

IDEA PROGRAM FINAL REPORT

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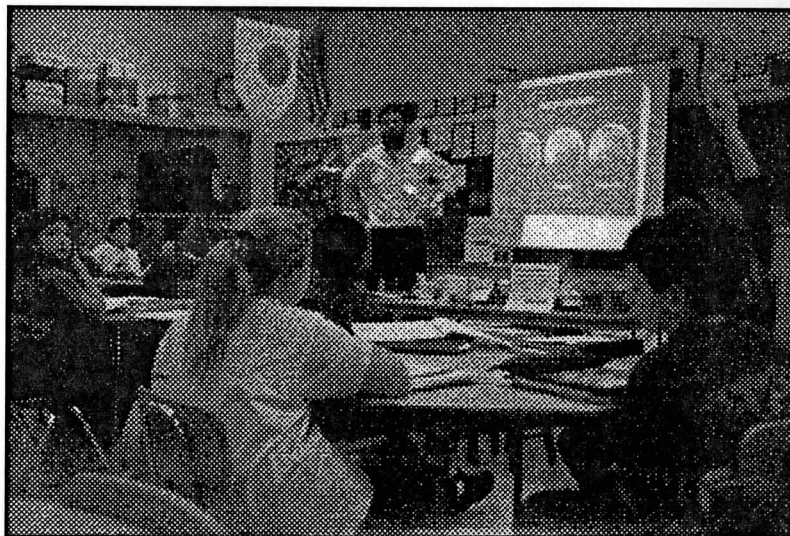
Resources for Teacher Development and Enhanced K-12 Astronomy/Planetary Science Education

IDEA Proposal Number: *ED90088.0195A*

Reporting Period: 1 March 1996 - 30 April 1997

Sanjay S. Limaye
Principal Investigator
Space Science & Engineering Center
University of Wisconsin-Madison

30 September 1997



Dr. McKay at Velma Hamilton Middle School,
Madison, Wisconsin
19 November 1996

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Summary of Project Activities

(Please answer the following questions. Be clear and concise.)

1. Describe the primary objectives and scope of the project.

The primary objectives of the effort were to increase the knowledge level awareness of K-12 teachers as well as the general public regarding recent findings from space exploration, particularly in astronomy and the solar system. The project's scope included a one week summer teacher enhancement workshop, lectures for the general public by invited speakers on a variety of space exploration topics as well as school visits and summer internships for high school students. Additionally, information about our research on planetary exploration, including the HST observations of Neptune were posted on the web (<http://www.ssec.wisc.edu/~sanjayl/planets/neptune.htm>).

2. Describe the partnerships established for the project

Partnerships were established for this project with the School of Education (College for Kids, a summer enrichment program aimed at Talented and Gifted upper elementary students from Dane County, Wisconsin), the Wisconsin Space Grant Consortium (Summer Workshop for teachers) and the Adler Planetarium (Hands on Universe Program).

3. Describe the evaluation component of the project

The evaluation component of the project included a survey questionnaire distributed at the public lectures and detailed daily questionnaires during the teacher workshop.

A. Briefly describe the type of evaluation that was conducted.

(process, outcome, or impact evaluation)

B. Briefly describe the data collection procedures used in the project.

(questionnaires, interviews, records, observation, and/or existing data/statistics)

C. Were the data collection procedures effective in measuring the project's objectives?

Yes

4. If appropriate, briefly describe how NASA source data were used in the project.

The teacher workshop utilized STScI lithographs and posters to interest the participants. The project did not dwell heavily on data analysis for lack of adequate time and resources.

5. Describe the project's findings.

A. If appropriate, describe the demographic information on the audience reached.

Summer Workshop

There were 12 teacher participants in the summer workshop - two elementary, four middle school, and six high school. Six were from the Madison, Wisconsin metropolitan area, and six were from rural areas in the Madison vicinity.

In addition, there were approximately 30 high school students in the summer workshop who were also exposed to topics in astronomy and space exploration. Most of these were from Wisconsin and included two minority students.

QEM/SHARP High School Summer Interns

Two minority high school students were sponsored through the NASA/Quality Education for Minorities (QEM) Summer High School Apprenticeship Research Program (Mr. Edward Little, West Palm Beach, Florida, and Mr. Ramsey Isler from Detroit, Michigan) as part of this program.

College for Kids

The space exploration extravaganza was offered to approximately 200 fifth grade elementary school students from Madison, Wisconsin area, through the UW-Madison/School of Education. The students were selected by the teachers/principals from about one hundred elementary schools.

B. Describe the goals accomplished.

The primary goals of increasing the awareness of recent findings and events in space exploration among the general public and the K-12 education community were met effectively with a diversity of projects.

C. Describe the lessons learned.

The public is eager to learn about the universe, space exploration programs, its relevance to terrestrial issues and shows a tremendous level of support for the outreach efforts.

D. Describe the implications for future education and/or astronomy projects.

Regular events are useful to keep the public informed about current scientific research initiatives and discoveries. An infrastructure for carrying out the outreach and education efforts is essential to the longevity of the institutional efforts. A local connection is extremely useful and important for engaging the public and for the generating interest among the local print and television media.

6. Are there plans to continue the project after the IDEA funding cycle ends? If so, describe how the project will be funded.

The efforts will be continued as resources permit. Links are being established with the UW-Madison School of Education, School Districts as well as the Department of Public Instruction.

7. If appropriate, briefly describe the dissemination of project findings, including name and date of publication or conference.

A poster presentation on the project's efforts was made at the 29th Annual meeting of the Division for Planetary Sciences, Cambridge, MA, 26 July-30 July, 1997 (Explorations in K-12 education and public outreach: S.S. Limaye, R.A. Pertzborn, and L.A. Sromovsky, *Bull. Amer. Astron. Soc.*, **29**, 1014).

A presentation was made at the Wisconsin Society of Science Teachers meeting, 11-13 April 1996, Fond du Lac, Wisconsin.

Articles were published in Madison Skies, a monthly newsletter of the Madison Metropolitan School District's Planetarium (<http://www.madison.k12.wi.us/planetarium/invade.htm>) on Mars exploration, Life on Mars lecture (<http://www.madison.k12.wi.us/planetarium/marslife.htm>) and astronomical observations from schools (Appendix II).

8. If appropriate, provide the URL for the project WEB page.

The various outreach activities supported by this grant are described on the web at: <http://www.ssec.wisc.edu/~sanjayl/planets/plan.html>

9. Suggestions and additional comments:

Multi-year support would be useful in creating sustainable programs.

Name of Principal Investigator: Sanjay S. Limaye

Date: September 30, 1997

APPENDIX I

Description of Project Activities

Initiative to Develop Astronomy through Education Grant Report

S.S. Limaye, (PI), SSEC, UW-Madison

1 March 1996 - 30 April 1997

A variety of activities have been undertaken under the NASA IDEA Grant Resources for Teacher Development and Enhanced K-12 Astronomy/Planetary Science Education (# ED-90088.01-95A, S.S. Limaye, PI) since its inception in March 1996. The outreach efforts were received well by a wide range of audiences. These can be generally categorized into the following broad categories: a) School Visits, b) Public Lectures, c) Summer Workshop for Teachers and Inservices, d) Resources for the World Wide Web, e) Summer Internship for a High School Student, f) Hands-On Activities, and g) Media Reports. These are described below.

School Visits

Longfellow Junior High School, Wauwatosa, Wisconsin

Cottage Grove Elementary School, Cottage Grove Wisconsin

Akira Toki Middle School, Madison, Wisconsin

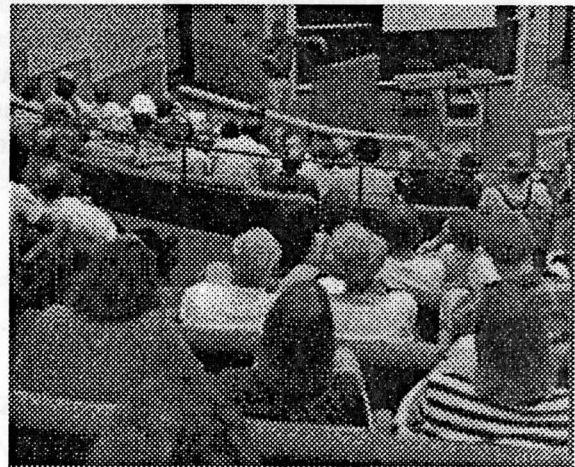
Randall Elementary School, Madison, Wisconsin

Public Lectures

A series of four lectures aimed towards the general public and school age children on several topics of current astronomical interest and space exploration by experts in the field were arranged between June 9 - June 13, 1996:



←



Dr. John Trauger (JPL) speaking about the findings from Hubble Space Telescope. ↑

Dr. David Black speaking about discovery of planets around other stars.

