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Letters

STScl Institute New Contact

Greetings from Space Telescope Science Institute!

Many of you may not be aware that the Office of Public Outreach at STScI has a new contact person for the planetarium and science museum community. My name is Prue Campbell and I'll be handling the requests you used to send to Rob Landis. In pursuit of his career interests, Rob has moved from Outreach to the technical side of the Institute. (I want to thank Rob for the enthusiastic support he has given us. Congratulations on the career move!)

I have been working in planetaria for the last ten years, and I look forward to supporting you in our efforts to educate and inspire.

At the Institute, we are currently reviewing how we can best serve you.

How are we doing? Is there a service we provide that you find particularly useful or exciting? Could we do a better job? I'm hoping you will take a moment to drop me a line and let us know what you think. Your input is critical to this process.

You can contact me at:
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campbell@stsci.edu

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(410) 338-4562 phone
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I look forward to hearing from you!

Sloppy Research

May one whose name and book title was mentioned several times in your journal (Vol. 23, No.3, Sept. '94) reply to the points in Wade Allen’s “5-5-2000” article.

Wade E. Allen writes that his first indication that “something new was occurring,” occurred when “several phone calls in a short period” from the general public, asking his advice about the May 5, 2000 alignment began. Allen gives the reader of his article the impression that calls from the general public asking questions about astronomy are as rare as calls to the Maytag repairman.

Allen complains that, “trying to get accurate information from the general public can be as easy as trying to give an astronomy lecture about the images by Voyager after the slide projector bulb burns out,” but then he says “an 'informed' patron called with the first hard fact; a book titled 5-5-2000 exists.”

Allen then recounts his personal quest in search of my book. After some difficulties, a local bookstore found the book, offered to order a copy for him and told him it would cost him $12.95. Allen does not want to pay the bookstore and says, “I have trouble springing money for something that is sure to be a pain in the neck.”

He then makes a trip to the public library where he can see what’s in the book, for free. Arriving at the library, Allen learns the book is checked out. Undaunted, Allen’s quest for the book, 5/5/2000 Ice: The Ultimate Disaster continues.

His next journey is to a used book store where he might find a copy at a cheap price. Arriving at the store, Allen diligently searches through title after title but, alas! his third trip out is also in vain because, he says, “I came up empty-handed.”

“As luck would have it,” Allen writes, “I was able to catch a rebroadcast of the In Search Of episode and was then able to at least get first-hand information on what this was all about.” Allen then lists five statements from the television interview he thought he was seeing me make.

It appears from Allen’s article that he never got the book, never read the book, learned about it from television (almost an oxymoron to paraphrase Allen) and leads your readers to believe I made five statements such as “The interior of the earth will cool,” which I did not, during a television show on which I’ve never appeared. So much for Allen’s “first-hand information.”

Richard W. Noone
Bayonet Point, Florida

Jackass Tartare

Your [John Moseley’s] article in the March 1996 Planetarian has been brought to my attention.

Only a very foolish general reveals his war plan to the enemy. I am taking steps to ensure that the astrogogical community is made aware of yours if they are not already.

As the astronomer, I repeat, astronomer, Dennis Rawlins wrote in his expose of the CSICOP’s squallid shenanigans in the Michelin Gaquelain/Mars effect controversy of the 80s, Paul Kurtz’s notion of science, was (and is) ‘Our PR versus their PR’. This proves to be a rare prescient observation on Kurtz’s part. Our PR is more effective than yours. If the game plan suggested by you is applied on the media by your colleagues it will only become more so.

Fraknoi’s Ten Embarrassing Questions would be hard to top for unembarrassingness. Any astrologer conversant with my book The Case for Astrology would have little difficulty reducing Fraknoi or anyone else asking these questions to mince meat. Since some of us have acquired a taste for jackass tartare, there could be some interesting meals in store.

There is, certainly, no shortage of charlatans and ignoramuses within the astrological community. The ‘Joyce’ ad you quote is fairly typical of the breed. But your own article makes it very clear that astrologers have no monopoly on charlatanry and ignorance.

To cite Gauquelin’s several ruses pulled on the astrologers of his day without even mentioning Gauquelin’s lifelong statistical work validating at least one key premise of astrology is either a sin, or a crime of omission, depending on how you look at it. If academic malpractice were a crime (and it should be) you’d be arraigned in court.

Meanwhile, the exhortation to ‘exude wisdom and confidence’ is I’m afraid, both comic and futile. You and your colleagues could no more exude ‘wisdom and confidence’ on television than I could exude ‘virtuous’ if someone stuck me in the violon section of a symphony orchestra. Though my own frequent television appearances these days generally concern ancient Egypt, if I’m ever asked to take part in an astrological panel, I’ll suggest you as the opponent of choice. I’d enjoy an opportunity of allowing you to put your strategy to the test.

John Anthony West
Athens, New York

I forgot to mention in my article that if you become publically involved in pseudoscience, you should be prepared to encounter strange characters that crawl out of the woodwork. Most are pleasant enough, although misguided, but some are pretty obnoxious. It’s all part of the territory.

—JM

Please note that the new home page for the Planetarian on the World Wide Web is:

http://www.GriffithObs.org/IPSPlanetarian.html

Prospective contributors: please read the Guidelines.
Preschool Program Evaluation

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Introduction

During the spring of 1994 we decided that we would throw out our venerable old preschool programs (Magic Sky opened in 1970, and Wonderful Rocket debuted in 1972) and create new shows for our youngest visitors. We had, of course, revised and updated both shows many times, but this time we decided to start from scratch, using formative evaluation to produce new shows. We also decided to get a little evaluating audience reactions to Magic Sky before it closed.

The Program

Magic Sky was produced for 3 to 5 year olds (although the audience ranged from pre-sentient beings to the older brothers and sisters, parents, and grandparents of the target audience). The 30-minute program was presented as a live lecture in a story-telling format with pre-recorded music. The program re-created what children could observe from their own backyards during a 24-hour period: the east to west movement of the sun; a sunset sequence; twinkling stars; a few seasonal constellations; the east to west movement of the stars and moon; and a sunrise sequence. The program also included a song about the sun, and we encouraged children to sing "Twinkle, Twinkle, Little Star" along with the narrator. The character of Mr. Moon occasionally interrupted the program ("Is it my turn yet?") and finally got 'his turn' just before sunrise.

The Objectives

First we obtained a list of the original behavioral objectives for the program. Then we deduced from the content of the program a few additional objectives, which appear to have been added to the program over the years of its evolution.

The objectives:

1. Visitors who see Magic Sky should enjoy the experience.
2. Visitors who see Magic Sky should not have any complaints about the experience.
3. Learning objectives: Visitors who see Magic Sky should
   a) Recognize that there are four primary directions, named north, south, east, and west.
   b) Be able to name objects in the daytime sky, such as clouds and the sun.
   c) Be able to name objects in the night sky, such as the stars, the moon, and constellations (including the Big Bear, the Queen, and the Swan).
   d) Be able to describe constellations as areas of the night sky, or as star patterns, named for people, animals, or objects.
   e) Recognize that the stars, sun and moon move across the sky from east to west.
   f) Be able to state the reason for the east-to-west movement of the sun, moon and stars (the earth's rotation).
   g) Be able to describe the sun as bright, and the closest star to us.
   h) Be able to state that the stars twinkle.
   i) Be able to describe the stars we see at night as distant suns.
   j) Be able to name craters as prominent features on the moon.

Simply putting all of the objectives down on paper made it clear that Magic Sky was a rather ambitious program. We began to suspect that we needed to limit and simplify our objectives.

The Survey, or What We Asked Them

We surveyed a sample of 39 children (23 girls, 15 boys, and 1 gender unreported). The children we interviewed ranged in age from 2.5 through 6. We conducted the survey following two performances, with 20 children in the first survey and 19 in the second. Adults in the audience used our survey forms to question most of the children in the sample; planetarium staff members conducted a small proportion of the questioning. As a practical matter, we discovered that we could realistically expect to question children for only a very few minutes after the program. They quickly became distracted and restless. We also noticed that they frequently received coaching from other children and adults with their group. Not every child responded to every question, and frequently children had their own agendas of things they wanted to talk about. A list of the survey questions follows:

1. Can you name the four directions?
2. a) What are some things you can see in the sky during the day?
   (If child names the sun, ask the next question.)
   b) Does the sun move? Yes / No
   (If answer is 'yes,' ask next the question.)
   c) In what direction does the sun move?
3. a) What are some things you can see in the night-time sky?
   (If child names the stars and/or the moon, ask the next questions)
   b) The stars move? Yes / No
   (If answer is 'yes,' ask the next questions)
   c) In what direction do the stars move? In what direction does the moon move?
4. What makes the sun, moon and stars move in the sky?
5. What is the sun?
6. What are the stars we see at night?
7. What can we see on the moon?
8. a) Would you like to come to the planetarium again? Yes / No
   b) What did you like about coming to the planetarium today?
   c) What did you dislike about coming to the planetarium today?

Notes and Conclusions

The process outlined above is not science. The variables were numerous (and not always identifiable), and the results are not replicable. For example, adults in the audience did most of the questioning, and we had no good way to ensure that the children and/or the adults were not trying to tell us what they thought we wanted to hear. However, the evaluation process did put us in direct contact with our audience in a
unique way, and allowed them to react to the show and some of the concepts we were trying to communicate. As such, the process may allow us to draw some interesting, if tentative, conclusions.

1. For years, we asked children in the audience to blow at the clouds to get them moving, or to get the wind blowing. It was a 'cute bit' near the start of the show. The children enjoyed it, and it may even have given them a sense of some measure of control over the changes taking place in their environment. But, when we did our first audience survey, only 1 of 20 (5%) stated that earth's rotation caused the east to west movement of objects in sky. 35% stated that the wind caused the sun, stars and moon to move. Hmm... we were apparently teaching just what we did not want to teach about why celestial objects appear to move in the sky. So we dropped the 'cute bit.' When we cut blowing at the clouds from the show, 31.5% stated that the earth's motion/rotation caused the east to west movement of objects in the sky. We were still not successfully teaching children about the earth's rotation, but at least we were no longer teaching them wrong information.

2. We succeeded with the overwhelming majority (95%) in providing a positive experience which made them want to visit the Planetarium again.

3. 54% of our visitors had no complaints. 33% of those surveyed had negative comments, including 23% who disliked waiting before the show, and 5% who disliked the darkness. We introduced gathering darkness as slowly and carefully as possible, but there will probably always be some preschoolers who dislike, or are frightened by, the darkness. Because so many children disliked waiting around for the show to start (we suggest that visitors arrive at least fifteen minutes before showtime, in order to allow time for ticketing, visits to the rest rooms, etc.), we have begun to provide lobby activities for children to engage in before the show.

4. In terms of the show's behavioral objectives...
   a. A large majority (74%) of those surveyed could name some or all of the four primary directions following the show.
   b. A large majority of those surveyed could name a variety of objects visible in the day and night skies: sun (77%), clouds (64%), the stars (77%), and the moon (64%). However, significant numbers (49%) of those surveyed named objects in the day sky which were not mentioned during the show (stars, moon, airplanes, birds); a small number (20.5%) named objects in the night sky which were not mentioned during the show (clouds, sun, airplanes, planets); and a small number (20.5%) named constellations as objects visible in the night sky, although constellations were a major feature of the show. Clearly, preschoolers (just like everyone else) bring their own personal observations and experiences with them when they come to the planetarium. Their ideas about the world may run counter to the scientific world-view. It would be interesting to investigate how children perceive the physical world around them (e.g. what they already believe about the movement of objects in the sky) before they come to the planetarium, and to then try to address their misconceptions in our programs.
   c. The apparent east to west motion of the sun, stars and moon was a major emphasis of the show... A majority (64%) of those surveyed stated that the sun and stars move across the sky; a small majority (56%) stated that the moon moves across the sky; a small majority (53%) were able to identify correctly the direction of motion of the sun; and a minority (37%) were able to identify correctly the direction of motion of the moon and stars.
   d. A minority of those surveyed (31.5%) stated that the apparent motion of objects in the sky is caused by the earth's motion (rotation). If we want to teach this concept to preschoolers (probably an impossibility), we'll have to do a much better job. More realistically, this concept should be dropped from preschool shows and saved for older children who are developmentally ready to more easily grasp the abstract concepts involved.
   e. A major emphasis of the show is that the sun is a nearby star and the stars are distant suns... A minority (41%) of those surveyed described the sun as a star; a minority (23%) described the stars as distant suns; and a minority (15.4%) described the sun as hot and/or bright. We did not communicate well here. Again, we may have been expecting more from the children than they were developmentally ready for.
   f. Mr. Moon interrupts the show several times, until he finally gets 'his turn' near the end of the program and shows the children a crater... A minority (33%) of those surveyed named craters as things we can see on the moon; a smaller minority (20.5%) named the face on the moon (the character of Mr. Moon himself); 28% had no answer. We didn't seem to be succeeding at teaching anything about what the moon looks like; but the character face on the moon was a striking and memorable image for the children.

What's Next?

This project was an early attempt at surveying audience reactions to an existing preschool program. We have learned to simplify our objectives, and to tailor the concepts to the developmental stage of the audience. What we think is important to teach doesn't matter if the children are not able to handle the level of abstraction required. We have also learned a bit about how much post-show questioning children will tolerate. We think it would be interesting to question children at some time after the planetarium program, under the real sky, to see how well learning under the dome translates to the real world. Anecdotal evidence suggests that preschoolers can be guided to apply what they see in the planetarium sky to what they see in the real sky, but we have not actually tested this. Amidst all the apparent failures in meeting learning objectives, we reassure ourselves with the fact that we succeed with an overwhelming majority in providing such a positive experience that the children want to visit the planetarium again.

We went on to meet extensively with preschool teachers to solicit their suggestions for new programming, and to develop a new program, I See the Sky, using formative evaluation techniques at several key steps in the production process. But that's a different article.

Eight hundred life spans can bridge more than 50,000 years. But of these 800 people, 650 spent their lives in caves or worse; only the last 70 had any truly effective means of communicating with one another; only the last six ever saw a printed word or had any real means of measuring heat or cold; only the last four could measure time with any precision; only the last two used an electric motor; and the vast majority of the items that make up our material world were developed within the lifespan of the eight-hundredth person.

R. L. Lester and G. J. Howick
Assessing Technology Transfer, 1966
The latest buzzword in today's modern society is the Internet—a vast web of computer systems connected to each other. The Internet is one of the best research resources available today because of its speed and ease of use. Most information on the Internet can be found through the World Wide Web graphical navigation system.

To begin, you will need a connection to the Internet and a World Wide Web browser such as Netscape or the Microsoft Internet Explorer. Commercial online services, such as Prodigy and America Online, also offer World Wide Web access, but are often slower and more expensive than full-service Internet service providers. Once you're connected, you'll find a wealth of information at your fingertips. If you can imagine a topic, there's probably a forum or World Wide Web page on it.

It soon becomes important to devise a system through which you can determine which information is of value to you and which information you are not interested in. Because of the massive amounts of data on the 'net, services such as Webcrawler and Yahoo have been setup to help search this data to find what you're looking for. However, try entering "astronomy" or "space" and you'll be absolutely astounded at the number of World Wide Web and Internet resources you'll find.

I have written this article to try and pick out some of the most useful sites on the Internet for astronomy information and research. With the United States Government now entering the electronic era, you will find that organizations such as NASA and affiliate organizations have a very large presence. But what sites are the best, and contain the most information on the subject you're looking for? Hopefully, this article will help you answer that question.

Be warned, that many of the sites listed in this article contain heavy graphics, and thus may take several minutes to load through your browser. You may consider loading the pages without graphics first, to see if the page is worth your time, and if so, then reload with graphics turned on.

Planetary Sites and Planetarium Related Sites

By far the most comprehensive, and most visited list of planetaria on the World Wide Web, resides at the Loch Ness Productions homepage. Mark Petersen has prepared two lists, one of which links to planetaria, and the other to planetarium related sites (manufacturers, suppliers, etc.). There is also now an online version of the Loch Ness Productions' Planetarium Compendium online. Both resources can be reached by accessing the Loch Ness Productions homepage, at http://www.lochness.com.

Another excellent starting place is the European Planetarium Network at http://ecf.hq.eso.org/ktkaupe.

At Chris Reed Productions we also maintain a list of planetarium and astronomy related sites, which includes manufacturers and suppliers, including show producers, laser system manufacturers, and various astronomy organizations. Our list can be reached by accessing the Chris Reed Productions homepage, at http://pages.prodigy.com/planetarium/.

General Space Information

If you're looking for general information about space exploration, and the like, try the NASA homepage at http://www.nasa.gov first.

From this homepage you'll find links to many of the popular NASA centers, including the Jet Propulsion Laboratory, Kennedy Space Center, and the Johnson Space Center. You will also be able to see what's new at NASA that day, as well as updates to their Internet presence and World Wide Web homepage.

The NASA Newsroom is also a popular site for general, easy-to-understand information. Through the newsroom, you can access full text of all NASA's past and present press releases, press kits, status reports, fact sheets, biographies, and Internet advisories. You can access the NASA Newsroom at http://www.nasa.gov/pressroom.html.

If you're looking for images and multimedia, don't forget to check the NASA Gallery, which is also accessible through the NASA Homepage (listed above) or by going directly to http://www.nasa.gov/hqpao/library.html. At the NASA Gallery lobby, you can decide whether you want to look at their photo, video, or audio archive. Additionally, NASA has created a mini "virtual-museum" of Apollo 11 memorabilia, which is also available through the NASA Gallery.

Planetary Science Information

Some of the best resources for planetary sciences can be found on the NASA homepages and affiliate organizations. Extensive homepages housed at the Jet Propulsion Laboratory can provide you with both in-depth and general information about planetary research and developments.

Through the JPL homepage, you can access information on a number of past, present, and future space exploration programs, including Viking, Magellan, Galileo, Cassini, Pluto Express, and the Mars Rover. In addition, photographs can be downloaded in either GIF or JPEG format of mission spacecraft, and of images taken by the spacecraft. This can all be found at the Jet Propulsion Laboratory homepage, at http://www.jpl.nasa.gov. The Jet Propulsion laboratory also operates a Learning Link homepage, with additional educational information, which can be accessed at http://learn.jpl.nasa.gov.

If you're just looking for general planetary information, you may want to try the Planetary Society Homepage at http://planetary.org/tps/. From their homepage, you can obtain general planetary information and photographs, as well as information on joining the Planetary Society, and an online version of their current newsletter.

