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As I write this, you are still awaiting the delivery of the Winter, 1976 and the Spring, 1977 issues. By the time you read this, we will be very close to being back on schedule again. We can keep it this way with a little bit of luck and a whole lot of help.

With a "little bit of luck" maybe the postal service will stop losing the material we entrust to them for safe delivery. Can you top this? I sent a package, containing the material for the Spring issue, to Ron Hartman. It went certified mail, return receipt requested. The following day a mail clerk in Fairfax tore the receipt from the parcel, signed it, and mailed it to me. The next day both the receipt and the parcel were returned to me. Ron finally received the third mailing of the materials. We do need "a little bit of luck".

In order to get the journal into your hands prior to, or at least closer to, the date of issue, we are going to begin working with a new publication schedule. Once caught up, material for the March issue must be in my hands prior to Jan. 1; for the June issue, April 1; for the September issue, July 1 and for the Dec. issue, October 1. The schedule will allow me to get the material to Ron Hartman with sufficient time for him to get the journal typed, pasted up, to the printers, enveloped, tied for bulk mailing, and into the mail with (hopefully) sufficient time to allow for delivery to you by the cover date (solstices and equinoxes).

We also need "a whole lot of help" from you. As I stated in the previous issue, I am running out of articles to print. I do not have enough material to put another issue together, although we are close to the amount of material needed for the Autumn issue. If I do not get material during the next six weeks we will again be without a journal. If I do, and the trend continues, we can be back on schedule with the March, 1978 issue IN YOUR HANDS by March 21, (according to Ron), assuming a two week delivery time. I need both short and long articles; the serious, scholarly reports and the informal, lighthearted dissertations. PLEASE WRITE. Ron and I cannot do everything! YOU MUST HELP!

Please note the return of Jane's Corner. The crisis is not yet over. She still needs your help. We also feature a return of the P.O.P. series; this one and the one that will appear in the September issue were written by Sheldon Schafer. Wait until the next issue. This space will contain only good news!

Bill Fagan

A NOTE REGARDING DELIVERY SERVICE

As we go to press a continuing problem reaffirms itself. I.S.P.E. President, Don Hall has just again informed me he is getting his mailings of this journal and the newsletter 4 - 8 weeks late. The last Newsletter, mailed at Walnut, California on September 2 reached him on the 28th. A number of members complain of late delivery (or no delivery). New members should be aware that we are 'catching up' after a two year publication delay (due to financial problems, which now are solved). Old members are finding journals arriving at a more frequent rate than four a year, and we are closing the gap rapidly (see above). We continue to have the delivery problem. The U.S. Postal Service should deliver all bulk mail within two weeks - so I am told. This however, is not the case.

TO KEEP YOU INFORMED, henceforth, a date will be stamped in the lower left corner of each envelope. YOU ARE GUARANTEED THAT YOUR COPY WAS MAILED AT THE ORIGINATING POSTOFFICE ON OR BEFORE THE DATE SO INDICATED. Lets see how long it takes! We shall also be making a survey of delivery times across the continent. Random samplings will be made. If your name is selected, your cooperation will be appreciated. Results will be published.

Ronald N. Hartman/ Circulation
Mark your calendars and begin preparations to attend the next biannual meeting of ISPE in the Washington, D. C. area. The dates are August 6-10, 1978. Meeting headquarters will be Loews L'Enfant Plaza Hotel located within easy walking distance of Washington's principal tourist attractions.

The Smithsonian Institution's National Air and Space Museum, which will host the meeting, is located nearby. Also in the vicinity are other Smithsonian Museums: the Museum of History and Technology; the National Museum of Natural History; the National Gallery of Art; the Hirshhorn Museum and Sculpture Garden; the Freer Gallery; the National Fine Arts and Portrait Galleries; the Renwick Gallery. And that's not all! One can easily reach the Kennedy Center for the Performing Arts, the U. S. Capitol Building, the Washington Monument and the Lincoln and Jefferson Memorials. These and other places of interest provide a unique background for the meeting.

The meeting agenda will be arranged to provide time to visit interesting places of your choice and you will be encouraged to visit selected ones at specific times. The National Air and Space Museum will be of special interest and in particular, you will want to visit the Museum's Albert Einstein Spacearium. You may wish to plan to extend your travel schedule to allow additional time to play tourist.

The agenda for the meeting has not yet been finalized. It is clear, however, that the Executive Committee will meet on Sunday, August 6 and that the group will travel to Baltimore on Wednesday, August 9. The Davis Planetarium will plan and host the day in Baltimore. There will be the usual paper and business sessions and several special lectures. You can also look forward to an evening at the U. S. Naval Observatory.

If you are driving, your travel plans might include stops at places like the Goddard Space Flight Center, the National Radio Astronomy Observatory, Wallops Island, and the many planetariums along your route. You might also plan to visit NASA's Audio Visual office to see samples of available space photos.

Watch for additional details about the meeting during the coming months. Plan now to attend.
ARCHAEOASTRONOMY IN THE UNITED STATES

Judith A. Jackson and Laura Somerville

Archaeoastronomy is a little noticed field of study encompassing astronomy and archaeology. In 1967 the term "Megalithic astronomy" was coined (Thom 1967) for the study of the evidence for man's skills in astronomy, engineering and mathematics. Shortly afterwards, Gerald Hawkins, a pioneer in archaeoastronomy, labeled the juncture of astronomy to archaeology (for the purpose of studying and explaining the functions of specific prehistoric structures) as "astroarchaeology". More recently the term archaeoastronomy has become the most widely used.

Archaeoastronomy attempts to recover information with time-and-space aspects/inferences. It focuses on analysing the placements and measurements of monumental ancient structures which might have been used to determine the times of solar and lunar eclipses and the changing seasons. Seasons would have been recognized by the occurrence of the solstices and equinoxes. The determination of these events enabled the people to set dates for annual agricultural and ritual cycles.

It is hoped that with analyzed and refined facts archaeoastronomy will provide a new, useful foundation for explaining certain problems of prehistory. A method of producing, ordering and expressing data regarding the socio-economic systems of specific cultures is also hoped for through these investigations.

Archaeoastronomy is not a particularly new field, however, until recently most worldwide attention has been given to Great Britain's Stonehenge and the Aztec and Mayan astronomical practices. Only after World War II did archaeologists recognize the astronomical abilities of the North American Indians. It is assumed that to Paleolithic hunters these structures had a cultural-economic significance and were employed by Neolithic and later peoples as guides to successful cultivation and the length of the growing season. When walking through the ruins of Indian villages with a compass it is possible to see relationships between particular features of walls and the surrounding landscape or sky. Various structures and edifices are also laid out by careful astronomical observations. Rock art, depicting features of the sky and the alignment of living dwellings are remaining physical proof of the importance of astronomical observation to the American Indian. Studies reveal that many single family dwellings as well as small cities were laid out according to observations of the rising or setting of the summer and winter solstice sun. Many kivas as well may have been aligned astronomically. It is believed that a majority of these underground ceremonial rooms were arranged according to the observations of rising or setting stars significant to the particular group building them. It has been determined that the Indians of North America aligned these walls or buildings by using three sticks and sighting over them to a rising or setting star. This same method was used to align cultural features to the solstice points.
Recently, many more astronomically oriented structures have been located in North America than was previously thought to exist. For example, there is growing evidence that the Indians who occupied Chaco Canyon, New Mexico from A.D. 700-1200 had a sophisticated understanding of elementary astronomy. In August 1972 the directional alignments of the three large kivas was taken. It was discovered that walls of two of these, known as Pueblo Bonita A and Casa Rinconada, were aligned in a North-South direction. Archaeologists believe that the Indians used either solar or stellar observations to arrive at these accurate alignments. These alignments are true to our North Star, Polaris, but at the time the Kivas were built a different object would have been to the true north.