The audience included people of all ages and responded to a number of questions after the lecture. The interest in these lectures was surprisingly high. One point worth noting is that these lectures had one distinct advantage over broadcast or print media and that was the direct interaction possible with the speaker regarding questions about the topic.

The following lectures were arranged:

<u>Date</u>	<u>Speaker(s)</u>	<u>Topic</u>
June 9, 1996 Sunday	William Sheehan Author, and Sanjay Limaye UW-Madison	Once in a Blue Moon: The SL-9 Impacts on Jupiter and What We Learned from Them
June 10, 1996 Monday	David Black Director, Lunar & Planetary Institute	In Search of Other Planetary Systems: Completing the Copernican Revolution
June 12, 1996 Wednesday	John Briggs	Astronomy in the Cold: Winter- Yerkes Observatory Over at the Geographic South Pole
June 13, 1996 Thursday	John Trauger Jet Propulsion Laboratory	New Views of the Universe with the Hubble Space Telescope

Abstracts of these lectures are attached in the Appendix. A questionnaire was passed out during the third and the fourth lectures to get some feedback on level of interest in similar events in the future, suitability of the lecture dates and times and also about the speakers and the topics. On average about 100 persons attended each lecture (65 to 175), which was significant considering that the lectures were held just the week after the area schools closed for summer vacation and NBA finals were being broadcast on two of the lecture nights.

Comments about the current series of lectures, speakers and topics:

EXCELLENT, BETTER THAN TV OR VIDEO

Age 43

**SAMPLE
AUDIENCE COMMENTS**

Comments about the current series of lectures, speakers and topics:

*Both lectures were informative —
Thank you for offering them to the public.*

Age 45

Comments about the current series of lectures, speakers and topics:

I really enjoyed this lecture. It was very easy to understand and fun to learn about unknown areas as how I have only just started in this course. (Not even a week!)

Thankyou for a great Lecture!

Age 27

Age 53

Comments about the current series of lectures, speakers and topics: Terrific. A nice mix of science and anecdote. Thank you

WONDERFUL!

Age 24

A fifth lecture was arranged for November 1996 (Dr. C.P. McKay, NASA/Ames Research Center, Life on Mars: Past, present and Future). The lecture has been taped and a high quality video tape has been produced for use by schools. A visit by Dr. McKay to a local middle school to give two presentations on the same topic was also arranged.

Summer Workshop for Teachers

We collaborated with the organizers of the fifth Summer Workshop for Earth Science Teachers held by the Space Science and Engineering Center to expand the scope of the workshop to include Astronomy and Space Science. In a departure from the past when the entire workshop was open to high school science teachers and high school seniors, the focus for the one and a half day Astronomy and Space Science session was changed to separate activities for teachers and students. Further, the teacher attendance was opened to elementary and middle school levels.

Marianne Jackson demonstrating one way to introduce elliptical galaxies!



Teachers were introduced to remote astronomical observing through a link to the Mt. Wilson Telescope in California. Karin Dahlgren, a seventh grader with prior experience, is showing the teachers how.

This allowed the presentations to be directed at teachers and students to address different goals - teacher development and exposure to astronomy respectively.

Generally, most middle school teachers teach science as a single subject with units on different branches, it worked out well to include geoscience and astronomy as the workshop topic. Further, by including all three levels, it was useful for scientists and teachers to understand and appreciate level appropriate lessons and knowledge.

Introduction to observing the sky through binoculars for the workshop attendees.

One of the main elements of the workshop was to interest the teachers in evaluating their curriculum and to explore where they could employ some hands-on activities and recruit help from scientists as appropriate. This initial workshop enabled the establishing of a dialog between teachers and scientists that hopefully will continue. To this end, follow-up activities such as arranging astronomical observing sessions through a portable telescope are being undertaken.



Participants

The teachers were recruited for this workshop jointly through direct mailings and presentation at the Wisconsin Society of Science Teachers meeting. The presenters for the Astronomy and Space Science sessions were Ms. Vivian Hoette, Adler Planetarium, Chicago (Hands On Universe) Ms. Jan Wee, Passport to Knowledge Project, (Live from Mars) Sanjay Limaye and Wilt Sanders of SSEC, and Marianne Jackson, a graduate of the AAS Astronomy Resource Agent Workshops.

Name	Grade	School	School District	City
Tom Adas	11/12	Verona High School	Verona	Verona, WI
Mary Miller Brush	7	Velma Hamilton Middle School	Madison	Madison, WI
Doris Dubielzig	8	Velma Hamilton Middle School	Madison	Madison, WI
Gene Haffele	11/12	Monroe High School	Monroe	Madison, WI
Marianne Jackson	3	Lakeview Elementary School	Madison	Madison, WI
James Kotoski	7	Spring Harbor Middle School	Madison	Madison, WI
Chris Mason	10/11	Delavan- Darien High School	Delavan	Lake Geneva, WI
Arno Morton	7/8	Ben Franklin Junior High	Plover	Plover, WI
Todd Orth	11	West Bend East High School	West Bend	West Bend, WI
Ruth Paulson	4	Cottage Grove Elementary School	Monona Grove	Cottage Grove, WI
Norman Schroeder	9/10	Riverview High School	Plymouth	Plymouth, WI
Bob Shannon	11-12	Edgewood High School		Madison, WI

Workshop Activities

The workshop presentations included topics such as astronomical observations, National Science Standards, Current outreach projects such as the programs offered by the Passport to Knowledge Project and the Hands On Universe Project. A small telescope and

binoculars were used on one clear evening to introduce the participants to the night sky. Additionally, the 24" Mt. Wilson telescope was used remotely to introduce the teachers to observing using CCD images. A detailed program is attached and is summarized below.

Sunday, July 21, 1996

Hands On Universe - *Vivian Hoette, Adler Planetarium*
 Astronomical Imaging Using the a Remote Link to
 Mt. Wilson Telescope, California - *Limaye and Kotoski*

Monday, July 22, 1996

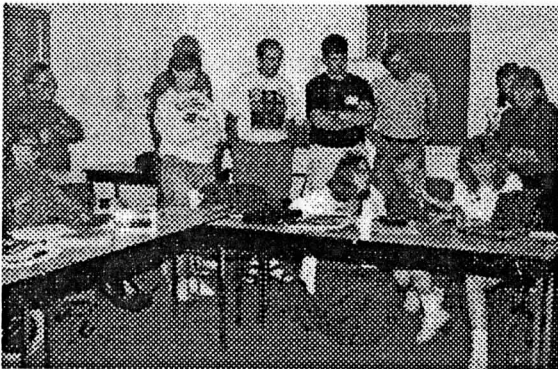
A Private Universe - General Misconceptions about Astronomical topics (Video)
 Passport to Knowledge (Electronic Field Trips) - *Jan Wee, Passport to Knowledge Program*
 World Wide Web Resources - *Sanders & Limaye (SSEC)*
 Using the Mt. Wilson Telescope: A Teacher's Perspective - *Kotoski*
 Universe in the Classroom - *M. Jackson*
 Workshop Evaluation - *All participants*



Vivian Hoette leading the workshop teacher participants in a constellation name game. ↑



Wilt Sanders and Doris Dubielzig making their model of a spiral galaxy with glass beads.



Here Vivian Hoette is demonstrating the Hands On Universe astronomical image display program. →

A number of laptop computers were employed to introduce the teachers to the internet and the astronomy/space science resources available as well as software. Jan Wee is showing the Live from Hubble Web site. ←





Demonstrations of galaxies by the participants, an activity aimed at the elementary levels.

are planned as resources permit.

Follow-up activities during the school year

World Wide Web Resources Efforts aimed at K-12 audience

A planetary science world wide web home page has been developed and linked to the SSEC home page (<http://www.ssec.wisc.edu/>). The SSEC home page is visited a very large number of times daily to access the real time weather satellite imagery, and many of these visitors take the time to visit the planetary and space science pages as well. One of the pages that has been receiving some attention is the Question and Answer section wherein web visitors are able to submit a question about the planets/space science. The questions and answers are posted on the web. The site also contains links to other planetary and space physics sites of interest.

Sanjay Limaye served as a support astronomer for the **Live from the Hubble Space Telescope** Program of the Passport to Knowledge Project (Mr. Geoff Haines-Stiles) during Spring 1996 and answered many questions over the internet (now archived at <http://quest.arc.nasa.gov/>). He expects to work in a similar capacity for the upcoming Live from Mars program.