Another excellent resource for information on the sun, planets, asteroids, as well as a variety of spacecraft missions to various solar system bodies, is the "Welcome to The Planets" homepage, at http://stardust

Chris Reed is the president of Chris Reed Productions in Denver. In addition to creating multimedia presentations for planetaria, Chris Reed Productions also holds interests in syndicated broadcast radio and television programming.
Deep Space Science Information

One of the best sources on the Internet for information and photographs of deep space objects, is the Space Telescope Science Institute (STScI) homepage, that can be reached by pointing your browser to http://www.stsci.edu/. Through the STScI homepage, you can access a massive electronic photograph library of recent deep space discoveries as seen through the Hubble Space Telescope. The URL for the "Hubble Space Telescope's Greatest Hits of 1990-1995" photograph library is http://www.stsci.edu/public.html. Hard copies of many of the online images can be requested online through the Public Affairs office. Information on recent discoveries, press releases, and educational information from the educational outreach department can also be found on the STScI homepage.

In addition to the above resources, the Space Telescope Science Institute also collaborates information and photographs from recent Hubble discoveries into digital "picture books" that run on Macintosh computers. The picture books are free, and can be downloaded from their "Exploration in Education Picture Book" homepage, at http://stsci.edu/exined-html/exined-home.html.

Manned Space Mission Information

All manned space missions are coordinated by the Johnson Space Center in Houston, and likewise, it's on their homepage where much of the information regarding the Space Shuttle missions can be found. The address for the Johnson Space Center homepage is http://jsc.nasa.gov, and contains information and reports on the current status of the space shuttle program. The Johnson Space Center also maintains a photograph archive with photographs of Earth taken from the shuttle, including a separate IMAX image gallery of 70 millimeter images.

In addition to the Johnson Space Center, the homepage of the Kennedy Space Center also holds a wide variety of information on the space shuttle program and their launch facility in Florida. From their homepage, at http://ksc.nasa.gov, you can obtain the status of the current or upcoming shuttle flight, as well as view and print a copy of the entire Space Shuttle Reference Manual. You can also view information on how to obtain car passes to watch a launch, if you're in the area.

Additional Educational Resources

In addition to the above listed resources, there are also a number of homepages and Internet sites that cater to professional educators, looking for lesson-plans, and information to educate their students about astronomy and the night sky.

NASA operates one of the largest electronic educational resources libraries. They call it the NASA Spacelink and it can be reached on the World Wide Web at http://spacelink.msfc.nasa.gov. From the homepage, you'll have the ability to download and print copies of complete lesson plans as well as any supplementary images, data, or resources. The Spacelink system also contains information on how educators can obtain free videotapes and other educational materials through the Teachers Resource Centers, located at various NASA facilities, and at various locations throughout the United States.

Interactive Educational Projects

While many people consider the Internet to be simply a new way of gathering and organizing information, the Internet truly is an interactive system. Through electronic mail and other means, it becomes literally possible for students to interact with professional scientists at mission control, and that's just what NASA and STScI have done. Through the Internet, NASA and STScI have teamed up to create a series of interactive projects that tie participating classrooms with the professional mission scientists at NASA, the Jet Propulsion Laboratory, and the Space Telescope Science Institute.

These projects are often called "Live From..." and past projects include "Live From the Hubble Space Telescope," and "Live From Jupiter." Since the world of space exploration is changing all the time, so are the current interactive projects, so search the NASA and STScI web pages for more information about current and upcoming "Live From..." projects and activities.

Each interactive project usually starts with the supervising teacher obtaining a series of mission reports, and journals through e-mail for his or her class to read through. From that information, it is the class' job to formulate creative and meaningful questions for mission scientists, submitted via electronic mail. As the project ends, scientists answer many of the questions on a personal level. Internet interaction is often supplemented with videotape materials on PBS or more commonly, NASA Television (the NASA television homepage can be reached at http://www.hq.nasa.gov/office/pao/Television/ntvtext3.html).

In Conclusion...

While the Internet is growing quickly, some things will always remain the same. Regardless of how much information is out there, and how much information you have access to, you will always need some means of finding what you want when you need it. Hopefully, I've helped you do some of that today in this article. I hope you find the Internet an enjoyable experience, and find it useful as an information gathering tool for the future.

Ten More web home pages of planetarium and laser related sites:

Henrietta Leavitt Flat Screen Space Theater
http://ucsu.colorado.edu/~peterscc/Home.html

Fiske Planetarium
http://stripe.colorado.edu/~planet/Home.html

Morrison Planetarium - excellent "web documentary" on the show production process
http://www.laserium.com/planetarium

McDonnell Planetarium
http://www.ssc.org/docs/mod2/proginfo/pgm005.htm

Laser Images, Inc.
http://www.laserium.com

Audio Visual Imagineering, Inc.
http://www.gate.net/~laser3d/

Laser Fantasy International
http://www.laserfantasy.com/~mlutz

Laser F/X International
http://www.laser-fx.com

Technofear
http://www.technofear.com.au

Laser Production Network
http://www.gate.net/~lasernet
Projection Pit Lighting Case Study

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Planetarium lighting that is based in the projection pit serves a number of purposes. I will use a recent planetarium renovation as a case study to illustrate some applications of pit lighting.

In early 1995 the Charles Hayden Planetarium at the Museum of Science in Boston, Massachusetts, underwent a major renovation. One objective was a complete restructuring of the projection pit including its lighting system.

Pit lighting is used for several purposes.

- It provides general illumination of the planetarium environment for the audience as they enter and exit the theater.
- The projection instrument is featured for the audience directly or indirectly by the pit lighting which surrounds it.
- The projection instrument is featured for the audience directly or indirectly by the pit lighting which surrounds it.

The Hayden was originally constructed in the 1950s and has undergone several renovations since it first opened. In addition to upgrading automation and projection systems, this most recent renovation was the most far-reaching in terms of physically reshaping the theater. Audience flow was reoriented, the theater floor was raised, and the projection cove was reshaped. The Hayden does not have a cove lighting system and the retrofit of one was explored, but it proved infeasible at this time. In the absence of cove lighting the special effect lighting was and continues to be delivered from the projection pit. (In other situations, particularly in large domes, pit lighting may also be desirable to supplement cove lighting.)

Existing Pit Lights

The existing pit lighting consisted of red and blue flood-type lamps following the interior face of the pit’s perimeter wall. The lamps were fully exposed to view and directly socketed into boxes. These boxes were linked with short pieces of electrical conduit. This type of installation, or a variation thereof, was the norm for many years.

This approach has a number of disadvantages.

- The color quality of the red and blue lamps is less than ideal.
- The lamps are fully exposed to view and do not present a neat or high-tech imagery to the audience.
- The bare lamps themselves are very hot and a hazard for the public and staff alike.
- There is no flexibility in the system.

Working Towards a Solution

Working with the planetarium staff, we were able to develop effective solutions for the design and operation of the renovated theater. However, a solution for the pit lighting was elusive. Working with the electrical engineers and lighting manufacturers, we developed several prospective solutions and field tested them, but with limited success. In hindsight the approach at the time was too cosmetic. It still centered around the type of lamps used in the existing pit (see Figure 1).

We were looking at a means of concealing the lights in a trough and covering that trough with different types of louver or lens material. We were also trying to dissipate the light and protect hands from contacting the hot lamps.

I had seen several similar solutions in my visits to other planetariums but each had its drawbacks. We were looking for the perfect solution. Access for relamping, heat dissipation, light cutoff, and color rendition were of ongoing concern. In our case we also needed to preserve as much space in the new pit as we could to accommodate additional video and special effects projectors. The trough and its cover were becoming cumbersome and expensive to fabricate.

Redirecting the Approach

A simpler and better solution was found in the use of standard track lighting components. Commercial track lighting has become quite sophisticated and is increasingly used in museum applications. The lighting effects and accessories resemble stage lighting.

The essence of the solution was to mount two continuous light tracks along the inside of the pit wall—one for the blue lights and one for red (see Figures 2 and 3). The track couldn’t be formed to the curve of the pit wall, but in a series of 16 segments it appears to be nearly circular. The track manufacturers make a flexible angle connector that allows track continuity between segments without interrupting circuiting and lamp placement.

The lamps themselves are neatly housed in individual fixtures supplied with accessory holders to receive color filters. Each lamp is now a standard white, 75W par 30 flood. The red and blue color filters cover the light aperture and provide very good color rendition. The fixture housings are compact, and this allows the lamps to be spaced as closely as any socket array that we had previously examined. This was doubly important as we were trying to increase the overall wattage of the original pit lighting. The top of the fixtures are set in line with the top of the pit wall to help cut the light source off from audience view. In this approach, versus the trough, the lamps are in a better position to throw light more effectively onto the dome. The lights are noticeable but not distracting when you are seated in the planetarium. The color filters also buffer the light so that the audience can circulate around the pit and...
examine the Zeiss VI without any significant glare. The housings and filters are still hot to the touch but not nearly as hot as the bare bulbs were.

The interior radius of the new projection pit at the Hayden is 87 inches (221 cm) and accommodates a total of 80, 75 watt R.30 flood lamps. The blue to red ratio is 4 to 1. The blue lamps are equally distributed amongst the blues and are set into the lower circuit track. This results in an array of 5 lamps for each of the 16 segments.

The pit lights are circuited through and controlled by dimmer pack modules. The blue lamps are circuited and controlled by quadrant, whereas the red lamps are on a single circuit. This allows for an asymmetrical distribution of blue daylight should this effect be desired. A sunrise or sunset is effected by bringing up the red circuit and superimposing the blue. The red circuit can also be "flashed" to supplement a special effect explosion. I have noticed that some facilities also introduce a green light component which could be readily accommodated in this approach. The lower track, in this case the red track, could be a dual circuit track allowing separate power and control of an additional color such as green.

**System Advantages**

Distinct advantages of the use of track lighting are its availability, serviceability and flexibility.

The track, accessories and fixtures are available from at least the following three manufacturers: Prescolite, Lightolier and Halo. Having several potential suppliers of the product is a plus when it comes to pricing and purchase. Accessories and parts tend to be manufacture-specific and therefore not interchangeable. However each provides a similar broad array of accessories that can be combined to achieve the desired result. The parts and accessories are also available in a standard matte black finish, as was specified for the Hayden.

The installation is readily serviceable. Individual lamps are replaced by removing the accessory collar. The lamp fixtures themselves quickly connect and disconnect from the track for service or inspection. Stock parts are generally available from a local distributor or they can be ordered overnight from the manufacturer.

The track system is flexible in that you can experiment with color filters and other trim accessories. Accessories can be mounted over the color filter to elongate beam, spread beam, cutoff at 45\(^\circ\), reduce brightness, etc. The fixture housing is also adjustable so that you can aim the lights to improve light distribution in the dome.

**Feedback**

I recently visited the Hayden for feedback on the effectiveness of this and other solutions that were implemented. Comments relative to the pit lighting were generally favorable. The only mechanical problem relative to the lights was that the joint which allowed their position to be adjusted would relax over time, causing the lights to sag. This was probably hastened by the audience poking at the lights. The planetarium staff fabricated a simple metal bracket to restrain the lights in each segment of the pit. This was recently installed and works to hold the lights in an upward position. Symptomatic of dome lighting from the pit was the comment that the horizon was darker than the dome. Ideally the reverse would be the case with a glow of light on the horizon to simulate sunrise and sunset. Directing some of the lights at the horizon would also face them into the audience, so that situation is not easily corrected. As it so happens, one of our cove lighting experiments may have worked to complement the pit lighting effect. We tried a bundled fiber optic tube along a section of the cove. It is compact, dimmable and color variable. It was not effective as true cove lighting but may provide enough light to supplement pit lights and to create that glow on the horizon.

The perfect solution continues to be elusive, but this installation is effective and serves well. As with many situations in the planetarium it is only through full scale mock ups and experimentation that the effectiveness of these systems can be judged. The system as noted before is flexible enough to allow for some modification. The time and effort expended in exploring alternatives at the Hayden was well spent. Hopefully this information will be of some value. I would welcome your feedback.
Comets Are Coming! The New Sky Show.

It's over 1.5 million miles long.

It travels at over 90,000 miles per hour.

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Comets Are Coming! is a smash hit at Chicago’s Adler Planetarium. And in July, this incredible show can be headed right at your planetarium for just $795. Written by David Levy, the 30-minute show features an in-depth look at comets, interviews with Hyakutake, Hale, Bopp, and others, over 240 slides, a digitally mastered soundtrack, an annotated script and production notes, and a spectacular SL9 Jupiter impact sequence. Marketing materials are also available for a separate fee.

For more information or a demonstration tape about Comets Are Coming!, contact Larry Ciupik at 312.322.0313.
**Book Reviews**

**April S. Whitt**  
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At the turn of the season, nothing's better than turning some pages. Especially in these great books, generously reviewed by readers like you. It's never too late to join the reviewers in IPS. Just let me know your name, postal address and favorite astronomy topic, and be willing to exchange a review for a free book.

Thank you to this issue's reviewers: Bob Ballou, Chuck Bueter, Richard Dreiser, John Flynn, Sandra G. Holland, Rob Landis, and Dennis Mammana.


Reviewed by Chuck Bueter, Fairview Park, Ohio.

Spotting a meteor is often a chance circumstance. The ALPO Guide to Watching Meteors supports anyone who wants to turn happenstance into a fun, scientifically useful event. Participants are encouraged to submit simple data about observed meteors with the only required equipment being paper, a pencil, a watch, and a lounge chair.

The 10-page booklet opens with background information on meteors and tips for viewing them effectively. A chart listing the major annual meteor showers suggests when and where to look, typical meteor speeds, and anticipated numbers per hour. Also included is a calendar that indicates favorable viewing dates with consideration given to the moon's phase.

A blank Visual Meteor Observing Form is accompanied by clear instructions. The booklet's appeal to amateur observers is typified by a sample observing form filled out in layman's terms. The only demands made on observers is that they keep individual records and they commit a minimum of one hour to viewing.

Observer forms sent to ALPO are archived and sent to the International Meteor Organization for analysis. Participants also get their efforts published in ALPO's quarterly journal *The Strolling Astronomer*. The Astronomical League, which distributes the booklet for $3.00 plus shipping and handling, also recognizes observers with achievement certificates. (Note: send $3.00 + $1.00 for shipping (US) for each booklet ordered to Astronomical League Sales Office, P. O. Box 572, West Burlington, Iowa, USA 52655-9998.)

While author Robert Lunsford asserts that even the most novice stargazer can contribute meaningful data to the professional astronomical community, the booklet's emphasis is on having a pleasurable experience under the firmament.


Reviewed by Bob Ballou for Cherry Planetarium, Fernbank Science Center, 156 Heaton Park Drive, Atlanta, GA 30307.

In the introduction of *The Story of Philosophy*, author Will Durant muses that we are all like the Dostoyevsky character who doesn't want millions but rather answers to his questions. "We want to seize the value and perspective of passing things, and so to pull ourselves up out of the maelstrom of daily circumstance. We want to know that the little things are little, and the big things big, before it is too late." Well, if you're looking for answers to your questions about the little things and the big things, seize *From Quarks to the Cosmos* by Leon Lederman and David Schramm before it's too late.

This book is a reprise, in paperback only, of the authors' 1989 work of the same title, which brings together the little things (subatomic particle phenomena) and the big ones (the elements of cosmology). Particle physicist Lederman and theoretical astrophysicist Schramm use this latest opportunity to correct some errors, comment on the 1995 discovery of the top quark, and review the Cosmic Background Explorer of the early 1990s.

This work is about the search for the most elementary stuff of nature; and it is this heady stuff that underlies both particle physics and the cosmology of the early universe. And there is a subsidiary search: one for a theory that can unify the forces that govern the fundamental elements, whether particle or radiation or something else—a Theory of Everything. *Quarks* approaches something of a smooth, moving drama—withstanding the occasional bouts of tediousness inherent in breathtaking abstruseness—of scientists, their machines and experiments, their failures and doubts, and their remarkable successes.

The action begins in the early morning hours at Fermilab's Tevatron (a powerful particle accelerator) where scientists anxiously await the collision of protons and antiprotons. A spectacular collision ensues resulting in a shower of exotic subatomic particles and radiation. Cheers erupt as the watchful confirm that "for the very briefest instant, below a former corn field in Illinois, [they] have replicated the conditions that existed throughout the universe some billions of a second after its creation in the cosmic event known as the 'big bang,' 15 billion years ago." And so we're off, to search for mysterious, hitherto unknown particles and radiation, here and from the heavens, and for a unifying theory that will effectively merge inner and outer space and allow us to understand, well, everything.

The chapters are well organized. There is ample material on the origins of modern physics, with good coverage of the thinkers and their ideas. A chapter on probing the heart of the atom with particle accelerators and detectors helps to answer the big astronomical questions such as "What makes the stars shine?" Midway through the book, the reader is confronted with the Standard Model (of the atom and its multitude of constituents including the quark), which came about "as experiment suggested theory and theory suggested experiment," and a history of the development of the machines that brought the "particle zoo" into focus. There are synchrotrons and synchrocyclotrons, bevatrons and tevatrons, cosmotrons, betatrons, and plain old cyclotrons. They are wielded by generally quiet and reserved physicists, one group of which is whimsically yet enigmatically referred to as "Murder, Incorporated" (read the book). The early universe is given lots of room and we learn that "With the establishment of the big bang, it became clear that the early universe was in some sense an elementary particle-physics laboratory, since the energies and densities in the very early universe were enormous, far greater than even those achieved in particle accelerators. In fact, the physics governing what was going on in the early universe is the physics of elementary particles." The convergence of inner and outer space is treated in a full chapter, and a chapter on discovery tools for this decade and later, includ-
ing a section maudlinly and alliteratively titled The Sad Story of the Superconducting Supercollider (SSC) and the Hope for the Year 2003, concludes the major work of the book.

This is a readable book, although the reading is challenging. But this is because the subject is challenging, often in a disturbing, dizzying way, sometimes requiring the reader to suspend long-held beliefs about what makes up inner and outer space. The authors wisely include many good visuals to soften the blow of the often recondite text. There are photos, charts and graphs, illustrations and well captioned diagrams, on almost every page.

Quarks lacks a bibliography, which isn't so bad, but a Further or Suggested Reading would be helpful after the tortuous ride. There is an annoying superfluousness of exclamation points in the text, and I'm not sure why. The words easily convey the excitement, puzzlement, and urgency that the authors intend; the abundance of these points, more common in puerile writing, merely hinders the flow of words.

