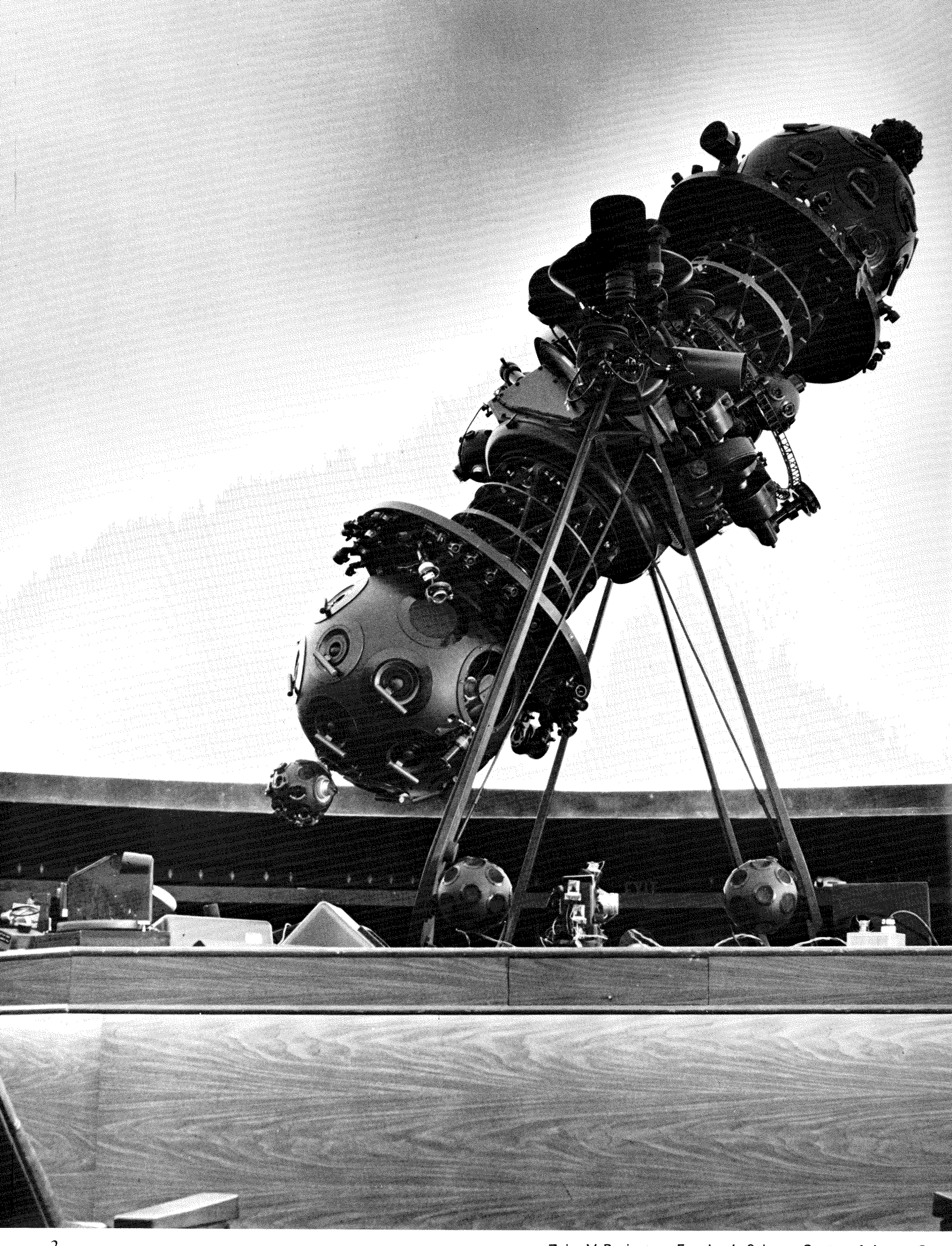
Journal of the International Planetarium Society

PLANETARIAN

In This Issue

Vol. 10 No. 2

Second Quarter, 1981



Zeiss V Projector: Fernbank Science Center, Atlanta, GA

PLANETARIAN

Volume 10, Number 2

Publication Date: December 1981

The PLANETARIAN *ISSN 0090–3213* is published quarterly by the International Planetarium Society under the auspices of the Publications Committee.

Membership and Subscription

Correspondence regarding membership or library subscriptions, and change of address notification should be addressed to:

Walt Tenschert, I.P.S. Membership Chairman
Thomas Jefferson High School
6560 Braddock Rd., Alexandria, VA 22312

For missed numbers, please notify the membership chairman.

ANNOUNCEMENTS

NOTICE
CONTRIBUTORS AND MEMBERS

The following changes are in effect until further notice:

All contributions for the PLANETARIAN should be sent directly to R. N. Hartman, Department of Mathematics-Astronomy, Mt. San Antonio College, Walnut, CA 91789.

Authors wishing extra copies of the PLANETARIAN containing their article should make requests at the time material is submitted. Quantity prices will be quoted. Proofs will not be sent unless a specific request is made.

ADDENDUM

The following references were omitted from Dr. Mallon's feature article in the last issue (V. 10, No. 1).

Freuchen, Peter, *Peter Freuchen's Book of the Seven Seas,* N.Y.: Julian Messner, 1957.

Heyerdahl, Thor, *Early Man and the Ocean* N.Y.: Doubleday and Co. 1979.

Taylor, E.G., *The Haven-Finding Art,* N.Y.: American Elsevier, 1971.

Villiers, Alan, *Men, Ships, and the Sea,* Washington, D.C.: National Geographic Society, 1973.

LETTERS TO THE EDITOR

Dear Editor,

While thanking the *Planetarian* and James Brown for mentioning Loch Ness Monster Productions in the "What's New" column (Vol. 10, No. 1), for clarity's sake, I should point out that the information in the article is slightly out of date—by nearly two years.

As of July 1, 1981, we have *SIX* MUSIC BACK-PACKS available; each contains about 45 minutes of original electronic music designed specifically for use in planetarium soundtrack productions. The price is: $25 each, plus tape cost (which varies depending on what speed and format are requested) and handling.

Our record album, GEODESIUM, is still $5.99, plus $.75 handling.

Last year, we introduced a new product line—the ShowTrack series. Virtually complete planetarium programs without the visuals, each ShowTrack contains a script, with time, audio cues, text transcription, and suggested visuals; the audio tape, with narrator, effects, and of course, our original electronic music; and production notes. Each ShowTrack is designed to work with readily-available slides (from the planetarium library, recycled from other shows, or easily made) to allow visual production to suit each facility's own projection capabilities. ShowTrack packets come in 20-minute "Mini" versions, and 40-minute "feature" lengths, costing $50 and $100 respectively, plus tape cost and handling.

Samplers of all our products—audio excerpts, script pages, etc.—are available for $2 (our cost of mailing the materials).

Thanks again to the *Planetarian* staff; we look forward to each issue.

Sincerely,

Mark Petersen, President
Loch Ness Monster Productions
P.O. Box 3023 Boulder, Colorado 80307
New Phone Number: 303–455–0611

Continued on page 27

TEACHING IN AN OUTREACH PROGRAM

David H. Levy

Flandrau Planetarium
Tucson, Arizona

I am an amateur astronomer, and I also work at a major planetarium. The connection might seem frivolous to some, but it is surprising how few amateurs develop planetarium careers, and even more surprising how even fewer try to turn their love of astronomy into teaching careers.

For "amateur" does indeed come from the Latin "to love." Amateur astronomy is not just a hobby for me, it is an all-consuming way of life. I breathe it, think and dream it, and I try to pass these thoughts and dreams on to the children I teach.

Astronomy is a natural for young children, and the central question that it both poses and tries to answer is vital to young minds. Look into the eyes of a baby and imagine the question coming from it: "Where am I?" The toddler tries to explore the rooms of his house; again, "Where am I?" The question expands as a child grows up, now including countries, the seasons, the world, and often by the time the child is six years old, the universe.

The central concept of our Outreach educational program is to encourage and develop this question in their innocent but inquiring minds. I do this by carefully selecting a series of topics and presentations that will capture their imagination. Accordingly, the traditional subjects of moon phases, constellation study boxes, and order of the planets often get a back seat in my elementary classes. Instead, I include a bit of relativity, stellar evolution, and always something about the history of the subject.

Especially history. It took me a while to understand just how excited six, seven, and eight year olds could get over the history of astronomy, and particularly the story of Galileo and the moons of Jupiter. Let me try to recreate the drama that is possible with a story, such as that of Galileo.

Galileo is sitting in his room. There is a knock on the door (three loud knocks) and four men in long (pause) black (pause) robes come in.

"Galileo, we understand that you are telling the children that there are four moons that do not revolve around the earth! (pause) EVERYTHING revolves around the earth! The MOON revolves around the earth (is that true?), the SUN revolves around the earth (what about that?). ALL the PLANETS and the STARS go around the earth, too!"

I then go through a similar episode with regard to the sunspots. Once again there are the three loud knocks, and the four men in the robes. "We teach our children that the sun is perfect! The sun doesn't have any spots; your telescope has spots!" Then I tell the children how they forced Galileo to stay in his house; how they locked the door from the outside and kept the key; how much later they took him away to Rome, to a large hall. (I pause) At one end of the hall, at a large ornate table, sit the men in the long black robes. At the other end, in a small wooden chair with one leg shorter than the other, and with a back that is straight and hard, sits Galileo. And in the middle of this great hall is Galileo's little telescope. The choice to recant or not to recant is then offered. For a long time Galileo just sits there. He looks at the men in the robes. And again he looks at his telescope (I've told this story a hundred times and each time the children are at the edges of their chairs by this point). Finally, Galileo stands up from his rickity chair. "Gentlemen in the long black robes (pause), my telescope (pause) is (pause) broken!" And with that Galileo picks up his telescope and returns to his house where he will spend the remainder of his years. As he enters his front door, he turns to his sister and says, "But there is nothing wrong with my telescope. One day a group of children will look at these same sunspots through telescopes much better than mine, and they will remember me." And now, boys and girls, let's go outside and see these sunspots of Galileo.

This is a story, not a verbatim record of historical fact. It is designed to transport children to a different time. I want especially to give them a sense of respect and reverence for telescopes. The story often is followed with a discussion of the modern telescopes up at Kitt Peak, and a comparison between them and the small refractor I have in the classroom. "So which is better, the four-meter reflector or this little telescope? . . . Oh, really? Well then if the four-meter is so much better, why can't I bring it here to show you? What good is a telescope if you can't look through it?" I consider that there is some wisdom in that question. A child should get an appreciation for the fact that different types of telescopes are used for different purposes, just as some children are better at some things and other children are better at other things. And in many ways a four-inch reflector that a child first looks through, sees the craters on the moon, and then looks back at me with eyes wide with wonder and excitement, is a much, much "better" telescope than the remote Leviathan of the mountain-top with its 50 arc-second field of view. Here is a way of explaining to children that the telescope they use deserves respect, that its lineage includes some noble patriarchs dating back 400 years and that the discoveries they can make with it are meaningful.

And it was with these thoughts that I began to look at the many different types of telescopes that pass as beginners' instruments and think, shouldn't the same care go into the design of a children's telescope as goes into the manufacture of the world's largest research instrument? Is there a telescope that would be good for children? I think there are four things to keep in mind in designing such a telescope:

1. Children like big things, so the telescope should be fairly large, meaning long, and showing the appearance of something with substance. If the telescope is too small, like for example, a three-inch f/11 Schmidt-Cassegrain, the children might think it is just a toy.
2. On the other hand, the telescope can't be too big or the child won't be able to get up to it. Also, a teacher who can't move it easily won't

put it to much use. So the upshot of these two rules is, perhaps, a reflector of about 4 inches in aperture with a long f/10 focal length, mounted firmly but on a lightweight tripod.

3. The telescope should be designed so that a child does not have to be lifted up. The youngster should be able to look through it with ease and comfort and to use it as a vehicle of communion with the Cosmos. Our telescope has an elevator tripod so that children of various sizes can use it.
4. It helps if the telescope is strong enough to withstand a thermonuclear fission explosion of about 30 megatons.

