshops at the 2013 Annual Conference of the Great Lakes Planetarium Association (GLPA) (<http://www.glpaweb.org>) in Peoria, IL, featured comet-related activities for educators based on that experience.

Workshop participants received a NASA printout of Comet ISON's orbit (http://svs.gsfc.nasa.gov/vis/a010000/a011200/a011222/Paper_Model_of_Comet_ISONs_Orbit.pdf), which can be made into a 3D model. When the model is built, note the proximity of ISON and earth on December 26. That may be closest point of approach, but very distant nonetheless--if there even is a comet remaining. This activity takes focus to cut the hard stock paper and to cut slits and apply tape, so it has been used only at more relaxed public outreach venues.

The second activity is to make a simple comet model (<http://cometfestival.com/index.php/events/simple-comet-model/>) by sticking pipe cleaners into foam balls. I have found the kids' versions are vastly more imaginative than my own sample. The rest of the GLPA workshop paralleled the school presentations, leading up to the making of a dry ice comet. **[Image: comet-SVdP-pair.jpeg]**

After introducing the students' role in the Comet Festival, first clarify what a comet is. Announce in advance and then ask three questions: Is a comet a ball of ice? A ball of fire? Or (and you can change your mind for this third question) do you not know? For the latter group, I always let them know that I respect their having the courage to say they don't know, for there is much scientists don't know about comets.

After the 3-question survey, summon a teacher to offer a clue. At the center of the room is a backlit yellow ball to represent the sun. In the case of Comet ISON, the teacher carries a frozen turkey sunward, stopping as the bird rounds the yellow ball. Kids, what happens when the frozen material approaches the hot sun? **[Image: turkey-helion.JPG]**

Comets are described classically as large "dirty snowballs" with some revision to "icy dirtballs" to emphasize their darkness. Comet ISON may be a few kilometers in diameter, which is a typical size. As the ice melts, in space it sublimates. Dust and crud is swept up and expelled in the outgassing, resulting in the shroud of debris (coma) around the nucleus.

Dialogue with the audience describes Comet ISON's schedule, and the turkey continues outbound and goes over the head of a student who represents earth on December 26, 2013. The messages are that comets are cold, come from the depths of the solar system, and that ISON rounds the sun on Thanksgiving 2013. It then nearly goes over the earth on the day after Christmas, December 26, 2013.

On a table is a Fargo model fan from Fanimation of Noblesville, IN. The spherical fan represents the sun with its outflowing "solar wind." Be aware that the fan draws in air from above and below, and anyone with long hair is at risk of having it rapidly drawn in if they approach too close. Attached to the round fan cage on a stiff wire is a styrofoam ball with tinsel-like strands streaming downwind. The foam ball is akin to the comet coma, with the comet debris "blown downwind," resulting in the tail. **[Image: fargo-horiz07462.JPG]**

With the tail fluttering outward from the fan, it's a good time to show why we have meteor showers. Have an orbiting ball repeatedly plow through the debris tail at a specified date and ask the participants what result they might observe.

I also use another model of a comet, this time with a foam ball and pipe cleaners wrapped in sparkly string that extend outward as the tail. The comet nears the sun, but as it rounds the fan be certain to keep the tail pointing away from the sphere. When it's outbound, of course, the comet appears to travel tail first. "What do you notice?"

After the demonstration of Comet ISON rounding the sun, for expediency we settle into a rapid series of projected slides. The images are available online for educational purposes at <http://www.slideshare.net/chuckbueter/comet-ison-and-the>, though you won't necessarily use all of them all the time. For astronomy educators, the slides are self explanatory. We ask the kids to note details, like the blue ion tail in some comets, aimed downstream of the sun's solar wind. Then their art can reflect aspects of what

we observe. Notice, for example, the turkey's blue left wing sticking outward while the tail trail curves somewhat. Illustration by Dacota Schrader. **[Image: dacota-turkey]**

With the house lights back up, it's time to build a comet. With all-school assemblies, time is certainly limited, so I usually have a pre-selected teacher assist me rather than some students. Ask the principal to choose someone who will indulge you with lots of theatrics while helping to make the comet. This is where the kids lean forward most attentively.

Making a dry ice comet is a classic demonstration first promoted by Dennis Schatz of the Pacific Science Center. Links to recipes and chef tips are at <http://www.nightwise.org/blog/make-comet/>. Basically, you mix dirt, sand, ammonia, some dark organic material, and water, then rapidly freeze with dry ice.