The Epilogue attempts to provide philosophical perspective by raising the big questions: Why does the universe have three dimensions (plus time)? What came before the big bang? When will we arrive at the Theory of Everything? The authors leave the musing to the philosopher in the reader. They speculate only about when we might achieve the higher and higher energies in particle accelerators that will allow us more of a glimpse of the little things and the big ones.


Reviewed by Richard Dreiser, The University of Chicago, Yerkes Observatory, Williams Bay, Wisconsin, USA 53191-0258

When I was young (and fascinated by everything), I chanced upon a discounted soft bound book (regular price $1.95, now forty-five cents) entitled Bombarde Earth, John Baker Publishers Ltd, London, 1964. In his preface the author Rene Gallant begins by saying: "Here is another book dealing with cosmic catastrophe." (pg. 16, paragraph 1)

I had never heard of such a thing and was astonished. It was years before the first humans walked on the surface of the Moon, sinking their boots into the regolith, a pulverized surface built up over billions of years by meteoritic impacts, and few seemed to believe that Earth had been affected by major meteorite impacts.

In Bombarde Earth I first learned about fossil meteorite craters, including the Canadian Clearwater Lakes and Brent Crater. Every vaguely circular structure on a map was a possible meteorite crater.

At the time, of course, Mr. Gallant was considered to be something of an eccentric. But by the mid 1980s, few doubted that planet Earth, like the Moon, Mercury, and the rest of the rocky planets, moons and asteroids, showed signs of meteoritic bombardment.

Duncan Steel begins Rogue Asteroids with an absolutely riveting paragraph:

"It is difficult to overstate the almost unimaginable energy that is released when a massive asteroid or comet hits the Earth. Merely stating that the explosive power is far greater than all the world's nuclear arsenals combined does not properly convey matters. The reader may think that such combined power might simply result in a larger area being flatted than that which a nuclear bomb devastates. Instead of the holocaust wreaked in the few square kilometers of central Hiroshima, for example, we might imagine all the buildings in the metropolis of Los Angeles being toppled. In fact, the impact of a large asteroid or comet is quite different from that. Were one to land in Southern California, for example, all of Los Angeles along with several kilometers of the rock from the Earth's crust beneath it would be picked up and largely vaporized, lumps raining down on Hawaii and New York an hour or so later. Not that Honolulu or New York City would be left standing by then. Phenomenal seismic shocks following the impact would have already shaken them flat." 

In his cosmic roller coaster of a book, Steel promises, then delivers, a chilling scenario of possibilities. The book is divided into three major themes: 1) The threat that impactors pose; 2) Evidence that such devastation has been caused by impacts on the Earth in the past; and 3) The plans for searching out and destroying incoming objects, if we decide to do so (pg. 14, paragraph 2).

What follows within this reasonably short book (259 pages) is a curious spellbinding combination of undisputed facts, physical laws, and acknowledged speculation. The book includes lengthy notes, a glossary of terms more complete than that found in some other popular books, and an extensive bibliography.

The book is designed for non-scientists, and it contains little to thwart anyone over the age of twelve who is persistent enough to read through what seemed to me at times to be more than enough information to make the case for bombardment by comets and asteroids. The Library of Congress lists it as a popular work under four headings: asteroids, comets, impact, and extinction (biology).

I am not a physicist and was unprepared to cross-check Steel's figures in regard to speed, mass, and other physical properties. Let's assume he is correct. The probabilities of destruction, including the masses and speeds of comets and asteroids are terrible enough be they off by a factor of ten.

I was able to find one glaring error which rather surprised me. Within the first of the notes for Chapter 12, Steel uses the word spectroscope three times when writing about the four-vaned spindles painted black on one side and silver on the other suspended within glass spheres from which most of the air has been evacuated. The vanes rotate when the device is exposed to sunlight. Clearly, Steel means radiospectroscope.

In the Epilogue, Steel devotes twelve pages to "The Crash of '94," that is, the discovery of Comet Shoemaker-Levy IX and its eventual collision with Jupiter in July, 1995. Had Rogue Asteroids and Doomsday Comets been written five or ten years earlier, it might have simply joined the ranks of other books, whose authors write hystically and with far less scientific expertise. Duncan Steel is, according to the book jacket, "a research astronomer at the Anglo-Australian Observatory and a research fellow at the University of Adelaide, Australia." He has served "on both the Detection Committee and the Intercept Committee created by NASA to assess the threat of asteroid and comet collisions and investigate technologies to avert such impacts." He knows, it seems, what he is talking about.

Rogue Asteroids is alternately scary and fascinating, sometimes a trifle long-winded, but never dull. I wish the world could witness a sampling of a relatively safe cosmic catastrophe (say, one-dozen 10-meter objects falling on Antarctica over a ten-day period?). No mass extinctions need occur, but such an event would bring about Spaceguard in an instant, and who can foresee what we would learn, aside from the likely salvation of our species.
Space Sailing by D. M. Souza; Lerner Publications Company

Reviewed by Sandra M. Holland, Hornd Toad Academy, Pleasanton, Texas, 78064.

With the unlikely but accurate title of Space Sailing, this 64-page book aimed at readers 10 years of age and older delves into the research that has been done on fuel-less space flight. Based upon the popular short story of the sixties by Arthur C. Clark—"Wind from the Sun"—the book addresses an increasingly common outcome of science fiction, that "yesterday's fiction is becoming today's reality."

Chapter 2 details the ideas and specifications for sailing instead of rocketing through space. "Although faster at first, a rocket-powered spacecraft will eventually run out of fuel and be forced to coast. A sail, however, will require no fuel. The push will be constant as long as the Sun shines on the sail, and the speed of the sail will continue to increase year after year."

"Scientists realized a space sail would have to be made of a material that reflects as many photons as possible. It would have to be extremely large, perhaps extending over as much as several miles. The larger the sail, the greater the number of photons that will hit it."

The author goes into detail about why various materials and processes, such as silver or crinkly aluminum, will and won't work in space sails.

This book deserves a place in the library of every budding astronaut and junior or senior space historian. The unlikely scenario, based upon a science fiction story, of ships of space actually carrying sails like ships of the sea, makes an interesting read. The ship itself, however, more resembles a kite or some kind of odd-shaped sea creature such as an octopus or a jellyfish than sails of a clipper ship.

The book leaves off with the information that "In Japan, Europe and the United States, scientists are actually assembling giant sails for a race to the Moon." Readers will want to dig into other resources for the fate of those sails.

Five chapters and a conclusion detail this historical narrative of a different kind of space travel. The book is adequately illustrated with mostly black-and-white photos to flesh out the idea of space sailing. The text is very straightforward and factual. A two-page index and a glossary of 20 words round out this book.


Reviewed by Sandra M. Holland, Hornd Toad Academy, Pleasanton, Texas, 78064.

"So let's take a space hike. We will base our views of the planets and satellites on pictures and data from spacecraft and Earth telescopes."

Another book on the Solar System? That was my first thought. This book, however, is very interesting and informative.

"Where have we traveled in the solar system? Twelve astronauts have walked on the moon. The Viking spacecraft landed on Mars and sent pictures back to Earth. The Venera spacecraft took the first photographs of the rocks of Venus. Other spacecraft, such as the Mariners, Pioneers and Voyagers, have sent back photos of other planet and satellite surfaces. In fact, Pluto and its moon, Charon, are the only planetary bodies we have not yet visited."

This attractive, colorful book is 80 pages long, including three charts, a one-page index and a short glossary. It has nine chapters plus introduction and conclusion. The text is interspersed by informative photos and fact boxes ("Why is Venus Like a Greenhouse?").

The writing is vibrant and meaty, easy to read and easy to understand. Barnes-Svarney takes the theme of traveling to the features of the Solar System but does not use the theme in a cute way. The book, for children of about middle school age, is very informative and detailed. The author contrasts and compares in interesting ways.

"Whoosh! We had better watch out as we approach this moon; it is one of the most active in the solar system. It is called Io . . ."

"Mars also has four seasons like the Earth . . . There are no fall leaves or spring growth as on Earth, and no rain, sleet, or snow. Seasons on Mars are marked by frost on the rocks, the strength of the desert storms, and the changing of the polar caps . . ."

To keep readers interested, the author presents such scenarios as, "Will we see life on Uranus or its moons? There is probably no life on the small moons because they don't seem to have atmospheres. But is there life on the planet? Probably not. If life were to exist on Uranus, it would have to be able to breathe hydrogen, helium, and many poisonous gases. And it would have to be able to withstand extreme cold." Young readers will find a browse through this book is almost as good as spring break.


Reviewed by Bob Ballou, Cherry Planetarium, Fernbank Science Center, 156 Heaton Park Drive, Atlanta, GA 30307.

This is a nice, colorful set of young children's books (32 pages and $4.95, each) by Jeanne Bendick, with illustrations by Lynne Willey, Mike Roffe, and Chris Forsey—depending on the title. These are thoughtful little books with some big concepts (e.g., solar wind, earth's magnetism, neutron stars, light-year), simple experiments to help with the understanding, and key words set in bold face and nicely explained.

To wit: "During a total eclipse, the sun's inner atmosphere looks like a thin, bright ring around the black shadow of the Moon. The sun's outer atmosphere, which is called the corona, extends past the ring in rays, like flower petals. But the moon is much smaller than the sun! Can you guess how something as small as the Moon can cover something as big as the sun? Try this. Hold your hand up in front of your face. Close one eye. Can your hand cover a car?" And so on.

You can't go wrong with these books, and neither can the children for whom you love to buy books. You'll enjoy reading these smart books with them.


Reviewed by John Flynn, Armagh Planetarium, Armagh, Northern Ireland.

This delightful little book is particularly well suited for 8 to 12 year olds and would be a useful addition to any school library. Despite the small size (32 pages) it contains quite a bit of information. More important is the kind of information contained.

Types of satellites and their importance are looked at. It is very significant that the first types of artificial satellites considered are environmental satellites monitoring
Earth's environment. In this way the importance of satellites is brought home to the reader.

Other types of satellites are considered: weather, military, navigation, communication and astronomical research satellites. The descriptions of their purposes are a bit brief, but they do convey the essential message nevertheless.

Orbits, gravity, energy for satellites, and what a satellite is are all considered and explained in a manner simple enough for the young reader to follow. A straightforward one-page simple index makes this information easy to find and can provide a useful exercise in "looking things up" for young students.

Almost every page contains a colourful illustration or diagram by Mike Raffe, each of which is not only accurate and informative, but also quite pretty and will interest the child almost as much as the text.

A child who reads this book carefully should know what an artificial satellite is, what powers it, what is does, and why it is important. I only wish most adults knew that information!

_reviewed by Mike Raffe, Armagh Planetarium, Armagh, Northern Ireland._

This little book is another "Early bird" book on astronomy by Jeanne Bendick. It has set out with the rather ambitious task of covering the subject of moons and rings in the solar system. Considering the size of this task, and the fact that it has only 32 pages to do it in, I feel the book has succeeded well.

The reader begins with a look at our own Moon and touches upon gravity and tides. The phases of the Moon are also covered, although I am unsure if the average 8 to 12 year old would understand the phases from the information in the text. Lunar phases are extremely complicated for children to understand, and the book only allocates four pages for the subject, so it is a brave try, and, given the limitations, one of the better efforts I have seen.

On a slightly negative note, the book does use the term "half moon" for what we call "quarter moon." I know some people will shrug and accept this abuse, but I feel the concept of a "quarter moon" is not beyond most kids this age and some attempt should have been made to address this problem. That is the most negative thing I have to say about this otherwise wonderful book.

The moons of the other planets are then examined and with a total number of at least 63 moons in the solar system the book will remain useful even after other moons may be discovered.

_reviewed by Rob Landis, Space Telescope Science Institute, Baltimore, Maryland, USA._

At the CORONA conference in Washington last year I had the pleasure of meeting Fred Ordway (the second author of these double volumes) whose earlier books are an inspiration for anyone thinking of a career in space science. Ordway also worked with von Braun's rocket team at Huntsville, Alabama for several years.

The first author, Ernst Stuhlinger, was a member of von Braun's Peenemunde team. Following World War II, more than 100 German scientists and engineers (including Stuhlinger), continued their rocketry work at Ft. Bliss, Texas and White Sands, New Mexico before settling in Huntsville, Alabama.

This two-volume set presents a retrospective, in words and pictures, of a man recognized as a unique genius in this century. The purpose of these two volumes is to accurately chronicle Werner von Braun's extraordinary life. The books accomplish this exceedingly well. Not only are von Braun's professional accomplishments discussed, but his personal life is nicely detailed. I cannot think of any authors who could write a biography better than Stuhlinger and Ordway who had very close personal and work relationships with von Braun.

More than 100 carefully recorded, edited, and documented interviews with the people who knew him well were used in the creation of these books.

The biographical memoir begins with a history of rocketry in war and in peace. Rockets have long and deep roots within the context of their use as military weapons. The book contains numerous, pithy quotes by von Braun and his gut-level feelings on the issue of technology vis-a-vis the military.

The book is packed with kernels of information and truth. Many myths I had held were blown away. For instance, Hitler ignored and ridiculed the Wehrmacht's rocket development efforts. It was only in late 1943—long after the Luftwaffe lost the Battle of Britain—that Hitler turned to Peenemunde as a last resort. General Dornberger, the military commander at Peenemunde, and von Braun opposed the use of the A-4 (what we know as the V-2—"vengeance 2 weapon"—thanks to Goebbels who re-dubbed the rocket) as a weapon. Accused of not sufficiently supporting the war effort, the SS imprisoned von Braun. In fact, von Braun relates that this was his darkest hour when Himmler and the SS wrenched control of the A-4 from his team.

The illustrated memoir contains photographs, all of which are thoroughly captioned, which detail von Braun's life. The earliest photographs are from his boyhood (age 10 - 15). Subsequent pictures chronicle his life studying under Hermann Oberth, as a Luftwaffe cadet, technical director at Peenemunde, his coming to the United States (and subsequent stations within the US; Ft. Bliss, Redstone Arsenal, Marshall Spaceflight Center, Washington, DC, etc.).

The photographic collection punctuates the high notes of the rocket scientist's life. Practically all of the individuals in every photograph are named. This must have been extremely painstaking research for the authors. Through it all, I detected only one minor error, on the bottom of page 79. It's an aerial shot of the Alabama Space and Rocket Center in Huntsville. The Saturn I rocket is mis-identified as a Saturn IB. (Hopefully, this won't start another dweb list ala the Apollo 13 movie that was recently posted to the dome-l email listserver.)

The last section is a series of color plates of Chesley Bonestell's artwork that appeared in Collier's magazine in the early 1950s. This includes the construction of an Earth-orbiting space station, a lunar base, and the human exploration of Mars.

What the illustrated memoir says in pictures, the biographical memoir says in words.

The biographical memoir is a very detailed narrative of von Braun's life from early childhood to death. While that may seem a bit much, it isn't. The reader gains insight into von Braun's character. Further, the book is superbly written so that the level of detail is quite pleasant. All quotations, verbal and written, are well documented with endnotes. This is the best and most complete biography of von Braun this reviewer knows of.

The final chapter very tastefully describes...
SPACE CREATORS

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The Space Shuttle in Orbit and
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The following planetarium lesson was developed by Greg Plotycia of the Aberdeen High School Planetarium in Harford County, Maryland. In this lesson, Greg utilizes the planetarium orrery to develop a simple, yet effective method for helping students to use Kepler's Third Law to determine the distances to the planets. The meridian is used to set the solar system to scale, utilizing a predetermined number of degrees calibrated to one astronomical unit. A stopwatch is utilized to record the number of seconds required for one earth revolution, which is in turn calibrated to one year.

Students are actively involved where they collect and reduce data and practice the development of scientific "habits of mind" using the planetarium as a laboratory. I would certainly like to encourage you to try this lesson with your students and contact Greg with your impressions.

If this column is to continue, we will need some of your ideas too! We would certainly like to encourage other who have participatory lessons to submit them for publication in this column. Planetarium lessons are welcomed and encouraged for all grade levels. Please send your submissions on either an IBM or Macintosh formatted floppy disk and specify which word processor was used. Please also include an ascii version (save as DOS text or SimpleText on the Mac). You can reach me by e-mail at schapman@umd5.umd.edu.

Kepler's Third Law of Planetary Motion

A Planetarium Lesson for High School

Gregory Plotycia,
Planetarium Director
Harford County Schools
Aberdeen High School

Introduction
The application of abstract mathematical concepts to concrete "real-world" observations is the basis for any advanced study of science. The identification of mathematical relationships is what allows a scientist to be able to predict the occurrence of a future event with some degree of accuracy. Johannes Kepler (1571-1630) was a mathematician who strove to discover the relationships hidden in the planetary motions of the solar system. Working with the data of the astronomer, Tycho Brahe, Kepler was able to ascertain what are now known as the three laws of planetary motion. In this activity, the students will observe the sidereal periods of several planets, then apply Kepler's Third (or Harmonic) Law to their observations to predict the average distance between each planet and the sun.

Outcomes and Indicators: Students will work cooperatively in groups to:
1. Measure the sidereal period of a planet using a stopwatch.
2. Calculate the average distance between a planet and the sun using the mathematical relationship discovered by Kepler.
3. Compare calculated values of distance to observed values and identify causes of discrepancies.
4. Explain why the synodic and sidereal periods of a planet are different.
5. Describe the historical development of the heliocentric model of the solar system.

Mathematical Skills
Students should be able to calculate cube roots, square roots, squares, and cubes. Students should also be able to set-up and solve proportions.

Materials
For each student, a pencil and data chart to record observations.
For each group of students, a stopwatch and scientific calculator.

Advance Preparation

1. The students should be familiar with the following words and names: geocentric, heliocentric, Ptolemy, Copernicus, Brahe, Kepler, Newton.
2. A brief description of Kepler's Laws of Planetary Motion may be helpful but is not absolutely necessary.