I developed such a telescope after several years of summer work as an astronomy instructor in a camp whose director was at first uneasy about my teaching astronomy because he felt that astronomy could only be done at night. How many people forget about the nearest and brightest star of all, which happily shines outside the sleeping astronomer's bedroom window every day of the year? I asked the children, "How long would it take you to get blind if you peer directly through a telescope at the sun?" Then I went to a nearby garbage can, cut a piece of green garbage bag, and put it at the center of the eyepiece. The children got ready to count the seconds, but before the bag had even had a chance to reach the focal plane it had already ignited. As I inscribed the fiery commandment of the sun on the plastic parchment, 30 mouths hung open in wonder, and thus ended the problem of keeping young eyes from solar telescopes. We then safely projected a two- or three-foot wide image of the sun, a process that was easily handled by all the children in about 5 minutes. This way they were able to see the changing positions of the sunspots from day to day without placing a burden on the rest of our program.

And how about Venus, a daylight planet which is about the size of the earth? One day I showed Venus to a group of children just before they were scheduled to have a barbeque lunch. "You mean to say that if we were that far in space, this is what the earth would look like?" one eight-year-old asked. He didn't want his lunch and neither did most of the rest of his group. "We can eat any time; this is Venus!"

In January of 1980, I began to handle the Outreach Program of Flandrau Planetarium. This is set up so that when a class requests assistance from the Planetarium, I go out and spend three quarters of an hour with them. We hope that in the coming years, the budget will permit an expansion of this service and that we will be able to "hit" a much greater percentage of the Tucson area schools. We are also trying joint Outreach experiements with other astronomical institutions, especially the Smithsonian and their MMT (Multi-Mirror Telescope) staff.

I begin each of these programs with a brief ice-breaker. On one occasion, I might write in large letters on the blackboard, "ASTRONOMY IS FUN." On another, I may simply say, "Flandrau Planetarium has asked me to announce that there will be **no smiling** during this presentation." Then it's only a matter of waiting for the laughter. Such beginnings are important. They establish a relationship and an environment in which learning can proceed, and in which the creative process of give-and-take can blossom. One eight year old asked on Career Day, "How do you become an astronomer?" I saw no advantage at that age, of a discussion of the college and graduate school curricula that are required to enter the already overcrowded market of professional astronomy. So this was my answer:

"Here is how you become an astronomer. On the next clear night go outside and look up at the sky. Ask yourself, 'What is that group of stars?' Go inside again and find out on a star map. Then when you've checked and you think you know, go out again, look up and be able to say, 'Now I know.'"

"That is when you will be an astronomer."

Before closing, I would like to acknowledge that the development and expansion of Flandrau's Outreach Program has been greatly aided by Richard Willey, former Director, Dennis Mamana, current Director, and Larry Dunlap, Education Director. Their help is also evidenced in the little things, like the decision to post the beautiful "Thank You" cards from the children in the main lobby. clearly establishing this program as an important role of the planetarium. Their suggestions and encouragement should affect future young minds for years to come.

As it has existed for the last two years the Outreach Program could not have been successful were it not for Lonny Baker, Assistant Education Director. Her suggestions come from her own strong experience in classrooms and other teaching situations, and her unceasing attention to Outreach has done much to advance our work.

I thank them all.

HIGHLIGHTS OF INTERNATIONAL PLANETARIUM WEEK

George Reed

West Chester State College
West Chester, PA

We had Pennsylvania Planetarium Week declared by the governor of the Keystone State. We had Morehead Planetarium Day declared by the mayor of Chapel Hill. We had special programs and tours on "How the Planetarium Works." We had lectures, exhibits, and of course we had our normal planetarium shows and classes. All of these events took place as part of the IPS-endorsed celebration of International Planetarium Week during October 20–26, 1980.

The award for the most energetic and imaginative celebration goes to A.F. Jenzano's Morehead Planetarium at the University of North Carolina. Can you imagine a 45-foot long banner proclaiming "International Planetarium Week" hanging from your building? When was the last time the airport called you and told you to tone down your party? It seems that they were worried some of the helium filled weather and party balloons hung on the building might escape into their jet lanes.

The Morehead staff used recorded radio spots, the campus public television station, the North Caroline State Fair, and the North Carolina Science Teacher's convention in Raleigh to announce the planetarium's week of recognition. Jim Manning, Morehead Planetarium assistant director, spent several days dressed as an extraterrestrial carrying a sign asking, "When was the last time you visited YOUR planetarium?" and handing out Morehead planetarium pennants and schedules. His close encounters with prospective planetarium goers took place at a "Festive Fall," a street fair, and in a local shopping mall.

What did the Morehead Planetarium get for all of this extra effort and enthusiasm? According to April S. Whitt, Morehead Planetarium educational assistant, the payoff was a significantly increased attendance. Congratulations to the Morehead Planetarium staff.

Dennis Mammana, director of the Flandrau Planetarium at the University of Arizona used the services of the Tucson Amateur Astronomers Association to add several star parties to their week-long schedule of events. They also used the week to celebrate their fifth anniversary.

Thomas R. Clarke, associate curator in charge of Ontario's McLaughlin Planetarium, reported that 2000 people took part in the various activities that were scheduled for the week. The activities included a K-3 School Planetarium program that was presented for young families. This well attended program was used in place of the regular Sunday program. Other activities included a lecture by Dr. J. Veverka on Voyager, current sky talks, and public observing sessions.

Claire and Quent Carr, the dynamic duo of the Herkimer County Planetarium in New York State used International Planetarium Week as the focus for a variety of activities. One of their invited lecturers, Dr. Anthony Aveni, spoke on astroarcheology in Mesoamerica. Moon rock and meteorite display disks were on exhibit. Movies and slide presentations were shown. Telescopes and computers were demonstrated. Planetarium programs were, of course, offered thoughout the week by the Carrs and their "staff" of students from the local gifted program.

Herb Teuscher at the Virginia Beach Planetarium in Virginia used the same encompassing approach. His celebration included a NASA speaker, the Einstein Centennial Exhibit and the mobile Solar Energy Exhibit from the Virginia Science Museum in Richmond. Like many other planetariums, Teuscher used International Planetarium Week to feature Carl Sagan's *Cosmos* planetarium program. Teuscher's only failure was his attempt to include a few night sessions with telescopes. The weather did not cooperate. (Didn't he realize that was why planetariums were invented in the first place?).

Dr. Gerald Mallon Methacton School District

COMMONWEALTH OF PENNSYLVANIA
GOVERNOR'S OFFICE
HARRISBURG

PROCLAMATION

PLANETARIUM WEEK
OCTOBER 20-26, 1980

Astronomy is humankind's consistent, scientific attempt to interpret the cosmos and set the scene for human experience. The planetarium has had significant impact on our awareness and understanding of our universe.

In October of 1923, the first modern planetarium program was presented at the Deutsches Museum in Munich, Germany. Since that time, the number of planetariums has greatly increased.

Pennsylvania is proud to be a leader in the planetarium movement. With the opening of the Fels Planetarium of the Franklin Institute in Philadelphia, the Commonwealth became the second state to have a major planetarium. The William Penn Memorial Museum Planetarium in Harrisburg opened to visitors in 1965. The Commonwealth also has the distinction of being the only state in which planetariums are manufactured. From one manufacturer in Chadds Ford, planetariums have been supplied to educational institutions across the United States.

The planetarium has developed into a successful, multimedia, educational and entertainment facility which conveys the evolving concepts of our universe. The International Planetarium Society, a non-profit educational organization with members from affiliate planetarium associations throughout the world, sets aside one week in October to commemorate the first public planetarium show and to inform the public of the knowledge and entertainment which is available through planetariums.

Therefore, I, Dick Thornburgh, Governor of the Commonwealth of Pennsylvania, do hereby proclaim October 20-26, 1980 as PLANETARIUM WEEK in Pennsylvania in conjunction with the observance of the International Planetarium Society. I urge all citizens to participate in this week's activities which are designed to increase awareness and appreciation of planetariums.

GIVEN under my hand and the Seal of the Governor, at the City of Harrisburg, this tenth day of October in the year of our Lord one thousand nine hundred and eighty and of the Commonwealth the two hundred and fifth.

Dick Thornburgh
Governor

Sam Mims, Planetarium Curator at the Louisiana Arts and Science Center Planetarium in Baton Rouge, Louisiana, produced a special I.P.W. "How the Planetarium Works" program to preceed his regular showing of *Cosmos: The Voyage to the Stars.* Both shows were free in observance of Intarnational Planetarium Week.

Dr. Gerald L. Mallon at the Methacton School District Planetarium in Pennsylvania used IPW to conduct three separate planetarium open house sessions for the parents of his community. Mallon used the sessions as a means to communicate the goals and methods of plenetarium instruction, provide a tour of the facility, and present a demonstration lesson in the planetarium. His efforts were hampered somewhat by the picket lines of striking school support personnel.

West Chester State College, "The Home of IPW," offered a Week of programming in honor of International Planetarium Week. Hubert Harber and graduate student David Dickson presented "Cosmos" to packed audiences on two nights of the week. Dr. George Reed conducted several "The Sky Tonight" programs during the week and finished with three different Saturday afternoon programs. The attendance was very good considering that the competition was a World Series game involving the now-World Champion Philadelphia Phillies. The programs were representative of the interaction programs used with area schools. Reed was also responsible for having Governor Dick Thornburgh declare October 20–26, 1980 as Pennsylvania Planetarium Week.

Art Johnson, director of the Fleischmann Atmospherium/Planetarium at the University of Nevada in Reno reduced the cost of admission to his facility for International Planetarium Week. David Dundee, astronomer at the Fernbank Science Center, reported that they conducted a special lecture program on how the Zeiss projector works and how the audio tape, artwork, and special effects of a planetarium show are put together. Joseph Kippert, planetarium director at the Punxsutawney Junior High School Planetarium in Pennyslvania delayed a special student presentation in honor of the IPW celebration until the school's annual open house night in November.

The late Governor of Connecticut, Ella Grasso, proclaimed the Third Week in October as International Planetarium Week in Connecticut. Planetarium Directors John Klimenok, Craig Robinson, James Della Valle, Charles Walker, and James Yankee met with Grovernor Grasso at the state capital in Hartford to receive her "offical statement" and to talk about planetarium programs and related efforts in astronomy and space science education.

What was perhaps, for planetarians, the best IPW planetarium celebration of all took place in Jackson, Mississippi where Richard Knapp threw a party for his staff.

Mark Wallace reported from Andrews, Texas that his radio, newspaper, and poster efforts on behalf of International Planetarium Week brought a large number of first time patrons to his planetarium programs. Every activity of the week was filled to capacity.

And, of course, there were a lot of activities that took place which, unfortunately, were not reported.

What has International Planetarium Week accomplished? Well, we had some fun, we let our existence be known, and we finally achieved equal recognition status with "nature's most humorous vegetable," the pickle, We too have had our International Week of Recognition.

In Virginia Beach

Planetarium announces a voyage to the stars

Herb Teuscher, director of the Virginia Beach Planetarium, has announced the showing of Dr. Carl Sagan's production of "Cosmos: The Voyage to the Stars" every Sunday and Tuesday evening in October.

Dr. Sagan, the distinguished space scientist, narrates the multi-media planetarium show. He and Ann Druyan wrote the "Cosmos" series for the Public Broadcasting Service where the series will be broadcast.

"Cosmos" will premiere on PBS at 8 p.m. Eastern Time on Sunday, September 28, 1980. Teuscher believes it will be an exciting series because it encompasses highlights of the know universe, life and its origins, travels in space and time, the life cycle of stars, the probability of life elsewhere, and many other topics. Tuescher appreciates the timing of this event as it occurs during the month of October when International Planetarium Week is observed. This year it is the week of October 20-26.

Dr. Carl Sagen

Virginia Beach *Sun* September 24, 1980.