Summer Internship for High School Seniors

Two high school seniors were hosted by the investigators for an eight-week period during June - August 1996 to provide them with an opportunity to work on current space science related research. Mr. Edward Little (Suncoast High School, Riviera Beach, Florida) worked with Sanjay Limaye to investigate the height of the Shoemaker Levy-9 impact features on Jupiter from measurements of parallax from ground based images. Mr. Ramsey Isler (Detroit, Michigan) worked with Dr. Sanders to explore the effectiveness of a magnetic torque attitude control system for an X-ray satellite. These internships were arranged through the efforts of Ms. Rosalyn Pertzborn of SSEC under the SHARP Plus program sponsored jointly by NASA and QEM Inc. on the UW-Madison Campus. Out of a total of 22 students, SSEC hosted five students.

Hands-On Activities

The following activities were undertaken to expose elementary and middle school students to astronomy and space science:

Demonstration of a Comet Nucleus - Randall Elementary School, Madison
Craters, Scale of the Solar System - Longfellow Junior High School, Wauwatosa

Astronomical Observations from Telescopes

Mt. Wilson Telescopes in Education (TIE) Program at:

Akira Toki Middle School

Summer Workshop

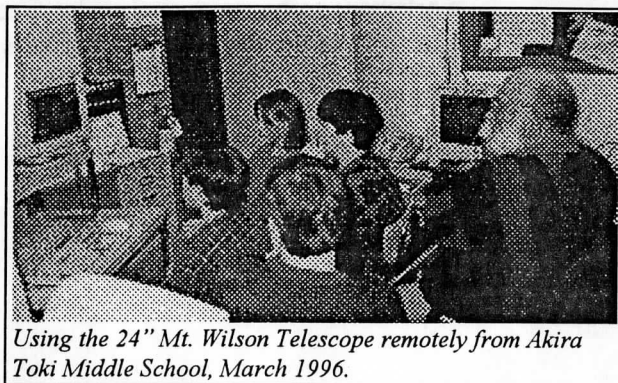
Observing through a Portable Telescope

Summer Workshop - July 22, 1996

Velma Hamilton Middle School - October 2, 1996

Washburn Telescope

*Observing at Velma Hamilton Middle School,
Madison, October 2, 1996*



Using the 24" Mt. Wilson Telescope remotely from Akira Toki Middle School, March 1996.

Media Reports

Print Media

Several short articles were written for **Madison Skies**, a newsletter published by the planetarium of the Madison Metropolitan School District (attached).

Broadcast Television

Sanjay Limaye appeared in two different segments of a locally produced children's television program shown in about 30 national markets, called the Talkbox. The topics were Galileo exploration of Jupiter and Remote Observing.

Radio

An Interview with Dr. David Black was arranged for "To the Best Of Our Knowledge", a locally produced radio program.

Miscellaneous

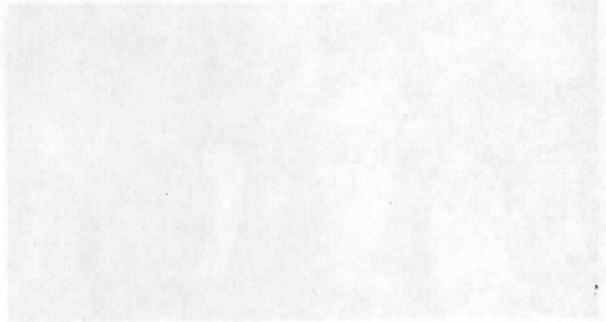
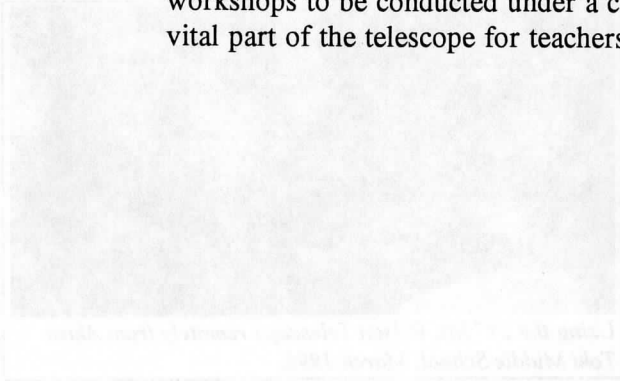
Finally, there were other miscellaneous outreach activities conducted by the investigators. These are noted below.

- Presentation at the **AAS Teachers Workshop** in Madison - Dr. Andrew Collard
- Galileo at Jupiter - Public Lecture at **UW Space Place** - Dr. Andrew Collard
- Presentation at the Education Workshop, **28th Meeting of the Division of Planetary Sciences (AAS)**, Tucson, Arizona, October 21-22, 1996

- Presentation at the Meeting of **Wisconsin Society of Science Teachers** - Fond du Lac (April 13, 1996)
- Consultant for the **whyfiles** web pages for some topics.

Proposal for a Remote Telescope for Schools

In view of the enthusiastic response to the remote use of the Mt. Wilson Telescope, we have been developing a proposal to set up a small, remotely accessible telescope for school use. About half a dozen school districts have expressed a desire to support this telescope, and funds are being currently sought for the implementation. The workshops to be conducted under a continuation IDEA proposal are seen as a very vital part of the telescope for teachers.



AGENDA

5TH WISCONSIN SPACE GRANT CONSORTIUM WORKSHOP ON ATMOSPHERIC, EARTH, AND SPACE SCIENCE

UNIVERSITY OF WISCONSIN-MADISON CAMPUS
21 JULY - 26 JULY 1996

Sunday : 21 July, 1996

- | | |
|----------|---|
| 5:00 pm | Welcome:
Overview of the Wisconsin Space Grant Consortium
Introductions of Participants
Review of Workshop Agenda |
| 6:30 pm | Hands-on Universe |
| 8:00 pm | Break |
| 10:30 pm | Washburn Observatory or Mt. Wilson remote hookup (Teachers)
Discussion of telescopes, and viewing the heavens |

Monday: 22 July, 1996: Split session for teachers and students

Teachers:

- | | |
|-------------------|--|
| 8:00 am | Preliminaries - at JFFC |
| 8:15 am | Excerpts from "A Private Universe" |
| 9:00 am | Discussion on National Science Standards |
| 9:45 am | Break |
| 10:00 am | Passport to Knowledge |
| 11:00 am | WWW resources - Astronomy and Space Science |
| Noon | Lunch |
| 1:00 pm | Mt. Wilson Telescope |
| 1:45 pm | Discussion on handout materials |
| 2:30 pm | Discussion:
1) Curriculum
2) Role of Scientists
3) Future events |
| 5:00 pm | Evaluation of day's events |
| Evening free time | |

Monday:	22 July, 1996: Split session for teachers and students
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Students:

8:00 am	Weather for Breakfast A daily look at current global, regional and local weather events, and the tools scientists use to study them. Meteorological Data and Tools
9:00 am	Radiosonde launch / Rooftop tour
10:00 am	Weather maps: how to make them and how to read them
12:00 am	Lunch at SSEC
1:15 pm	McIDAS Weather Session
3:00 pm	Using the WWW for find Weather and Climate Information
3:30 pm	Campus walking tour with GPS demonstration / Daily Evaluation
5:00 pm	Dinner at the JFFC
6:30 pm	Volleyball party

Tuesday:	23 July, 1996
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8:00 am	Weather for Breakfast Global weather and climate
8:30 pm	The Environmental Impact of Biomass Burning
9:00 am	Environmental Remote Sensing Topics An overview of how airborne and satellite-based sensors are used for natural resource management and environmental monitoring Review and compare GPS data with digital maps Overview of how satellite sensors are used with land cover mapping Introduction to supervised image classification Classification of land cover around Madison using Landsat images Comparison of classification accuracy
12:30 pm	Lunch: Pizza on the roof
Afternoon	SSEC Research Programs
1:30 pm	SSEC Engineering Programs
2:15 pm	Advanced instruments for studying the atmosphere
3:00 pm	Break
3:15 pm	Visit to the Particle Accelerator Lab - Physics/Engineering
4:00 pm	Daily Evaluation / Return to the Friedrich Center
5:00 pm	Dinner at the JFFC
7:00 pm	Ice cream on the Memorial Union terrace
8:30 pm	Visit to Washburn Observatory