Steps For Teaching the Lesson

1. After seating the students, provide background information about the development of the heliocentric model of the solar system. Describe the contributions of Copernicus, Brahe, Kepler, and Newton.
2. Once the student's eyes are dark-adapted, project the sun and planets onto the dome using the orrery. Ask the students if they can identify a relationship between a planet's distance from the sun and its period of revolution. (Most should observe that as distance from the sun increases, so too does the period of revolution.) Ask the students to compare the orbital periods of the inferior planets (Mercury and Venus) and of the superior planets (Jupiter and Saturn) to the Earth's orbital period. (Most should observe that the inferior planets revolve at a faster rate than the Earth while the superior planets revolve at a slower rate.)
3. Turn off all of the planets except Earth. Turn on the stars. Distribute a stopwatch to each group of students. Have the students choose a background star to use as a fixed reference point and have the students use the stopwatches to measure the time it takes the earth to complete 1 orbit relative to the fixed reference star. Have each group report the number of seconds measured. Calculate the average number of seconds. Have the students record this number in the data table in the column labeled Period (in seconds). Since one revolution = one year, the average number...
**KEPLER’S THIRD LAW: DATA TABLE**

Earth Data: Observed Period (seconds) = \( \frac{365.25 \text{ days}}{365.25 \text{ days/year} \times 86400 \text{ s/day}} = 1 \text{ year} \)

<table>
<thead>
<tr>
<th>Planet</th>
<th>Observed Aphelion Distance (tics)</th>
<th>Observed Perihelion Distance (tics)</th>
<th>Average Earth-Sun Distance (tics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
<td>1 Astronomical Unit</td>
</tr>
<tr>
<td>Venus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
of seconds = one year. (example: 65 seconds of planetarium time represents 1 year of real time).

4. Turn on the meridian. Explain to the students that they will be measuring the distance between the planet and the center of the sun in "tics". Since the planet's orbits are elliptical, we must measure the distance at both aphelion and at perihelion in order to calculate the average distance.

5. Turn on the orrery motor and have students observe and record the earth-sun distance (in tics) at aphelion and perihelion. Students should then calculate the average distance. Explain to the students that this average distance represents 1 Astronomical Unit. (example: 26 tics represents 1 AU).

6. Turn off the Earth, and project Mercury onto the dome. Have the students measure and record the number of seconds Mercury takes complete one orbit. Have the students calculate and record the orbital period in years (using the proportionality constant found in step 3).

7. The students will now use Kepler's Third Law of Planetary Motion to calculate the average Mercury-Sun distance. Kepler's law can be written as \( p^2 = ka^3 \). If the units used are AU and years, then since the Earth orbits the Sun in one year at a distance of one AU, the constant \( k \) becomes unity. In this exercise we will make that assumption. However, it would be an interesting exercise for students to use their dimensional data (seconds instead of years, and degree units instead of AU) to actually calculate the value of the constant \( k \).

a. Square the period (in years). This is \( p^2 \).

b. Since \( p^2 = ka^3 \), take the cube root of \( p^2 \) to calculate the value of \( a \) (where \( a \) is the average distance in astronomical units).

c. Have the students calculate the average number of "tics" that should exist between Mercury and the Sun using the proportionality constant found in step 5. Record the average distance in "tics" in the data table in the column labeled "Predicted distance.

8. Project the meridian onto the dome and have the students observe and record the aphelion and perihelion distances of Mercury. The students should then calculate the observed average distance from the Sun. Record this number in the column labeled "observed average distance (tics)". Convert this number to AU's using the proportionality constant from step 5.

9. Repeat steps 6-8 for Venus and Mars.

10. Turn the orrery off. Project the Sun, Mercury, and the ecliptic onto the dome. Have the students observe the date indicated by the sun's position. Turn on annual motion and observe how long it takes Mercury to appear to complete one orbit of the sun. Compare this to the time observed when using the orrery (the sidereal period). Ask the students to explain why there is a difference. Explain the concepts of synodic and sidereal periods.

Review by Dennis L. Mammana, Reuben H. Fleet Space Theater, San Diego, California.

If you're looking for a book to bridge the gap between an astronomical primer for the totally uninformed and the advanced amateur, this might be just the ticket. It's not a slick publication with bright, glossy color photos and floral language describing our universe's most glorious phenomena. It is, instead, a valuable and no-nonsense manual for getting into the hobby of amateur astronomy.

The book is aimed at one who has significant knowledge of the sky and is ready for the next step—a telescopic journey into the cosmos. Not only does Porcellino describe the basics of amateur astronomy (how telescopes work, light pollution, the physics of the eye, atmospheric turbulence, etc.), he also takes a step beyond to show how amateurs can contribute in a significant way to science. Entire sections are devoted to comet hunting, measuring double stars, monitoring variable stars and solar observations, among others. These serve to inspire the reader and provide further resources for more information (e.g., AAVSO, IAU, etc.).

Nowhere does he delve into astrophotography which, in this age of CCD cameras and computer enhancement techniques, is becoming one of the ways amateurs can make a contribution. But this is all well and good since entire volumes can be, and have been, written on the subject. It would have been nice, however, if he had listed some of these in his extensive bibliography.

One of the book's poorer qualities is its reproduction of photographs. All are black and white which in itself is not bad, but they are sometimes overly dark and difficult to distinguish detail in the shadows. Some very nice graphics illustrate a variety of phenomena from aperture masks to orbital mechanics to the equatorial coordinate system.

Thankfully, Porcellino makes it a point to communicate that often a beginner's expectations of a telescope lead to disappointment. He makes sure that readers know exactly what they can and cannot expect to see. Overall, the book is full of information and insights, and is one which should be on every amateur astronomer's shelf, and one which should be stocked by every planetarium store.

Summary

Although the data that Kepler obtained from Tycho Brahe's observations were the most precise available at that time, the derivation of the Laws of Planetary Motion was an extremely difficult process. To begin with, Kepler's worldview led him to assume that the shape of a planet's orbit around the sun would be a perfect circle. This assumption, however, did not fit the data taken from direct observation of the planets. After rejecting the "perfect circle," Kepler eventually discovered that the true shape of the orbit is an ellipse. Another difficulty encountered was that in the heliocentric model of the solar system, the Earth is also a planet in orbit around the sun. Any observation of the motion of another planet would have to take into account the fact the observer is also moving. This is much more complicated than the geocentric model in which the observer would be stationary. In this activity, the students can directly observe the difference in the results between a moving and fixed observer.

Reviewed by Dennis L. Mammana, Reuben H. Fleet Space Theater, San Diego, California.
To planetarians who say:

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PIPS June Meeting:

The seventh PIPS USERS' Group meeting was held on Monday, June 24, 1996 with eleven enthusiastic (experienced and novice) planetarians. The host facility was the Oneida-Herkimer-Madison BOCES (Information and Technology Division, 1900 Bleeker Street, Utica, NY 13501 USA), where the dynamic Lindarae Bauer wowed us with her gracious hospitality and ingenious teaching methods. Lindarae led us to explore some unique ways to use the Geographic cylinder and the Ocean Current cylinder. She uses a sewing tape measure with markings applied with glow-in-the dark paint (each inch is about 40 mi; or 2 cm is about 66 km; this is a very rough scale, please check this yourself). With this tape students can measure such things as the distance traveled by explorers and compare it to the time it took them. Then the Ocean Current cylinder could be used to discuss why certain routes were popular. Students could also measure, with this tape, areas of land masses to compare such things as population per square km, amount of oil from a square area, and to notice real sizes of nations (Australia to USA) on the more size-accurate continent projection of Starlab.

Mary Stebbins (Museum of Science and Technology, Franklin at W. Jefferson St., Syracuse, NY 13202 USA) presented a pre-recorded Native American Show, "How Fisher Brought Warmth to the Earth", and then discussed how it is used in the stationary dome versus the mobile dome. In Starlab it is a much more interactive presentation.

Ted Stalac (Herkimer BOCES, 480 Gross Blvd, Herkimer, NY 13350 USA) showed us a demonstration he uses with junior and senior high school students. He calls this demonstration "A Reason to Study Astronomy-It will save you thousands of dollars and make you more comfortable." A Suntracker and a Sun Sensor combined with a small model house makes a new tool for teaching practical astronomy. The use of a mini mag light as the sun (or the real sun) lets the student quantitatively examine the positive and negative aspects of windows in different walls of a structure. Solar radiation variations are measured as the sun's position shifts through the day and the year. These variations are examined as a function of direction and its heating of the structure. The following is a list of the components: hot glue and 2 two inch (5 cm) wires; Fisher Scientific (90-91 catalog) SUNTRACKER, $42213-5, $59.95 and SUN SENSOR, $42212, $17.90; model house cut from Styrofoam plate.

Of course a multitude of interesting tips and resources were shared—too many to keep a list. People were delighted to spend the day with colleagues and plan to meet again in the month of September. Thank you Lindarae for a wonderful day!

IPS '96- Japan:

As I write this column, plans have been finalized and a three-hour workshop will be presented at IPS '96. A printed copy of this workshop will appear in the proceedings. The workshop is called "I.D.E.A.S. Interactive/Interdisciplinary Didactic Experiences with Advanced STARLAB". Discussion topics will include: Starlab as a Versatile Teaching Tool; The Lapp (Sam) Sky; The Cosmic Moose Hunting Scene; A new Starlab Cylinder; Interdisciplinary Experiences with STARLAB; Introduction of Transparent Cylinders; and Methods of Making New Hemispheric Images with Transparent Cylinders and Photographic Film. Presenters will include Loris Ramponi, Susan Reynolds and Torbjorn Urke.

STARLAB Transparent Cylinder Contest:

Learning Technologies, Inc., is sponsoring a contest to inspire creative uses of their clear cylinders. For rules etc. please contact Learning Technologies, Inc., Transparent Cylinder Contest, 40 Cameron Ave., Somerville, MA 02144.

An Adventure for American Planetarians in Italy:

The participant for 1996 will be chosen this month. We are now seeking applicants for September or October 1997. A reminder: Each year Serafino Zani Astronomical Observatory (Lumezzane/Brescia), in collaboration with the IPS Mobile Planetarium Committee and with the support of Learning Technologies, Inc., will host an American Planetarium Operator who presents lessons with the itinerant planetarium Starlab to high school students of English. Transportation from the United States will be provided, along with bed and meals from Tuesday to Sunday. For further information and a copy of the application please write to Susan Reynolds at the address at the top of this column.

New Letters and Phone Calls:

Cheryl Zimmerman (National Science Center, ATZH-NSC, Fort Gordon, GA 30905-5689 USA) tells me they have 15 Starlabs at their location and are involved in offering extensive training. She was provided with a sample training schedule and permission was given for her to duplicate and give out some of the committee’s public domain materials (giving each author credit as well as the committee).

Juan Carlos Zabalgorta (C.C. 4184, 1000 Buenos Aires, Argentina) writes, "With this letter I hope to contribute to enhance the 'I' of the IPS as you said in an earlier column. I am sending you a guide of practical activities for the classroom that we give to the schools that we visit with our portable planetarium. This is written, of course, in Spanish and it could be useful for other Spanish speakers of the Society." Thank you so much, Juan, for your valuable contribution and effort to provide for the Spanish speaking community.

Marilyn Zaretsky (Assist. Superintendent, South Huntington School, Long Island, NY, USA) just purchased a Starlab and wanted guidance with training and curriculum for a summer instructor training program. She was also provided with a sample training schedule.

Signing Off:

Good-bye until next time, when I’ll give some news about the First Science Centre World Congress and IPS '96 Japan!
Ever since the discovery of ancient bones and the first use of the word “dinosaur” to describe the creatures they once were, people around the world have been fascinated by these prehistoric beasts.

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Jon U. Bell
Planetary Director
Hallstrom Planetarium
Indian River Co. College
Fort Pierce, Florida 34981

"Opening the Dome" addresses strategies and logistics for conducting active, aggressive real sky observation programs as adjuncts to planetarium shows.

Call for Contributions — An Astronomer’s Book of Days

I've been doing these "skywatch" type newspaper columns and radio programs for quite a few years now. Sometimes it's incredibly easy, sometimes it's an amazing pain. For example, before leaving for summer vacation, I had to write and narrate two month's worth of 1-minute programs, so that the local PBS station would have something in the can until I got back into town.

I do five different Skywatch programs each week, which air at 7:20 a.m. and 1 p.m. Monday through Friday on WQCS Classic Radio. Each program script consists of approximately 40 seconds of narration (10 to 11 lines in the Courier font) and 15 seconds of musical introduction and ending tag. On average, it takes me two and a half hours each week to research, write and record the spots. So for two months worth of Skywatches, let's see, that's nine weeks times 2.5... well, anyhow, it's a lot of time.

I try to make the information useful to the listeners, so that later on that evening, they can try to find the stuff that I've been talking about. Of course, you don't have moon-planet conjunctions, meteor showers or eclipses every day, so I have to come with lots of filler for those times when nothing’s happening.

Good filler includes various prominent stars and constellations currently visible in the evening sky, or basic concepts in astronomy, or important historical happenings, such as, “W. H. Olber’s birthday is today – this astronomer came up with a very significant question about the universe, namely, “why is the sky dark at night?” And then I talk about Olber's Paradox for the next thirty seconds.

I've collected quite a lot of these historical dates, culled from Chases’ Calendar of Events, old Sky and Telescope columns, astronomy textbooks and so on; but it's been rather a hodge-podge exercise. I'd like to be able to put the stuff I've collected into a booklet that could be distributed to the IPS membership, because it occurs to me that many of you may find yourselves in a similar situation, and could find the information useful.

It also occurs to me that many of you may already have similar assemblages of this material, some of which I probably don't have. In order to make this a more complete collection (ideally, at least one significant historical astronomy event for each calendar day), would you please send me a copy of what you've collected, and then I'll try to put it all together as an Astronomer's Book of Days – and Nights!


The Great Constellation Shootout of 1996

At the 1996 South Eastern Planetarium Association conference in Nashville, Tennessee's Sudekum Planetarium, the first ever Constellation Shootout was held (so far as I know...). The idea was simple: make up a list of stars, constellations, asterisms and deep sky objects, and then have contestants point them out. Last person left standing is the winner.

Sixteen people signed up for the Shootout. When I put this thing together, I was afraid that there would be so many contestants that the Shootout would take a really long time and tend to drag on. Then when I started talking to folks at the conference, I discovered exactly the opposite problem: who would want to put themselves on the spot like this, sitting in a dark theater filled with planetarium professionals, and end up missing a really easy star pattern like Orion or the Big Dipper? But sixteen was a good number – the contest really moved along.

I had nightmares about possible snafus. One of the scarier was that when I asked someone to point out a constellation, all of a sudden there'd be a dozen red laser dots on the dome. (In fact, the first night of the conference, that's exactly what happened when the lights went down.) So to circumvent this, Sudekum Planetarium Director Kris McCall provided us with a battery-operated incandescent pointer – you know, the kind that projects a lamp filament as a pointer arrow. I put a piece of red gel over it and it made for a very distinctive pointer, which the contestants passed around during the Shootout.

I set up the sky for four different sidereal settings: 0 hours, 6 hours, 12 hours and 18 hours. I kept the Sudekum's Spitz 512 polar altitude setting at 35 degrees North, which was a fairly representative placement for the SEPA region. (I'd initially considered different latitude settings, but mixed it for two reasons: 1. the southern circumpolar constellations are really amazingly difficult to spot, and 2. when you tip a Spitz 512 below the equator, you get this big dark void rising up out of the south, caused by the planet cage and yoke blocking the path of the projected stars.)

Then I made up two lists for each of these settings — an “easy” list of the 25 most prominent stars, constellations, etc. and a “difficult” list of 40 or more not so prominent sky objects. I planned on starting with the easy list at the 0 hour setting, then the easy list for 6 hours, then 12, then 18. If anyone was left in the contest at this point, I intended to next go on to the hard lists for each of those settings. As it turned out, after we got past the easy list for the 0 hour setting, the 6 hour setting seemed too easy for the remaining participants, so after Orion and Taurus and a couple of others, we jumped to the hard list for 6 hours.

In compiling the lists, I arranged them roughly in order of decreasing brightness and increasing difficulty. I avoided anything that wasn’t projected by the host institution’s instrument, a Spitz 512. So, tempting as it was to ask folks to point out the Hercules Star Cluster or the Ring Nebula or Cygnus X-1, the invisible stuff got left off the list.

An hour had been set aside for us to hold the Shootout, but unfortunately the presentations that morning went overtime, and we were left with a scant half hour before the planetarium theater was needed for a public show. So we were a little rushed. I'd wanted to give the participants a few minutes to get dark adapted and familiar with the first sky setting before asking them to identify anything, but there just wasn't any time for that, so we plunged right in.

The method I employed: it was set up very much like a spelling bee. Participants were asked, one at a time, to point out a particular star, constellation, asterism or deep sky object. If the star or whatever was pointed out correctly, the contestant remained in the game. If the object was incorrectly pointed out, the contestant was disqualified, and the next person had to correctly point out the missed object and then successfully point out a new object to continue in the game. The order of the contestants was chosen by

(please see Opening on page 28)
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I was invited to the Space Telescope Science Institute to deliver a colloquium on the relationship and interaction between astronomers and planetarians. I gave the talk the slightly juicy title “Marriages Made in Heaven: The Astronomer-Planetarian Connection,” loaded up the slide tray, and left an unseasonable 80 in Montana for an unseasonable 40 in Baltimore.

I’d never been to the Institute before, so it was with great anticipation, that bright, brisk morning, that I showed up on the doorstep of the building I’d seen many times before in pictures, snuggled next to a tree-filled ravine in a woodsier section of the Johns Hopkins University campus. I was instantly greeted by Dr. Anne Kinney, Project Scientist for Education, who served as my gracious host for the visit. And what a visit it was!

The colloquium in the afternoon gave me an opportunity to offer a few thoughts to people on the cutting edge of astronomical discovery. About the irony of our times in which great advances are accompanied nonetheless by considerable public misconception and skepticism toward science and scientists...about perceptions and misperceptions of scientists and planetarians toward each other...about the need not just to do science, but to communicate that science effectively to the public...about what planetariums are and do, how many people we reach each year, how we can help...about how we are currently working and collaborating with scientists and seeking more and closer connections...about how we can be powerful allies in the work that they do.

But for me, this privilege was only part of the experience. The other part was the chance to be where the action was, and to get a sense of discovery-in-the-making.

I had opportunities to talk with astronaut Abhijit Saha, who has the distinction of working on both the Sandage and Freedman teams currently slugging it out over the Hubble constant and the age of the universe...with Ray Lucas, an old friend and colleague from my salad days at the Morehead Planetarium, who was on the team that targeted and imaged the “Hubble Deep Field”...with former planetarian Ray Villard who helps keep us posted on the latest from Hubble in his Public Outreach position, and with Carol Christian, who heads that effort.