Script Section

Conducted by
RONALD N. HARTMAN

NOTHING LIKE A COMET

A Script Prepared by **David A. Rodger**

Originally Produced by the Staff of and Presented at the

H. R. MacMillan Planetarium 1100 Chestnut Street Vancouver, B.C., Canada V6J 3J9

VISUAL	AUDIO	COMMENTARY
LIGHTS and PROJECTORS: Blue sky and Clouds	Prelude music	
ZEISS: in well, flat (set at 10 hours R.A., latitude 50 north)	Fade music out	
	Short LIVE introduction	
Crossfade to		
ALL SKY PROJECTORS: Small bright comet framed in church arches. Comet is in west. Twilight and sunset clouds visible.	Music up	
	Fade music under	
	Voice (slight echo)	Lord, save us from the devil, the Turk, and the comet . . . Amen
	Bells up	
	Fade bells under	
	Narrator	With those words, European churches in the mid-fourteen-hundreds closed their services. The faithful prayed for deliverance from their enemies, and included in the list was a bright comet that had intruded upon their orderly skies. You may wonder what on earth the comet had done to those people to cause them to be so terrified of what we consider today to be a rare and beautiful celestial object. The answer lies in the fact that comets had a bad reputation for appearing in the wrong place at the wrong time.
	Fade sound out	
Begin slow crossfade to		
Blackout		
Medium-rate crossfade to	Music up	
PANORAMA: Roman scene (night time)	Fade music under	
ZEISS: Stars SLIDE: Small bright comet in Ursa Major	Narrator	For instance, when Julius Caesar was assassinated in 44 B.C., it wasn't a good idea to hang around Rome, and even a worse idea to hang *above* Rome, especially, if you were a comet!
	Music up	
	Fade music under	
	Voice	A hairy star was then seen for seven days under the Great Bear. It rose about five in the morning and was very brilliant, and was seen from all parts of the known world. The common people supposed that the appearance of the comet indicated the admission of the soul of Julius Caesar into the ranks of the immortal gods.
Fade stars out	Fade music out	
Crossfade to		
SLIDE: Bayeux tapestry (one location)	Sound of battle	
SLIDE: Comet (as before)	Fade sound under	
	Narrator	In the year 1066, when King Harold prepared to fight an invading army, he looked upon the appearance of a bright comet as a sign of his own misfortune. After all, that fellow Caesar hadn't had much luck with the things! It turned out that Harold had every right to feel uneasy. The invading army was led by William . . . the conquerer!
	Fade sound out	
Add		
SLIDE: Mount Vesuvius erupting (one location)	Sound of volcano	
	Fade sound under	
	Narrator	Shortly before Mount Vesuvius blew its top in 1631, there was a fairly bright comet in the sky. People, especially those living at the base of the mountain, blamed the comet for the eruption. But this was the only comet that had coincided with any of the eight previous recorded eruptions of the volcano.
	Fade sound out	
Add		
SLIDE: London in 1665 (one location)	Music up	
	Fade music under	

	Narrator Fade music out	A lot of people in London shook their fists at the comet of 1665 as they died of bubonic plague. London was the only major city ravaged by the plague that year. However, elsewhere, when people saw the comet, they were busy moving out of the range of volcanoes! You can depend on disasters to happen quite often, whether they are natural or man-made. In fact, disasters are so frequent that an unsuspecting comet could easily find itself involved in such events by sheer coincidence!
Add		
SLIDE: Photograph of Halley's comet in 1910. (one position)	Music up (ragtime) Fade music under	
	Narrator Fade music out	By the Twentieth Centry, the time was ripe for enterprising capitalists to cash in on people's fear and ignorance of comets. During the last passage of Halley's comet in 1910, a certain American doctor made himself quite wealthy by prescribing comet pills for his patients. The pills were to be taken every hour until the comet had passed. He had lots of customers, especially after it was advertised that the earth would pass right through the comet's tail!
Add		
SLIDE: Children of God pamphlet (one position		And who can forget the doom and gloom that was supposed to occur with the passage of Comet Kohoutek in 1973 and early 1974? One group said the comet would cause the end of the world, among other things. For those of you who missed that important event, it took place on January 31st, 1974!
	Music up	
Slow crossfade to	Fade music under	
PANORAMA: Ancient landscape, daylight scene DOME BULB: Sun LIGHTS: Faint blue sky	Narrator Fade music out	But amid all the voices of fear and superstition that have greeted the appearance of comets down through history, there have also been ones that suggested that comets weren't all that bad. Some early observers even thought about comets in a rational and friendly manner. In ancient Mesopotamia, for instance, a group of influential magicians studied the heavens in great detail. Certainly they were impressed by comets, but proclaimed them to be quite harmless objects that revolved around the sun. Even the Roman writer Seneca said that comets were beyond the moon, and that they moved in definite paths . . . not at random.
Add		
PROJECTOR: Flaming comet slowly moving up to the sun. The flames should grow longer and more brilliant as the object nears the sun.	Music up Fade music under Narrator Fade music out	Intelligent theories about comets were all but forgotten in Aristotle's time in early Greece. Then the accepted belief was that comets were effects of our atmosphere. In those days, many people thought that comets were huge clouds of gas that were ignited by the heat of the sun. These so-called flaming clouds grew larger and brighter as they neared the sun. And the idea seemed to be a good one; it lasted through to the Sixteenth Century!
Rapid fade to	Music up	
Blackout		
SLIDE: Very gruesome comet (two locations)	Fade music under	
	Voice A	It is the work of the devil!
	Voice B	The end of the world is at hand!
	Voice C	Behold the wandering souls of mortal man!
	Voice D	God has set the sins of motal man to burn in the firmament!
Cross fade to	Music up	
PARTIAL PANORAMA: Uraniborg silhouette (Tucho's observatory) SLIDE: Comet in sky ZEISS: Faint stars	Fade music under Narrator	As the great comet of 1577 blazed overhead, the people of Europe were once again in a state of panic. But the Danish astronomer, Tycho Brahe wasn't concerned. During that year, he had kept a careful record of the comet's position with respect to the stars, from his observatory on the island of Hveen.
Add		
PARTIAL PANORAMA: Prague silhouette (opposite Uraniborg)	Fade music out	Four hundred miles away, in Prague, his assistant was making similar observations. When they had compared notes and drawings, Tycho confidently announced that the comet was not only beyond our atmosphere, but beyond the moon, as well! What had he discovered that enabled him to reach such a conclusion?

Fade Zeiss stars	Music up	
Move Zeiss to 14 hours right ascension	Fade music under	
	Narrator	If you hold your finger a few inches from your face and look at it, first with one eye and then the other, you will see it change position against any objects in the background. If you hold your finger at arm's length, it will still change its position . . . but to a lesser degree.
RAISE ZEISS	Music up	
	Fade music under	
	Narrator	People who enjoy making up strange words decided to give one to the change in position your finger appeared to make. They called it parallax. When your finger was at arm's length, the parallax of your finger was less than it was when your finger was closer to your eyes.
Add SLIDE: Full moon	Music up	
	Fade music under	
	Narrator	Our eyes are too close together to measure the parallax of the moon, but the moon's parallax can be measured if it's observed simultaneously from two locations just four miles apart. Of course, precise measurements are essential. The stars are used as the background objects.
	Fade music out	Tycho found that his assistant had drawn the comet in exactly the same position from Prague as he had drawn at Stjerneberg. The lack of any parallax from the two observing sites four hundred miles apart, proved beyond a doubt that the comet was much further away than the moon.
Slow crossfade to	Music up	
ZEISS: Stars	Fade music under	
ZEISS: Slow daily motion		
ZEISS: Comet		
ZEISS: Twilight in west	Narrator	To the casual observer, who doesn't worry about plagues or global destruction, a comet's motion might appear deceptively simple to explain. As the earth rotates on its axis, the comet, along with the stars, conducts a leisurely journey in a westerly direction. Even it it rises at nightfall and remains visible for the rest of the night, it won't appear to move except in this manner.
ZEISS COMET MOVES EASTWARD	Music up	
Gradually stop daily motion	Fade music under	
	Narrator	But if the observer notes the comet's position with respect to the stars over a series of nights, he will see a definite change. Each night, the comet would occupy a slightly different position.
	Music up	
Slow crossfade to	Fade music under	
BULB IN DOME: Sun SLIDE: Straight line superimposed on sun	Narrator	In time, a comet would appear to move from one side of the sun to the other. Several famous astronomers, including Galileo and Kepler, believed that comets moved in straight lines, but Sir Isaac Newton put an end to all the guessing when he showed that comets moved along curved paths. He studied the orbits of a number of comets for which there was sufficient observational data, and then he announced that the paths of comets were, in fact, parabolas. A parabola is a simple curve constructed in such a way that the two ends, if extended into space, will never meet. In fact, they grow further and further apart. That would mean that no comet could ever make more than one visit to the sun.
Lower Zeiss	Fade music out	
Fade comet and stars Stop daily motion		
Crossfade rapidly to SLIDE: Colored parabola BULB IN DOME: Sun Slow crossfade to SLIDE: Inner solar system, showing orbits out to Mars, brightly colored and labelled	Music up	
ZOOM: (at small end) Ellipse, with one focus at the sun. ZOOM OUT SLOWLY.	Fade music under	
	Narrator	Further research by Newton prompted him to publish his Theory of Gravitation, which he applied in attempting to describe the orbit of a brilliant comet seen in 1680. In his theory, Newton suggested that some comets might move, not in parabolas, but in very large ellipses. Newton then brought together all his parabolas and ellipses to make one final and startling connection. He said that if a comet travelled in a huge ellipse, it would be very difficult to distinguish the ellipse from a parabola, so tiny would be the part of the ellipse visible from earth. The difficulty was that the observations made during Newton's time could not make that distinction.

Slow crossfade to	Music up	
ZEISS: Faint stars		
SLIDE: Small bright comet	Fade music under	
SLIDE: Newton SLIDE: Halley	Narrator	Newton, and his good friend Edmund Halley, worked on the orbit of that comet of 1680 and calculated that a round trip for that comet along its elliptical pathway would take 575 years to complete. Remarkably, their estimate was out by only a few thousand years! But Halley had just started his research. He investigated the records of all the bright comets seen in the previous 200 years, and found that two of them had similar orbits.
Slow crossfade to		
PARTIAL PANORAMA: Greenwich Observatory at twilight	Music up	
	Fade music under	
SLIDE: Small bright comet	Narrator	Then in August, 1682, an observing assistant at the Grennwich Observatory discovered a comet. It attracted the attention of all the leading astronomers of the time, including Halley. He calculated the orbital path of the comet, and, to his amazement, he found that the orbit was virtually the same as two earlier comets; ones seen in 1531 and 1607. The appearances of the three comets were separated by exactly seventy-five and a half years. This led him to predict that the same comet would return in 1758.
ZEISS: Stars		
Crossfade to		
SLIDE: Halley		
ZEISS: Faint stars		
SLIDE: Small bright comet		Halley never lived to know whether or not his prediction would come true. He died in 1742, sixteen years before the comet was due to return. That wasn't too surprising, however. He would have been 108 years old by 1758!
Slow crossfade to	Music up	
PANORAMA: Countryside scene with snow on the ground	Fade music under	
	Narrator	There were many people who remained skeptical about Halley's prediction and, ironically, most of them lived in England. But others thought he might be right, so the watch for his comet began in January, 1758. As the year went on, though, some began to wonder if Edmund Halley wasn't just another science-fiction fanatic. And by December, 1758, a good many astronomers had given up the search and turned to other projects.
ZEISS: Faint stars	Fade music out	
Add		
SLIDE: Small fuzzy blob in telescopic field		On Christmas night, an amateur astronomer discovered a comet with his small telescope. When the orbit was calculated, the world realized that Halley had been right after all. It was the same comet that had appeared in 1682.
Add		
SLIDE: Halley	Music up	
	Fade music under	
	Narrator	A few years before his death, Halley had written . . .
	Voice of Halley	*If according to what we have already said it should return again about the year 1758, candid posterity will not refuse to acknowledge that this orbit was first discovered by an Englishman!*
Slow crossfade to SLIDE: Small bright comet ZEISS: Faint stars	Narrator	Posterity did not refuse to acknowledge the first discoverer of a periodic comet, and the comet now bears Halley's name in recognition of his work. Later, two other Englishmen, Cowell and Crommelin, carried out an intensive study, and traced appearances of Halley's comet back as far as 466 B.C.
	Fade music out	In less than 100 years, with trial, error, and some intellectual imagination, comets had evolved from being thought of as gaseous fires in the earth's atmosphere, to wanderers in the solar system and the depths of space.
SLIDE: Horrible comet (two locations)		
	Music up	
	Fade music under	
	Voice	So horrible was it, so terrible, so great a fright did it engender in the populace, that some died of fear, others fell sick. This comet was the color of blood. At its extremity we saw the shape of an arm holding a great sword as if to strike us down. At the end of the blade were three stars. On either side of the rays of this comet were seen great numbers of axes, knives, bloody swords, amongst which were a great number of hideous human faces, with beards and hair all awry!