A survey of the mesa tops North and East of the two kivas revealed perpendicular directional markings cut into the rock. These markings are directed to point to the position on the horizon where the sun would rise on the day of the winter solstice. These have been interpreted as being carved as solstice markers and the mesa to the East of the site may have been used as an observatory of the sun.

At Cahokia also, astronomical implications are obvious. Witory excavated four henge-type structures which are part of a huge ceremonial complex dated at approximately A.D. 1000. Wooden posts seem to have been spaced evenly to form circles ranging in diameter from 240 to 480 feet. When these "woodhenges" were discovered at Cahokia, they "were the only known indications north of Mexico of structures which could have served as sun circles defining the tropical year". With careful study it is clear that the circles are formed of "elongated house patterns placed around a patio within the ditched zone; the houses appear to have served as sighting lines of the sunrise points of the solstices. Recent studies indicate that similar henge structures located in central Kansas may have had the same ceremonial use".²

Also at Cahokia, on top of Monks Mound (the name given to one of the larger flat topped pyramids located there) four more circles of post holes have been recently discovered. One circle has been surveyed and does give indication of astronomical alignment. "The circle contained 48 equally spaced posts with an 'observer's' pole set five feet off center toward the East. By squatting on the top of the pole, the observer would see the sun over the east post on the first day of spring and fall... At midsummer, it would rise over the fourth post to the North, at midwinter, the fourth post to the South".³

Archaeoastronomy has helped to shed light on certain ties or communications between North American cultures and others. In a few North American sites, ground figures (i.e. effigy mounds and the serpent-and-egg motif) exist which have been associated with the occurrences of eclipses in several Asian cultures.

There have also been noted "architectural parallels between Mexico and Southwest (America). At the time level of 1000 B.C., both Poverty Point, Louisiana is, like La Venta, Tabasco oriented in a line 8 degrees West of polar North".⁴ This may be entirely coincidental but many believe that it indicates some sort of tie stretching the 1500 miles separating the builders of the two sites.

Reyman has made various feature analyses of sites both in the Southwest and in Mexico. Bases on his studies, Reyman has drawn the hypothesis that "consistent astronomical features within the structures reflect similar ceremonial contexts"⁵, indicating some form of contact between the areas.
Some forms of astronomical associations are hard to determine positively. An example of this is the significance (or lack of it) to the alignment of burials. In Pennsylvania, examples have been found where the body is oriented looking towards the position of the sun on the eastern horizon at dawn.

Also Precolombian towers in the Southwest have been investigated. Frequent sightings of astronomical phenomena among historic and modern pueblos coincide with the alignments of these surrounding prehistoric structures. Much difficulty has also been encountered while trying to evaluate astronomical observations of nomadic Indian groups, but some evidence does exist which is indicative of their fascination with the sky and stellar phenomena. Evidence, both archaeological and ethnographic, exists telling of a highly developed star cult among the Pawnee Indians. Their villages were grouped to represent the principle deities of certain stars. Each village had a shrine associated with its appropriate star and deity. The earth lodges of the Pawnee were also constructed in a manner of orientation which reflected the associations between earth and sky objects.

The council circles of the Wichita Nation are aligned with each other along summer and winter solstice sun risings and settings. But perhaps the best known of astronomically aligned structures in North America is the Big Horn Medicine Wheel located just north of the timberline in the Big Horn Mountains of Wyoming.

The Big Horn Medicine Wheel is a pattern of stones laid out at an altitude of 9,640 feet in North Wyoming on a shoulder of Medicine Mountain. It is essentially in the pattern resembling the form of a bicycle wheel. The pattern is an imperfect circle about 25 meters in diameter. In the center is a pile of stones, or carin, approximately four meters in diameter. Radiating from this center are 28 unevenly spaced "spokes" or lines of stones which connect the center carin with an outer circle. Six smaller circular carins are situated around the rim.

The actual use of the Big Horn Medicine Wheel is unknown since after contact with the white man the use and folklore of the Wheel were dropped. Many suppositions have been developed to explain the use of the Medicine Wheel.

Due to its similarity to an Indian Medicine Lodge it has been hypothesized that it was a 2-dimensional lodge, used for the Sun Dance and built of stone in an area where wood was not readily available. This theory has been almost completely ignored however, since the area shows no signs of being inhabited for other than short periods of time.

In 1972-1973, John Eddy, head of the National Center for Atmospheric Research in Boulder, did an intensive study of the structure. His findings greatly supported the belief that the Big Horn Medicine Wheel was an astronomical observatory which was used as a calendar. It is believed that its primary purpose was to predict the summer solstice—the longest day of the year. This marked the point, according to Indian legend, "when the sun is then highest and the growing power of the world is
Solstice
Sunset

Aldebaran
Rises

Solstice
Sunrise

Rigel
Rises

Sirius
Rises

BIG HORN MEDICINE WHEEL
It may have then been time for certain Plains tribes to begin their sacred Sun Dance ceremony.

Eddy's survey illustrated that the center carin and one on the rim lined up exactly with the rising sun on 'Midsummer Day', while another of the small carins was in a line with the central carin and the setting sun of the same day. He concluded that they appear to have been "built for the specific purpose of marking the summer solstice". He speculates that the other carins lined up with certain bright stars in the sky. Aldebaran could have signaled the arrival of the solstice a day or two in advance. Rigel appeared one month later and Sirius one month after Rigel, marking the end of the summer season and of the snow that would follow. It is assumed that the 28 spokes represented the lunar month.

Since the area shows no signs of being inhabited for any long period of time and the area is subjected to extremely cold, snowy weather during the winter months, it is assumed that nomadic people used the Big Horn Medicine Wheel. This has caused people to question why a nomadic people would use such a structure. The people were undoubtedly only seasonally nomadic and had a basic need to plan for colder weather to increase the efficiency of their subsistence activities.

Seasonal change is especially important to those people who acquire their subsistence directly from the land or sea. The Big Horn Medicine Wheel may have been constructed as a fixed calendrical reference point to determine seasonal changes and to predict animal population movements. Lowie states, "many Plains groups, particularly in the Historic period, relied on agriculture as a significant part of their subsistence base." One theory (Kehoe, 1972) even states that the Big Horn Medicine Wheel may have served as grave markers for places of the deaths of important medicine men or chiefs. His conclusions here are based on the remote location of the Big Horn Medicine Wheel indicating the area probably was of religious or mystical relevance and could be a ceremonial area of personal ritual.