Al Holm explained to me the convoluted path by which images come from Hubble to the receiving area in which I stood (and I had a chance to ask Charles Kowal, seated next to the “correct” pronunciation of Pluto’s moon; he said Charon as in “Karon,” not Charon as in “Sharon,” and if it’s good enough for Charles ...) Conrad Stern showed me an example of the monstrous Palomar plates and the equipment and technique used to turn them into computer files for Hubble...I previewed some of the video produced by STScI for their NASA TV broadcasts, and saw the Helix Nebula “tadpoles” before the image was released ... and Anne Kinney and I talked about adding affiliate contacts to the press release list to get materials into the hands of planetarians for distribution, and the possibility of doing the same with video segments...and being ever the planetarium pack rat, I left with slides and prints offered by Anne, and a new prized possession: a print of the extraordinary “Hubble Deep Field.”

If everyone or anyone could have such a day as this, I wondered, how could the excitement and reward of scientific discovery not rub off?

And yet there are places where anyone and everyone can go—and just a few days later, I was at such a place: the Air and Space Museum in Washington D.C.

Granted, with so many visitors to the U.S. capital, one could gather a crowd for almost anything, but that as it may, it was clear that a large portion of visitors choose to spend part of their time in the U.S.’s premier museum on space and flight.

There were long lines for the Einstein Planetarium. And the IMAX theater. And the Skylab exhibit. The exhibits were crowded with people. And I found it as fascinating to watch the people experiencing the museum as it was to experience it again myself—to watch them gawk at the “Spirit of St. Louis” or the cramped capsule which brought three men home from the moon. To marvel at the size of Voyager, or the 30-year old scribblings in a Gemini astronaut’s flight notebook. To whisper excitedly as an all-dome image of the surface of Io appeared in the planetarium, or to gasp at the clarity of the close-up view of an orbiting shuttle in the IMAX theater’s film Destiny in Space.

After such a visit, it was easy to leave thinking that many people shared the excitement about our efforts to know the universe and to reach for the stars.

And there was a “bookend” experience to reinforce the feeling. Hardly a month later, I was in Los Angeles to supervise the narration recording for our planetarium’s upcoming summer main feature. In a moment of free time, colleagues David Falk and Bonnie Kent of the Valley College Planetarium in Van Nuys arranged a visit to the Jet Propulsion Laboratory one afternoon—and the Space Telescope Institute feeling came flooding back.

I had an opportunity to talk with Jurrie van der Woude of JPL’s Office of Public Information (and with colleague Terence Murtagh who was serendipitously visiting at the time) about materials availability. And I took the tour—to Von Karman auditorium where so much Voyager history was announced, and to the adjacent museum displaying, among other items, a life-sized Galileo spacecraft, a model of the Mars Pathfinder rover, and the proposed Pluto Express mission with its unusual flat antenna design...to the control center, monitoring a bevy of assorted spacecraft on various missions throughout the solar system...to the assembly building where we could peer through glass into the clean room to watch technicians putting together and testing the Cassini probe.

Again, if everyone could have such an experience, I thought...

But if my spring wanderings left me feeling energized and excited about the work of astronomical discovery, my own words at STScI about great advances in the face of much public misconception and skepticism soon came back to haunt me.

Item: the National Science Foundation survey in the U.S., released this spring, shows that only relatively modest percentages of adults could correctly answer basic science questions. Most favorably perceived scientific topics: medical. Least favorably perceived: space exploration.

Item: in the June 8 issue of Science News, an article entitled “When Science and Beliefs Collide” suggests that a large and growing share of the population rejects aspects of science when it conflicts with belief systems, and that rejection of scientific truths and logic may be eroding support for the teaching of critical thinking, which itself is critical to basic research. It further suggests that scientists must work to understand the dynamics at work in order to improve support for science and to improve science literacy, and to win over critics who challenge the validity of science.
Item: On the same date as the Science News article, Julie Phifer initiates a Dome-L discussion by asking how others deal with a question she gets all too often from visitors: "Why should anybody learn about astronomy anyway?"

It's enough to bring one up short. And to feel gored by both horns of the proverbial dilemma.

If this spring has reminded me of anything, it's that we must be wary of the "selection effect" with which we often deal: namely, that our own interests and our own work naturally throw us together with people who are to some degree of like mind. It's all those people we hardly ever see—the ones who don't visit our planetariums or the world's Air and Space Museums, who wonder what good it does to bother with astronomy—that we must watch out for, that we need to reach the most, that are the hardest of all to reach.

This June, our museum conducted a three-day NASA workshop on the upcoming Mars missions for about two-dozen teachers from all over Montana. During the opening introduction, each was asked to say a few words about what they hoped to get out of the workshop. Invariably, the answers came: I'm really interested in science and space, I love to teach science, I conduct a unit on space, I love astronomy, and didn't know how it moved, and wanted to learn more. The teachers who didn't like science, who didn't feel comfortable talking about astronomical concepts because they didn't understand them well themselves, who didn't have space materials and didn't know how to get any, were not much in evidence.

Contrast this with Gloria Rall's Dome-L account of her experience with a group of teachers in their twenties who were being trained as naturalists for summer day camps: a lesson plan that stated the earth was warmer in summer because it was closer to the sun, an exercise that involved looking at the sun, ignorance about how to create or use a simple sundial... the Big Dipper readily identified without knowing how it moved, how to use it to find the Little Dipper, or knowing any Big Bear legends... surprise to discover that stars had different colors, and that that meant something...

Clearly, Gloria Rall had the more difficult task—and arguably the more important one. It's vital, of course, to support and to advance teachers who are motivated and knowledgeable about basic science and astronomy, to help them get better and do better. But it's positively critical to enlighten those who are ignorant of even the most basic astronomical concepts—and who can be frightfully adept at passing their ignorance and attitudes on to generations of future thinkers, whether they be their children or their students.

So what's the solution? As with all tricky questions, there aren't easy answers—and all involve hard work. We need to do more of what the Science News article suggested, I think: to try to better understand the belief systems and attitudes and thinking of those who don't come to our planetariums, who reject scientific ideas, who see no value in hurling another little spacecraft at Mars. If we can understand better how Gloria Rall's budding naturalists came to be so unschooled in astronomy, why our NASA workshop didn't attract more teachers with no knowledge or materials and no apparent motivation to acquire either, perhaps we can discover how to reach them better—and earlier.

Perhaps it means going out to malls with a telescope and offering passers-by an unexpected opportunity to become acquainted with the universe. Perhaps it means running a laser show to attract the college crowd, and then tempting them with previews of other offerings. Perhaps it means taking advantage of the next time something hits Jupiter or Hale-Bopp whizzes by, when even the most hardened non-scientists may come out just to see what all the fuss is about. Perhaps it means finding out what people are interested in, and working new themes into your shows.

Perhaps it means, when people ask "why study astronomy?", that we need to point out that there's a reason we're at the top of the food chain, that we didn't get here by eschewing the study of the natural world, or by turning off our brains when our bellies were full. We got where we are because we had ancestors with enough brainpower to turn curiosity and the assimilation and use of knowledge into not only survival, but advancement. That when we started out, knowledge was survival, and if some types of knowledge seem less necessary for survival today, it doesn't mean they've lost value; they've just changed context.

Why study astronomy? Because astronomy helped us to get where we are today, and it's a foolish person who doesn't realize it's important to know how we got here. Because it's not a smart long-term survival strategy to live off the legacy of knowledge gathered by our forebears without adding anything new to the store. Because it can help to place our lives and roles in perspective. Because it can enhance our lives (every bit as much as art or music or literature or—God help us—sports) to maintain a connection with the cosmos from which we came, and to which we remain connected whether we are ignorant of the fact or not. Because the pursuit of knowledge—of all sorts, whether is seems practical at the time or not—helps us to advance and survive and develop, even today.

Hard sell? Perhaps consider a gentle reminder that if our ancestors didn't have the curiosity and gumption to start out wondering about the stars, we probably wouldn't be enjoying cars, air-conditioned offices, cable TV, medical technology, designer jeans, days at the ball park, or beer and pizza on Friday night. It's a package deal.

Christopher Marlowe said it much more poetically long ago:

Nature that framed us of four elements,
Warring within our breasts for regiment,
Dosth teach us all to have aspiring minds:
Our souls, whose faculties can comprehend
The wondrous Architecture of the world:
And measure every wandering planet's course,
Still climbing after knowledge infinite,
And always moving as the restless Spheres,
Will us to wear ourselves and never rest,
Until we reach the ripest fruit of all,
That perfect bliss and sole felicity,
The sweet fruition of an earthly crown.

And if you think getting people to appreciate astronomy is difficult, imagine what it would take to get them to read Marlowe...

There's still work to be done, and lots of it. Not just to teach people the stars, but also to convince them that the practice has value. Good luck! Share your ideas and your success stories. And hey, let's be careful out there!

Meeting Time Survey

On to a bit of business... Concerning the meeting-time survey which appeared in the March issue of the Planetarian, asking members their preferences for the time of our biennial meeting: we received precisely five replies.

This thunderous lack of response suggests one of two things: either members are satisfied with the current custom of holding the conference in the summer, usually July, or it is simply not a matter of concern.

The results will have been duly presented to the Council in Osaka. Thanks to those who did respond.

Changes

Last year, Don Hall retired after a long, innovative, and distinguished career in the...
planetarium profession. This year, we find another such retirement—that of Von Del Chamberlain, who retired in May after more than a decade as director of the Hansen Planetarium in Salt Lake City.

Von Del's resume would be the envy of most of us. He has guided some of the premier planetarium facilities in the United States as astronomer at the Longway Planetarium in Flint, Michigan, director of the Abrams Planetarium in East Lansing, Michigan, chief of the Presentations Division at the National Air and Space Museum, and as director of the Hansen.

He established one of the early degree programs in planetarium education at Michigan State University. He hosted the founding conference of our society at Abrams in 1970, and hosted again in 1992 at Hansen. He has served our society as president. And his extensive research in archaeoastronomy and Native American sky concepts, in astronomy education, and in sky interpretation in the national parks, as well as his advocacy of formative evaluation, has made him a well-known in figure far beyond our own ranks. And nobody can play a meaner Indian flute! His prestigious Governor's Medal for Science and Technology, received from the governor of Utah and the Utah State Advisory Council on Science and Technology on the occasion of his retirement, was well-earned indeed.

Von Del's distinguished career and many accomplishments have advanced our profession in immeasurable ways; his has been an experienced, influential, and eloquent voice for the planetarium and the sky it seeks to interpret. For all those who love the night sky and have appreciated his efforts to help us all to see it a little more clearly, and on behalf of IPS, I thank him for a lifetime dedicated to the stars, and wish him well in his active retirement.

Outreach

Our efforts continue ... In July, Undine Concannon presented a paper entitled "The Current Role of Planetariums in Astronomy Education," prepared by Bill Gutsch, our representative on the IAU Commission 46 on the Teaching of Astronomy, before the IAU Colloquium on the Teaching of Astronomy in London. This is another way for us to reach out and make connections with other professionals in the field.

Initiatives

The initiatives mentioned in the previous issue continue, including discussions with other agencies on materials distribution, the magazine subscription discount program, and Astronomy Link. Watch for more word of these in the next issue.

IPS '96

I'm barely back from the IPS conference in Osaka and running up against publishing deadlines as I write this last section, so look for a full report on the conference next issue. Suffice it to say for the moment that those fortunate enough to attend had a wonderful and productive experience—one of the best meetings ever, in my estimation.

Our Japanese hosts are to be congratulated for their breathtaking hospitality and for an extremely well-run conference. Special thanks also to the numerous conference sponsors who made the meeting remarkably affordable. And thanks also to all of those who took part—for new friends made and new things learned, and new connections which I hope will continue to grow around the world.

There are two items in particular I want to mention: Site 2000: congratulations to the Planetarium de Montreal in Montreal, Quebec, Canada, on its selection by Council as the site for the 2000 conference. Best wishes to director Pierre Lacombe and his staff as they begin to plan for the event, and special thanks to all of the sites which offered invitations. We had many excellent bids, and I hope the other invitees will consider resubmitting their offers in future years.

Officer Election: the slate of officer candidates for the fall election was finalized with nominations from the floor at the general business meeting in Osaka. The candidates for IPS President (listed in alphabetical order) are Jon Bell, Fort Pierce, Florida USA; Shoichito Itoh, Suginami-ku, Tokyo, Japan; Marie Radbo, Gothenburg, Sweden; and Dale Smith, Bowling Green, Ohio USA. For Secretary: Noreen Grice, Boston, Massachusetts USA, and Lee Ann Hennig, Alexandria, Virginia USA. For Treasurer: Shawn Laatsch, Nashville, Tennessee USA. Congratulations and best wishes to all of the candidates! When you receive your ballot this fall, please be sure to vote.

All for now; again, look for a full conference report next issue.

(Opening, concluded from page 24)

lottery (we put their names into a hat, and then set up the list as we pulled them out.)

Besides myself, there were three other judges, renowned for their sky expertise: George Fleenor, Director of the Bishop Planetarium in Bradenton, Florida; Carole Helper of the Mark Smith Planetarium in Macon, Georgia; and Dave Hoster, Director of the Lafayette, Louisiana Planetarium. I'm very glad I asked them to help with the judging, as we could confer with each other whenever a question arose about the correctness of a particular identification. And they also served as a safety net in case I myself mislabeled something (I momentarily confused Alnitak with Alnilam in Orion's Belt.) At one point, we managed to stump everyone with Columbia, the Dove. The audience demanded I point it out before we continued on to the next one. When I did, some one called out, "Hey, how do we know if you're right?" to which I replied, "Hey yourself! I got three other judges here lookin' over my shoulder, and you don't hear any complaints from them, do you?"

When each contestant told us he was ready, I would call out the name of the object, and the contestant then had ten seconds to point it out. Ten seconds turned out to be not quite enough time, especially if the contestant wanted to relocate to another part of the dome to get a better perspective on the part of the sky where the target object was located. All contestants assembled near the center of the theater, and passed the pointer around as their turn came up. Next time we try this I'll probably make it a 15 second grace period to alleviate some of the inevitable "point or perish" pressure.

The Shootout turned out great. The last two people were Duncan Teague of Craigmont Planetarium in Memphis, Tennessee, and Geoff Chester of the Einstein Planetarium in Washington, D.C. The two battled it out until we got to the "guard stars." Duncan hadn't heard of this asterism (the two outermost stars of the Little Dipper's bowl), but Geoff had. Then Geoff went on to point out Mizar and Alcor in the handle of the Big Dipper, and won the Shootout. Geoff's prize was a laser pointer, donated by the International Laser Display Association.

I think this kind of event is a good one to have. It sharpens our identification skills, and makes us more at home in the starry heavens. Besides, it was a lot of fun for participants and non-participants alike.

I'm hoping we can do this event again at next year's SEPA conference, but I expect it will be more of a challenge, as the host institution is the Space and Science Theater at the Junior College in Pensacola, Florida. They have a Digistar.

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What's New

Jim Manning
Taylor Planetarium
Museum of the Rockies
Montana State University
Bozeman, Montana 59717

What's new lately is the news—just days old as I write—that NASA has chosen a successor to the shuttle Lockheed Martin's X-33 design, a wedge-shaped, reusable craft which beat out Rockwell International's shuttle-like model and McDonnell Douglas' vertical launcher and lander prototype which has been going up and coming down in tests for several years. Ultimately, the X-33 could grow into the planned end product, twice as large and called the "VentureStar" (ugh—it must have been named in one of those contests like the "Rename the Big Bang" project a few years back).

Despite the moniker, it's nice to see space technology advancing. And speaking of space technology, this column's first few items deal with the clear-eyed Hubble Space Telescope.

New STScI Outreach Contact

Prue Campbell is the new Space Telescope Science Institute (STScI) contact person for the planetarium and science museum community, replacing Rob Landis who has transferred to the technical side of the Institute. Prue takes on her new tasks with ten years of planetarium experience behind her, and is looking forward to working with us on ways in which the Institute can help us to do our work.

As of this writing, the Public Outreach Office is reviewing how it can best serve our needs, and Prue is welcoming input from planetarians. So give her a call or write her a letter or send a fax or e-mail. I'm sure she'll be glad to hear from you. She can be reached at: Office of Public Outreach, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, Maryland 21218 USA, telephone 410-338-4834 or 410-338-4562, fax 410-338-4579, e-mail campbell@stsci.edu.

STScI Video

One of the things Prue and I have already been discussing—in addition to distributing slide and press releases to the regional affiliates—is the possibility of doing the same with video. When I visited STScI in April, I had an opportunity to see some of the video animation and presentations that the Institute prepares for broadcast over NASA TV. It's really good stuff, and very usable for planetariums.

I've since received a copy of a 26-minute video which is a montage of images and sequences mostly developed from Hubble images. There are lots of rotation sequences (Mars, Jupiter, Saturn, Venus, Pluto), a good deal of material on the Shoemaker-Levy 9 impacts, animation illustrating the ring plane crossing for Saturn, new cloud features on Neptune, and more.

It's great material for shows, and some of it has already crept into some of our tours. Stay tuned, as we continue to work to get such material into the hands of planetarians.

Planispheres

Earlier this year, I received samples of some very nice planispheres from Rob Walrath, Fuutstraat 6, 3815 JP Amersfoort, The Netherlands, telephone/fax 31-33-47-55-543. He designed his first for the Amsterdam Planetarium where he was a staff member, and has been making them ever since, selling them in Europe and in the U.S.

Mr. Walrath currently offers plastic models for latitudes 30, 40, and 50 degrees north, round and a little over 9.5 inches (24 cm) wide, showing more than 600 stars and the familiar constellation patterns. They're quite attractive, with a blue color for the sky and the Milky Way shown in shades of lighter blue. They follow a standard planisphere design, but also have several features I've not seen in other planispheres: nearly 200 deep sky binocular objects are plotted, and the transparent cover plate has a declination line and a curve through the zenith marked in degrees of altitude. And the outer edge of the base plate is marked in right ascension. Handy bits to have—if you know what they are and how to make use of them. The English instructions on the back don't tell you, and I wonder if there is an instruction booklet which accompanies to help people get maximum use out of this planisphere's innovations. A Dutch version I received did seem to include such information.

I received no price list, but if you'd like this and other information, you may wish to contact Mr. Walrath as given above. It's an attractive product, and I like the extras he's worked into the design. He's planning more latitude choices for the future, and the current models can be customized.

All-Sky Masks

Through Keith Johnson, I've recently received some samples of soft-edge all-sky masks for a six-projector all-sky system from Paul Cato of Splits International, The Pastures, Littlemoor Lane, Sibsby, Boston, Lincolnshire PE22 0TU England, telephone/fax 0125-750773, e-mail paul.cato@ukonline .co.uk. They're the pie-wedge-shaped kind for six-projector all-sky, and I understand that Mr. Cato has been supplying these to the London Planetarium for some years.