Wednesday: 24 July, 1996

- 8:00 am **Weather for Breakfast**
Regional Scale Weather
- 8:30 am **Earth Science Field Trip** (Van trip with box lunch)
Environmental Geology (9:30 am Landfill site)
Box Picnic Lunch at Devil's Lake State Park
Ice Age features in the Devil's Lake area
- 5:00 pm Return to Friedrich Center
Daily Evaluation
- 7:00 pm **Cookout at the Friedrich Center**

Thursday: 25 July, 1996

- 8:00 am **Weather for Breakfast**
Mesoscale Weather
- 9:00 am **Atmospheric Science Topics:**
Using Satellites and Radar to study Thunderstorms
- 9:45 am Break
- 10:00 am Tropical Cyclones
- 10:45 am Break
- 11:00 am Climate and Global Change issues
- 12:00 pm Lunch at SSEC
- 1:00 pm **McIDAS Weather session**
- 4:00 pm Weather discussions
- 4:30 pm Daily Evaluation
Return to Friedrich Center
- 5:00 pm Dinner at JFFC
- 6:30 pm Walk to Picnic Point
- 8:00 pm Ice cream at JFFC

Friday: 26 July, 1996

- 8:00 am **Weather for Breakfast: Why is the Weather so Difficult to Forecast**
- 9:00 am **Earth Science Topics**
- Groundwater
 - Earthquakes
- 10:30 am **Visit to Geology Museum**
- 12:30 pm Lunch at JFFC
- 1:30 pm Daily/Workshop Evaluation

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Organizers:

Rosalyn Pertzborn
 Bill Smith
 Tom Achtor
 Sanjay Limaye
 Herb Wang
 David Bolgrien

Photographer:

Nick Nalli

Presentations

Wayne Feltz - WWW sites
 Elaine Prins - Biomass Burning
 David Bolgrien - Environment Remote Sensing
 Evan Richards - SSEC Engineering
 Fred Best, Bob Knuteson - HIS / AERI
 Dan Pertzborn - Particle Accelerator
 Bob Rabin - Thunderstorms
 Tim Olander - Tropical Cyclones
 Fred Wu - Climate and Global Change

Weather for Breakfast

Monday	Achtor	Meteorological Measurements
Tuesday:	Achtor	Planetary Circulations
Wednesday	Wade	Synoptic Scale
Thursday	Mecikalski	Mesoscale
Friday	Aune	Forecast Models

Activities:

Radiosonde (Mon): Wayne Feltz, Dan DeSlover

Map Analysis (Mon): Wayne Feltz, Joline Kugi, John Mecikalski, Gary Wade, Tom Achtor

McIDAS (Mon & Thurs): Wayne Feltz, Gary Wade, John Mecikalski, Tom Achtor, Tim Schmit, Tim Olander, Scott Bachmeier, Steve Wanzong (?) and Tom Adas

Walking Tour (Mon): David Bolegrin, Rosalyn Pertzborn, Nick Nalli

Volleyball (Mon): Rosalyn Pertzborn

Washburn Observatory (Tues. or Thurs): Barbara Whitney, Jerry Acord

Walk to Picnic Point: Chaperones

Chaperones:

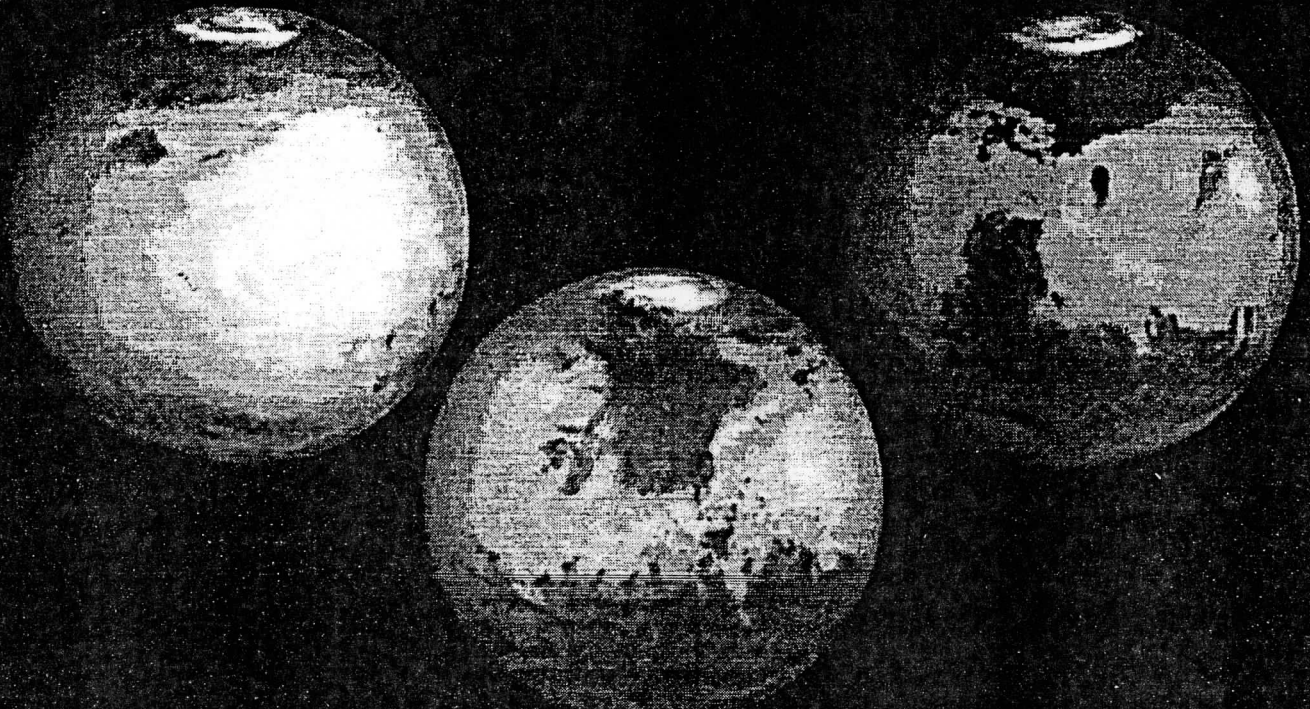
Sunday Chris Hedrick, Sanjay Limaye
 Monday Rosalyn Pertzborn, Bill Smith
 Tuesday Rosalyn Pertzborn, Nick Nalli
 Wednesday Rosalyn Pertzborn, Tom Achtor
 Thursday Chris Hedrick, Nick Nalli

Drivers:

APPENDIX II

Public Lecture Announcements

Life on Mars:



Past, Present and Future

A lecture for general audiences of all ages.

Christopher P. McKay

NASA's Ames Research Center, Space Science Division

According to Dr. McKay, "although Viking results may indicate that Mars has no life today, there is direct geomorphological evidence that, in the past, Mars had large amounts of liquid water on its surface, possibly due to a thicker atmosphere. From a biological perspective the existence of liquid water, by itself, motivates the question of the origin of life on Mars." McKay notes that the Martian meteorite found in Antarctica dates back to this early period and may contain evidence consistent with life. He states that, "From studies of the Earth's earliest biosphere we know that by 3.5 billion years ago, life had originated on Earth and reached a fair degree of biological sophistication. Surface activity and erosion on Earth make it difficult to trace the history of life before that," but that "Ecosystems in cold, dry locations on Earth, such as the Antarctic, provide examples of how life on Mars might have survived and where to look for fossils."

Monday, November 18, 7:00 p.m.

Educational Science Building
Room 204, 1025 W. Johnson Street



Public Astronomy Lectures

A series of four lectures aimed towards the general public and school age children on some topics of current astronomical interest and space exploration by experts in the field will be held between June 9–June 13, 1996 at 7:00 p.m. in 1100 Grainger Hall, School of Business, University of Wisconsin-Madison Campus. Grainger Hall is located just west of N. Park Street on University Avenue. Access to the lecture Hall is easiest from the main entrance on University Avenue. Public parking is available in the underground ramp (enter from N. Brooks Street).

The lectures are:

<u>Date</u>	<u>Speakers</u>	<u>Topic</u>
June 9, 1996	William Sheehan, Author, and Sanjay Limaye, UW-Madison	Once in a Blue Moon: The SL-9 Impacts on Jupiter and What We Learned from Them
June 10, 1996	David Black, Director, Lunar & Planetary Institute	In Search of Other Planetary Systems: Completing the Copernican Revolution
June 12, 1996	John Briggs, Yerkes Observatory	Astronomy in the Cold: Winter- Over at the Geographic South Pole
June 13, 1996	John Trauger, Jet Propulsion Laboratory	Hubble's Greatest Hits: WFPC/2 Images

These lectures are arranged with support from NASA's Initiative to Develop Education through Astronomy (IDEA) Program, S.S. Limaye and W.T. Sanders, Investigators.