All of this is speculation since the site is remote, crude and not part of a lasting settlement. It is difficult to tell what the structure's purpose was. It is only possible to say that Big Horn Medicine Wheel was a probable reference to summer solstice.

The line between archaeoastronomy and ethnoastronomy is exceedingly fine and somewhat vague causing a great deal of overlap between the two fields. Rock art is one area that has been classified both ways.

Ancient humans from all lands left reminders of their interest in the sky. Throughout the world there are symbolic drawings and carvings on stone surfaces which include figures representing the sky and its phenomena. These seem to illustrate attempts to offer explanations of astronomical phenomena. "Indications that North American Indians were interested in the sky are found throughout native American cultural and historical heritage. All across the United States symbolic drawings and carvings on stone surfaces indicative of the sky are found".

Early Americans had just cause to worship the sun since they watched its movement throughout the sky without knowing what it was or why it was. Sun
"The first step in the development of writing among Plains Indians was the annual recording of selected celestial events—represented by pictographic symbols—on leather and cloth. Known as "winter counts", Plains Indians used them to record the sequence of years in calendar form and devices to recall important events. The above drawings are representations of pictographs made by Dakota Indians at various times during the 19th and 20th centuries. A is said to represent a lunar eclipse, while B and C portray the total solar eclipse of August 7, 1869. The morning rise of Venus may be represented by D. The Leonid meteor shower of 1833 is shown in E through K, while fireballs during the winter of 1821-1822 and 1903 are shown in pictographs L through R."
discs are one of the most common symbols in western United States pictography. At Symbol Bridge in Lava Beds National Monument is the Astronomical Symbol Boulder. This structure, a large cracked lava boulder, has various different sun and sky symbols including crescents, sun discs, stars and dot chains. In Fern Cave, there is a 'sky wall', (Fern Cave is also located at Lava Beds National Monument), with star groups, crescents, suns and human figures. These particular pictographs were used as calendars. They closely resemble those used by Plains Indians today.

Pictographs were kept by Indians in other parts of the United States. Some of these depict one or two outstanding events each year, (i.e. eclipses, comets, etc.). These calendars allowed the Indians to look forward and backward in time.

In the Canyon de Chelly and other nearby locations, is a 'star ceiling'--sky symbols drawn on the roof of a cave. The figures present are believed to be related to particular parts of the sky, a sky chart maybe, or perhaps merely a few objects of special interest to the artists.

Recently a star and crescent pictograph was found at Chaco Canyon. Many kivas and kacinas in southwestern North America also contain a multitude of sky symbols done in paint drawings. These help to further illustrate the fascination of the North American Indians with the sky.

Footnotes


* "Medicine" is a term used by the Indians to connote magical or supernatural phenomena. The wheel was probably given its name due to its religious use and the fact that it closely resembles the floor plan of a ceremonial Medicine Lodge with the central carin representing the center lodge pole and the 28 spokes being the 28 rafters,


7 Ibid., p. 1038.


Bibliography


Reyman, Jonathon, "Big Horn Medicine Wheel: Why was it Built?", *Science*, April 18, 1975, pp. 278-279.


CONTRIBUTE

or this space will grow!

Read "Information for contributors - inside back cover.

Send articles to Bill Fagan,

PLANETARIAN Executive Editor

MOVING?

Please be sure to give us a CHANGE OF ADDRESS. Send old mailing label and new address to Ronald N. Hartman, ISPE Circulation Director, Mt. San Antonio College, Walnut, CA 91789.
Within the last 15 years, many school systems and public museums have built small planetariums for their constituencies. Most boating groups are now within a short driving distance of one of these installations, and many planetarium directors would be willing to accommodate a request to assist them in practicing their celestial navigation techniques.

A system has been devised using sextants in the planetarium for taking actual sights and determining a fix. In addition, this exercise will give the student navigator an opportunity to practice bringing a star down to the horizon, and rocking the sextant to be sure he has measured a true vertical angle. By using the inexpensive plastic sextants like the one manufactured by the Davis Instruments Corporation, the student can even experiment with various index mirror adjustments, an activity not too popular among the owners of high quality Marine Sextants!

When using a marine sextant in the planetarium, the eye is off-center and usually below the horizon line. If, however, these critical distances are known, calculations may be made to correct for the position of the observer. I have measured the height of the horizon line in the WCSC Planetarium and it is 7 feet (dimension "H" in Figure 1). In order to standardize the distance, (the observer stands "off-center"), I have made a circle with a radius of 4 feet ("M" in Figure 1). This circle was made by putting down short sections of two-inch wide plastic tape on the floor. Students are asked to stand with their toes on this line, on the same side of the machine as the star is on. In other words, they have to move around the circle on the floor to take sights on different stars of different azimuths. Since we use only bright stars for this exercise, the horizon lights may be up a little, and we put desk lamps with 40 watt red bulbs on the planetarium base. This allows the students to see how to move around and to read the index scale on their sextants.

By studying Figure 1, you can see that the observer will measure angle A9 and actual altitude of the star is angle C9. The "altitude correction" will therefore be the difference between these two numbers and it will always carry a negative sign (angle "E"). In order to calculate C9 for any given A9, you must know these values (See Figure 1):

- R: radius of the dome
- H: height of the horizon above the floor
- S: height of the observer's eye (see below)
- M: radius of circle marked on the floor of the planetarium
- A9: the sextant angle ("hs" on the Form Sheet for Circle of Position)
As you might guess, this is a very tedious and time consuming calculation to do by hand, but it is perfect for the kind of jobs that computers do so well.

A computer program was developed that prints out a table of altitude corrections (the value of "E") for each degree of sextant angle from 15° - 70° versus height of eye from 4.4 to 6.4 feet in 0.2 foot intervals. You may obtain a copy of the program, and/or print the correction table for the planetarium you use if you will send me the following information measured in feet:

1. Radius of dome ("R")
2. Height of horizon ("H")
3. Radius of Center Circle ("M")

Mail your request to me at the address given at the end of this article.

The problem that we give in our planetarium is stated as follows:
"You are the navigator on the Schooner 'Starshine' that departed La Rochelle, France on April 7, 1972, sailing due west to Newfoundland for 8 days and are preparing to take evening sights at 20:00 hours, Greenwich Mean Time. The stars that you will use to determine your fix are Regulus, Sirius, and Aldebaran. Using the Sextant, measure the altitude (hs) for each of these stars in the planetarium. Determine the altitude correction for your height of eye by using computer printed table. Enter these values on the Form Sheet for Circle of Position". (Figure 2)

The planetarium is set up for latitude of 45°N, and longitude 35°W. The latitude is set by putting the celestial equator at an altitude of 45°, and to set the longitude, rotate "Daily Motion" until Procyon is on the Observer's Meridian. This will be the correct position of the stars for a GHA of Aries of 144°. Actually you can set the problem up for any date by scanning the GHA Aries column in the Nautical Almanac for an entry that rounds off to 144°, around 20:00 hours GMT. The 20:00 hours GMT gives you an evening twilight time for longitude 35° West.