Depending on the audience, I stop to include a controversial notion. Some scientists suggest that comets may have "seeded the earth with the building blocks of life." That line always needs repeating and explanation. Using a simple comet model, I ask the audience what one would notice on the front edge of the comet after it travels for centuries in space--akin to what you'd see on the front of the car windshield after a road trip. In fact, I show a foam model that I had affixed to my car antenna, with the leading edge colored by dirt and bugs. The idea is that comets accreted atoms and molecules, and upon collision with earth the resultant energy could contribute to the making of amino acids, or the so-called building blocks of life.

We need to add some representation of life to our dry ice comet... "So spit in the bag." That action often elicits a collective, "Eeeewwwwww."

It's now showtime. With a flourish, dump in the dry ice and have the guest stir the mixture while you cite Macbeth. "Pull the spoon out when you hear 'snake.'"

*Double, double toil and trouble;
Fire burn, and caldron bubble.
Fillet of a fenny snake,
In the caldron boil and bake;
Eye of newt, and toe of frog,
Wool of bat, and tongue of dog...*

When you pull the spoon and squeeze the budding iceball, a key consideration is not to keep kneading the ice. Allow the gas to vent, though you can first build up a little vapor inside the bag so it plumes dramatically when released. Tighten the throat of the plastic bag (releasing gas buildup) so the bottom of the bag tightens around the iceball and gives it shape. You gotta work the bag, not the ice. If you knead the iceball continuously, you may get a crumbly result. If your comet is too dry and is falling apart, go ahead and quickly splash some extra water into the bag. You can't have too much water, for any excess water can simply remain in the bag.

Once you've got the iceball firming up, call the participant closer to help squeeze the bottom of the iceball. It's a good time to ask how comets are named, as you are allowing the iceball to solidify during the Q&A. When it's time to reveal the comet, ask the person his/her name for emphasis, and have them pull out the comet. "Ladies and gentlemen, Comet [name]!" **[Image: 2comets.JPG] or [Image: comet-pride]**

Remember, no dry ice comet is a failure. If the ice gets stuck in the seams of the bag and the comet rips apart when you pull it out, no worries. Seize the opportunity to say real comets sometimes behave like that, such as Shoemaker-Levy 9, which crashed into Jupiter like a train wreck.

I also like to cleave off a chunk of the completed comet to reveal fresh white ice underneath. In real comets such exposure may result in new outgassing or tail growth, and it looks very much like the closeup images from spacecraft of Comet Hartley 2 and Halley's Comet that show active jets.

At the end of the dry ice demonstration I suggest that, with Comet ISON and its uncertain outcome, we hope to learn about comets, the sun, and ourselves. On the latter point, the notion is that we celebrate what we value, like sports, or religion or freedoms. We celebrate sports because we value sports. The thousands of students creating original comet artwork for the Comet Festival are leading the way in showing we value science in South Bend. **[Image: assembly.JPG]**

I recommend you make a dry ice comet at least once in private before doing it before a large audience. Then with confidence you'll be able to add flair and engage your audience genuinely. You can watch a brief demo of making a dry ice comet on *Experience Michiana* by WNIT Public Television at <http://youtu.be/syStSJa4lag>.

For all the conference attendees out there, this GLPA workshop answers the question of what to do with all those conference bags you've accumulated over the years. Answer: They make a great bag in which to bust up the dry ice with a mallet.

Thanks go to all of the people who have supported comet outreach in South Bend and at the GLPA conference in GLPA. Regardless of Comet ISON's visibility, we have much to learn about these interlopers from the depths of the solar system.

Links related to comet activities, Comet ISON, and the Comet Festival.

Make a Dry Ice Comet
<http://www.nightwise.org/blog/make-comet/>

Slideshare: Comet ISON and the Comet Festival
<http://www.slideshare.net/chuckbueter/comet-ison-and-the>

Prezi: Comet Festival Intro v.1

<http://prezi.com/n-saadzqkuhm/comet-festival-intro-v1/>

Activity: Simple Comet Model

<http://cometfestival.com/index.php/events/simple-comet-model/>

Activity: Paper Model of Comet ISON's Orbit

<http://svs.gsfc.nasa.gov/vis/a010000/a011200/a011222/>

[Paper Model of Comet ISONs Orbit.pdf](#)

Fargo desktop fan from Fanimation

<http://cometfestival.com/index.php/supporters/meet-fanimation/>

Video: Comets Bitin' the Dust

<https://vimeo.com/59828520>

What Sungrazing Comets Reveal

<http://cometfestival.com/index.php/comets/learning-sungra/>

Comet Festival

<http://cometfestival.com>

2013 Comet Festival on Facebook

<https://www.facebook.com/pages/2013-Comet-Festival/281597451975282>