The mask parts are a denser black than other all-sky masks I've used, and I tried them out in our all-sky system on an all-dome nebula. They were a bit undersized for our set-up, but sized properly for your dome, I'd bet they'd work very nicely.

No price list came with the samples, so for this and other information, you can contact Paul at the above address and numbers.

Software

Also recently received is a catalog from Zephyr Services, a computer software company, located at 1900 Murray Avenue, Pittsburgh, Pennsylvania 15217 USA, telephone 412-422-6600. The company had a sale going, but only until August 31. Still, it's worth a look at the catalog.

There are a wide variety of astronomical programs offered, from general "let's explore the night sky" offerings like "StarMaster" to more specific programs offering such activities as tracking satellites, generating sunrise and sunset tables for a given locality, displaying the day-night regions of the earth, calling up tide information, plotting eclipse paths, and piloting a spacecraft through the solar system or imaginary star systems.

There are also programs here on math and financial planning, but I harumphed a bit when I got to the software on tarot, astrology, numerology, and biorhythms.

A little of everything here, but lots that may interest. Prices ranged mostly between $20 U.S. and $100 U.S., with a few as high as $150. To get a copy of the catalog, contact as given above.

Finally...

That's it for now. Next time, look for news from the IPS '96 conference. Until then... what's new?
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MARYLAND SCIENCE CENTER
Forum

Steve Tidey
58 Prince Avenue
Southend, Essex, SS2 6NN
England

I can't believe another three months has gone by since my last column. I know that time slows down with increasing speed, but it also seems to accelerate in proportion to your age and the number of things one has to do!

The Forum topic for discussion in this issue is:

**Sticking strictly to planetarium issues, if you could ask God one question what would it be, and why?**

Bess Amaral kicks us off.

***

First of all, the question is a double bind one. It implies that humans may not have had the opportunity to talk to God. Forgive me, but we are definitely entering into the personal realm of religious beliefs here. I personally chat with God on a daily basis. Those conversations have ranged from the purely mundane such as "Oh God, what did I do with those slides on M100?" and then St. Anthony intercedes and bingo ... there are my slides right where I left them last. Then there are those more profound questions such as "Oh God, what am I doing here trying to run this planetarium on a shoestring budget?"

Seriously though, I suspect the really BIG questions that most professionals have would fall somewhere between finding out what the fate of the universe has in store for us? Or just how do we utilize the energy generated by black holes? Or how do we manipulate the space-time continuum so humans could ferry between between the future and the past...

The truth is, I personally wouldn't ask any of those questions, because I am one of those hopeless romantics who believes the a large part of the beauty and majesty of our universe comes from its mystery. It's the not knowing and finding out little by little that is so intriguing. I'll just wait, thank you very much, until I pass away and have my first up-front close and personal chat with God, give a great big hug and let him know how grateful I am he didn't give it all away.

Bess Amaral
Robert Goddard Planetarium
Roswell Museum and Arts Center
11th and North Main
Roswell, New Mexico 88201

***

I ask you, God, why?
You, who were 'there', outside everything, outside space, outside time. Because there was no space, nor time. So 'there' and 'then' were you ... and nothing else.

Then, why?
Since I became aware of the environment around me, especially of those strange objects and points of light that appear to move in the sky, I have tried and tried to figure out how all this — I call it Universe — works. Now, after only a few thousand years I claim that I can explain its history since only a small fraction of a second after it was, say, 'created'. Assuming you as the creator, I have not found indication of any other of your interventions. I keep searching, I keep trying to know more about the Universe and this keeps me going, although I confess I am not happy with what I am finding about the future ... Again: why?

In any case, why my need for a reason to everything? Could I not simply accept to live in a purposeless Universe? Could it not be enough for me to be part of it all?

So then, let me ask: why do I need to ask why?

Francisco Diego
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***

If I could ask God just one scientific question, I would ask why we are able to describe and perhaps understand the Universe with equations and numbers. The Universe is populated with material objects such as stars and nebulae, but we describe these objects with the mathematical constructs called equations.

Consider, for example, a planet moving in orbit around the Sun. We can write an equation of the form \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \) (the equation for an ellipse) that describes this orbit. This equation derives from some others: \( F = Gm_1m_2/R^2 \) and \( F = ma \) (the equations for gravity and inertia) combined with the methods of calculus. We can even add in the perturbing effect of another planet on this motion using a further equation with more terms that look like these. Yet another equation derived using integrals and spherical shells shows that we can treat extended objects like planets as point masses in doing these calculations.

Consider another example. A star is a collection of perhaps 10^10 nucleons and electrons. If that star is contracting, we can describe the collective and random motions of those 10^10 particles with equations for quantities we call kinetic, potential, and thermal energy. (These are terms we may be used to, so we think we know what they mean. Try defining them in words sometime!) We manipulate those equations, and — presto! — we find the star makes energy when it shrinks, holds on to exactly half of that energy to warm itself up, and radiates away exactly half of that energy to make itself shine. (This result is something astronomers call the virial theorem.) Amazingly, nature actually behaves this way! Our equations actually describe the way those 10^10 little particles or waves or whatever they are behave! Incredible! You can undoubtedly think of many other examples of what strike you as nifty equations or neat quantitative explanations of things you know about.

Why do these human constructs called equations work? Why do they let us describe nature so accurately? Are they telling us something fundamental about nature? It's like taking your favorite equation, say the wave equation for particles or Einstein's tensor equation for the curvature of space or maybe just plain old \( E=mc^2 \), and trying to understand the physical meaning of each term in it. Have our equations locked on to some real physical properties of the world, or are they just fictional human constructs that happen to work and that we have developed and fine-tuned so carefully that we attribute to them a reality they don't in fact possess? The answer to this I would like to know, but can't see how to find out.

It would be tempting to ask a question of a different class, such as "what is the Hubble constant, really?" or "what was the Universe like 10^4 seconds after the Big Bang?" or "is there other biological life in the Universe and what is it like?" or "how much aerosol haze is there in Jupiter's stratosphere?" (In translation, the last question really means: was the answer I gave in my dissertation many years ago right or wrong?) These are all really important and really interesting questions (well, maybe not the last one,

(See please Forum on page 37)
Most Frequently Asked Questions:

QUESTION: What is the most frequently asked question about 'STAR HUSTLER'?

ANSWER: That's easy. Everybody asks about our theme song which is the classic "Arabesque #1" by Claude Debussy performed by Tomita on the still available "Showflakes Are Dancing" album (RCA).

QUESTION: At what times and days of the week can I see 'STAR HUSTLER'?

ANSWER: Most TV stations air 'STAR HUSTLER' just before nightly sign-off. However, due to 'STAR HUSTLER's enormous popularity a number of stations find the show's 5-minute format can fit anywhere during the broadcast day and air the show more frequently. Local TV listings seldom include 5-minute shows, so it's best to call the station for the broadcast schedule.

QUESTION: If I can't find 'STAR HUSTLER' on my hometown PBS station, how can I see it where I live?

ANSWER: 'STAR HUSTLER' is provided free of charge by WPBT, Miami to all PBS stations. If you can't find it, write or call your local PBS station and ask if they will air it and remind them that it is available free of charge.

QUESTION: Is it necessary to get special permission to use 'STAR HUSTLER' for astronomy club meetings, teaching in the classroom, science museum or planetarium use?

ANSWER: No. In fact, many astronomy clubs, teachers, science museums and planetariums have been taping 'STAR HUSTLER' off the air and using it regularly as a way to reach their public.

QUESTION: Is there any way I can get 'STAR HUSTLER' other than my local PBS station?

ANSWER: Yes. A month's worth of 'STAR HUSTLER' episodes are fed monthly to a satellite from which all PBS stations take it for their local programming. Anyone with a satellite dish is welcome to the satellite feed. Again, no permission is required. For satellite feed dates and times call Monday through Friday (Eastern time) 305-854-4242. Ask for Mrs. Harper or Mr. Dishong.

QUESTION: I am a teacher planning my curriculum and would like several 'STAR HUSTLER' episodes in advance, but I do not have access to a satellite dish. Is there any other way I can obtain 'STAR HUSTLER'?

ANSWER: Any teacher anywhere around the world can obtain 'STAR HUSTLER' episodes in advance through their NASA C.O.R.E. Teachers' Resource Center. For details write: NASA C.O.R.E.; Lorain County Joint Vocational School; 15181 Route 58 South; Oberlin, OH 44074.

QUESTION: Why does 'STAR HUSTLER' always say "Keep Looking Up!" at the end of each show?

ANSWER: Have you ever tried star gazing looking down?
Planetarium Memories

Kenneth E. Perkins
6624 12th Avenue North
St. Petersburg, Florida
33710

Moon Earth Orrery in Planetarium

Why could we see the moon in the sky this morning but not last night?

Why does the moon jump around different places in the sky?

How can we see the moon and the sun in the sky at the same time?

Why does the moon do what it does?

These are questions that students asked but weren't answered in older science textbooks.

To answer these and other questions was the object of a series of demonstrations and student projects that evolved over the years.

The first attempt took place in a sterile classroom that had glass block from the top of the window to the ceiling. How I darkened the room, I cannot remember but I do remember the orrery.

It started as a framed piece of chicken wire (6' by 6') suspended horizontally above chalkboard. Angle brackets on two corners slid down behind the aluminum frame of the chalkboard. The outward corners were suspended by wires fastened to the fluorescent light fixtures.

A mottled blue water color painted softball representing the earth hung from the center of the framed chicken wire. A movable moon was represented by ping pong ball hung by a string from a bellhook and was moved from one position to the next by a bluntly sharpened dowel rod.

A bellhook was a small inch bell with the tongue replaced by a short length of 14 gauge copper wire soldered in position and bent to form a hook on each end.

The ping pong ball moon was suspended from the end of an 18-inch length of aluminum TV antenna rod attached to the motor's crank arm and a wooden wedge cocked the motor at an angle to prevent eclipsing every revolution.

The sun was a filmstrip projector with lens removed and placed on the top shelf of the coat closet off to the right. The door of the closet was unscrewed from its hinges for the duration of the demonstration.

In the years that followed, the softball earth was painted with more realistic and proportional colors, the ping pong ball moon was painted light yellow and the chicken wire frame was replaced by a one rpm furnace damper motor. It was noisy with an unpleasant grinding sound but it served well for two years. That damper motor was in turn replaced by another given by my brother-in-law, Allilio Valenti. It functioned with a quiet whisper.

The motor was fastened to 2x4 beam suspended horizontally above the demonstration table and was controlled by SPST momentary switch held as a signal switch and controlled by one of the students who acted on cue with the snap of fingers.

That was the equipment but before the performance there was background preparation—the moon observation assignment.

Observations were to begin NM plus 2—two days after new moon. Their notebooks were to be readied by a special appendix with three pages from the end being reserved. On the first two pages there were to be fastened nine pieces of black construction paper (or reasonable substitute) measuring 2 by 2\1/2 half inches. On the third page, there were to be three pieces of paper allowing room for six additional one.

Each piece of black paper was to have drawn with pencil or ball-point pen a dashed circle the size of a half dollar. Nowadays it would be the size of a milk jug cap. Written below each piece of black paper would be Date ______ and Time ________.

The notebook page facing the first set of black pieces was to be the title page with MOON OBS written in big letters and the year date written in big letters. Written on the second page would be a title of the date and a second pocket in the other lower corner, there were to be another small envelopes, one containing 21 discs of white construction paper, three yellow and three orange all cut to the size of a half dollar. In a second pocket in the other lower corner, there was to be another small envelope containing a few free forms pieces of gray paper. Student Linda Frazer appeared the next day with all paper pieces intact and the envelopes labeled A Pocketful of Moons and A Pocketful of Clouds.

As the observation was underway, the demonstrations with the Moon-Earth Orrery began with three students participating. One sat near the sun-projector representing an observer on Mercury and served as the motor operator with the push-button in hand. The second one stood on the other side of the room representing an observer on Jupiter. The third observer sat on a stool atop the demonstration table with his head immediately under the softball earth. Their eyes represented the eyes of all observers on Planet Earth.

Where was the audience? Out in space—on a Space Platform or Space Grandstand watching what was happening.

Beginning with the ping pong ball between the projector and the softball, each observer reported what he saw. The observations were recorded on the chalkboard beginning from the right and moving to the left. An 11 inch square of corrugated cardboard with an 8 inch hole served as a template for drawing nine sets of three circles at one time. The circles were chalked in to represent the observations.

From Mercury: "I see a fully lighted disc." From Earth: "I see no moon." From Jupiter: "I see no moon."

New Moon, New Crescent, First Quarter, Early (Waxing) Gibbous, Full Moon, Late (Waning) Gibbous, Last (Third) Quarter, Old Crescent and New Moon.

Each third of a revolution the set of student observer changed. As the record of the observations were recorded on the chalkboard, a set of clamp lamps, serving as flood lights and fastened to the sink base under the demonstration table, were brightened and dimmed by a Variac as the house lights remained dark. Several incandescent bulbs, strung in revival tent fashion the length of the classroom, were similarly dimmed up and down to illuminate student notebook inserts as they copied what was recorded on the chalkboard.

The student observation record, a standard sheet of paper that was "Ditto-ed" at first and offset later, was to be torn in two lengthwise, taped together end-to-end and fastened in the notebook with the ears folded in.

Moon Earth Orrery Evolves to the Planetarium. This classroom demonstration was adapted to the planetarium as a public show.

At first, it was in two parts with the demonstration conducted in a science lecture room across the hallway. The audience moved to the planetarium where the projected image of the moon moved eastward along the ecliptic changing phase moment by moment.

Later, the furnace damper motor was moved to the outside of the planetarium dome and a hole was cut in the fiberglass dome to allow the access of the rotation shaft.

A problem occurred. The connecting shaft

(Please see Memories on page 40)
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You can therefore develop your own productions, simply using the trackball, the action menus and configuring the timing for each tool. You may also purchase existing productions, which are easy to implement, develop or modify.

RS Automation manufactures planetariums from 9 to 15 meters diameter, horizontal or inclined, and will, following your request, undertake overall implementation of a complete planetarium (including a spherical screen, floor and wall covering, seats, electricity, air conditioning,...). Specific developments are also possible, such as planetary device elevating systems associated to a trap-door mechanism allowing use of the room for other purposes.

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Regional Roundup

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The Regional Roundup column depends entirely on contributions that I receive from IPS Affiliate Associations all over the world. Please continue to contribute as you have done before. To be sure that your text will make it into the column, please send it so I have it at the first day of the Planetarian deadline month, preferably by e-mail. The deadlines for contributions to No. 4/96 is thus 1 October, and for No. 1/97 is 1 January.

Thanks to Ignacio Castro, Jon Elvert, Mike Murray, Loris Ramponi, and Zinaida Sitkova for contributing to the Regional Roundup Column this time. You are welcome back with new reports, and I look forward to reports from other Associations as well. Please remember that a short note is also appreciated!

Association of Mexican Planetariums

Slowly but surely some planetariums are using the Internet as an effective means to reach audiences and popularize their activities. The Planetarium of Ciudad Victoria in Tamaulipas, Mexico uses it to present schedules and topics of its shows as well as other services as information related to astronomy. Check it out via Internet at http://wwwнят.mx/html/docs/int-tam/planetap/video2.html.

Unfortunately no AMPAC member planetarians attended the IPS 13th Conference at Osaka, but some will probably attend the quadruple conjunction of RMPA, SWAT, GPPA, and AMPAC at El Paso, Texas on 18-21 September 1996. Surely Texans do meet in a big way!

The Planetario Viajero, with Director Fernando Oviedo, has produced a VHS video What is a Planetarium. It briefly describes a basic planetarium and shows images of most AMPAC member planetariums. It is narrated in Spanish.

The Planetario de Hidalgo inaugurated recently its preschool show The Sun's Family with sound success among children and teachers.

Italian Planetaria's Friends Association

The XI National Meeting of Italian Planetaria will be held 6 October in Bologna. The program includes communications about new projects and the latest international meetings in the morning, a conference about cosmology by an astronomer from the University of Bologna, the first meeting of the users of the Italian manual planetarium model Galileo and the visit to the Aula Didattica Planetario where a Galileo works under a half dome. Prof. Angela Turricchia chairs the Meeting.

The National Day for the awareness of light pollution will be held on October 12, in connection with the partial solar eclipse visible also in Italy. Also the Italian planetaria collaborate in this initiative. During the day, an updated list of the Star Parks will be presented. These are the best dark astronomical sites located inside the boundaries of the protected natural areas, and should be maintained also for the future generations.

The works of the participants in the international contest for the logo of the Day of Planetaria must be sent to the Centro studi e ricerche Serafino Zani (address: via Bosca 24, C.P. 104, 25066 Lumezzane - BS, Italy) before 15 October. The first selection among the works will be made by an international pre­ committee. See Planetarian 2/96, page 54, for a full description of the contest!

A new planetarium with a 6,5 meter dome has been opened in the Nautical Institute of Crotone in the province of Catanzaro. This planetarium is the second largest in the south of Italy and one of the main in the country. The star projector was made by the Italian craftsman Gianpaolo Gambato and shows 3200 stars up to 5th magnitude. Each hole of the star sphere contains a lens. The planet movement is controlled by a computer program. Teachers at the planetarium are Luigi Saccomanno (secretary of the school), Eugenio Saraceni (geography teacher), and Sandro Rossano and Alberto Vega (navigation teachers).

Nordic Planetarian Association

The Nordic summer nights don't lend themselves to much outdoor starwatching, but this summer has been even worse: We haven't seen much of our cherished daytime star either.

Instead, at least some of the Nordic planetarians have traveled, some to the IPS Congress in Osaka, some to the First International Science Center Congress, held at Heureka Science Center in Vantaa outside Helsinki, Finland. There, Lars Broman conducted a workshop on mobile planetariums with Per Broman, Susan Reynolds, and Philip Sadler as panelists. Especially the part of the workshop that was held inside an inflated Starlab dome was very appreciated. Directly after the Congress, Lars, Per, and Susan taught at a two-day Mobile Planetarium Workshop at Falun Science Center, Sweden, which had attracted participants from the region of Dalarna.

This year's Nordic Planetarium Conference will be hosted by the world's northernmost planetarium, Nordlysplanetariat, in Tromso, Norway, at latitude 69 degrees north. The conference dates are 19-20 October, just when the sun has disappeared for the winter — the period when the sun never rises is called moerkerta in Norwegian. If you want to participate in this exotic event, please contact Reidun Lunndal of Norlysplanetariat at fax +47 7767 5700 or by e-mail to nptweb@ntt.uit.no.