The various steps in the exercise are described as follows:

1. To determine the height of eye, I put up a vertical piece of masking tape and marked it off in tenths of a foot, from 4 to 7 feet, on a door frame near the planetarium. Before or after the observation, the students simply stand in front of the tape, holding their heads horizontal, and read off the value that appears directly before their eyes. They enter this number on the "Form Sheet for Circle of Position". (See Figure 2).

2. The index error can be minimized by the instructor adjusting the sextants beforehand. Parallax is a problem with the finite planetarium sky and a sextant that is adjusted for the real sky will not work well in the planetarium or, at best, have a large index correction. To make the initial adjustment, pick a bright star at about 45° altitude, and standing on the circle on the floor (around the center of the room), set the index arm to "zero" and adjust the screws on the rear of the index mirror until the star image and reflected image in the horizon mirror are side by side (in a horizontal line).
3. The student then should pick a similar bright star and adjust the index arm until they "line up" as described above. This can also be done with the horizon line, if it is back lighted by the dim cove lights. The student then notes if the zero on the index arm is to the left or right of the zero on the sextant arc. If it is to the right, it is "off the arc", and if it is to the left, it is "on the arc". Now apply that famous old navigators' saying: "Off is on, and on is off", which means if it is off the arc, the correction is positive and added on the sextant reading, and, of course, vice versa, if "on the arc", subtract off the correction from the sextant reading.

4. The students, standing with their toes on the circle on the floor and nearest to the star being measured, set the sextants to zero and aim at the star. When they see the two images side by side, they slowly bring the sextant down, pushing the index arm forward at the same time, always keeping the reflected star image in the horizon mirror. When they reach the horizon, they then make a fine adjustment on the index arm until the reflected star (in the horizon mirror) image is exactly in the horizontal line with the horizon line, rocking the sextant to determine the most accurate value of the angle. The student then reads the value above the index arm "zero" and interpolates on the vernier scale. This value is entered on the "Form Sheet", see Figure 2.

In the example given in Figure 2, the altitude correction is $-8.3^\circ$ and is also entered on "The Form Sheet for Circle of Position". The process is repeated for two more stars, before the final plotting is done.

5. After the corrected altitude has been obtained, called the "observed altitude ($H_o$)", then the radius of the circle of position can be determined by simply taking the compliment of these angles. The centers of these circles, called the "Geographic Position (G.P.)" can be determined by following the steps.

   A. Latitude of G.P. = Declination of Star
   B. Longitude of G.P. =
      If GHA* is less than 360° go to step 2.

Step #1 If GHA* is greater than 360°, subtract 360° and go to step 2.

Step #2 If GHA* is less than 180°, then the long. of G.P. is numerically equal to the GHA* and named "West" longitude or:

Step #3 If GHA* is greater than 180°, subtract the number from 360° and name it "East" longitude.

THE INTERNATIONAL SOCIETY OF PLANETARIUM EDUCATORS

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FORM SHEET FOR CIRCLE OF POSITION

DATE: 15 Apr. 1972

GREENWICH MEAN TIME (G.M.T.) 20 00

GREENWICH HOUR ANGLE OF ARIES 144°

HEIGHT OF EYE 5.5'

<table>
<thead>
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<th>Name*</th>
<th>REGULUS</th>
<th>SIRIUS</th>
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<td>Co-Altitude (90°-ho)</td>
<td>48°</td>
<td>62°</td>
<td>47°</td>
</tr>
</tbody>
</table>

Position of Fix: Latitude 45° N
Longitude 35° W
(Figure 2)
(SAMPLE)

Figure 3
6. Completing the "Form Sheet for Circle of Position":

<table>
<thead>
<tr>
<th>Blank to be filled in:</th>
<th>Source of information or comment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and G. M. T.</td>
<td>Statement of problem</td>
</tr>
<tr>
<td>GHA of Aries (T)</td>
<td>Nautical Almanac</td>
</tr>
<tr>
<td>Height of eye</td>
<td>&quot;homemade&quot; scale on door frame</td>
</tr>
<tr>
<td>SHA*</td>
<td>Nautical Almanac</td>
</tr>
<tr>
<td>GHA*</td>
<td>SHA* + GHA T</td>
</tr>
<tr>
<td>Longitude of G. P.</td>
<td>See notes above</td>
</tr>
<tr>
<td>Dec*</td>
<td>Nautical Almanac</td>
</tr>
<tr>
<td>Latitude G. P.</td>
<td>See notes above</td>
</tr>
<tr>
<td>Sextant Angle (hs)</td>
<td>measured in Planetarium</td>
</tr>
<tr>
<td>Altitude Correction</td>
<td>Computer generated correction table</td>
</tr>
<tr>
<td>Obs. Altitude (ho)</td>
<td>hs - (alt. correction)</td>
</tr>
</tbody>
</table>

7. Plotting the "G.P."

and drawing the circles of position can be done on a semi-elliptical projection of the world. (Figure 3) Setting the compass for the radius of these circles can be done along the prime meridian and should be determined at the latitude of each G.P. that is used. This is because the latitude scale is not constant as you move vertically across the map. An 8 1/2" x 11" version of this map is available from the Denoyer-Geppert Company of Chicago, order # 7099a, "Cartocraft Desk Outline Map, World".

The three G.P.'s are located, and the three circles of position are drawn (see Figure 3). They should intersect at one point, or form a small triangle. If the triangle is very large, then the exercise has not been done properly. In the case of the small triangle, the position or "fix" is at the geometric center of the triangle.

Using a sextant in the planetarium offers students an opportunity to practice their techniques in a comfortable environment. Any errors that show up can easily be detected and corrected. Going through the exercise of finding G.P. points and plotting circles of position vividly demonstrates the basic theory of celestial navigation. More detailed laboratory instructions and computer generated correction tables are free and readily available from the author at Department of Earth Sciences, West Chester State College, West Chester, Pennsylvania 19380.

Happy Sailing!
An Experiment in Participatory Planetarium Programming

Sheldon Schafer

A recent innovative trend in planetarium education has been the introduction of participatory planetarium programming to the general public. With the introduction of any new programming style, one of the first questions posed must be: How does the public react to this type of show? or more simply: Do they like it? Even more to the point, Do they like it more than the presentation which they usually receive at the planetarium? This may be difficult to assess for several reasons:

1. If the visitor has had no recent planetarium experience, he will be unable to make a fair comparison between show styles.
2. If the visitor has been exposed to a particular type of program for some time, the "newness" of the participatory experience may introduce some bias (either pro or con) into his immediate reaction to the participatory planetarium experience.
3. If the visitors' prior planetarium experiences have been varied, that is, if some have seen good theatrical multimedia styled planetarium shows while others have seen mediocre star lectures, then their opinions cannot be compared.
4. If the visitors know beforehand that they are to see either a participatory program or a multimedia show, their expectations and the fact that they chose to come may introduce a bias.