	Narrator	That cheerful little description of a comet was penned by a famous sixteenth century medical doctor. So much for factual and honest reporting!
Slow crossfade to SLIDE: Telescopic view of comet (to locations)		But assuming a comet isn't a conglomeration of horrible heads, swords, and blood, what is it made of? Most comets have three distinct parts: a nucleus, a coma, and a tail.
Add SLIDE: "nucleus" and arrow (two locations) Add SLIDE: "coma" and "tail" and arrows (two locations	Music up	The nucleus is the heart of the comet, and it is from the nucleus that the coma and tail are formed.
Crossfade to ZEISS: Faint stars SPECIAL EFFECT: Small comet develops Motion of comet should be towards the south where a partial panorama of the edge of the sun is to appear later. Tail of comet must point away from edge of sun	Fade music under Narrator	In the cold, dark reaches of outer space, a comet is only a dull grey blob, about a mile or two in diameter. At this point, the comet is just a nucleus, composed of dust, held together by frozen moleculues of ammonia, methane, carbon dioxide, methyl cyanide, and water.
Add PARTIAL PANORAMA: Edge of sun SPECIAL EFFECT: Solar wind radiating from Edge of Sun panorama	Music up Fade music under Narrator	When these frozen gases are touched by the sun's rays, they begin to evaporate, forming the coma. The gases that make up the coma are spread out for several hundred miles in all directions, forming a halo around the nucleus. As the comet nears the sun, it feels the pressure of the solar wind, an overflow of charged particles. The solar wind forces the evaporating particles from the comet to stream away from the sun. The comet now has a tail . . . a tail that could stretch out for hundreds of millions of miles.
Slow crossfade to SLIDES: Telescopic views of various comets	Narrator	All of this takes place if the comet is an ordinary one. The trouble is, most comets prefer to be nonconformists. Some don't have a coma; others doen't have a tail. Some comets, instead of growing bigger and brighter as they neared the sun have faded and disappeared without a trace.
Slow crossfade to PANORAMA: Mountainous country-side ALL SKYS: Sunset effect LARGE FORMAT SLIDE: Comet Cheseaux	Music up Fade music under Narrator	There is no rule that says comets can only have one tail, either. In 1744, Comet Cheseaux emerged from behind the sun with no less than six tails, fanning out like a plume of feathers. From studies of comets like these, astronomers have generally concluded that the tail of a comet occupiies a wide angle in space.
Slow crossfade to BULB IN DOME: Sun LIGHTS: Blue sky, dim SPECIAL EFFECT: Comet of 1882, as described in the script	Music up Fade music under Narrator	In 1882, there was a comet that was so bright it could be seen in full daylight. A few days after it rounded the sun, it began to grow longer, until at last if formed a brilliant streak estimated to be some 100 thousand miles long. Within the streak were four or five star-like condensations that witnesses compared to a luminous string of pearls. These condensations gradually separated from each other until they had become five individual comets. Each of the five comets headed out into space along a similar path.

Raise Zeiss		
Crossfade to	Music up	
ZEISS: Stars (full bright) at 2 hours, right ascension	Narrator	Biela's comet, discovered in 1826, divided into two parts during its return in 1845. Both comets came back again in 1851, then they were never seen again.
ZEISS: Meteor shower	Music up	
	Fade music under	
	Narrator	In November, 1872, a dazzling display of meteors produced the incredible sight of over one hundred meteors a minute for almost an hour. Imagine the surprise of investigating scientists when they discovered that the meteors radiated from the same part of the sky in which Biela's comet was to have appeared on its predicted return that month.
Crossfade to	Music up	
ORRERY: All planets in motion	Fade music under	
SPECIAL EFFECT: Particle stream, with orrery sun at one focus of the long elliptical shape	Narrator Fade music out	This confirmed the growing suspicion that comets and meteor showers were related. The annual recurrence of a meteor shower indicates that the stream of particles responsible must be spread entirely around the old comet orbit. The show may last for several days as the earth passes throught the stream. These comet-related showers are usually qute weak. Other stronger shows may not make an annual appearance, presumbably because they are at an earlier stage of development, and the cometary debris hasn't had time to distribute itself evenly around the orbital highway. For instance, the earth passes through the Leonid meteor shower every November, yet it intersects the dense part of the shower only once in thirty-three years. This last happened in 1966, and on that occasion, thousands of meteors were seen during a space of a few hours.
Crossfade to		
ZEISS: Stars		The meteor shower debris left behind by comets tells us a surprising amount about the structure of the nucleus. For instance, there has been no known case of a meteorite hitting the earth during a meteor shower, no matter how intense the shower has been. This curious circumstance indicates that either the cometary debris is very small or is composed of ice. In either case, the debris burns up or melts as it plunges into the earth's atmosphere.
ZEISS: Meteor shower		
Crossfade to	Music up	
ZEISS: Stars		
PANORAMA: Paris rooftops (18th century)		
SPECIAL EFFECT: Moving telescopic field of stars, sweeping back and forth across the stars to suggest comet-hunting	Fade music under	
	Narrator	Hunting for comets is a time-consuming and tedious process. The first person to make it a kind of vocation was the Frenchman, Charles Messier, who lived during the middle and late 1700's. During his many nights of scanning the skies, he came upon fuzzy globs that looked just like distant comets, but which maintained their positions amongst the stars.
SPECIAL EFFECT: *Stop* moving star field projector in a position so that a Messier object can be projected into it		Messier was quite disappointed when the fuzzy globs didn't turn out to be comets, but he made a list of them anyway, so others wouldn't be fooled. Today, the one hundred and ten galaxies, nebulae, and star clusters in Messier's catalogue are permanently featured on star charts. By the way, Messier was eventually successful in discovering thirteen comets.
Crossfade to		
PANORAMA: Silhouette of major observatory	Music up	
ZEISS: Stars	Fade music under	
	Narrator	Nowadays, most professional astronomers don't have much time to spare for comet-hunting. Our universe seems far more complicated than it dit in the Eighteenth Century, so when an astronomer takes his turn at a large telescope, that valuable time must be spent on observations related to current problems in cosmology and astrophysics.

Slow crossfade to		
ZEISS: Stars	Music up	
ZEISS: Slow daily motion	Fade music under	
	Narrator	As a result, the work of discovering comets has been left to amateur astronomers. Comets can appear, without warning, in any part of the sky, and most of them never appear any brighter than Messier's faint, fuzzy globs. It has been estimated that a person must spend an average of two hundred long, dull, and very often . . . cold . . . hours to find one. Some peple have searched for a lifetime without a discovery; others have found comets without even trying! Accidental discoveries have been made by professional astronomers when a faint distant comet showed up on photographic plates taken to reveal something completely different!
Lower Zeiss	Fade music out	
Fade Zeiss stars		
Stop daily motion		
Crossfade to		
SLIDE: Telescopic view of Arend-Roland (label and date)	Music up	
	Fade music under	
Add		
SLIDE: Telescopic view of Mrkos (label and date)	Narrator	Whether they are found by searching or by accident, about twelve new comets are discovered every year.
Add		
SLIDE: Telescopic view of Ikeya-Seki (label and date)	Music up	
Add	Fade music under	
SLIDE: Telescopic view of Bennett (label and date)	Narrator	On the average, a naked-eye comet can be seen from at least part of the earth once every two years. The comet's location with respect to the stars determines what parts of the earth can see it. Obviously one near the Southern Cross could not be seen from Canada, since that constellation never appears this far north.
Add		
SLIDE: Telescopic view of Kohoutek (label and date)		
Add		
SLIDE: Telescopic view of Bradfield (label and date)	Music up	
	Fade music under	
Add		
SLIDE: Telescopic view of Kabayashi-Berger-Milon (label and date)	Narrator	Every five to ten years, a bright comet can be seen for a while from all parts of the earth. Three or four times a centruy, there are comets bright enough to be seen in broad daylight. The last of these was Comet Ikeya-Seki in 1965. That comet was not placed for easy observation from Canada.
	Music up	
	Fade music under	
	Narrator	In spite of all the information we have gathered about comets these last few hundred years, the puzzle that Tycho Brahe, Isaac Newton, and Edmund Halley helped to put together, still missing is an important piece! That piece contains the answer to the origin of comets. It has challenged some of the great thinkers of our time, as well as some of the great dreamers!
Slow crossfade to		
BLACKOUT		
SPECIAL EFFECT: Sun throwing off material. Solar prominences	Music up	
	Fade music under	
	Narrator	The idea that comets are flung into space from the sun is a little far-fetched. Solar prominences, the tongue-like columns of gas and material bursting up from the sun's surface, can eject matter. But that matter either escapes the solar system altogether, or falls back into the sun. It cannot go into orbit. Any anyway, comparisons of the light emitted by comets with the light emitted by the sun, have shown that comets do not contain the same material as the sun.
	Fade music out	
Slow crossfade to		
ZEISS: Stars (faint)	Music up	
SLIDE: Jupiter	Fade music under	
SPECIAL EFFECT: Asteroid passes near Jupiter	Narrator	It has been suggested that comets are the result of asteroids broken into pieces by Jupiter's gravitational field. But calculations have shown that even an asteroid 300 miles in diameter would escape a close encounter with Jupiter without suffering so much as a crack. It is impossible for a larger asteroid to break up into the tiny pieces that exist in the nucleus of a comet.

Crossfade to	Music up	
SLIDE: Venus (Mariner 10 photo)	Fade music under	
ZEISS: Stars (faint)	Narration	One rather fanciful theory suggests that the planet Venus was once a comet, and that it was ejected from within Jupiter. Venus is about four thousand times larger than the largest known comet nucleus, and the density of Venus is about 500 billion times greater than the average comet.
Rapid crossfade to	Fade music out	
SLIDE: Venera photos of Venus surface		
Lower Zeiss		Moreover, photographs taken from the surface of Venus by the Soviet spacecraft Venus 9, in October, 1975, showed evidence of recent volcanic activity; hardly the kind of behavior we can expect of comets!
Slow crossfade to		
SPECIAL EFFECT: Slowly rotating material covering the dome. Similar Similar to the transition effects.	Music up Fade music under	
	Narrator	About the same time as the Venus-as-comet theory was being hotly debated in the early 1950's, the Dutch astronomer Jan Oort made his theory public. He proposed the existence of a great comet cloud surrounding the sun in all directions at a distance of up to nearly two light-years.
Add		
SLIDE: Small dot and surrounding circle to represent the sun and solar system; brightly colored to help the audience distinguish it from within the rotating material	Music up Fade music under	
	Narrator	The theory goes on to propose that passing stars or other objects give a gravitational kick to the proto-comets in the cloud, thereby sending them in to a rendezvous with the sun.
Add		
SPECIAL EFFECT: A single bright object begins moving in towards the slide from the outskirts of the comet cloud	Music up Fade music under	
	Narrator	Oort proposed that the comet cloud has existed since the formation of the solar system, an idea that evoked cirticism in two areas. First, the number of occasions when passing stars or other objects are encountered would seem to be infinitesimally small. The galaxy just isn't that dense. And secondly, after five billion years of existence, the comet cloud should have passed out of existence. Yet, the number of comets discovered each year is actually on the increase. Oort's theory still has its adherenets, however, and the idea of the comet cloud has a fair amount of support.
Slow crossfade to		
PROJECTOR: Rotating galaxy (up and fixed in position)	Music up Fade music under	
Add		
SLIDES: TELESCOPIC field views of several nebulae	Narrator	Our Milky Way Galaxy contains over one hundred billion stars. Around and between the stars lie a variety of dust and gas clouds called nebulae. Our sun completes a rotation around the hub of the galaxy every two hundred million years, and this has given rise to another theory about the origin of comets . . .
Slow crossfade to		
ALL SKYS: Nebulosity	Music up	
SPECIAL EFFECT: Sun slowly moving through	Fade music under	
	Narrator	This theory proposes that there have been occasions when the sun has passed through zones of high nebulosity, and that it may pick up material destined to condense into the nuclei of comets. Many astronomers believe this may happen as often as twice every rotation of the galaxy. Even more surprising is some tentative evidence to suggest that we passed through one of these dust and gas clouds as recently as 25 thousand years ago, and that the nebula involved was the great nebula in the constellation Orion.
Crossfade to		
SPECIAL EFFECT: Sun continues to move, now it has shimmering effect around it		
	Music up	