For additional information or questions, contact Sanjay Limaye at (608)262-9541, or SanjayL@ssec.wisc.edu.

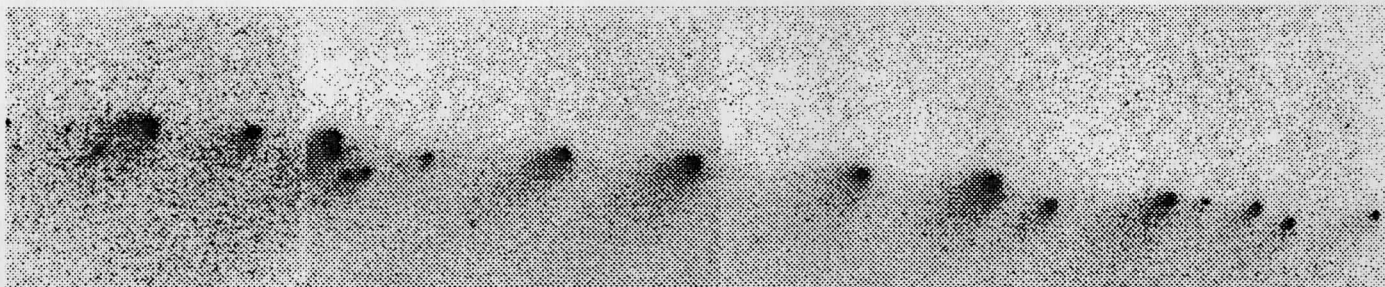


Once in a Blue Moon: The SL-9 Impacts on Jupiter and What We Learned From Them

William Sheehan and Sanjay Limaye

Abstract

Dr. Sheehan will discuss the earlier records of planet Jupiter and of possible comet impacts. Since the SL9 impacts, earlier mentions of features that could be indicators of cometary impact, have been discovered in the archives. Dr. Limaye will then talk about what we have learned from the observations of the impact of Shoemaker Levy 9 Comet fragments with Jupiter.



Fragments of Comet Shoemaker Levy 9, imaged by the Hubble Space Telescope

William Sheehan is an amateur astronomer and historian of science, whose special interest is the Moon and planets. He has published *Planets and Perception* (named a book of the year 1988 by the Astronomical Society of the Pacific), *Worlds in the Sky*, and *The Immortal Fire within: The Life and Work of Edward Emerson Barnard*. He has also completed *The Planet Mars*, due in fall 1996, and (with Richard Baum) *"Le Verrier's Wild Geese": The Romantic Quest for the Intra-Mercurial Planet Vulcan*, in 1997.

Professionally, William Sheehan is a psychiatrist. Dr. Sheehan received his Bachelor's degree from University of Minnesota, Master's Degree from University of Chicago, and the Doctor of Medicine from University of Minnesota. He lives in Hutchinson, Minnesota.

Sanjay Limaye is a scientist with the Space Science & Engineering Center, University of Wisconsin-Madison. His research interests include weather on the planets and he has enjoyed analyzing data from Mariner 10, Pioneer Venus Orbiter and Voyager missions to Venus and the outer planets.

**7:00 p.m., June 9, 1996, 1100 Grainger Hall, University of Wisconsin-Madison
975 University Avenue, Madison**

In Search of Other Planetary Systems: Completing the Copernican Revolution

David C. Black

Abstract

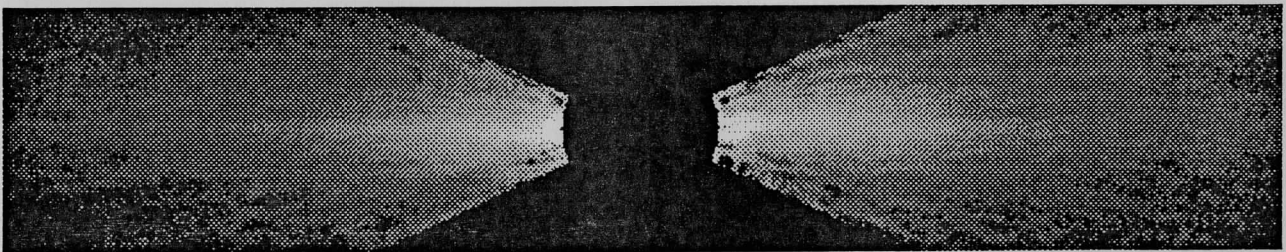


Humanity has long been fascinated with the heavens. Our ancestors carefully monitored the night sky as a means of anticipating the migration of herds of animals, and later as a guide in the planting and harvesting of crops. Beyond these practical reasons for careful monitoring of the sky, our perception of how the universe around us worked has been at the core of our world view with strong influences on religion and other major facets of how we live our lives.

Some five hundred years ago the framework of the way Western civilization perceived the universe underwent a significant and fundamental change. The Polish astronomer Copernicus advanced the notion that the Earth was not the center of the universe. Instead, it was but one of several planets that revolve around the Sun. It is difficult for people living today to appreciate how greatly this simple notion affected life at that time. People lost their lives because they adhered to these notions.

Modern telescopes have now shown that our majestic Sun is itself nothing unusual, there are some 100 billion such stars in our galaxy alone, and we now know that our galaxy is but one of again some 100 billion galaxies in the universe. The Copernican notion is clearly correct, at least as far as the Sun and the galaxy are concerned. However, we still have no observational evidence that other planetary systems exist, nor that there is life elsewhere. The confirmed discovery of other examples of these two phenomena will complete the revolution in thought began by Copernicus.

I will discuss plans to mount a search for other planetary systems, as well as recent discoveries that may be related to this important problem. Whatever the outcome of a truly systematic search, be it positive or negative, it is bound to have profound and irreversible effects on our perception of ourselves and our place in the universe.



Beta Pictoris, home of a Jupiter-sized planet, imaged by the Hubble Space Telescope's Wide Field Planetary Camera.

David C. Black, director of Houston's Lunar and Planetary Institute, is an ex-Madisonian who graduated from West High School in 1961. He has directed or participated in many space science committees and is an expert in theoretical astrophysics and planetary science, specializing in studies of star and planetary system formation. Dr. Black is the recognized leader of a growing effort to search for and study other planetary systems.

**7:00 p.m., June 10, 1100 Grainger Hall, University of Wisconsin-Madison
975 University Avenue, Madison**

New Views of the Universe with the Hubble Space Telescope

John Trauger

Abstract

The second generation Wide Field/Planetary Camera on the Hubble Space Telescope was exchanged for the original camera by the Space Shuttle astronauts slightly over two years ago. The camera, with its own corrective optics for the misshaped primary mirror, has returned stunning images of planets, galaxies and nebulae. This lecture will be a visual tour of the universe as seen through the WF/PC 2's four "eyes." I'll cover these topics and will illustrate them with about 80 slides:

- ◆ Hubble's niche in astronomy, overview of the mission
- ◆ Sampler of imaging science programs:
 - ◆ Distant universe, deepest field, galaxy evolution
 - ◆ Familiar astronomy in more distant galaxies—stars, nebulae, distances
 - ◆ Our galaxy—star forming regions, nascent stars and planetary systems
 - ◆ Demise of stars, nebulae, and renewal of the galaxy
 - ◆ Solar system—recent events
- ◆ Conclusions, prospects for the future.

Evaporating globules in Nebula M16, J.Hunter & P.Scowen



John Trauger led the team that developed the second generation Wide Field Planetary Camera (WFPC/2) on the Hubble Space Telescope that has returned spectacular astronomical images in the last two years that are revolutionizing our knowledge of the universe. He is currently a member of the Space Telescope User's Committee and the HST Servicing Science Working Group. He is a research scientist with the Earth and Space Sciences Division at the Jet Propulsion Laboratory, operated for NASA by the California Institute of Technology. He was a Senior Research Fellow in Planetary Science at Caltech prior to joining JPL full time in 1985.

Dr. Trauger received his BA in physics from Oberlin College, and MS and PhD degrees in physics at the University of Wisconsin-Madison. His research interests center on the origins and nature of solar system objects, with focus on the atmospheres and magnetospheres of the outer planets and their implications for planetary evolution. He has been active throughout his career in the development of optical and interferometric instrumentation for astronomy. In March 1994 he was awarded NASA's Outstanding Leadership Medal for his work with the WFPC/2 program.