Thus, to properly assess the public's preference for programming style, one must isolate a set of visitors, all of whom have recently seen the same participatory planetarium show and a similar planetarium show of some other style. Although such a situation could be set up artificially, it is preferable that these conditions be achieved under natural circumstances.

Recently, at the Lakeview Center for the Arts and Sciences Planetarium, because of a revision of programming style, these circumstances have been closely approximated. From 1963 to August 1976, planetarium shows were, with only two exceptions, live narrated traditional star lectures. After the addition of a number of carousel projectors and the capability of handling a number of special effects, the show format was changed to present more theatrical multimedia planetarium shows. The first such show presented was "The People-Sky Lore of the American Indian" (August-November 1976), followed by "The Star of Bethlehem" (December, 1976). Although the content of these shows was different, their styles may be considered essentially the same (both were taped, theatrical multimedia shows), and in general audience reaction to both was overwhelmingly favorable. In January,
1977 the program presented was "How to Find That Star", a modified version of the participatory planetarium show "Finding Your Star", developed at the Lawrence Hall of Science, Berkeley, California. (Note: The participatory program was presented in the normal planetarium setting - a traditional concentric seating arrangement with 118 seats under a 10 meter dome. Performances were at our regularly scheduled showtimes, one weekday afternoon and evening and two each Saturday and Sunday. No attempt was made to limit attendance and audience sizes ranged between 6 and 87, the average being 31. In only 3 of the 20 performances did the audience size exceed 50, and in only one of these did the instructor feel that a large number of the participants were not following along. In the future, based on this experience, we plan to limit attendance to 50. Each visitor was given a star map and a one-celled flashlight dimmed by either a 3 ohm or 1 ohm resistor.)

At the conclusion of the participatory show, the audience was polled to identify those who had seen either "The People" or "Star of Bethlehem". In this way a set of people who had seen one multimedia and one participatory planetarium show within a period of five months was selected. It was assumed that these people had no recent experience with either style of planetarium show, since neither had been presented in this region recently, and planetarium experiences outside of Peoria are infrequent, usually described as "a visit to the Adler in Chicago some years back". It was also assumed that these people did not expect to see a participatory type show since advance publicity was minimal.

All those indicating they had seen one of the previous shows were asked to remain after for some additional questions. 86% (61 of 71) of those asked to remain did so. They accounted for 10% of the total audience at the shows (61 of 620). Each subject was questioned individually, nominally out of earshot from the others, and asked the following four questions:

1. Would you say that the style of presentation of this show was different from the style of the last show you saw here?
2. Have you ever attended a planetarium show anywhere presented the way today's show was?
3. How would you describe the difference between the two shows?
4. Which show or style of presentation did you prefer, if you had a preference? Why?

The first and third questions were asked as a check to be certain that the visitor perceived some difference between the shows, since no perceived difference would either indicate that the visitor didn't remember one of the shows (perhaps even fallen asleep), or was too young to understand the question. In fact, all but one young child perceived a difference between the two shows or styles of presentation. When asked to describe the difference between the shows, several responses were received: 46% of the visitors used the term "Audience participation" in describing the difference, 7% cited the participatory show as more of a learning experience in describing the difference, and 20% described a content difference, contrasting the presentation of the "stars" with the presentation of "stories". The remaining 27% used some other terms to describe the difference.

Although it can be assumed that most of our audience had seen some other planetarium show in the past, we were interested to know if any had been to a
participatory planetarium show before. Seven percent (4 of 61) indicated that they
had, although the reliability of this figure is uncertain since further conversation
with one respondent indicated that he had interpreted the question as "Have you
ever attended a planetarium show anywhere which was all constellation identifica-
tion?", which is obviously a show style which many planetarium visitors might
well have encountered. It is still, however, safe to conclude that few of our vis-
itors have had a previous experience with a participatory planetarium show.

The response to the last question, indicating whether the visitor preferred
one show style over the other, was the focus of the survey. The results were as
follows:

48% Preferred the participatory show
21% Preferred the theatrical multimedia show
31% Had no preference—enjoyed both shows

Of those who preferred the participatory show, 34% gave as the reason for their
preference that there was "more learning", 31% indicated that they in some way
"liked to participate", and the remainder had some other reason for preferring
the participatory show. Of those who preferred the theatrical multimedia show,
45% "enjoyed the story line" and 36% felt that this style was "more entertaining".

Although over twice as many visitors preferred the participatory show to
the multimedia show, the size of the group which had no preference, and in fact
liked both shows, was large enough that one is unable to say that one show style
was clearly preferred over the other. In addition, the sample of visitors was
chosen in such a way that a bias in favor of the participatory show had been ex-
pected. Since 89% of our audience comes once a year at most (learned from
earlier audience surveys), those visitors chosen to express their preference were
among the few repeat visitors. It was our assumption, based on our indirect know-
ledge of this group, that being more interested in astronomy than the casual once-
a-year attender (yet still not knowing how to use a star map), and more of a par-
ticipator in as much as they attend more often, they would prefer the participatory
show. If our assumption is correct, there is even less of a preference shown by
the group for one show style over another.

If any conclusion can be made, it must be that our planetarium audience
likes both styles of planetarium show. This being the case, our planned response
to this situation will be to offer both styles of programs on a regular basis.
Rather than alternate show runs, we plan to offer our multimedia presentations at
the present regular show times and establish a new series of times for our par-
ticipatory shows. Audience reaction will determine if this format is acceptable.
ON PRODUCING "The Black Cloud"

William F. Rush, Rebecca R. Katzenmeyer, Brian J. Bensch and Anita M. Rush

The Ritter Planetarium recently presented "The Black Cloud", a planetarium program produced by the Hansen Planetarium and based on a science fiction novel of the same title by Sir Fred Hoyle and adapted for the planetarium by Littman (1974). We note in passing that this program has been extremely well received by our planetarium audiences and that it is of excellent quality.

While the script, tape, and artwork are available for purchase from Hansen Planetarium, the planetarium which is presenting the program is required to produce several unusual special effects. Although the Hansen Planetarium package does include production notes describing techniques by which the required effects can be achieved, we devised alternate methods of producing three of these effects, our alternate methods being somewhat easier to accomplish than those described in the production notes for "The Black Cloud".

The first technique which we will discuss is intended to produce the effect of a small interstellar cloud of high opacity which is moving toward the solar system. This requires that the stars slightly south of Orion be systematically extinguished by the incoming cloud. The result is a circle of darkness in the planetarium sky which grows steadily for a period of nearly 1 minute, ultimately involving the extinction of most or all of the stars in Orion. In the extreme case, nearly a quarter of the sky is occulted.