Crossfade to	Fade music under	
PANORAMA: Observatory silhouette	Narrator	Thanks to the early discovery of Comet Kohoutek in 1973, an unprecedented observing program was able to be mounted as it approached the sun.
ZEISS: Stars		
SLIDE: Comet Kohoutek in sky	Music up	
Add		
LATERAL PROJECTOR: Skylab	Fade music under	
	Narrator	From ground-based observatories and from Skylab Three in orbit around the earth; from unmannned satellites, radio telescopes, and from Mariner Ten on its way to Venus and Mercury, Comet Kohoutek drew more attention than all the previous comets in recorded history. And, naturally, this resulted in a bonanza of new information. The discovery of the molecules cyanogan and methyl cyanide in the comet gave a hefty boost to the theory that comets were picked up as the sun passed through a nebula in prehistoric times. For those molecules exist in relatively large numbers in the spaces between the stars.
Raise Zeiss		
Slow crossfade to		
ZEISS: Stars	Music up	
SLIDE: Small prominent comet	Fade music under	
PANORAMA: Countryside sillhouette	Narrator	Comet Kohoutek has left an important legacy of information about the nature and origin of comets. But there's still much to be learned and much to be confirmed about these strange objects. Hopefully soon, there will be another bright comet that will be kind enough to give us plenty of advance warning so that sophisticated studies can be set up in preparation for its passage by our part of the solar system. Of course, there is one comet that gives up to seventy-six years warning: Comet Halley! But, if you missed seeing Comet Kohoutek in early 1974, you'll probably miss Comet Halley in 1986. Despite its considerable fame, Comet Halley's reputation is built more on its persistence than its brightness. At its last appearance in 1910, it was fainter than Comet Kohoutek. What many people alive today remember as Halley's Comet was, in fact, another brighter comet that passed through the sky in January and February of that year. So what is the outlook for Halley's Comet in 1986? Unfortunately, it isn't very promising. For one thing, it will be located in the low southern sky for a good part of the time, and that's a very awkward location for good viewing from Canada.
Add	Music up	
SLIDE: Full moon (realistic size)	Fade music under	
LIGHTS: Moonlight	Narrator	There will be a full moon just when the comet should be at its best, and that means a white-washed sky, and a white-washed comet!
Crossfade to		
PANORAMA: City scene	Fade music under	
ZEISS: Stars (fainter)		
SLIDE: Faint comet		
SLIDE: Full moon	Narrator	And, if you're living in a city, there's even more bad news. Light pollution, which spoiled the view of Comet Kohoutek for a lot of people, is predicted to be ten times worse in the 1980's than it is now! So, if you want to have a good look at Halley's Comet in 1986, you should plan now to get to the African desert, Australia, or the southern part of South America. Otherwise, you'll ust have to take your chances on the next return of Comet Halley in 2061!
LIGHTS: Moonlight		
Slow crossfade to		
ALL SKY: Giant moving comet rises slowly and moves across dome		Like Comet Kohoutek, Comet Halley will probably be a scientists' comet. New tests and observations will be made to determine the comet's age and, possibly, its orgin. And there are tentative plans to send a spaceprobe right to the heart of the comet . . .
SLIDE: Earth in distance		
ZOOM: Spacecraft (slow zoom from large to small)		
	Music up to finish show	
Slow crossfade to		
ALL SKY: Moving twilight with comet positioned just above twilight colors	STOP TAPE	LIVE CLOSING REMARKS

THE COSMOS ACCORDING TO SAGAN

A Personal View

Alan Dyer
Queen Elizabeth Planetarium Edmonton, Alberta, Canada

(**Editor's Note**: Reprinted from *The North Star,* PAC Newsletter, Paul Deans, Ed.)

By now I'm sure that everyone in the Planetarium world has had a chance to see the thirteen episodes of Carl Sagan's PBS TV series, *Cosmos.* At least, I would hope that everyone involved in planetarium production has seen the series, since there is a great deal to be learned from it. *Cosmos* was essentially thirteen "planetarium" programs, produced not for a hemispherical dome, but for a TV screen. Beside the basic topics themselves, there were many similarities between the weekly episodes of *Cosmos* and typical planetarium shows. But for one difference–*Cosmos* episodes were vastly more entertaining than the majority of planetarium programs.

Cosmos was an excellent series, produced with a professional style that I have seldom seen equalled in a planetarium theatre. However, amid the $8,000,000 worth of professional polish, there were some major flaws, and certainly a lot of weak moments, flaws that we should be able to learn from (as much as we should also be able to learn from the finest features of the series).

The fact that the series was flawed is very encouraging to me. It gives me some hope that *given a properly equipped theater,* it should be possible to produce planetarium programs that are every bit as professional and as entertaining as was *Cosmos*, and that perhaps we as producers can avoid some of the mistakes that Carl Sagan Productions, Inc. made.

THE FINER POINTS

The best aspect of the entire *Cosmos* series was the fact that it existed at all, especially at so lavish a cost. What we have been working for all these years–the popularization of astronomy–has finally arrived. Astronomy, and all of science *is* popular, not just the eccentric hobby of a few ardent amateurs and the obscure profession of a few academics. Millions of people have at least some interest in astronomy. The fact that *Cosmos* exists proves that its financial backers were also convinced of that. And if there are still those out there in the field of science education that think the general public is ignorant of or disinterested in astronomy, then *Cosmos* should be proof to them that this is not the case.

A check of the newstands each month to see the proliferation of new and very glossy science magazines should serve as additional evidence that science has at last achieved the popularity and respect we have been working for.

What does that mean to us, as science writers, program producers, and theater direcrors? It means that our work is not in vain, that it *is* appreciated, *if* (and as always, it is a big IF) the quality of programs is very, very good.

Cosmos, and the popularity of astronomy it represents, should serve as an inspiration to us all (a hackneyed phrase, but I know of no better). If there is anything that the planetarium field needs in the next few years, it's *motivation*–motivation to use the resources at our disposal to their full potential to promote science, and a wonder of nature.

What else was "good" about *Cosmos*? It was entertaining because it showed *people*, either in real life or in dramatized re-creations of history. I'm surprised the series did not make greater use of the "personalities" of science–it adds a human touch to the otherwise cold array of facts and theories of science. Planetarium programs could do well to put greater emphasis on the *people* of science, and not just the facts. It's a tough proposition, though, given our limitations of budget and projection capability. It would be fascinating to make more use of live actors in the theater. Though expensive, it would be worth attempting on certain occasions.

Even without resorting to expensive actors, film footage, or elaborate historical re-creations, I'm sure that most planetarium shows could be made more interesting by including some anecdotes, biographical material and such, information that relates something about character, something about science as a *human* endeavor.

The emphasis on people as much as on scientific findings reflects the quality of writing that went into the series. It's very easy to collect together a set of facts, place them in some logical order, then write a script around them. The inevitable result is a boring show, but unfortunately, that's how most planetarium scripts I've encountered are written. Sagan dealt with not only the discoveries of science, but also with *how* they were discovered, and by whom. Putting that extra touch to a script requires a bit more work and imagination.

Sagan was obviously out to relate the drama, mystery, and joy of science. To a large extent he succeeded. Too many planetarium shows, on the other hand, are no better than illustrated university lectures. BORING!

Cosmos was poetic (sometimes overly poetic) and dramatic (sometimes melodramatic). The scripts had feeling; they had emotion as well as information. Inevitably, it is an emotional appeal that will have the greatest impact on an audience. Sheer volumes of information rarely impress.

Well-written scripts are essential to any successful show, but words are soon forgotten. The element of any program that will be best remembered will always be the visuals. TV *and* planetarium theaters are both visual media; the sounds and words are secondary.

Cosmos was of course very strong on visuals. The location photography, the computer animation sequences, the model photography and the "cosmic zoom" art were all quite decent. This might be the most discouraging aspect of *Cosmos*, seeing all these marvelous visuals and thinking that they can never be duplicated in the planetarium theater. To a certain extent that's true. But with imagination and the right equipment, many of the same sort of sequences could be accomplished in the planetarium medium, with the advantage of a huge screen area for additional effect.

It is fairly evident that computer animation is going to be the "next big thing" in the realm of motion picture special effects, and perhaps in the planetarium theater as well. The Evans and Sutherland Digistar projector is the most exciting bit of planetarium hardware to come along since the invention of the Zeiss itself. Its capabilities would certainly put many of the *Cosmos* effects within reach of those planetariums lucky enough to acquire the device. Even without the marvels of Digistar, a lot more could be done with motion picture projection, and with a good multi-screen slide projector array. Most planetariums have never learned to use even these basic media well. Film segments used in shows too often look like home movies, with tiny unmasked frames lost amid the expanse of the dome. And most of the time, the use of slides is no better. Anyone who has seen a well-choreographed multi-screen A/V show knows the potential of the 35 mm slide.

Cosmos was able to use the techniques of video and film well to put together an entertaining show. Planetarium theaters can use some of these same techniques, but also have their own special media to work with, to create effects that, if done right, can be just as entertaining.

What is important is not what visual techniques are used, but how well they are used. Tied into this is the *quantity* of visuals and the pace of the show. *Cosmos* was able to hold audience attention, even through difficult concepts, because the visual pace was maintained. There was always something happening on the screen. Can this be said of planetarium shows? Decidedly not! Too many programs allow whole paragraphs of script (and in really horrid cases, whole pages), to go by without adding or changing any visuals. The screen is left blank or static; again BORING!

It takes a great deal more work to find or produce enough visuals (be they slides, movies, special effects, or whatever) to properly fill a typical planetarium show *and screen*, but this achievement, more than any other, will make most planetarium shows as interesting as *Cosmos* episodes.

But even *Cosmos* was not wall-to-wall special effects. Many times, sections of shows were covered by Sagan informally addressing the audience from some suitable location which might sometimes be just a basic studio. The audience attention is inevitably drawn to the narrator, and to any props he might have at hand. I think this says something for the power of a live narrator in a planetarium show, a technique that is fast becoming a lost art. Could this trend be altered? I think so. Live narrators used today are often no more than disembodied voices, from lecturers hiding behind consoles. Put the narrator out front, "on stage," lit with proper theatrical lighting; provide him or her with some props, and you have a program element capable of capturing an audience's attention in a way no gee-whiz effect can. But the narrator has to be good, a trait often reserved only for taped narration. Canned voices are certainly not detrimental to a program. but they make greater demands on the visual content. A disembodied voice alone can rarely carry a show for any longer than 10 to 20 seconds without the need for something happening on the screen.

THE FLAWS

I've spoken of some of the finer points of *Cosmos*. But what of its flaws? As creators of science programs, we should look at a series like *Cosmos* with a critical eye. Obviously, we can learn as much from other people's mistakes as we can from our own.

So what were the weak points of *Cosmos?*

Many would say that the worst part of *Cosmos* was Sagan himself, and the way he dominated scenes such as the spaceship interiors. It's a valid complaint, though I wouldn't know if the fault lies with Sagan or with the program directors.