Pacific Planetarian Association

A consensus was reached at the previous PPA Conference to use some of the Association's funds to support several projects. These include: 1) Purchase supplies/materials for a planetarium in Lithuania, China or India. PPA members are drafting a process on how to select the planetarium(s), and what kind of supplies would be needed. 2) Reduce the cost of conferences by up to 20%. 3) Produce a generic planetarium video for PR purposes (although the IPS is considering a similar project). 4) Establish a scholarship fund to aid planetarians in need to attend a conference.

We are in the process of constructing our own home page on the wide web. More on this next time.

Of our 11B current members, 81 also belong to IPS (that's 69%). Hubble Space Telescope slides are being distributed at the cost of $5.00 (PPA picks up the remaining cost). You receive six of the latest slides released plus a description of each image. Contact Jon Elvert (planetarium@edlane.lane.edu) if you are interested in receiving future or past HST images.

Once again, our '96 fall conference is being hosted by the Fleischmann Planetarium in Reno, Nevada 10-13 October.

Rocky Mountain Planetarian Association

The Taylor Planetarium of the Museum of the Rockies, Bozeman, Montana recently received a $19,000 grant from NASA's Montana Space Grant Consortium to produce a show titled How to Build a Planet, an original
production that will feature the voice of John de Lance. The program is designed to tie in with a new $1.5 million permanent exhibit at the Museum called Landforms/Lifeforms, chronicling the development of geology and biology in the northern Rocky Mountain region. The planetarium also received a $40,000 grant from the Taylor Foundation to install a new laser system and production equipment. The new equipment will debut in a new show Laser Rock Hall of Fame in the fall.

The Faulkner Planetarium of the Herrett Center for Arts and Science, Twin Falls, Idaho, added Chris Anderson to its staff in March as Planetarium Production Specialist. Formerly with the Science Center of Iowa, Chris' new position includes handling show presentation and production assistance. Having just opened in November 1995, the planetarium's second show to the public was Inner Space, which opened in May. This production, funded by Glaxo Welcome Pharmaceutical and produced by John Stokes at Sky Skan, focuses on the human immune system and how medicines are used to help combat diseases. Rick Greenawald, Director, reports that the planetarium is still enjoying an average attendance rate of over 50% for public feature programs and nearly 70% capacity for school shows. It will soon add Planet Patrol as its new school show. For its first summer, the Faulkner Planetarium ran an expanded schedule of 17 shows/week from Memorial Day to Labor Day.

The Rocky Mountain Planetarium Association will hold its annual conference at the El Paso ISD Planetarium on 19-21 September 1996. Joining RMPA this year will be the Southwest Association of Planetariums, the Great Plains Planetarium Association, and the Asociacion Mexicana De Planetarios, A.C. This quad conjunction is titled "On the Border in 96". The EPISD Planetarium sits on the border of RMPA, SWAP, and AMFAC.

The key to this conference will be convenience. The EPISD Planetarium, El Paso International Airport, Region 19 Education Center, our host hotels (Radisson and Clarion), and several restaurants are all within a two block area. Automobiles are optional and conference travel time will be minimal.

With six conference rooms reserved, there should be plenty of rooms for various activities. There will be a permanent vendors' area, a "Star-Lab" area, as well as meeting rooms. As a school district planetarium, there will be an emphasis on the educational uses of a planetarium as well as classroom astronomy education materials. Alan Hale of "Hale-Kopp" fame will be one of the guest speakers at a star party hosted by the El Paso Astronomy Club. Registration materials will be sent out during May. For further information contact: John Peterson at (915) 779-4316 or johnp@tenet.edu

Russian Planetarium Association

In this spring, many Russian planetariums participated in many interesting "holidays": The day of planetariums, The day of astronomers, The day of astronomy, The day of the earth, The day of the nation (although the planetarium is fine place where every day is holiday).

For the first time on 12 April, cosmonaut George Grechko and cosmonaut-researcher Valentina Ponomareva (backup of Valentina Tereshkova) were not among their cosmonaut friends but among schoolchildren in planetariums. George visited the planetarium in Kostroma and Valentina the planetarium in Nizhny Novgorod.

"I was shook by the scope of the science-educational and pedagogical work which the planetarium carries out. It is very important for moral breeding of our children", wrote Valentina in the Nizhny Novgorod Planetarium's book-report. She handed presents to the children, conquerors at cosmic quiz, devoted to the 35th anniversary of Yuri Gagarin's historic space flight. Schoolchildren of Nizhny Novgorod Region took part in this event. At the same time, the all-Russia competition The Space was going on. The result of this competition will be summed up in September.

The second all-Russia astronomy olympic contest among schoolchildren took place in May in Kaluga. A Russian Association of Astronomy Teachers was then formed. At the same time, the Association of Astronomy Teachers of Nizhny Novgorod Region was formed at Nizhny Novgorod Planetarium. RPA thanks the honorary member of RPA Dr. William A. Gutsch for information and educational materials. Thanks to him, the program Live from the Hubble Space Telescope became intelligible for all teachers and schoolchildren of Nizhny Novgorod Region.

(Forum, concluded from page 32)

except to me) and I would really like to know the answers to them, but I wouldn't ask them. Why not?

Because in science it's not just the answer that counts, but the also the pursuit of the answer. Much of the fun in science lies in the process, in the quest to decipher what the universe and its parts are like. Scientists relish the quest for its own sake as well as for the answers it will eventually yield. One cosmologist quipped that he liked working in that field because the problems were so hard! It's like getting to that viewpoint at the top of the mountain: the view is so much richer when I've sweated my way up the trail than when I've driven up the paved road. So I don't want to just be told these answers if they are in fact ones that I (or someone) can uncover by pursuing the sweat and rigor of scientific research. I don't want to be short-changed out of the excitement that comes from the process of discovery. But I do want to find out why those arcane symbolic constructs called equations really do seem to work, and that is what I would ask.

Dale Smith
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If I could ask God a planetarium-related question, the light-hearted, rhetorical one would be inspired by England's current Astronomer Royal, Martin Rees, who is occasionally asked by members of the public, "Why didn't the Big Bang happen earlier?". But the serious one would be "Is there currently intelligent life elsewhere in the Universe?" I wouldn't want to know where they are, as we'd have a lot of fun looking and knowing there really is an answer out there, rather than hoping (sometimes against hope) that there may be.

The next Forum topic will be:

Planeteers are spending an increasing amount of their valuable time trying to knock down walls put in their way by their astronomy-and planetarium-ignorant administrators. The optimum educational output of planetariums suffers as a result, and morale is hit. How can more productive lines of communication be facilitated between planetarians and administrators, and the latter be made more aware that a planetarium is a unique educational tool whose value to the local community goes beyond mere economics?

I'll be delighted to receive your contributions by October 10.
Have a good Autumn/Spring.

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Planeteer

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Congratulations
to Yoshiya Watanabe and all of the staff of the Science Museum of Osaka for hosting a wonderful IPS conference! It was described by President Jim Manning (Museum of the Rockies, Bozeman Montana) as one of the best IPS conferences ever, with more than 300 participants in attendance from about 30 countries. On the post-conference tour alone, some of the participants were from Sri Lanka, Canada, South Africa, China, Belgium, Finland, Italy, the United States, and (of course) Japan. Alan Gould (Lawrence Hall of Science, Berkeley California) said that this conference has had the strongest international “feel” to it that he’s ever experienced, and that it kind of feels like being at the UN. (I presume that it’s a kinder, gentler, friendlier United Nations to which he’s referring.)

Timo Rahunen (Tampere Planetarium, Finland) said that it was his first trip to Japan, and that it exceeded all of his expectations. And Johan Gjilsenberg (Europланетарий, Belgium) said that whoever wants to organize another IPS-meeting should meet the Japanese standards met during the conference, but that it would be hard to beat them.

to Wendi Elliot (Kirkpatrick Planetarium, Oklahoma City) for receiving her black belt in Aikido. She says that after years of being in the dark, she can finally protect herself. Now she can butt heads with the best of them.

to Tim Slater (formerly of the Kelce Planetarium, Pittsburg Kansas and now at Montana State University) and Kellie Hill (also formerly at Pittsburg KS and now planning to relocate to Bozeman Montana) for their recent engagement during the SWAP conference. He proposed during the beautiful riverboat cruise and she accepted. Congratulations also to Kris McCall and all of the staff at the Sudekum Planetarium (Nashville, Tennessee) for a very successful SWAP conference. Kris was awarded a gold-painted toilet plunger by the “Great Plains Plunger Association” by Tim for the conference; Tim had given a talk on “101 Best Ways to Teach Astronomy with a Toilet Plunger.”

to Keith Georing (Chanute High School, Iola Kansas) on being awarded the 1995 Outstanding Physics Teacher Award, by the Kansas-Oklahoma-Arkansas regional of the AAPT last fall.

to George Fleenor (Bishop Planetarium, Bradenton Florida) and his wife, who should have a newborn by the time you read this. Congratulations also on being elected as SWAP’s President-elect!

Did You Know...

You may have heard, Von Del Chamberlain (of Hansen Planetarium, Salt Lake City) has retired. I hope he keeps in close touch with the international planetarium community that he has done so much for. Also, Thomas Krappe is no longer with Forum der Technik Planetarium in Munich. His friends know that he definitely has a bright, starry future ahead of him, and that he’ll be successful wherever he is. And Tom Hocking (formerly of Morehead Planetarium, Chapel Hill NC) has moved on to Indianapolis. Not to worry, he’s still keeping in contact with the planetarium community on Dome-L.

Also on the move is Andrea Gianopoulos (Ethy Universe Planetarium, Richmond Virginia). She started on May 1st as the new Education Coordinator. Andrea was formerly the Planetarium Specialist at the University of Wisconsin-Fox Valley Planetarium in Menasha.

Thanks to Steve Savage (Sky-Skan, Inc) for passing around his laptop during the IPS post-conference tour and posting everyone’s messages to Dome-L. Those of us unfortunate who were unable to make the trip really enjoyed reading about the wonderful experience everyone had. (Some of us have to experience these things vicariously.) Sue Reynolds (Starlab Planetarium, Syracuse New York) really enjoyed the Japanese hospitality and culture at the IPS conference. Her message posted to Dome-L lists her as “Watashi no namae wa Susan Reynolds desu from OCM BOCES Planetarium...” Very clever! Others got into the international spirit by writing messages in French and German.

An update from June’s edition: Mike and Barb Lutz (Laser Fantasy Int.) had daughter Natalie Jane on April 25th. Mike says having two little ones really keeps you hopping. The announcement was a very cute baseball card, which listed Natalie’s hobbies as eating leisurely meals and sleeping in late.

Funny planetarium stories ought to be an entire column. Pam Eastlick (Mangilau, Guam) had an interesting experience last April. She was having an extremely busy day (10 shows) and a group of difficult middle-school kids were behaving badly. Pam has a rechargeable flashlight plugged into an outlet near the seating area as an emergency light. About ten minutes into the last show, the rechargeable flashlight came on and the beam wavered wildly. There was a loud thump as the flashlight hit the floor, and someone yelped in surprise. Pam said “Just pick it up and plug it back into the wall and the light will go out.” The kid was apparently trying to steal the flashlight, but had to plug it back in to get it to turn off. Pam delights in “the joys of small desirable, portable items that have their own built-in alarm systems”

John Schroer (Phillips Space Theater, Dayton Ohio) was busy organizing the Dayton Museum of Natural History’s 26th Annual Apollo Rendezvous last June. Activities included an astrophoto contest, and Rob Landis (Space Telescope Science Institute, Baltimore Maryland) spoke on the HST. Sounds like a challenging event!

Ask Elizabeth Roetger (Adler Planetarium, Chicago) about the essay “A Girl’s Guide to Geek Guys”. Her favorite one-liner comes from it: “Many geeks extend their work friendships into what they jokingly refer to as RL. (Real Life, also known as “that big room with the ceiling that is sometimes blue and sometimes black with little lights.”)

As a part of the last SWAP conference, Jon Bell (Indian River Community College, Fort Pierce Florida) organized the first Constellation Shuffle-Out. 16-18 people signed up in this competition—Kris McCall says it’s a real challenge to find things in a sky that’s not your own. The winner was Geoff Chester (National Air and Space Museum, Washington DC), who was awarded a laser pointer, courtesy of ILSA.

More news on SEPA—the featured speaker for the banquet was Dr. Mark Littmann (University of Tennessee). He was the Director of the Hansen Planetarium in Salt Lake City from 1965 until 1983, and wrote and produced many of their shows still performed worldwide.

In addition to being a planetarium director, Rod Martin (Washington County Planetarium, Hagerstown Maryland) is also a scoutmaster. He and former Eagle Scout Rob Landis (STSci, Baltimore) awarded Rod’s son the Eagle Scout award. Rob spoke at the ceremony on the history of the eagle, from prehistoric Egyptians, to those famous words “Houston, Tranquility Base here. The Eagle has landed,” spoken by another Eagle Scout.
The stars descended on Griffith Observatory overlooking the Hollywood Hills of Los Angeles, California when a surprise birthday party was held for Tom Hanks on June 29th. The Observatory was closed all day for the major Hollywood event. John Mosley presented a short planetarium show. Guests included John Travolta, Meg Ryan, Geena Davis, Dennis Miller, Steven Spielberg, Bruce Springsteen, Ron Howard, Dana Carvey, Jim Carry, and Robin Williams! The guests enjoyed a catered dinner and dancing on the roof and glimpsed the moon and Jupiter through the 12-inch refractor. With an audience like that, John will have planetarians volunteering to help anytime!

Again, if anyone has any information/news/stories or even jokes worth telling, please don't be shy! (It's hard to imagine anyone in our profession being shy, but it happens.) Write, call, or e-mail me and let me know—people out there want to hear about it!

(Memories, concluded from page 34)

needed a left-handed thread to keep the moon arm from unwinding. Where could such a left-handed thread be obtained? Answer: from one-half of a hardware store turnbuckle.

Now, by hindsight, it can be seen that the problem could have been solved more easily by switching the moon arm crank to the other end of the damper motor shaft.

The chalkboard drawings were replaced by slide visuals in single slide projectors that stepped the images from west to east around the dome.

Moon and How It Works was an ongoing public show. Later, it was pulled "off the shelf" and used as a supplement to the star shows for two groups of Elderhostelers.

Footnote and Epilogue

The chicken wire orrery and the furnace damper motor version were used in the early 50s at the Fairfield Township Schools, Hamilton, Ohio. The overhead support beam and the student sitting on the demonstration table took place at Morton Junior High School, Vandalia, Ohio. Use as a planetarium presentation was at St. Petersburg Junior College, St. Petersburg, Florida.

At the planetarium, it was a fond dream to be able to use the Dork automation system to be able to control the motion of the ping pong ball moon with the touch of a button and the projected phase pictures with the touch of the down arrow or both from a hand held remote. 

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Authored by Phil Groce,
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Planetarian
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Stop Wasting That Kodalith!

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Kodalith and its sister high-contrast films have provided planetarians with a shot-in-the-arm for producing text, graphics and slide masks without those Big Fat Rectangles (BFRs) that foul-up our simulated space environments. The down-side of using Kodalith, however, is that exposing and developing it creates problems for the occasional photographer because of its atypical characteristics. The ultra-high-contrast nature of the film-stock, along with the need for special development chemicals available only in large capacities often create waste and wasteful habits at the copystand and in the darkroom. Let’s explore some ways to minimize this waste and make the “Kodalith system” a more efficient one.

Bracketing Waste

The biggest advantage of Kodalith film also creates its biggest problem—namely the film-stock’s extreme contrast. While the high-contrast of this negative film serves to effectively drop-out the background of a graphic- or text-slide into opaque black, it makes the stock very intolerant of inexact exposure. Some users of Kodalith compensate for this by “bracketing” their exposures. This entails shooting not only a “standard” exposure, but also at least a couple more—one with a stop more light than standard and another with a stop less.

For example, let’s say experience has shown, with our hypothetical copystand and lighting setup, that our best ballpark exposures with Kodalith gravitate around f/5.6 at 1/2 second. To bracket shots for a particular text slide (one stop either way), we’d take one exposure with the lens aperture set at f/5.6, one at f/8, and a third at f/4—all with the shutter speed set for 1/2 second. (Alternatively, we could take an exposure at 1/2 second, one at 1/4 second, and the third one at 1 second—all with the aperture set at f/5.6. The advantage with the second bracketing approach being that—with the aperture set at f/5.6 throughout—the depth-of-focus remains constant.)

While this system of bracketing exposures works well most of the time, it does have a couple of distinct disadvantages. (We’ve touched on the disadvantages of unnecessary exposure-bracketing in a previous installment, but it’s an issue worth repeating.) First, variables such as the “whiteness” of the paper stock can change the density (blackness) of the film background. Likewise, tight shooting of very small originals—and an associated extension of the lens to compensate for focus—can alter the relative amount of light striking the film. These variables—together with changes in the precise positioning of the copystand lights—can conspire to throw the optimal exposure outside of the entire bracketing range.

Second, taking three (or more) shots for every final image used in a show is a waste of materials and money. And we know all-too-well that most planetarium budgets aren’t growing—in many cases they’re actually shrinking—particularly now, in an era of imposed frugality and cutbacks in non-profit institutions.

Of Meters and Gray Cards

The alternative to bracketing is to do a better job of determining the optimal exposure for a particular piece of “art” and a particular copy setup. Because of the number of variables which can affect exposure—copyright output and distance, and camera-lens extension (to properly focus on close subjects)—it’s important to be able to “meter” the subject and adjust exposure for each shot, or group of similar shots.

Metering when shooting Kodalith images would be pretty straightforward except for one problem: the subjects (text, line art, etc.) are far from “average”, and the camera meter is set up to “see” average scenes. What I mean by “average” are scenes which have more-or-less equal amounts of light and dark areas, or lots of middle tones. That’s why camera meters work great for shots of Grandma and Grandpa at the beach—except in special situations, such as when the Sun is behind the “ancestors” in question. In such exceptions, the meter tries to make the super-bright sky behind our seniors fit into its “average world” of seeing, and darkens optical path within the camera “slower”, or less light-efficient, and effectively reduces the amount of light striking the film.