**7:00 p.m., June 13, 1100 Grainger Hall, University of Wisconsin-Madison
975 University Avenue**

APPENDIX III

Copies of articles from Madison Skies

Madison Skies

March, 1996

Madison Metropolitan School District Planetarium

Vol. 1 Num. 4

Galileo Probe Update

—reveals a different Jupiter than we thought we knew.

Sanjay S. Limaye

Space Science & Engineering Center
University of Wisconsin-Madison

On December 7, 1995, after a journey of more than two billion miles in just over six years, the first man made object plunged into Jupiter's atmosphere at a speed of nearly 106,000 miles per hour. Its descent was slowed by the increasing resistance of the atmosphere of Jupiter. Then, the parachute opened, slowing its descent further, to enable its trove of six instruments to make detailed measurements of the Jovian atmosphere for the first time. The in-situ sampling was to provide a test of how valid our knowledge and assumptions about Jupiter are. Some preliminary results were announced at a press conference held at the NASA Ames Research Center on January 22, 1996. The emphasis is on preliminary, meaning that the final analysis may change the results and our understanding significantly. The press conference was delayed due to the federal budget impasse, preventing the federal scientists from participating (non-essential employees), and actually was somewhat beneficial in that it provided some additional time for analysis of the data. So, how valid was our knowledge of Jupiter? Sampled by one probe, in a descent of about 160 km in about one hour, that sampled a planet's atmosphere that extends outwards over 71,400 km from its center at the equator (and some 5,000 km less towards the poles), one must use caution in extending the results to the whole planet.

The expectation from results of flybys of Jupiter by Pioneers 10 and 11 (in 1973) and Voyagers 1 and 2 (1979, 1980)

as well as earth based observations dating back to Galileo, was that the bulk composition of Jupiter should be not too dissimilar from that of the Sun (since they formed in the same region of the galaxy from the same distribution of gas), that is mostly hydrogen and helium. The amount of water vapor in the atmosphere was either solar-like, or according to one recent proposal, ten times the solar abundance (based on data gathered during the impact of Shoemaker Levy 9 comet fragments). It was expected that the eastward winds would first increase with depth below the clouds and then decrease. There were three layers of clouds expected—ammonia (top), ammonium hydrosulfide (middle), and water (bottom). Not much lightning activity was expected.

The results available to date deviate from these expectations to different degrees. They show that our basic understanding of Jupiter and its formation is not too wrong, but there is a need for some re-thinking. First of all, it is difficult to truly characterize a giant planet with a single probe. Jupiter is far from homogeneous as any image of Jupiter shows. In fact, in the infrared, Jupiter shows a rather noticeable hot spot at the latitude where the probe was expected to enter Jupiter—months before the probe arrived. Indeed, the probe appears to have entered at the edge of this bright infrared feature that is some 1,600 km long, and about 300 km wide. Sometimes referred to as the hot spot, this feature merely implies that there is less cloud opacity at that wavelength, at that part of Jupiter, and the radiation detected is from deeper levels of Jupiter (where it is indeed warmer). It is not surprising then that some of the probe results, particularly those about the cloud

layers, may not be representative of the whole planet.

There were some surprises in the performance of the probe, based on pre-entry simulations, although it is important to remember that the probe performance met the required expectations. First of all, the parachute opened about 53 seconds later than anticipated or planned. Analysis of the engineering data and the ground model suggests that this may be due to a software error. The impact of the late opening of the chute is that the probe measurements began at a lower level (higher pressure) than planned since the probe did not slow down enough. Thus, the first instrument measurements began some 25 km deeper than planned, perhaps missing the upper cloud layer on Jupiter. The internal temperature of the probe also reached higher than anticipated, exceeding 100° C. Consequently, most instruments returned less data than anticipated. Briefly, the results can be summarized as:

1. Less helium than expected was found in the sampled portion of Jupiter's atmosphere. This is believed to be due to the fact that some of the helium is precipitating down to lower levels in the atmosphere, depleting the upper atmosphere of Jupiter. The overall amount of helium in Jupiter, in relation to hydrogen, may still be comparable to the solar composition.

(continued on page 2)

How to contact the Planetarium:

- Geoff Holt, Director
201 South Gammon Road
Madison, Wisconsin 53717-1499
- E-mail: gholt@madison.k12.wi.us
- Phone: (608)829-4053
- FAX: (608)829-4092



Madison Metropolitan School District Planetarium Newsletter -- November, 1996

Invading Mars!

A new beginning of the exploration of the Red Planet

By Dr. Sanjay Limaye

In late October through early November, three man-made robot vessels will leave the confines of Earth's gravity and sail on towards Mars, marking another "beginning" of the exploration of Mars. The last new beginning suffered triple casualties--two Phobos spacecraft launched by the Soviet Union, and the Mars Observer. In the face of dwindling resources, the newly born Russia and the United States have individually regrouped and redesigned a number of robotic spacecraft to send toward Mars. The Russian mission is now named Mars 96 (it was originally Mars 94), to be launched in 1994.

On Fourth of July 1997, the first of these earth messengers, the Mars Pathfinder, will enter the Martian environment and descend towards the surface--aided by a parachute and eventually land on the surface aided by inflated air bags to break its fall. Thereafter begins a carefully planned sequence of events that could scare the daylights out of any Martian microbes if they happen to be watching!

Shortly after landing, the airbags will deflate, and the Pathfinder will reveal its inner self to the Martian environment by opening up its four petals. The airbags will then be swept aside by the robot lander, to make way for a miniature vehicle, the Sojourner MicroRover, to tread its way onto Martian soil. Before Sojourner leaves the mothership however, a pair of stereoscopic eyes will make a multi-color survey of the environment to chart the way for Sojourner's travels. Sojourner is also equipped with electronic vision so that it can look over its progress over a sol (Martian day), as well as see how the mothership looks from its vantage point. The limited communications range restricts the rover to go no further than half a kilometer.

As the Pathfinder and Sojourner familiarize themselves and the distant Earthlings about their immediate environment, two other visitors will appear in the Martian skies in September 1997. One of these, the Mars 96, will send two piercing devices (Penetrators) to attack the Martian crust and bury their heads underneath to determine what Mars is truly made of. Two other microrovers, encapsulated in an acorn like shell like the Pathfinder will soon follow on parachutes to roam over the Martian landscape as well. Their mothership, is attracted towards Mars to hover at a safe distance in an inclined orbit that pulls it close to take a good look at the planet with German stereoscopic eyes, and takes it far away, only to return a day later.

Its American counterpart, the Mars Global Surveyor meanwhile, will circle around Mars keeping a fixed distance to systematically examine the surface, locally as well as globally, to help locate other sites for future visitors to explore. Its radio communication to earth can be used to determine the atmospheric conditions as the rays get bent by the atmosphere as the craft disappears over the Martian horizon as seen by the giant ears of the Deep Space Network.



Dr. Sanjay Limaye
Space Science and Engineering Center
University of Wisconsin - Madison

[Return to November, 1996 Madison Skies Online...](#)

Subscription Information

[Return to Madison Skies Online](#)

[Return to the MMSD Planetarium Homepage](#)

Your comments, questions, and feedback are welcome.

Author and Publisher: Geoff Holt gholt@madison.k12.wi.us

Page Design: Andrew Holbrook

Madison Metro. School District Webmaster: webmaster@madison.k12.wi.us

Updated February 11, 1997



Madison Metropolitan School District Planetarium Newsletter -- November, 1996

Life on Mars: Past, Present, and Future

Announcing the Fifth 1996 Public Space Science Lecture

By Dr. Sanjay Limaye

November 18
7:00 PM, Room 204
Educational Sciences Building
UW-Madison Campus
1025 West Johnson Street

Description

Although the Viking results may indicate that Mars has no life today, there is direct geomorphological evidence that, in the past, Mars had large amounts of liquid water on its surface - possibly due to a thicker atmosphere. From a biological perspective the existence of liquid water, by itself, motivates the question of the origin of life on Mars. One of the martian meteorites dates back to this early period and may contain evidence consistent with life. From studies of the Earth's earliest biosphere we know that by 3.5 billion years ago, life had originated on Earth and reached a fair degree of biological sophistication. Surface activity and erosion on Earth make it difficult to trace the history of life before the 3.5 billion years time-frame. Ecosystems in cold, dry locations on Earth - such as the Antarctic - provide examples of how life on Mars might have survived and where to look for fossils.