In assembling the program topics, Sagan obviously selected subjects and ideas that were favorites of his. One did tire of hearing about the absolute certainty of the existence of alien civilizations and of the contents of the Voyager record (a topic that alone cropped up in about three episodes). But Sagan's series was labelled "a personal voyage" and in exercising a bias in the selection of topics, Sagan was no more guilty of "misleading" the public than was Bronowski in his *Ascent of Man* series or Kenneth Clark in putting together *Civilisation*. I'm sure historians of art, architecture, and science objected to the personal biases in those series, yet that didn't detract from these programs' educational value. If anything, planetarium shows should have more of a distinctive "personal" touch—making it possible to recognize a program's author by its style and content. Planetarium shows tend to be too objective, which translates into blandness and mediocrity.

While *Cosmos* succeeded for the most part in portraying the beauty and wonder of the universe, it went too far in dwelling on these emotions. This led to an emotional "overkill" in the series and some monotony. The same happens in planetarium programs—an attempt is made at maintaining the same mood (usually one of quiet awe) throughout an entire program. It may work for five minutes or so, but after that the show slips into a tiring sameness. There has to be variety—changes of pace, of mood, and of visual technique (i.e., not 45 minutes of pans, or of slides, or whatever). *Cosmos* suffered from this fault to a certain extent, especially when considering the series as a whole, and not just individual episodes.

To provide the necessary variety, what *Cosmos* lacked more than anything else was humor. Is astronomy funny? It can be. But it is certainly fun. If you can communicate that to an audience, you've got it made. The trouble is, it's often more difficult to write a "light and humorous" show than it is to write a serious and imposing program.

A recent episode of the PBS Nova series made excellent use of humor to explain some rather complicated science. The program was called "Its About Time" (of course) and dealt with the paradoxes of relativity, time travel, the creation of the universe, and other weighty subjects. The host was none other than Dudley Moore, with a special cameo appearance by Isaac Asimov (who is always good for a laugh or two!). Try to get a copy of this show if you can (it was broadcast December 30, 1980)—it's an inspiring demonstration of what can be done with humor. I only wish Sagan had not taken himself and his subject so seriously.

This flaw led in part to several sequences that dragged on for longer than necessary, as Sagan attempted to emphasize some very important point, a point that perhaps in the end, was never very clearly stated anyway. As an example, I'm thinking of the episode called "The Backbone of Night" which dealt in great detail with the workings of Ionian and Pythagorean science circa 500 B.C. Yet, was the importance of this early science ever clearly stated?

It's a mistake too easily made. The author of a science program knows the importance of some topic, but by merely discussing or illustrating the topic, assumes that the audience will automatically realize its importance as well. Major points get buried in the details. If there is a theme to the show, state it, in one or two sentences. If there is no theme, then find one, otherwise, the show will be without direction.

Cosmos, like many planetarium shows trying to cover a literal universe of material, tended to wander a bit. Scenes and topics were juxtaposed without a clear indication at first of their relation. I mean, what *did* Japanese crabs have to do with the origin of life? After ten minutes of apparent digression it became obvious, sort of!

All too often, though, the digressions and wanderings from one topic to another had no real connection or purpose. In some episodes it became a matter of trying to squeeze in as many side-topics as was possible. They might all be interesting topics, but they don't necessarily belong together in one show.

Haphazard shows always leave audiences feeling a little dissatisfied, a sure sign of problems in the script.

Reflecting the sometimes chaotic nature of the topics was the rather random use of music. I'm one of the original Vangelis fans, so I thought the choice of music was excellent. It's just that it was used rather poorly. Music faded up and down behind the narration at random, sometimes with excerpts of several pieces strung together, with the majority of selections never clearly indicating the beginning or ending of the various show segments. Much of the music, despite its quality and dramatic mood, was only used as throwaway background muzak. While the music in any show doesn't necessarily have to dominate (and it certainly shouldn't overpower the narration), the manner in which it was edited in *Cosmos* did not enhance the impact of the series as much as it could have. For example, visual transitions weren't highlighted by crescendos of music as they should have been. Too much good music was "wasted."

The soundtrack is one area where planetarium programming can easily equal or exceed the artistic quality of anything produced for the television or motion picture media. The soundtrack for *Cosmos* was, I felt, its weakest component. It did the job, but not nearly as well as it might have.

For one thing, I was very surprised that with their budget, they had not commissioned original music, in particular original compositions from Vangelis. Carl Sagan Productions missed out on a good opportunity there—a TV series, a book, and an LP as well! Maybe even a videocassette or videodisc of music and selected special effects, just right for getting into that "cosmic frame of mind!"

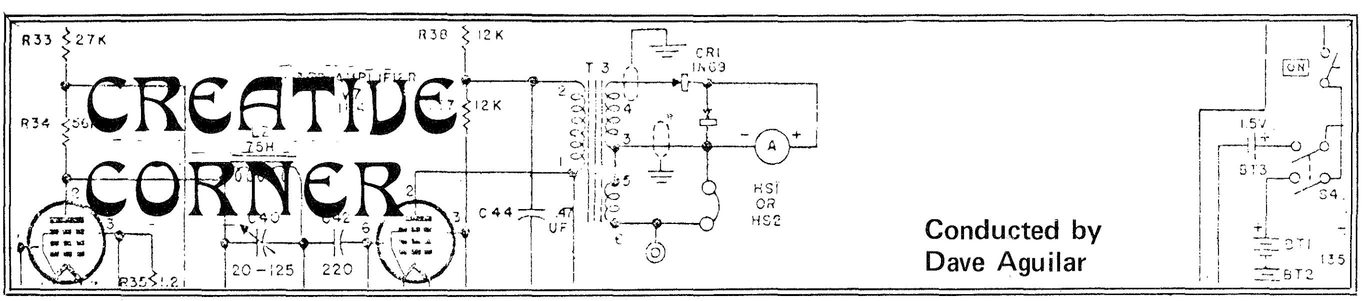
The last item that was a disappointment in *Cosmos* was the special effects. They were good, and served the purpose well. But they were not nearly as outstanding as all the preseries hype had led me to believe. The cosmic zoom sequences, used over and over again, were a far cry from even the quality of special effects created for the old classic NFB film, "The Universe." The effects in the recent NASA-sponsored film, *"Universe,"* were also far better than most of the *Cosmos* space scenes.

There is a lesson to be learned here as well. I was disappointed in the special effects in *Cosmos* becuase I expected too much. The general public may to a large extent be disappointed with planetarium shows because they, too, expect too much. Through misleading advertising they expect to see the planetarium a 360° version of *2001* or *Star Wars*. What's worse, we sometimes try to give it to them, and fail miserably.

If there is a single, severe problem in planetarium production today (and I think there is), then it is this: *We have never decided what the planetarium medium is really supposed to be*—it has never had a distinct identity as an autonomous, professional medium. And the fault lies not in the stars, but in ourselves. Even though we may never be able to present in the planetarium theater the same type of show as was *Cosmos*, with the techniques available to us, we can still produce shows that are every bit as good.

The trick is deciding what those techniques are, developing them to an art, and promoting them amongst ourselves, to the producers in other media, and to the general public.

Cosmos can teach us a lot, if we are willing to learn.



NOTE:

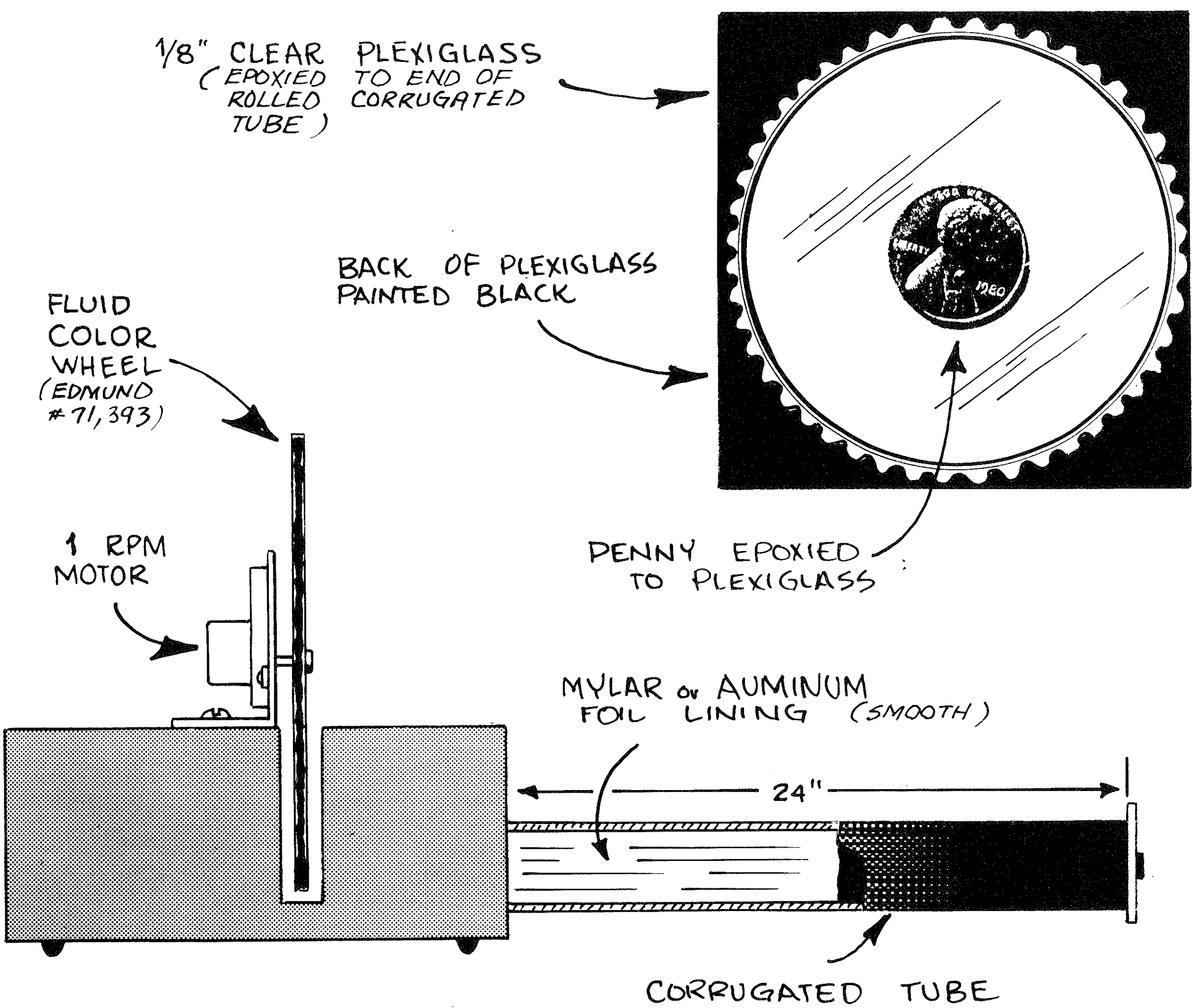
The Creative Corner page is being printed in the format of the Special Effects Handbook *(soon to be published), so that you can xerox the page for insertion therein if you wish.*

Pages from The Planetarian *will be sequenced alphabetically so you may order them in future handbook indices.*

BLACK HOLE

This BLACK HOLE PROJECTOR utilizes an Edmund Scientific 500w Sawyer projector, a motorized color wheel, and a special mylar lens tube to project one of the most beautiful effects ever seen. It never fails to be a crowd pleaser.

The lens tube is a piece of corrugated cardboard, the type used for bulletin boards and not cardboard boxes, rolled and glued into a piece of tubing that fits the lens opening of the projector. Before being rolled up and glued however, the corrugated piece of cardboard is lined half-way up with a piece of aluminized mylar or aluminum foil. The end of the tube is covered with a piece of thin clear plexiglass with a penny epoxy glued in the center.



Focus on EDUCATION

A Column Devoted to the Use of the Planetarium as an Educational Medium

Jeanne E. Bishop

German Planetarium Education

Uwe Lemmer of the Bochum Observatory Planetarium writes of the contemporary situation in German planetarium programs. He observes that there are three approaches, with a particular approach adopted by each institution.

