

## HOW TO ENSURE THAT YOUR PAPER WILL LOOK GREAT

GLPA recognizes that a great deal of time goes into the preparation of each invited and contributed paper that appears in the *Conference Proceedings*.

Accordingly, the *Proceedings* Editor and support staff want to do all they can to ensure that all papers show the author's work as well as possible.

Whenever an author believes that some aspect of their paper should depart from the standard two-column format shown on pages ii and iii, they are asked to provide written instructions describing their request(s) to the *Proceedings* Editor. Those same authors are also encouraged to provide PDFs or screen shots for their requested page layout to more accurately clarify their requests.

The Editor will consider all such requests, but final layout decisions will be made by the Editor.

On the following pages, we have illustrated the different types of page layouts that are used in each issue of the *Conference Proceedings*. Please review these examples to better acquaint you with what is typical to the *Proceedings*, as well as what can be done for circumstances that may suggest an alternative layout.

### **Proceedings Editor**

Dr. Dale W. Smith

Dept. of Physics and Astronomy  
Bowling Green State University  
Bowling Green, Ohio 43403

phone: +1 419 372 8666

fax: +1 419 372 9938

e-mail: [dwsmith@bgsu.edu](mailto:dwsmith@bgsu.edu)

GLPA's *Conference Proceedings* is generally formatted into two-column pages. Here is a typical first page of a contributed paper, which includes the Title of Paper, Author (with contact info), and Abstract. Photos (or diagrams) are sized to the column width.

## BIG HORN MEDICINE WHEEL: A PHOTOGRAPHIC TOUR OF ASTRONOMICAL ALIGNMENTS

Dale W. Smith  
BGSU Planetarium  
Department of Physics & Astronomy  
Bowling Green State University  
Bowling Green, Ohio 43403  
[dale@notmyrealaddress.com](mailto:dale@notmyrealaddress.com)

**Abstract:** The Big Horn Medicine Wheel in Wyoming is a Native American stone circle with several stone cairns around its perimeter. Lines of sight among these cairns encode probable astronomical alignments. This poster features explanations of these alignments and photographs taken during a July 2017 visit to the site.



### Introduction

The Big Horn Medicine Wheel is a well-known stone circle in Wyoming with probable astronomical alignments among cairns around its perimeter. It is located in the Bighorn Mountains between the cities of Sheridan and Cody. Access is via a spur road off Alt US 14. The spur road ends at a car park with interpretive signs and staffed in the summer as a National Historic Landmark.

Then you walk the last mile and a half to the Wheel itself. When I visited in July 2017, the guide explained to me that the walk is uphill both ways. Indeed it is! The walk is downhill, then uphill both ways. My walk from car park to site, cloudy both ways, helped me appreciate the effort of constructing the Wheel. Though the walk in and out was cloudy, during the hour I spent at the site, the Wheel was bathed in bright sunlight and completely free of other visitors!

I had had the impression from panoramas in planetarium shows that the Wheel was on a high plain, but it is in fact on a ridge-top, as is evident in the figure below. At 9600 feet elevation, the ridge top was at a comfortable 70°F while the cities below sweltered at nearly 100°F. Though snow-free in the summer, the site is buried in snow most of the year and the access road usually does not open until mid-June.

- at 9600 feet on ridge top in Wyoming
- at least 250 years old
- sacred site to Native Americans
- one of ~100 such wheels in US & Canada
- snow-free only in July & August



The site's age and origin are unknown, but it is at least 250 years old and was possibly built by Plains Indians 300-800 years ago. Today it is sacred to Native Americans, especially the Crow, and Native American groups visiting the site for ceremonies have priority over other non-Native visitors. There are dozens to hundreds of other such stone circles in the plains of the northern US and southern Canada.

### The Medicine Wheel

The Medicine Wheel, so called because of its sacred meaning to Native Americans, is a rough 25-meter-diameter stone circle. The ridge it rests on slopes gently to the east, so one has a view of the ridges and mountains to the east, but not to the west. This slope is evident in the lower south-facing photo in the figure below.

The stone circle is enclosed by a modern fence that protects it from visitors. Only Native Americans are allowed inside the enclosure. Access to the path around the enclosure is from the north and you are asked to walk clockwise around the path.