The Hansen production notes suggest that this effect may be achieved by a motorized umbrella which is operated remotely during the program to produce the desired effect. In practice, we experienced severe difficulties in producing a quiet, simple, and reliable mechanical drive system to achieve our goals. However, we found that we were able to achieve the same end with the simple solution of suspending a child's rubber balloon on the end of a metal tube located near the starball. The deflated balloon was positioned in a region of the sky relatively free of stars so that it would not obscure any readily recognizable constellations. The metal support tube was rigidly fixed to the projector support frame. Considerable difficulty was experienced in forcing the limp balloon to assume a position such that it blocked out the correct portion of the sky. In particular, the balloon frequently hung below the horizon upon inflation. This difficulty was circumvented by constructing a cardboard collar which formed a shallow cone. The collar details and entire balloon assembly are shown in Figure 1.

Air provided to the balloon through the metal support tube by means of an air supply tube which was "fished" through the support tube and the electrical cable conduit beneath the planetarium floor to the control console. The tubing for the
BALLOON ASSEMBLY

EXTENDED AIR LINE  
SUPPORTS LIMP BALLOON

COLLAR

METAL TUBE

AIR LINE

ASSEMBLY DETAIL

BALLOON ASSEMBLY

AIR LINE

PUMP OR AIR CAN
air supply was purchased from a hobby store and is of the type which is frequently used in gasoline engines for model airplanes. The problem of a tube-to-balloon seal was solved by wrapping tape tightly about the balloon nipple. This proved to be quite satisfactory. The only other problem with this particular arrangement that might be anticipated, the winding of the tube around the projector, does not present any difficulties since the program requires relatively little starball motion.

The source of pressurized air for inflation of the balloon represented a minor difficulty. An excellent solution was found to be cans of compressed air generally used for dusting film and lenses, available from most photography stores. Such cans are easy and convenient, but only contain enough air to be used two or three times in inflating a balloon. This results in an average cost of approximately $1.00 per inflation, but is an excellent approach if you feel you can afford it. A less expensive solution is to inflate the balloon with a foot pump of the type used for inflating air mattresses. This method is less convenient, and such pumps are frequently relatively noisy. This led us to place the pump in the backroom of the planetarium. The latter proved to be our final solution although we had tried one other method of inflation--that of having an operator blow into the tube. However, the small diameter of the tubing which we used had sufficiently large pressure drops that inflation by this means was completely impossible.

The second effect which we had to produce was a gradual revealing of stars to simulate the appearance of being inside an observatory dome while the shutter was opening. The Hansen Planetarium's production notes recommended this effect be accomplished by pin-hole projection of a strip of stars to simulate the fully opened dome shutter. It was then suggested that the strip of stars could be gradually revealed by "opening" a cardboard shield to expose the star strip. Accompanying the opening of the slit, Hansen had a sound effect on the show tape simulating a mechanical system in operation.

In attempting to create this effect, we experienced difficulty in producing an acceptable star field using a "quick and dirty" pin-hole projection system, and more serious difficulty in attempting to motorize a cardboard shutter. Since the tape already contained the sound effects, we were not free to delete this section. We, therefore, opted to replace the effect called for in the script with a film loop. We precisely timed the effect required by the tape, then made movies of domes opening, telescopes moving, and other scenes typical of setting up in an observatory. The movie was then spliced and mounted in a super-8 mm film loop cartridge. It proved quite effective and fit in well with the narration. In order to prevent other planetariums who wish to use this technique from having to duplicate our efforts, we will make available copies of this film loop at our cost of $6.00. To obtain a copy, please contact one of the above authors at: Dept. of Physics & Astronomy; The University of Toledo; Toledo, OH 43606.

The third modification which we made in the recommended system of special effects projectors was for the final scene of "The Black Cloud", in which the cloud dies. The Hansen script called for a special projector which would cover the ceiling with small, random explosions. The intent here is to simulate the effect of an expanding cloud of gas striking the upper atmosphere of the earth. While this effect would not have been terribly difficult to construct as suggested in Littman's script, we felt that this represented a "one-shot" effort since we could not anticipate using this effect in any other program. Due to our limited avail-
ability of funds and effort, we decided to modify the effect so that it could be used for other planetarium programs.

We chose to construct an expanding shell projector of the type described by Seeback (1974). This projector was initially designed to simulate an expanding shell of gas such as that ejected in a supernova explosion. Since the script describes the cloud as exploding in all directions except that of the earth, this expanding shell seems to fit the description in the script quite accurately.

We submit these suggestions in the hope that they will help enable other planetarium staffs to adapt an exciting, worthwhile production to limited schedules and budgets.

References


"If only they had waited . . ."
I had forgotten how bloodthirsty I was. And being often referred to as "Our Father Who Dwelleth Under the Artificial Heavens", I'll admit to a certain smugness about various media. When you get right down to it, all Planetarium directors have sort of an air of "being above it all" if you'll excuse the pun. It just goes with the territory. After all, three-fourths of my day is spent in the stars. So although it was flattering, nevertheless it seemed quite logical when the Miami Herald called to ask me to review "STAR WARS".

A couple of weeks before it hit Miami, it had zapped into Boston at Warp Speed 8. The President of Interscan, a laser show based in that city, was trying to further entice me to fly up to view his production. "...and we'll even get you tickets for "STAR WARS". You know most people have to wait six hours in line." I was unimpressed. I hadn't even heard of it. Art Barton, one of the Planetarium console operators who had just moved down from New Hampshire heard the conversation. "You haven't heard of "STAR WARS"? All the Planetarium staff up there say it's the best thing since sliced bread."

On the plane north, one couldn't help but notice that the then current Time magazine seemed to be one long paid advertisement for the flick. Then I saw the crowd in front of the theater in the city that sparked off the Revolutionary War. Strange... only two centuries later, here were the Founding Fathers' progeny paying five bucks a head to witness an Intra-galactic Rebellion. But I had no intention of sitting in a jam-packed movie theater.

Back home in Miami, several business calls from Planetarium types around the country invariably yielded the startled response on the other end..."What, you haven't seen 'STAR WARS'?"

A Planetarium director from Virginia phoned me that she was nervous about her summer job at Cape Kennedy. Two days later she called back: "This place is fantastic. You'll never believe what I did the first day. The director said 'Let's all go see "STAR WARS" this afternoon. We'll chalk it up to research in special effects.'"

Bill Dishong, our Planetarium's Technical Director, told me he'd seen it twice. Barton competitively and gleefully informed me that he'd viewed it three times, and hearsay has it that an ex-console operator has gorged himself on it no less than eight times.
So I feel guilty already! And thank God the Herald called, or I wouldn't be able to carry on a civil conversation with my peers for the next year. Then this idea hit me: I'll take along a couple of unusual types to see what their reactions are.

So I asked a friend of mine, who never goes to movies, but who's been involved in astronomy for over forty years, and another friend, a writer recently escaped from communist Europe, who knows more about English literature and cinema than most professors who purport to teach the subject, and with whom I also never agree. And...hating crowds, I decided that the 10:15 show on a Sunday night would be a good choice for the Astronomer, the Dissident and me. Surprise. I mentally counted heads, multiplied that by $3.50 and wished I had a piece of the action.