The first is to give only public programs, with no special programs for school classes. The public programs are taped, and they are usually dry and contain dated material. The operator presents projector effects without adding to the content of the program.

The second approach is one which Lemmer labels as "old fashioned," while explaining that it is much better than the first. A live lecturer-educator welcomes the audience, discusses the projector, and introduces the daytime sun. With sunset, he points out visible constellations for approximately 15 minutes and then he demonstates a couple or all of the motions possible for the next 15-30 minutes. Finally, a particular subject is introduced, such as planets or galaxies. This approach lasts from an hour to an hour-and-a-half, ending with music. Many slides are used, frequently with a single slide projector. The approach is used by the planetarium for all types of audiences. The format is one which older people have come to expect at all planetariums.

The third approach, used with far less frequency, includes attempts to individualize programs to special audiences and use "American-type" innovations in public and other programs. Lemmer prepares taped programs for the public which attract many young people (ages about 15–25). His older visitors complain, "You didn't show us how to find the North Star with the Big Dipper." He recently completed a German version of "Springtime of the Universe." Lemmer is currently working on a participatory (P.O.P.) program, but he anticiaptes "a crying mass of excited people" when he tries it out with audiences of 200 to 300.

Bochum staff member Thomas Weyer has interest in cultural programs, *i.e.*, relating astronomy to the history of different great peoples of the world. Weyer has completed his dissertation, which examines the effectiveness of live and taped programs and different presentation styles. Zeiss, Oberkochen, plans to print Weyer's research as a special publication, which will be available in German to all interested planetarians.

The Bochum Observatory complex includes three telescopes offering public services, a planetarium, and a satellite tracking station. The station, the largest for non-geostationary satellites, is used for environmental research with NOAA. Visitors to the Observatory are provided an interdisciplinary introduction to astronomy.

Lemmer notes that in terms of planetarium education, Germany is a "developing land."

Girls and Physical Science

Tom Callen of the U. S. National Air and Space Museum has brought an article from *New Scientist* to my attention. The article reports two British surveys concerning girls and science learning. *Girls and Science,* published in November 1980 by the British Department of Education and Science, concluded that girls in all-girls schools or classes are more interested in science and enjoy it more than girls in mixed classes, where they feel in competition with boys. Girls reported being afraid of making fools of themselves in front of boys during science lessons thinking that the boys are more clever.

It appeared to the researchers that girls are tentative in their approach to practical work because they lack previous practical experience, *e.g.*, replacing fuses and fixing bicycles. Home pressures mold girls to be ladylike and not "mess" with many things.

A second report, *Teenage Attitudes to Technology,* published by the British Standing Conference on School Science and Technology, concluded that physical science topics, including astronomy, are not resented or disliked by girls *if* they are a compulsory part of the curriculum. However, if given a chance, girls do not typically elect physical science courses. The authors of this report, Dr. Ray Page and Melanie Nash of Bath University, recommend that physical science and technology careers remain as options for both males and females by having compulsory physical science courses up to age 16.

Many planetarium educators have noted the less than enthusiastic response of quite a few girls to astronomy lessons, particularly above the elementary school level.

In 1977, planetarian Ted Smith speculated that spatial orientation ability comprises a large part of the aptitude necessary for learning basic astronomy concepts at every age level. Dale Etheridge (1976) confirmed this with college students, and I confirmed it with adolescents (Bishop, 1980).

Also, there is a large body of research which supports the hypothesis that most boys have better spatial ability than most girls by the time adolescence is reached. Some recent studies (Bishop, 1980; Jones, 1979; Smith and Litman, 1979), have shown further that adolescent boys improve more in their spatial ability than adolescent girls as a result of programs which involve modeling and other practical activities.

It is not clear whether this gender effect in favor of post-elementary boys is due to environment or genetics. Some animal studies (Begley and Carey, 1979; Durden-Smith, 1980) have shown that hormone levels and brain structure control spatial maze abilities. However, a simple analysis of societal roles for boys and girls and analyses from some major reports (*e.g.*, the

British 1980 *Girls and Science Report*) lend strength to the idea that environment is the major cause of many girls being afraid of physical science subjects. The proportional value of each cause is no doubt highly variable among individuals and among different cultures. But determining relative weights of the causes for the majority remains a fruitful area for further research.

Grants for Planetarium Projects. Within the United States, the Department of Education's Institute of Museum Services (IMS) has a fund to assist "museums of all types" with operating support and special projects. The 1981 grant application deadline was March 6, 1981. Although it is conceivable that drastic changes will occur for 1982, due to President Reagan's economic policy, next year's deadline will no doubt come at the same time if any programs are maintained. A booklet of grant application and information was mailed in February, 1981, much too late to communicate availability for 1981 through I.P.S. publications. To be on a mailing list for future notification, write: Department of Education, Institution of Museum Services, Washington, D.C., 20202.

The Vesto M. Slipher Fund awards funds for projects which "enhance the public's understanding of astronomy." About $4,000 is distributed annually, and projects which have been supported include workshops for teachers, an Astronomy in the Parks program, radio presentations, and booths at major science education meetings. For further information, contact Dennis Schatz, Chairman, Pacific Science Center, 200 Second Avenue, North, Seattle, Washington 98109.

References

Begley, S. and J. Carey, "The Sexual Brain," *Newsweek*, November 26, 1979, 100–5.

Bishop, J. E. The Development and Testing of a Participatory Planetarium Unit Emphasizing Projective Astronomy Concepts and Utilizing the Karplus Learning Cycle, Student Model Manipulation, and Student Drawing with Eighth Grade Students. Unpublished Ph.D. dissertation, University of Akron, 1980.

Durden-Smith, J. "Male and Female: Why?" *Quest/80, 4* (8), October 1980, 15-19; 93-99.

Etheridge, D. A. Simulation and Representation in Visual Learning: The Planetarium as a Simulation Device. Unpublished doctoral dissertation, University of California, Los Angeles, 1976.

Jones, D. R. The Mental Representation of 3-D Shape Conceptualized from 2-D Perspective Views by 6th and 8th Grade Students. Paper presented at the National Association for Research in Science Teaching Annual Meeting, Atlanta, March, 1979.

"Science Education Under the Microscope." *New Scientist*, November 6, 1980, 351.

Smith, T. V. "The Construction of a Variable Spatial Orientation Instrument." *The Planetarian,* 1977, *6* 3-12.

Smith, W. S. and C. I. Litman. "Early Adolescent Girls' and Boys' Learning of a Spatial Visualization Skill." *Science Education,* 1979, *63*, 671-676.

INFORMATION FOR CONTRIBUTORS

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 and white) or 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. Strikeovers 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 and 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 page(s). Example:

Nelson, Arnold, 1972. Distance Concepts in Astronomy. *Planetarian* 1, No. 2, 56-58.

MOVING?

CHANGE OF ADDRESS, missed issues, and circulation problems should be addressed to Walt Tenschert, Thomas Jefferson High School, 6560 Braddock Road, Alexandria, VA 22312.

IS THERE ASTRONOMY AFTER SIXTY?

Jim Manning

Morehead Planetarium
The University of North Carolina
Chapel Hill, NC 27514

We planetarians are constantly conducting specific programs, classes, and demonstrations for specific groups of people: School classes from nursery through college, girl scouts, boy scouts, PTA's, teacher groups, church groups, civic clubs, astronomy clubs, handicapped groups, visiting dignitaries, conventions of plastic surgeons (I made sure to point out Opiuchus in *that* one!), and so on, *ad infinitum*. That's our job. Surely we leave no one out. Or do we? What about senior citizens?

"Pooh, pooh," you say. "We catch them in our programs for the general public, and there always seems to be a few token retireees in the 'Introduction to Astronomy' night class." But what about something planned and conducted *specifically* for older people?

As our society seems only recently willing to generally acknowledge, people past the big six-oh need not automatically head *en masse* for the back porch like lemmings to the sea, there to petrify. Life can go on, and it can even be *good*. Moreover, they can continue to make valuable contributions, and can continue to be interested in things . . . like, well, *astronomy*.

Which brings me to my point. The University of North Carolina (UNC), of which Morehead Planetarium is a part, is one of a growing number of colleges and universities recognizing the needs and interests of senior citizens through a program called Elderhostel. It's a program Morehead has participated in for the last three years, and our experience may suggest a similar course of action for you, or provide ideas, at least, for ways to serve this sometimes (perhaps often) neglected group.

What *is* Elderhostel? Succinctly put, it's college on a Ritz Cracker for senior citizens. *Less* succinctly put, it's a no-frills, but meaty week on a college campus in the summertime designed to provide intellectual and social stimulation for people over 60. The "no frills" is manifested in the accommodations; in the true spirit of hostels (originally referring to modest overnight lodgings for travelers), participants live in college dormitories. The "meat" comes in the experiences; Elderhostelers may take up to three courses taught by college faculty during their week of residence (no academic requirements, homework, tests, or grades—paradise!) plus all the social and cultural events and group adventures they can stand, including tours, hikes, lectures, exhibits, plays, concerts, parties, cook-outs, and—perhaps not the least adventurous—eating in a college cafeteria! From a modest beginning in 1975 on five New Hampshire campuses, the Elderhostel program has burgeoned to a network of more than 370 colleges and universities in all fifty states, already having served more than 25,000 people and last year including national TV commercials featuring actress Helen Hayes among others.

Our involvement in the program began in 1978 when the UNC Department of Continuing Education asked us (we had to be prompted, too!) to conduct a basic short course in astronomy for each of its several weeks of Elderhostel. A variety of topics was desired, with an emphasis on Elderhosteler participation. We chose the following set of subjects for the five daily hour-and-a-half sessions:

1. A. Introductor Film. (NASA's "Universe" narrated by William Shatner. A bit dated by references to spacecraft missions, it remains nonetheless an excellent and well-made 30-minute introduction to, quite literally, the universe.)
   B. Concepts of the universe from ancient to modern.
2. A. Summer constellation-finding session in the planetarium, rife with sky lore and basic concepts such as the celestial sphere and diurnal motion.
   B. Update and explanation of current space missions.
3. A. A look at the cosmic "zoo" of familiar and exotic space objects from planets to quasars, plus rudimentary stellar evolution and how much of the menagerie fits into evolutionary schemes.
   B. Review of summer constellations in the planetarium, including simulations of some of the aforementioned exotic objects, and discussions of summer deep sky objects and currently visible planets.
4. A. Cosmogony (referring to the solar system in particular).
   B. Cosmology (referring to the universe in general), including formation theories, implications for the future of the universe, and just a sprinkle of relativity theory.
5. Extraterrestrial life; the possibility of it, the search for it, the implications of it, introduced by a brief discussion of the requirements for earth-based life.

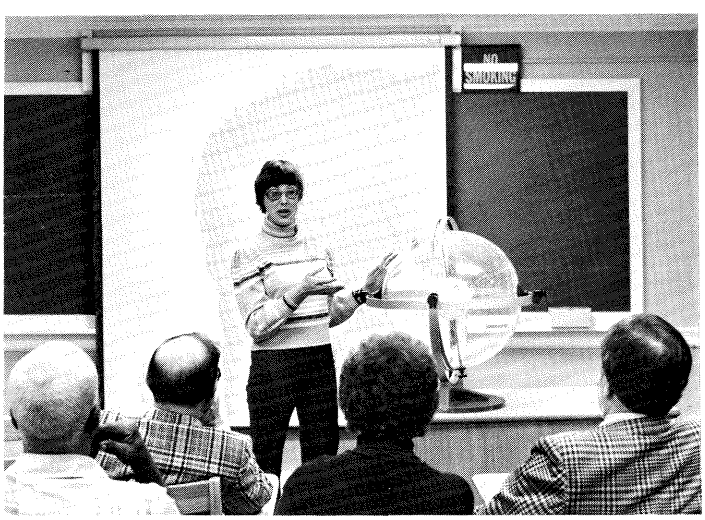
As exemplified in the course's title ("Exploring Space: The Strange and New"), we emphasized curent information and theories, the latest discoveries, the unusual, the bizarre. (We're particularly good with the bizarre.)

Planetarium intern Pat Madison (right) and the author (left) with Elderhostelers at a wine and cheese party, drinking and extolling the virtues of astronomy. Mostly drinking.