About the Speaker

Dr. McKay received his Ph.D. in AstroGeophysics from the University of Colorado in 1982 and has been a research scientist with the NASA Ames Research Center since that time. His current research focuses on the evolution of the solar system and the origin of life. He is also actively involved in planning for future Mars missions including human settlements. Chris has been involved with polar research since 1980, traveling to the Antarctic dry valleys and more recently to the Siberian and Canadian Arctic to conduct research in these Mars-like environments.

Parking

Available in the underground ramp of the Grainger School of Business one block to the north between Johnson St. and University Avenue.

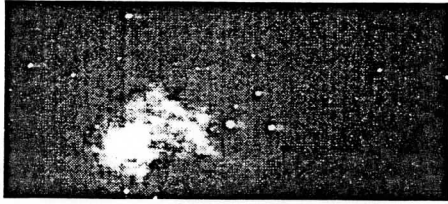
This lecture is made possible from a Initiative to Develop Education through Astronomy (IDEA) Grant. Contributions for future support of such activities are welcome. Donations may be sent to the Wisconsin Foundation, 1848 University Avenue, Madison, Wisconsin 53705, in the name of Space Science &

Madison Skies

April, 1996

Madison Metropolitan School District Planetarium

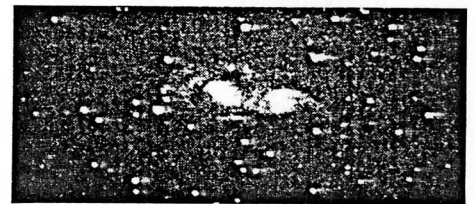
Vol. 1 Num. 5



Great Orion Nebula: image by Toki M.S. students using a telescope at Mt. Wilson.



Jim Kotoski and students remotely operating the 24" diameter telescope at Mt. Wilson.



NGC 2207 (colliding galaxies 108 million light years away): image by Toki students.

Young astronomers scour a distant sky

Two middle school students describe how their class is using a 24 inch diameter telescope at the Mount Wilson Observatory in California without ever leaving their classroom.

Karin Dahlgren
Seventh Grade Student
Akira Toki Middle School, Madison

Genny Morrow
Seventh Grade Student
Akira Toki Middle School, Madison

At Akira Toki Middle School in Madison, Wisconsin, about twenty seventh graders are enjoying a unique experience—myself included. We are operating a telescope at Mt. Wilson in California using a computer, a modem, and software titled *The Sky*. The participating students spend every lunch hour researching and preparing for the time when the link will occur.

The project has already proven most rewarding, since a snowball effect has taken place. Along with operating the telescope, we were in a local newspaper, as well as on a television show. The most intriguing facet of this undertaking is going beyond the limitations and capabilities set for the usual amateur astronomer.

One of the reasons I decided to participate in this project is because I really like space and studying the unknown. It is very intriguing to look up at the stars and wonder "what's out there?" So until I am of age to be boosted into space atop a rocket, this is the best I can get.

I am a regular seventh grade student at Akira Toki Middle School—with one major difference. I've had an unforgettable experience.

I've actually been able to travel in time, but not in a time machine. I travel in time by remotely controlling the Mt. Wilson telescope. I can't take all the credit. Twenty other kids also controlled the telescope. But, we wouldn't even be doing this if not for Mr. Kotoski. He is our science teacher. He hooked up with Dr. Lemay at the University of Wisconsin and got all the software, and got everything hooked up with the P.T.O. (Parent Teacher Organization). But it wasn't all fun and games. There was lots of preparation time.

All the kids spent their lunch hours (or lunch half-hours, as the case is here) talking to Mr. Kotoski, picking out groups to work in, picking out a constellation, using the Burnham's Celestial Handbook to find deep sky objects, hopping on the computer to find the right ascension, declination, and the brightness, and seeing what we are hoping to see.

Then, on the night we have designated to open a private line with Mt. Wilson, we

come to school at 8:00 PM. The line usually doesn't open until 9:00 PM. Until then we surf the internet to look for pictures of the stuff we were looking up that night. When you get on the computer, Mr. K. would tell them (the people on the phone at Mt. Wilson) what object you were going to be looking at. He also tells them the right ascension, declination, and the brightness level. You then type in the NGC number. Then you slide the telescope into position, you check on the picture and, if you like the picture you would decide on the proper exposure. Then you take the picture and look at it. If you don't like it, you throw it out and retake. At a later date you come in again at lunch to clean it up.

I thought of the whole thing as a truly enlightening and fun experience. It was something I can tell my children about. After the picture is cleaned up, I write the lab report. I get that as a keepsake. If my brother does the same thing next year, I would definitely come along.

(See also page 2 for more information.)

How to contact the Planetarium:

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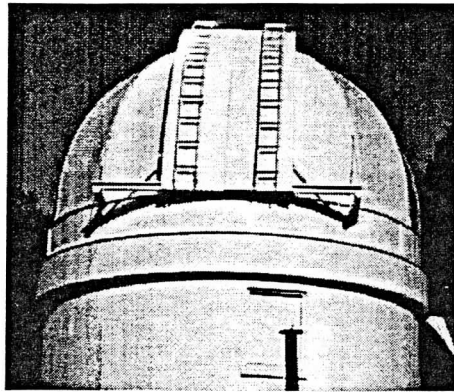
Future remote telescope in Wisconsin?

As usage of the Mount Wilson telescope increases, the need for a remotely operated telescope—used for education, and located here in Dairyland will become apparent. Your input and feedback are requested.

Dr. Sanjay Limaye
Space Science and Engineering Center
University of Wisconsin—Madison

The articles by Karin and Genny on page 1 illustrate the value of opportunities to interest students in learning. This particular example is made possible by the *Telescopes in Education (TIE) Program* offered through the Mount Wilson Observatory in California, with support from NASA and the Jet Propulsion Laboratory. This telescope is perhaps the only one that currently provides access to schools through a remote computer link. The software allows the students to point the telescope and acquire CCD images. A telescope operator is available for consulting when a problem arises. Controlling the telescope and acquiring an image is an inspiring experience, not just for students, but for their teachers and attendant parents as well.

Turning students into astronomers is not however the primary goal of this effort, although many are likely to develop an interest in astronomy. The real value of the exercise is to provide the students with an opportunity to tackle many different problems and arrive at workable solutions. The students gain familiarity with computers and how telescopes and CCD



Dome for the 24 inch diameter telescope used by the Toki Middle School students. Photo by Dr. Robert Donahue, Mt. Wilson Observatory.

cameras work, and write a report about the observations. They get an opportunity to research a topic, to apply their knowledge of math and basic concepts such as coordinates, rotation of the earth, clouds, weather, and hopefully, to think and communicate their ideas.

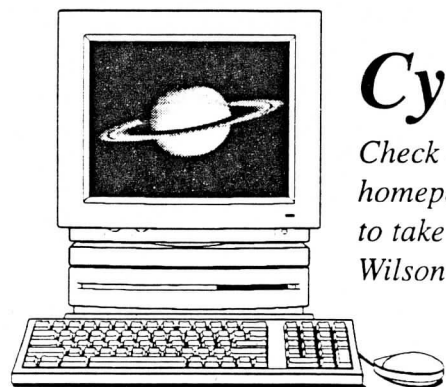
At Akira Toki Middle School, the TIE project was begun as an experiment. It was made possible by the generous financial support of the Toki Parent Teacher Organization for the purchase of the software, modem and the long distance telephone costs. We educators and the students would like to express our gratitude for the support. Based on the experience gained this semester, the plans are to continue the use

of telescope next year, with more focused curriculum elements.

The Mt. Wilson telescope is currently being used by schools from all over the world. As the usage grows, the need for similar telescopes accessible to area schools will become apparent. We need your input and support to explore the possibility of building or adapting a remotely operable telescope in Wisconsin for use by schools. As the number of such telescopes around the world grows, it would be reasonable to expect to use a telescope half way around the world during regular school hours, instead of coming to school after hours to observe—although many may find it appealing!

There are other projects that provide astronomical data and lesson plans as well. Resources such as these will be discussed at the Astronomy and Space Science Workshop to be held July 21-22, 1996 in Madison, Wisconsin on the University of Wisconsin campus. If you would like more information, or would like to provide input or feedback regarding future telescope projects, contact Sanjay Limaye.

E-mail: SanjayL@ssec.wisc.edu
Phone: 608-262-9541
WWW: <http://www.ssec.wisc.edu/>
(follow "planets" hyperlink)



Cyber-Space

Check out the new look of the planetarium's homepage and follow the link in the hotlist to take a virtual walking tour of the Mount Wilson Observatory in California.