It was an experience. Some guy behind me not only knew the scenes, but also the lines and verbalized what each character was going to say by a millisecond. His fervor was akin to that of someone who has memorized both the Old and New Testaments and misses no opportunity to let you know. The effect was shattering. The person wedged next to me on my right was completely stoned but less offensive. After ten minutes he dropped off and snored for the remaining hour and forty minutes. The projectionist must have been some sort of sadist. Unless you sat within the first ten rows you missed half of the dialogue, but I was lucky, all I had to do was lean back and listen to the verbalizer-devotee.

Then I just waited...for it to happen...for the film to do it to me...to get involved...to get totally sucked in by this piece of celluloid that has all America yammering. And it happened. The small space planes began repeatedly zooming at near light-speed down an endless corridor...pursued and attacked by the exotic weaponry of equally swift villainous space warriors. You could feel the rushes...mountainous walls of metal flashing by...one point perspective, zeroing towards a distant goal like a cosmic roller coaster out of control, fleeing towards infinity. An extra-terrestrial World War II dog fight with the appropriate deafening rumbling of engines, screeching weaponry, full orchestra blaring...beams of lethal light zapping both flying machines and their fliers into spectacular Fourth of July explosive, brilliant, beautiful death and oblivion. All that was missing was Pat O'Brien in a Roman collar administering the last rites. It was stunning. I was stunned.

"What'd you think?" I asked.

The Astronomer: "Well, it was easy to tell the goodies from the baddies. All the good guys had white lasers and the bad ones red. Great Fun".

The Dissident: "If they show this in my country, is going to be for the young people revolution. America is big technology and the future. This is new art. Great Fun". This from a man who only five years ago experienced future shock as he made the transition into the Free World.

It was midnight; I drove home, poured a glass of wine, punched up the video recorder and soothed my savagery while watching on my six foot wide Advent video-beam television a piece of Natalie Cole the machine had automatically taped from the Don Kirshner concert two nights before. Natalie writhed and
wailed and unadulterated lewdness oozed out of her lyrics and glistened in the sweat on her forehead. Talk about future shock. And then I realized: There was absolutely no sex whatsoever in "STAR WARS". Sort of like the old Roy Rogers and Gene Autry flicks. But instead of kissing the horse, Alec Guinness, like King Arthur, kissed his laser beam before his adversary snuffed him out. And neither the hero nor the heroine so much as took their shirts off, yet this is the film that is going to bust all box office records this year. There was a love interest but frankly I recall Lash LaRue displaying more lust for his whip. Could America have suddenly become moral overnight? There was no real pathos....no tear-jerking. When the hero, Luke Skywalker, viewed the charred remains of his family, only a glimmer of disgust and resolve showed upon his face. And when Princess Leah saw her entire beloved planet with its millions of people annihilated in a flash, her expression was akin to that of a young lovely in a TV commercial suffering from acid indigestion.

So I thought, what does "STAR WARS" have that can turn a nation on? The only nation in history since ancient Greece whose masses are continually entertained by the drama. Americans love their movies and television. The Greeks loved their theater. And after all, our American system is patterned after the ancient Greek philosophical and democratic ideals. Could it be possible that "STAR WARS" contained any classic elements? You've got to be kidding. The Greek theater abounded with sex and risque, bawdy humor. Pornography was not only accepted on the Greek stage...it was expected. In the over two thousand year old "Lysistrata", Greek women stopped making love until the men agreed to stop making war. And the dialogue would be considered by most Americans to be vulgar, if not downright dirty. But the Greeks refused to allow one thing to be enacted on their stages: violence against a human being. Oh yes, many of the ancient plays were centered around war, death and tragedy. But if you go back and read them, you'll find that these acts were not portrayed on stage. Rather, when some violent deed occurred, it was relayed to the audience via a messenger. Simulated sexual acts were seen on all Greek stages, but not murder. To portray this was considered the highest immorality and obscenity of all.

Bill Dishong was sitting across the desk from me. We were trying to recount how many people got fried in "STAR WARS". It was impossible. How often do you hear of a whole planet with all of its humanity being flushed into the great beyond? Not even "Star Trek" dared that. Bill remarked: "Kinda like a pure concentrate of Starsky and Hutch." A pretty apt description but I guess that's what America wants. Then I recalled the great furor raised over the movie "Barbarella"....the opening scene where Jane Fonda strips inside a space ship in zero gravity. A few years ago when the Planetarium staff got hold of a print to show to fellow planetarians at a conference, that opening sequence was practically worn out by being run back and forth through the projector and almost everyone pretended to be shocked by the outrageous sexual adventures of Jane as she planet-and-bed-hopped across the Milky Way. An X-rated Movie....not fit for general consumption. Certainly not fit for children. But "STAR WARS"? What kid in town hasn't seen it? Innocent fun....make war, not love.

But then its only been three years since Americans were involved in a real war and got their vicarious kicks watching people being blown to bits on the
evening news. Besides "STAR WARS" has religious implications and social redeeming value. Although God does not directly sponsor or take sides, nevertheless, his equivalency "May the Force be with you" somehow lends the appropriate Good Housekeeping-Anita Bryant-Prime time TV Code stamp of approval. After all, without the proper endorsement and glamorization, the Crusades or any other war for that matter, would not have been as well attended.

Oh, I know I'm taking this all too seriously. After all, the technical effects are brilliant and will undoubtedly cop the Academy Award this year. And besides, isn't it just a little perverse to be out of step? After all, when I was a kid, I used to scream with delight and count Indians as Roy and Gene plugged them full of holes and blasted them off their horses into the Happy Hunting Ground. GREAT FUN! God knows it didn't hurt my generation. Well, I'll concede that we have had a few minor wars since then but they were good for the economy. And I'll admit I felt a twinge when I saw people getting zapped left and right in one of America's earliest sci-fi flick endeavors that Channel 6 ran last week.... 'Flash Gordon'. And I hesitate, but will tell you, that I fully intend to see "STAR WARS" again, if only for that incredibly exhilarating space chase and dog fight sequence towards the end of the flick. For I'm sure that nobody except the producers takes this film seriously.... and they're only taking it very seriously because they know what sells. You can always sell blood to middle-America with the flimsiest of disguises.

Yet, somehow I think I'd feel more wholesome if I could just get hold of that worn out print of "Barbarella" and watch Jane Fonda strip and cavort her way across the galaxy once again. As I said, I had forgotten how bloodthirsty I was.

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A strangely familiar document crossed my desk recently. It is called the "Santarium Monthly", and was passed on to me by Tom Hamilton of the Wagner College Planetarium in New York, who says he doesn't know where it came from. Some excerpts:

-- The next meeting of the Department of Planetarium Educators (DOPE) will be held at Fagner's Sanitarium. Topics included will be:

"Construction of Bolide Projectors with Matches and a Slingshot" (Al B. Tross) and "How to Make Special Effects Projectors Easier to Carry" (Clem E. Hans).

Clem, incidentally, won instant fame three years ago when he converted several Kodagraphic slide projectors, as well as four single-slide projectors, into cigar boxes. The new cigar box design made the projectors "lift". Fagner is proud to have Clem at its institution. He is someone worth keeping an eye on in the future (indeed, he is watched carefully whenever he visits other planetariums).