We also emphasized class involvement. For example, the Elderhostelers located summer constellations in the planetarium using star maps, and helped to reinvent a simple H-R diagram. The class was formed into the cross-section of a star to demonstrate the basic internal forces at work and how those forces are involved in a star's aging process. Class members were given an "alien" binary message of 120 zeros and ones to decipher as an introduction to the Arecibo message and earthling attempts at interstellar communication; they were also given four different rectangular grids in which to put the string of zeros and ones, only one of which reproduced the visual message, to illustrate the difficulty of interpreting potential messages from space.

The class was sufficiently popular to be repeated the following two summers. In 1979, we retained the basic topics but altered the theme and title ("Astronomical Perspectives, or Yes, Virginia, There Is An Infinity") concentrating on how we view the universe and how it affects our thoughts and theories about it. In 1980 ("Astronomy: The Romance of Science"), we retained the most popular topics, such as the constellation session, cosmology, and extraterrestrial life, and added new ones like the development of the calendar and modern investigation techniques along with more planetarium time, concentrating on the history, aesthectics, and gol' darn thrill of astronomy. Each summer's course was conducted by members of the planetarium's education staff (consisting of assistant director, educational assistant, and two part-time planetarium interns), typically with two people sharing course duties and an occasional solo run.

The planetarium also proved to be a boon for Elderhostel extracurricular activities. Many Elderhostelers attended afternoon or evening performances of our summer public program during their week of residency, and one evening each week was reserved for a tour and observing session at the Morehead Observatory. Predictably, the most popular objects were the moon, Jupiter and its statellites, and Saturn (although we had trouble last summer convincing Elderhostelers that a ringless Saturn was a rare and therefore even more special sight!). Also, the adjacent terraces were useful sites on those nights from which to test Elderhostelers' constellation-finding abilities in the "real" sky (you know. the one we can't control at will but put up with anyway).



"The way to understanding is through props," quips Educational Assistant April Whitt as she prepares Elderhostelers for the larger celestial sphere of the planetarium dome.

Results of Elderhosteler surveys at the completion of each one-week session were always extremely positive, and the unit has been well-received not only by participants, but by the administrators of the program as well. The course will lie fallow this season, however—while we continue with just extracurricular activities— lest we overtill a fertile field. But we plan to have it spring from the ashes again in a new form in 1982, for the benefits of the course have been heady.

First, survey results as well as personal words of enthusiasm and appreciation have demonstrated without a doubt that we are providing a valuable service. In this case, age is no barrier to the realms of space.

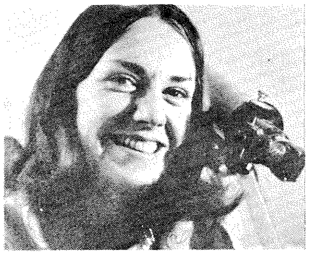
Secondly, the course has been personally as rewarding as any we've taught. Every class session we came cheek to jowl with a group of eager, uninhibited, experienced people bringing fascinating insights and penetrating questions ("Why should we spend money on space programs and radio telescopes?" "If we can only measure *relative* motion in the universe, how can we be sure there isn't some object which really *isn't* in motion?"). No subject was beyond their willingness to tackle. As instructors, we found ourselves as challenged and stimulated as we hoped our students were. Additionally, social events like the wine and cheese parties to which the Elderhostel faculty were invited provided more informal out-of-class opportunities to propound, discourse, and otherwise hobnob about astronomy.

Finally (with a perfunctory bow to Plutus), we even found the experience to be quite reasonably cost-effective. The planetarium received $225 for each weekly course, or seven and one-half hours of instruction, with some funds available for copying handout materials. And we didn't have to advertise or handle any paperwork!

If you feel as we did that Elderhostel may be a useful vehicle for expanding one facet of your educational effort, and if your planetarium is on a college campus, you may wish to contact your Extension or Continuing Education department to see if it's involved in the program. While the 1981 summer program is already set, you may still be able to offer a star-studded evening down at the local universe, and can certainly put in a word for next year. If you're not on but near an Elderhostel campus, you could no doubt likewise propose a stimulating field trip. The interested and curious who desire to investigate further or locate the nearest Elderhostel campus can write to the national office:

Elderhostel
100 Boylston Street
Suite 200
Boston, MA 02115

Of course, nothing prevents you from developing your own program of astronomy education for senior citizens. The most important thing is to realize that yes, Virginia, there *is* astronomy after 60. And whether through participation in a nationwide program or independently, planetariums can play a pivotal role in the cosmic education of this ever-growing segment of the population.



JANE'S CORNER

Jane P. Geohegan

Soon to be available for-planetarium-use-only is "Starbound," NASA-funded, written, produced, and directed by Jack Horkheimer of Miami Planetarium. A sample: "Once upon a time . . . in a galaxy not so very far away . . . there existed a creature strange, with an insatiable thirst for knowledge. Now this is the *peculiar* part: the more it learned, the less it knew . . . for with every answer, came another question. Now this is the *beautiful* part: of all the creature's thirsts, *this* one . . . brought him closest . . . to the Gods." After reading this beautiful prologue from "Starbound," I'm feeling myself reaching for the stars while picking up my mail. The mail brings an announcement that Abrams Planetarium at Michigan State University is in danger of closing due to lack of funds. Sigh! What a precarious profession is planetariumism.

As the autumnal equinox of 1980 drifted by, planetarians turned to their next seasonal consideration: the "Star of Bethlehem" was rising again soon. But this year, a new "Star" was born! For some planetarians, embroiled in the latest controversy about the nature of the "star," a whole new show emerged. (Some of you may not be aware of the controversy. The "traditional" astronomical event as described by Roy K. Marshall, David Hughes, et al, a triple conjunction of Jupiter and Saturn, occurred in 7-6 B.C. The "new" astronomical event is a conjoining of Jupiter with Regulus, a triple recurrence in 3-2 B.C., as described by Ernest Martin in "New Star Over Bethlehem").

The reports are trickling in from all over: Tom Hamilton of Wagner College on Staten Island, NY did the "new" version. So did Jon Bell and Dave Maness of Peninsula Planetarium, Newport News, VA, and Richard Joyce of Hampton Planetarium, Hampton, VA. Jon, Dave, and Richard report an unexpected result: the local newspapers got all caught up in the controversy, and ran several feature articles.

As time to put the "Bethlehem" show together approached, choices had to be scrupulously considered by planetarians:

1. "old" version—I have carefully studied the documentation and I believe that the astronomical events of 7-6 B.C. are the most likely explanation for the "star" phenomenon.
2. "new" version—I believe the new information is accurate and precludes my doing my old Christmas show; I plan to incorporate the 3-2 B.C. scenario.
3. "I'm confused"—I have read and re-read this stuff over and over. Maybe it's right, maybe it's not, I just don't know.

In some cases, academic decisions became easier by realisitic evaluation of the three choices:

1. "old" version—Visitors like my pretty Christmas scenes; they really don't care much about the movements of the planets and stars. Besides, I spent 25 hours on that tape 16 years ago, and I'm not about to change it now!
2. "new" version—My annual motion doesn't work too well, so I have a hard time doing the triple conjunction anyway.
3. "I'm confused"—We are having a rare triple conjunction of Jupiter and Saturn now, in 1980–81, so why mess with a good thing? Maybe next year.

How did *you* do it?

If you delight in such controversies, here's one for you: How does your narrator pronounce the seventh planet from the sun? Check one:

☐ U´rȧ nus
☐ U rā´nus
☐ U râ´nus

Overheard:

★ Betty Wasiluk, planetarian from McDonald Planetarium in Hastings, Nebraska, should have asked for brighter flashlights. While extolling the virtues of dim flashlights for star-watching to a visiting class, she recognized a familiar crunching sound as the teacher of the group backed into a nearby car.

☆ George Reed, planetarian from West Chester State College, Pennsylvania, explaining why writing a planetarium show is so difficult: "Having good ideas is like a pregnancy; the fun is in the conception, with the labor to follow!"

LETTERS: Continued from page 3

Dear Editor:

Subject: Information on Planetaria in India

I am sending alongwith a list of Planetaria in India for your information. The following things are listed.

1. Name of the Planetarium
2. Mailing address
3. Person in charge
4. Type of projector
5. Year of starting
6. Dome diameter
7. Seating capacity

I must say something about the Planetarium movement in India.

The first Planetarium projector in India was the Spitz Mark-I bought by the New English School of Pune in 1953. It is in operation even to this day. Subsequently, the National Physical Laboratory, New Delhi, bought a small Zeiss projector sometime in late 1950's. The first major insturment was the Birla Planetarium (Zeiss Universal) to come up in 1962. There were no new projectors until 1976 when Sardar Patel Planetarium in Baroda was established. The Baroda instrument is Zeiss Spacemaster (computer controlled). The year 1977 saw yet another Planetarium, in Bombay. This instrument is Zeiss Universal. In 1980, Allahaoad acquired a small Zeiss ZKP–2 instrument. During the two decades of sixties and seventies, some medium type of Zeiss Planetaria were acquired at Muzaffarpur, Porbunder, Surat, Vijayavada, and Salem. However, not much is known about their functioning.

Recently, there has been a spurt in Planetarium activity in India and many cities, bigger and smaller, are becoming aware of this wonderful medium of education. We hear that New Delhi is getting a Spacemaster Planetarium, whereas the cities like Hyderabad, Trivandrum, Ludhania, Chandigadh, etc. are getting smaller instruments.

An Indian Society of Planetarium Educators is being planned as a National Umbrella for all Planetaria in India. We hope this Association will help the present and future Planetaria in our country.

With best regards,

Yours sincerely,

(A.G. Kulkarni)
Director

PLANETARIA IN INDIA
(August 1981)

I

1. Birla Planetarium
2. 96 Jawahar Lal Nehru Road, Calcutta 700 016 (West Bengal)
3. Shri R. Subramanian
4. CZ Universal (Jena)
5. 1962
6. 23 meters
7. 550

II

1. Sardar Patel Planetarium
2. Sayaji Baug, Baroda 390018 (Gujarat)
3. Dr. A. G. Kulaarni
4. CA (Jena) Spacemaster (Computerized)
5. 1976
6. 12.5 meters
7. 200

III

1. Nehru Planetarium
2. Anni Besant Road, Worli, Bombay 400 018 (Maharashtra)
3. Dr. V. S. Venkatavaradan
4. CZ (Jena) Universal
5. 23 meters
6. 1977
7. 500

IV

1. Jawahar Planetarium
2. Anand Bhavan, Allahabad 211 002 (Utter Pradesh)
3. Shri Piyush Pandey
4. CA (Jena) Medium ZKP–2
5. 1980 (November)
6. 8 meters
7. 80

V

1. Planetarium
2. L. S. College, Muzafarpur (Bihar)
3. The Principal
4. Medium Type (CZ)
5. –
6. –
7. –

VI

1. NPL Planetarium
2. National Physical Laboratory, Hillside Road, New Delhi 110012
3. The Director, NPL
4. Medium Type (CZ)
5. –
6. –
7. –

VII

1. Planetarium
2. Shree Aryakanya, Vidyalaya, Porbunder (Gujarat)
3. The Principal
4. Medium Type (CZ)
5. –
6. –
7. –

VIII

1. Planetarium
2. Surat Municipal Corporation, Surat (Gujarat)
3. The Officer-in-Charge
4. Medium Type (CZ)
5. –
6. –
7. –

IX

1. Planetarium
2. Gandhi Hill Foundation, Gandhi Hill, Vijayawada 520001 (Andhra Pradesh)
3. Secretary: Dr. J. Shanker
4. Medium Type (CZ)
5. –
6. –
7. –

X

1. Planetarium
2. Government College of Engineering, Salem, (Tamil Nadu)
3. The Principal, Government College of Engineering
4. Medium Type (CZ)
5. –
6. –
7 –

XI

1. Planetarium
2. New English School, Tilak Road, Pune–30 (Maharashtra)
3. The Principal
4. Spitz Mark–1
5. 1953
6. –
7. –