Tables and text boxes can be made to span both columns, as illustrated here:

## CONSTRUCTION OF A UNIQUE TABLE TOP MODEL OF THE EARTH, SUN, & MOON

**Gary Tomlinson**  
 5075 Division Ave N  
 Comstock Park, Michigan 49321  
[gary@notmyrealaddress.com](mailto:gary@notmyrealaddress.com)

**Abstract:** This workshop details the construction and use of an inexpensive classroom lab station where students can actually investigate seasons, day & night, moon phases, eclipse and the reasons for each. In addition it allows students to measure the time and direction of sunrise/set at different latitudes as well as the altitude of the mid-day Sun.

**N.B.** This workshop will NOT result in a finished project (too big to easily transport) but will provide all hard to find & custom made items as well as provide detailed construction details and educational use instructions.  
 i.e. it will take approximately an additional \$32.00 to complete this project

**Participants will be furnished custom made materials.  
 The finished Table Top Model is not commercially available.**

Participants will receive the hard to find (almost impossible even) materials necessary to construct a table top model of the Earth, Sun and Moon that was described in an article appearing in the *Planetarian* Sept 2003, Vol 32. # 3 pp. 11-17.

- This model can be used in the classroom to:
- Explain the two reasons for seasons
- Why the seasons are reversed from Northern to Southern Hemisphere
- Tell time of sunrise/set at different latitudes
- Explain eclipses & eclipse seasons
- Explain day and night
- Illustrate the varying lengths of daylight at different latitudes/seasons

- Measure the altitude of the midday Sun at different seasons
- Illustrate "land of the midnight Sun"
- Explain the reason the North Star doesn't change with the Earth's rotation or as the Earth revolves around the Sun
- Explain why different stars are visible during different seasons
- Moon phases
- Address the misconception that the Earth changes its direction of "tilt" as it revolves around the sun

The complete construction of the table top model will be demonstrated as well as complete written instructions will be distributed. Plus other season demonstrations will be illustrated.

Materials NOT furnished:

<i>Item NOT furnished</i>	<i>Estimated Cost</i>	<i>Source</i>
4 three inch Styrofoam spheres	\$5.99/6	Craft store
1 four inch Styrofoam sphere	\$3.99	Craft store
1 3 by 4 foot science fair cardboard	\$5.50	Office or craft store
8 two inch Styrofoam spheres	\$5.99/12	Craft store
File folder	Free	Office supply store
Black latex spray paint (that can be used on Styrofoam without melting it!) such as Design Master Colorool #725	\$8.99	Craft store

For large diagrams or original handouts, full page formatting can be preserved:

## II. Inner Planets: Mercury and Venus

### 1) Period

Look at Figure 1, which shows the orbits of Mercury (M) and the Earth (E) around the Sun (S). At time 1, all three objects form a straight line with Mercury between the Earth and Sun. This arrangement is called inferior conjunction. Seen from the Earth, Mercury would appear directly in line with the Sun.

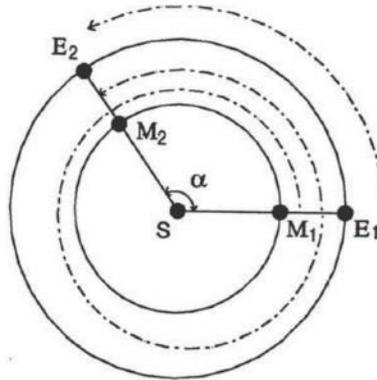


Figure 1. Inferior conjunctions of Mercury

But Mercury moves faster in its orbit than the Earth does, so it soon pulls ahead of the Earth, and eventually gains a full lap on the Earth. In fact, after the Earth has gone only about a third of the way around its orbit, Mercury has gone a full orbit plus another third and is once again lined up with the Earth and Sun in inferior conjunction. Seen from the Earth, it would again appear directly in line with the Sun, as at time 2. In the planetarium, we can observe the dates Mercury is at inferior conjunction.

By measuring the time interval between successive inferior conjunctions, we can calculate the period of Mercury as follows. Since the Earth moves about  $1^\circ$  per day in its orbit ( $360^\circ$  in 365 days), the number of days between conjunctions equals the number of degrees the Earth has moved in that time, or the angle  $\alpha$  in figure 1. Because Mercury has covered a full orbit and more, it has moved through an angle of  $360^\circ + \alpha$  in the same time. Since we now know the angle Mercury has moved through and the time it took, we can calculate Mercury's rate of motion in degrees per day. Then we can easily compute the time Mercury needs to go exactly once around its orbit (i.e., to go  $360^\circ$ ) by dividing  $360^\circ$  by the rate of motion. The result is the period, P.

In the planetarium, we will determine the periods of Mercury and Venus by measuring the dates of successive inferior conjunctions for each.