-- Art Carney will be at Fagner on August 7 to autograph copies of "Norton's Star Atlas". More on this next month.

**Celestial Highlights:**

-- Pluto will come to opposition on April 2. We urge everyone to look for it.

-- Mercury will stay the same, now that Mariner 10 has left for good. The inhabitants have taken down the moon pictures.
CREATIVE CORNER

A LASER LUMIA

Herbert J. Schwartz

With the popularity of the rock-light shows and the rise of companies like LASERIUM, EYE SEE THE LIGHT, and HEAVY WATER, the public is getting more and more light show oriented.

It is unfortunate that these groups cannot play to smaller, less capacity domes; economies of scale prevent this. As a result, the silent majority of the country is left out. Light shows in Alpena, Michigan, Hastings, Nebraska or Des Moines, Iowa are left to the ingenuity of their Directors. To add some light (?) to this subject, I hope this humble offering is useful.

After playing with our $100 Edmund He-Ne laser and some rotating disks, I observed the following: DUCO brand and AMBROID brand liquid cements break up laser light better than anything else I have played with. In the hopes of discovering the true secrets of the laser lumia, I built the following:

A 14" X 12" X 9" box with an insert to hold the laser exactly (almost) perpendicular to the twin spinning disks. One disk mainly consisted of liquid cement, a JUPITERSCOPE, and some pre-popped bubbles (packing material). The other disk had that plus some diffraction gratings and a piece of lamp diffuser. One disk rotated at 2 revolutions per hour (2 RPH). The other disk rotated at one revolution every ten minutes, (6 RPH). This means that the pattern repeated itself every half hour.

After experimenting further, I found that because of my laser's low power, the packing material and the light diffusers spread the beam too far to be seen. A brighter laser would have been nice.

However, between the liquid cement, the JUPITERSCOPES, and the diffraction gratings, the sky exploded with red patterns ungulating into grainy blobs, with occasional wisps shooting off in all directions.

The effect, in the word of one eighth grader, was "Gawd!"

Obviously, the biggest cost in this effect was the laser. Any RPM motor will do, but slower ones would be more desirable to catch the more delicate and subtle patterns. The JUPITERSCOPES are holographic diffraction disks that are available from Functional Products, Inc. in San Francisco. These holographic prisms are pocket sized disks of clear flexible plastic that would make a neat sales shop item.
There must be hundreds of other materials that would diffract and diffuse laser light. Perhaps someone out there in planetariumland has done more experimentation that I have. Let's hear from you.
BRINGING AMBIENCE SOUND SYSTEMS UP TO DATE

Jack A. Dunn

In the Fall/Winter 1975 issue of the "Planetarian", I wrote an article on adapting your Planetarium sound system for ambience recovery. At the time this article was originally written, it pre-dated most "quadraphonic" and "omniphonic" systems, as well as changes in the systems many schools are buying as the result of buying Spitz systems with automation.

Four channel sound as a commercial venture has not gone very far; and in fact, its growth seems to be slowing down. Some manufacturers who offered four channel equipment (such as Radio Shack) have now dropped this equipment from their product lines. Some larger planetariums are using discrete four channel sound but here we are dealing with professional technicians and specially prepared musical recordings.

The ambience recovery system still works quite well with most recording, and it is a cheap way to produce this effect. Certainly matrix decoders and separate rear channel amplification can improve on this. But there is also a new means of producing room information (more about that later).

If your system has an omniphonic or similar "moving sound" type of controls, it is unwise to try to change to the ambience circuit unless you are willing to surrender the moving sound capability. Unless you are willing to invest in more speakers, more amplification and technical assistance, you may only succeed in producing possibly disastrous results. (Here I am addressing the school planetarium which bought their sound system as a package.) Those systems were not designed with this in mind. It is only with the older four speaker stereo, found in many Spitz (or similar) installations, that the ambience circuit should be tried. In our own case it led to our system eventually adding rear channel amplification and matrix decoding.

Another way of simulating room acoustics has appeared on the scene. I have not had a chance to try it in a planetarium - but this is how it works. Signals from the front speakers are passed through a digital electronics delay circuit, which feeds a pair of speakers to the rear (and above) the listener. A separate amplifier is required for these speakers. You can see that this is starting to get expensive as the delay unit alone costs in the $100 - $500 range. A typical delay is the "Digital Time Delay". These units can be adjusted to make it sound like you are anywhere from a small live room to the bottom of the Grand Canyon. It is an interesting tool - one that deserves some experimentation.
Information For Contributors

(Effective September 1, 1977)

GENERAL INSTRUCTIONS

All materials submitted will be considered. Contributions should relate to one or more of the following: planetarium activities and/or education, astronomy or space sciences.

Articles, reports, planetarium programs, letters, technical comments, guest editorials, items of humor, pictorials (black & white) of selected planetarium facilities, and general news relating to the planetarium/astronomy community is published. (This list is not all-inclusive.) The PLANETARIAN will make the final decision as to appropriateness of material submitted.

All material should be submitted directly to the Executive Editor. Contributors will be notified of acceptance, rejection, or need for revision within a reasonable period of time.

The manuscript should be typed free from errors, double-spaced, on 8 1/2 x 11" paper. Typeovers and other markings are to be avoided. Use the first page to show the title, author's name, complete address, and exactly how the byline is to appear. Begin the text on the second page. Place all legends for figures on a separate sheet at the end of the manuscript, and enumerate in the text where each figure should be located. Place all tables in the manuscript in their appropriate locations.

Photographs must be black & white, on 8 x 10" glossy paper. DO NOT mark or label on photographs. Labels referring to a part of a photograph should be indicated on a separate sheet or onion-skin overlay.

Line drawings, charts, and similar drawings (excluding halftones) should be drawn with dense black (preferably India) ink with a high carbon content. If only printed copies are available they must be equal to the above specifications. Copies duplicated on electro-static type duplicators are not acceptable. DO NOT SUBMIT COLOR WORK of any kind.

REFERENCES should appear in the body of the manuscript by the Author's last name and the date of the publication, e.g.: (Nelson, 1972), with full references listed alphabetically at the conclusion of the manuscript, giving author's name, year, title, publication, volume, number and pages. Example:


Adherence to these instructions will be appreciated.
The unusual and infrequent celestial events—those having a 'spectacular' appeal—afford every planetarium a special opportunity to serve not only the public by interpreting them, but to also serve their own advantage by way of the extra publicity, not only of the event, but for their own facilities as well. The obvious benefit—an increased awareness from both the public and the media of their attempts to serve the community. Pictured on this page is just one example of the many planetariums which 'geared up' to 'present' the solar eclipse of October 12, 1977. Students and the community view the event at the Mount San Antonio College Community Planetarium (where the eclipse was 47%). Technician, Jeff Schroeder projects a 15" diameter image of the Sun onto a screen with an 11.5" refractor (which he constructed). Jeff is shown, also, holding a local newspaper which gave both the Sun and the planetarium 47% of its front page the next day. Hmmm! Not bad.