These effects can be overcome with a through-the-lens camera meter, by metering—not off the subject itself—but off a gray card. The gray card actually fools the meter into giving a “corrected reading” by providing it with what it’s designed to read in the first place—an average scene. It doesn’t matter whether the subject is nearly all white, nearly all black, or some unknown variation in-between, as the temporary intervention of the gray card on top of the subject (just for taking the meter-reading) with the proper camera-subject and light-subject distances will compensate for all the variables—as long
as the film-speed is set correctly. (For a more in-depth look at doing copy photography using a light meter and gray card see the “Planetchnica” installment, “Fine Tuning your Exposures”, p 27-30, Planetarian, Vol. 22, No. 1, March 1993.) Using and refining techniques for gray-card metering and exposing at the copystand should virtually eliminate the need for bracketing or reshooting Kodalith, and, as a result, will greatly reduce your high-contrast film costs.

Reducing Chemical Waste

Another Kodalith-related waste-problem concerns the developer. In the typical planetarium, the quantity of Kodalith developer that gets mixed and stored is much greater than what is consumed during the chemical’s shelf-life. (The amount of this developer that I’ve had to dump in my planetarium career is more than I care to remember!) The rated shelf-life of most photographic solutions stored in well-stopped bottles without opening or use is about six months. If the bottle is opened on a periodic basis, the longevity is a lot less, due to fresh oxygen entering the container and reacting with the chemical solution. This oxygen-replenishment in the bottle reduces the useful life of developer to around a month or so. Kodak’s developer, Kodalith Super RT, is the “standard” for developing Kodalith film and LPD4, and comes in solid, powered form with a capacity to make 3.8 liters (1 U.S. gallon) each of parts A and B liquid solution.

There are few planetariums that can use up 7.6 liters (2 gallons) of Kodalith developer in six months—and perhaps none that can do so in about a month or so. As a result, many planetariums around the world must dispose of large quantities of unused, Kodalith developer every year, or else ruin film with oxidation-exhausted chemicals.

The main problem is that Kodak only packages Kodalith developer as dry chemical in these large quantities, which tends to force folks into mixing the entire bulk at once. While most of us can easily measure and divide liquid concentrates to mix smaller quantities of photo-chemical solutions, doing so with prepackaged solid chemicals is much less appealing. This is especially true given that powered or granulated chemicals can only be measured with accuracy by weight, since volumetric measurements vary in accuracy depending upon how loosely- or tightly-packed the powder or crystals are. A lack of accurate weight-scales in many facilities can make parceling-out smaller quantities of solid chemicals even more problematic.

Putting the Problem to Scale

Although liquid photographic solutions have very limited shelf-lives, their solid concentrate “progenitors” can last almost indefinitely—especially if kept in sealed containers. Finding an accurate and convenient way to measure these materials would help a lot in combating chemical waste. One relatively simple way to measure solid chemicals by weight is with a kitchen scale (Figure 2). Of course, these inexpensive little devices—available in cooking or houseware shops—are typically somewhat inaccurate. But there’s a way around that problem, too. You can simply check the accuracy of the scale with an object of known weight, and use the variance in the scale’s reading to calculate a conversion factor. For instance, by using a darkroom graduate (the taller and more narrow for a given volume capacity, the more accurate—as in Figure 3), it’s possible to use ordinary tap-water to check the weight-scale. For example, I measured out 8 U.S. fluid ounces (0.24 liters) of water and accuracy-checked my scale with that. Since 1 U.S. fluid ounce virtually equals 1 ounce (28.35 grams) by weight, this provided me with a benchmark from which to check the variance of the scale. In this case, the scale read low—7.5 ounces with 8 ounces of actual weight on it—meaning that this unit reads 0.9375 of the actual weight value. Similar water-volume-to-weight (mass) can be performed using metric measurements, if needed.

Once you’ve determined how to accurately weight-measure with an otherwise inaccurate scale, it’s easy to divide-up powdered chemicals into smaller quantities for mixing more efficient (and less wasteful) volumes of liquid solutions. The following shows the weights and volumes of powder and water, respectively, to make up smaller batches of solution for Kodalith Super RT Developer:

For 0.946 liter (1 quart) of Kodalith Part-A solution:
- Start with 0.865 liters (29.25 fluid ounces) of water at 38 degrees C (100 F);
- Stir in 169 grams (6 oz) of Part-A powder
For 0.946 liter (1 U.S. quart) of Kodalith Part-B solution:
- Start with 0.917 liters (31 fluid ounces) of water at 38 degrees C (100 F);
- Stir in 164 grams (5.75 ounces) of Part-B powder

Of course, this type of approach is nothing new to some darkroom-photography aficionados. In fact, to get just the right photographic effects, some of these folks religiously mix various darkroom solutions from combinations of such raw chemical constituents as borax, hydroquinone, potassium bromide, etcetera. Fortunately, the solid developer for our use is already formulated—all we have to do is accurately divide it up and store it until needed to make the liquid solutions.

I simply dump the Kodalith A and B powders from their paper packets into separate 0.95 liter (1 quart) sealable plastic food-storage containers (Figure 4), and then scoop out and weigh what I need to make up 0.95 liter (1 U.S. quart) of each liquid solution whenever I need it. You can make the process even easier by measuring-out all of the packets’ contents at one time by weighing and dumping the A and B powders into small zip-seal storage bags—the sandwich-size works well here. (Just make sure that you clearly mark, and don’t mix up, the various baggies of powder, or else you’re in for a very unpleasant surprise once you use the stuff. Likewise, don’t use the same measuring and handling scoops and other utensils for both A and B powders without cleaning them well in-between steps, or you’ll contaminate the two solutions. Remember, Kodalith A and B must be kept completely separate until
4

just before film development.) Once you get a system set up with your weight-scale, scoops, and baggies, it'll actually take just a few minutes to get the powder measured and divided. With just a little investment of time whenever you buy a dual-pack of Kodalith developer, you can greatly reduce—or even eliminate—the waste that was associated with mixing large volumes of solution.

Other “Solutions”

Some planetarians bypass Kodalith Super RT developer altogether when creating their high-contrast graphic images. One alternative is Edwal Litho-F developer, which comes in a concentrated single-solution liquid that is diluted prior to use. It's a bit more expensive than Kodalith Super RT, but being a liquid it's very convenient. It does take a bit of getting used to, as obtaining maximum contrast with Litho-F requires development at around 32 degrees C (90° F), or higher. Unfortunately, many photo stores don't carry Litho-F. As an additional downside, I've noticed that the undiluted concentrate in an opened, partially-drained bottle turns dark brown rather quickly—a sure sign that a developer is oxidizing. Though developers in liquid concentrate form tend to have a longer shelf life than “working” solutions, Litho-F concentrate may not last very well if you use it only occasionally.

Another chemical option is Kodak D-11 developer. Unlike Kodalith developer, it comes as a one-part chemical, but like Kodalith it's a powdered chemical—in a packet to make 3.8 liters (1 U.S. gallon). Also like Kodalith developer, it is designed for developing Kodalith film stock for high-contrast images. But it's not as contrasty as Kodalith developer, meaning that D-11 provides the user with a bit more exposure latitude. However, this characteristic also slightly reduces the background-black density of the film. Also, the other end of the density scale isn't perfectly clear like with Kodalith developer, but has just the slightest bit of light-gray tonality. This wouldn't really be a problem for line-graphics or text, but it should be noted that any sandwiched slide masks generated with Kodalith film will tend to darken projected color slide images by a small degree. In addition, it should be noted that the ISO (ASA) rating of Kodalith film should be set to 25 when developed in D-11, instead of 8 as for Kodalith developer—actually an advantage when using cameras whose ISO (ASA) dial goes down only to 25 or 12.

By adopting some alternate strategies at the copystand and in the darkroom, it's possible to simultaneously ensure high-quality Kodalith images, while reducing waste. Your planetarium production budget will thank you for it.

Vol. 25, No. 3, September 1996

STARLAB Planetarium ... The Portable Universe

Many of you, in planetariums worldwide, already know how easy it is to incorporate a STARLAB into your existing planetarium programs. Because of its versatility, portability, ease-of-use, and cost-effectiveness, the STARLAB is considered an invaluable and exciting multicultural tool for education. STARLAB can be used in conjunction with a fixed planetarium for:

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If you haven’t noticed the explosive growth of the World Wide Web of the Internet over the past year, then you've probably been in a coma for the last twelve months! Even the computer phobic among us could not fail to notice those funny little electronic addresses that are now showing up on everything from TV commercials to pill bottles. And, if you’ve actually been surfing the web for a few months you know that the number of sites to visit is growing like electronic kudzu!

Even after cutting away all the hype, electronic junk mail, cyber equivalents of your neighbors endless vacation slide show, there is much of interest to planetarians in this ‘brave new world wide web.’

To begin with a common experience of planetarians the world over, consider new images and discoveries from space probes and Earth-based observatories. In the past the major wire services or TV networks might break a story about a new discovery in our local communities. Often the new media present incomplete or distorted interpretations of these discoveries. Inevitably confused members of the public turn to the local planetarium for clarification and additional information. In the past the local planetarian could be of little help unless he or she had access to the original wire story or was lucky enough to be on the mailing list for the press release. Failing that, all we could do was wait for some reputable source like Science News or Sky & Telescope to publish a story a week or more later. I'm sure this problem was even greater for planetarians outside of the U.S. when it came to NASA and U.S. observatories. Now we can see NASA (http://www.nasa.gov/NASA_homepage.html) and other press releases almost as soon as they're released. Even those prized color photos that required blood relationship to a deity to get copies from NASA are now available on-line as graphics files that you can download and print out with one of the new inexpensive color printers.

Likewise, information on new comet discoveries was problematic for those of us who couldn’t afford to subscribe to the IAU telegrams. Now we find out about new comets like Hyakutake and even see CCD images right after they’re discovered.

Several years ago NASA started issuing viewing predictions for the Space Shuttle for ‘selected’ cities. Unfortunately NASA's selection included only one Virginia city, Norfolk. When the media called me for predictions for Richmond, I couldn’t offer them much. So, I got some satellite prediction software and found out where to get the orbital elements of the Shuttle so that I could compute predictions for Richmond. Now there are sites (http://ssl.berkeley.edu/isi Www/ satpasses.html#sts) on the Web where I can go to see pre-computed predictions for Richmond and many other cities that didn’t
make NASA's 'select' list.

In much the same way, if you wanted local times of sunrise, sunset, moonrise, and moonset you needed to spend some time with a good set of tables or a good computer program. Now you can go to the U.S. Naval Observatory's Web site (http://tycho.usno.navy.mil/time.html) and have it do it for you!

Increasingly teachers are using the World Wide Web as a powerful teaching tool. A number of museums and planetaria in the U.S. have been involved with NASA sponsored projects to develop Web-based lesson plans. Look at: http://www.cea.berkeley.edu/Education/sil/sil_modules.html for some great examples.

Many of our fellow planetarians have been quick to weave their own webs. You'll find many individual planetarium web pages. The best place to look for them is at http://www.lochness.com/pltweb.html a site produced and maintained by Loch Ness Productions. Even I.P.S. now has a Web site at http://128.32.190.143/ips/ips.html and one for the Planetarian has been up and running for months.

If you have gotten caught up in this latest computer fad, give it a try and I think you will find that it offers more than passing glitz. There is much of value to planetarians in cyberspace. All you need is a 386 or better PC compatible computer with VGA graphics (or the Mac equivalent); a 14.4 or faster modem; dial-up account to give you access to the World Wide Web (or a service like CompuServe, America Online, or Prodigy); and good browser software like Netscape or Microsoft’s Internet Explorer.

I'll close with a list of a few more of my favorite sites on the World Wide Web. I know there are many more out there. Drop me a line with the addresses of your favorite sites.

Other ports to surf to:

Jet Propulsion Laboratory:
http://www.jpl.nasa.gov/

University of Arizona Students for the Exploration and Development of Space:
http://seds.jpl.arizona.edu/UASEDS/UASEDS.html

Space Telescope Electronic Information Service: http://www.stsci.edu/

The Earth Satellite Ephemeris Service:
http://www.chara.gsu.edu/sat.html

Satellite Tracking Pass Predictions:
http://acsprod1.acs.ncsu.edu/scripts/HamRadio/sattrack

The Aurora Page:
http://www.geo.mtu.edu/weather/aurora/

International Dark Sky Association:
http://www.darksky.org/ida/index.html

Solar System Live:
http://www.fourmilab.ch/solar/solar.html

Information Leaflets of the Royal Greenwich Observatory: http://www.ast.cam.ac.uk/pubinfo/leaflets/

Astronomical Society of the Pacific:
http://www.physics.sfsu.edu/asp/asp.html

The European Association for Astronomy Education: http://www.algonet.se/sirius/eaae.htm

AstroWeb:
http://fits.cv.nrao.edu/www/astronomy.html

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The Comet and Me

I'm sure every planetarian has Comet Hyakutake stories. Here's mine: On each Monday from March through May, 1996, the schedule of my time usage at work was a killer. During those months, I was taking a three-hour computer class which was added to the end of the school day, from 4 to 7. The class was entitled "Educational Uses of the Computer" or some other educationalese title. I've forgotten. At any rate, one of the requirements for the class was a nebulously defined "research project" which was to be a significant percentage of our final grade. Every Monday, as I entered the classroom at 4:00, I would wonder, "now what can I do for a project?" Mondays were long enough as it was, without the addition of the computer class. After arriving at school, I would make my usual morning rounds (get some coffee, check my mailbox, school gossip). Then I would head to the computer lab to "check the Web" (search Internet addresses) to see what delightful overnight surprises Comet Hyakutake had provided for me in photos and articles posted at several sites. I would reluctantly tear myself away from the fantastic images to attack my "things to do today" list, made the day before. My planetarium lessons were next: preparation for the day's handouts, do the lessons, and tiredly collapse for a few seconds in blessed relief as the last yellow bus departed. This part of my day was like most other days. But on Mondays, I wasn't finished yet.

I would have a very quick 15-minute lunch before my 1½ hour high school astronomy class began. The first thing my students and I would do each Monday (as well as other days) would be to head to the computer lab. We would check the "bookmarked" images and text captured earlier in the day and placed in a special Netscape (a popular Internet browser) file. We especially liked the images produced by Johnny Horne, a photographer with the Fayetteville News and Observer (North Carolina). Thanks go to Edna DeVore, former planetarian who is currently at NASA Ames Research Center in Mountain View, California; she recommended that site. Mr. Horne's pictures were fantastic; they were eventually featured in Astronomy and Sky & Telescope magazines. Seeing images of Comet Hyakutake eight hours after they had been taken showed me just how fast one can travel on the "information superhighway". Hyakutake consumed my computer visits in those months every day, not just Mondays. I had been following its story since early February. Though Sky & Telescope magazine did not feature Comet Hyakutake until the issue that came out in April, I wasn't afraid to ride on the "coattails" of the comet from the beginning of its appearance. Maybe they were afraid to take the chance, but I wasn't. No, sir! I wasn't afraid of another Comet Kohoutek, the 1974 fizzle; instead, I remembered Comet West, the 1976 dazzler that astronomers were afraid to announce lest it be an instant replay of Kohoutek. They didn't talk about it much; then Comet West came and astronomers were sorry that they hadn't alerted people to its appearance.

I was convinced by reading comments on the Internet that this comet was going to be something! Ken Wilson, planetarian from "down the street" at the Science Museum of Virginia, convinced me too. He saw it early on, in his telescope. We discussed the fact that you could see it all night, and it would be near the Big Dipper, a star pattern easily recognized by the public. As an astronomy educator, I decided that I needed to do something about it for my school district. I put together a 3-page mailing about the comet. The first page was Q & A format. Here's a sample: Question: "When is it coming?" Answer: "The best time to see it will be the evenings of March 24-28, when it is closest to earth (No, it will not hit the earth)." Page number two was a chart of a northern view of the sky, showing prominent stars and constellations overlaid with a curved line crossed with little slashes with dates shown for the diurnally changing position of the comet. The third page consisted of diagrams and information about how to use the 2nd page. I sent copies to all the teachers in my school system.

I altered my planetarium lessons to include a Comet Hyakutake update using 1) the overhead projector to show a diagram with earth and comet paths going around the sun and 2) a single-slide "fuzzy dot" projector which I moved each day to show the comet's position that night among the stars. The 15-second blurb about the comet on the evening news just wasn't enough. I turned to the Internet for information. It was then that I became slightly obsessed with the comet. As part of the requirement for the Monday afternoon computer class I was taking, we had little weekly assignments to complete. For one assignment, "Spend three hours on the Internet, using a gopher to follow a thread somewhere," I looked for information about the comet and comets in general. For another assignment, "Using the 'Works Wizard' program on the computer, create a newsletter," I created a newsletter about the comet. Assignment: "Use 'Powerpoint' to put together a "slide show"." My product: a "slide show" on the comet.

I paid $5 to the Computer Club to have all the computers on the school network advertise the prime dates for spotting the comet. I wasn't just "surfing the net"; my "computer life" was COMET MANIA! I began to think of the comet as "Comet Internet." But the information on the net helped me get ready for the questions. Questions about the comet: I got them all day, every day, from every one I saw, for the month of March. It was wonderful fun and everyone was "up" for the comet's arrival!

What is it about comets? We have to gear up for the public's interest in them, and we have to be ready for all the weird ideas and questions we get from the public. Sue French, planetarian from Rochester Academy of Science Planetarium in upstate New York, must have remembered a question she heard ten years ago as she prepared for Hyakutake's arrival: "Are you Astrologers going to show us Hay-lee's Comet in your fancy microscope?" Well, it finally came. Enough of the images off the 'net. Let's see the darn thing. As March 25 approached, planetarians were not prepared for the overwhelming show of public interest. For example, planetarian Gary Close of the Roanoke, Virginia Science Museum had to figure out what to do with 1500 people who showed up to "see the comet." Lines formed, backed up, and stayed backed up throughout the evening to get a view of it through the telescope. As for me, well, Richmond had seven consecutive evenings of clouds, starting with March 25, closest approach! I did see it easily, the day before the closest approach, with the naked eye and binoculars. From my city vantage point, however, the wispy tail eluded me. Oh, well, back to the Internet!

One Monday in late April, I entered the computer class at 4:00 and asked myself the usual question, "Now what can I do for a project?" Then it hit me. The comet! I had a folder full of resources noted from net sites, etc. I went right to work on the idea and it blossomed into a totally acceptable research project. I called it "Hooray for Hyakutake: A Constantly Evolving Lesson in Astronomy." Indeed, hooray for Hyakutake. It was a beautiful sight, a fabulous opportunity for planetarians to "show their stuff," and it gave me a grade of "A" in my class!
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