If you have access to the **World Wide Web** on the Internet, point your web browser to the following URL:

<http://danenet.wicip.org/mmsd-it/planetarium.html>

Our web site is updated periodically; so check back often. Feedback welcome.

This month, check out the new look of the planetarium's homepage. The hotlist (a list of links to other interesting astronomy sites) has also been updated again this month.

From our homepage, you will be able to browse through general information about the planetarium, suggestions for planning a trip to the planetarium, descriptions of planetarium programs which are available to groups, reservation informa-

tion, dates, information about our monthly public shows, and links to our favorite astronomy and space science WWW sites. In the near future (yes—we are still working on it), you will be able to request reservations for a group planetarium program...on-line from our homepage!

The articles in this month's issue of *Madison Skies* are focussed on the Mount Wilson Observatory. In the hotlist section of our homepage you can follow a link to Mt. Wilson and let your mouse do the walking on their virtual tour of the facility. To find the tour, follow the Tourist Information link on their homepage. The tour includes stops at the larger telescopes, the 24" TIE telescope, and even the gift shop.

Enjoy your visit, and take a moment to check out some of our other links!

APPENDIX IV

Workshop and Lecture Evaluations

Questionnaire: Public Space Science Lectures, June 9-13, 1996
Space Science & Engineering Center
University of Wisconsin-Madison

Please help us in planning future lectures or other activities by filling out this questionnaire. You may mail this form, or send your input by e-mail to planets@ssec.wisc.edu

Where did you hear about the lectures?

Wisconsin State Journal The Capital Times Isthmus Internet/World Wide Web/E-mail

Television Radio Flyers Other *UW Bull. Board*

Your Approximate Age: *43*

Which lecture(s) did you attend? Sunday Monday Tuesday Wednesday Thursday

Did you find the location convenient? Yes No

Was the time convenient? Yes No

Would you attend similar events in the future? Yes No May be

Did you find the lectures interesting and understandable? Yes No Somewhat

The Division of Planetary Sciences (American Astronomical Society) will hold its 30th Annual Meeting in Madison in October, 1998. Approximately 800 scientists involved in Solar System research are expected to attend. What sort of public outreach and K-12 educational activities would you envision supporting or participating in or help arrange?

Lectures Exhibition School Visits Interaction in small groups

Other: *LIVE TV Broadcast on WHA-TV-21*

Comments about the current series of lectures, speakers and topics:

EXCELLENT, BETTER THAN TV OR VIDEO

Questionnaire: Public Space Science Lectures, June 9-13, 1996
Space Science & Engineering Center
University of Wisconsin-Madison

Feed 4

Please help us in planning future lectures or other activities by filling out this questionnaire. You may mail this form, or send your input by e-mail to planets@ssec.wisc.edu

Where did you hear about the lectures?

Wisconsin State Journal The Capital Times Isthmus Internet/World Wide Web/E-mail

Television Radio Flyers Other

Your Approximate Age:

45

Which lecture(s) did you attend? Sunday Monday Tuesday Wednesday Thursday

Did you find the location convenient? Yes No

Was the time convenient? Yes No

Would you attend similar events in the future? Yes No May be

Did you find the lectures interesting and understandable? Yes No Somewhat

The Division of Planetary Sciences (American Astronomical Society) will hold its 30th Annual Meeting in Madison in October, 1998. Approximately 800 scientists involved in Solar System research are expected to attend. What sort of public outreach and K-12 educational activities would you envision supporting or participating in or help arrange?

Lectures Exhibition School Visits Interaction in small groups

Other:

Comments about the current series of lectures, speakers and topics:

Both lectures were informative —
Thank you for offering these to the public.

Questionnaire: Public Space Science Lectures, June 9-13, 1996
Space Science & Engineering Center
University of Wisconsin-Madison

#2
Feed 2

Please help us in planning future lectures or other activities by filling out this questionnaire. You may mail this form, or send your input by e-mail to planets@ssec.wisc.edu

Where did you hear about the lectures? *Paper*

Wisconsin State Journal The Capital Times Isthmus Internet/World Wide Web/E-mail
Television Radio Flyers Other

Your Approximate Age: *53*

Which lecture(s) did you attend? Sunday Monday Tuesday Wednesday Thursday

Did you find the location convenient? Yes No

Was the time convenient? Yes No

Would you attend similar events in the future? Yes No May be

Did you find the lectures interesting and understandable? Yes No Somewhat

The Division of Planetary Sciences (American Astronomical Society) will hold its 30th Annual Meeting in Madison in October, 1998. Approximately 800 scientists involved in Solar System research are expected to attend. What sort of public outreach and K-12 educational activities would you envision supporting or participating in or help arrange?

Lectures Exhibition School Visits Interaction in small groups
Other:

Comments about the current series of lectures, speakers and topics: *Terrific. A nice mix of science and anecdote. Thank you.*

Questionnaire: Public Space Science Lectures, June 9-13, 1996
Space Science & Engineering Center
University of Wisconsin-Madison

Please help us in planning future lectures or other activities by filling out this questionnaire. You may mail this form, or send your input by e-mail to planets@ssec.wisc.edu

Where did you hear about the lectures?

Wisconsin State Journal The Capital Times Isthmus Internet/World Wide Web/E-mail
Television Radio Flyers Other Astronomy Summer Course 1996 MATC Downtown Campus

Your Approximate Age: 27

Which lecture(s) did you attend? Sunday Monday Tuesday Wednesday Thursday

Did you find the location convenient? Yes No

Was the time convenient? Yes No

Would you attend similar events in the future? Yes No May be

Did you find the lectures interesting and understandable? Yes No Somewhat

The Division of Planetary Sciences (American Astronomical Society) will hold its 30th Annual Meeting in Madison in October, 1998. Approximately 800 scientists involved in Solar System research are expected to attend. What sort of public outreach and K-12 educational activities would you envision supporting or participating in or help arrange?

Lectures Exhibition School Visits Interaction in small groups

Other:

Comments about the current series of lectures, speakers and topics:

I really enjoyed this lecture. It was very easy to understand and fun to learn about unknown areas seeing as how I have only just started in this course. (Not even a week!)

Thankyou for a great Lecture!

Questionnaire: Public Space Science Lectures, June 9-13, 1996
Space Science & Engineering Center
University of Wisconsin-Madison
1225 West Dayton Street, Madison, Wisconsin 53706

Please help us in planning future lectures or other activities by filling out this questionnaire. You may mail this form, or send your comments by e-mail to planets@ssec.wisc.edu. Thank you.

Where did you learn about the lectures? Wisconsin State Journal

Name and Address (Optional): Joseph McDonald
162 E. Taylor St.
Cottage Grove, WI 53527

Wisconsin State Journal The Capital Times Isthmus Internet/World Wide Web/E-mail
Television Radio Flyers Other

Your Approximate Age: 41

Which lecture(s) did you attend? Sunday (Sheehan) Monday (Black) Wednesday (Briggs) Thursday (Trauger)

Did you find the location convenient? Yes No

Was the time convenient? Yes No
but 1/2 hour later would be better.

Would you attend similar events in the future? Yes No May be

Did you find the lectures interesting and understandable? Yes No Somewhat

The Division of Planetary Sciences (American Astronomical Society) will hold its 30th Annual Meeting in Madison in October, 1998. Approximately 800 scientists involved in Solar System research are expected to attend. What sort of public outreach and K-12 educational activities would you envision supporting or participating in or help arrange?

Lectures Exhibition School Visits Interaction in small groups Other (please explain)

Comments about the current series of lectures, speakers and/or topics:

All of the lectures were good. This is a subject that lends itself well to multi-media. Some were better at this than others. Black's lecture made good use of this. Trauger did an excellent job.
I would say all of the lectures could have aimed a little higher regarding the knowledge of the audience. I am interested in astronomy in general but certainly not trained in the field. I could have handled a somewhat higher level of information. Thanks for including

4-1
Feed!

Questionnaire: Public Space Science Lectures, June 9-13, 1996
Space Science & Engineering Center
University of Wisconsin-Madison
1225 West Dayton Street, Madison, Wisconsin 53706

Please help us in planning future lectures or other activities by filling out this questionnaire. You may mail this form, or send your comments by e-mail to planets@ssec.wisc.edu. Thank you.

Where did you learn about the lectures?

Name and Address (Optional):

Wisconsin State Journal The Capital Times Isthmus Internet/World Wide Web/E-mail
Television Radio Flyers Other

Your Approximate Age: 24

Which lecture(s) did you attend? Sunday (Sheehan) Monday (Black) Wednesday (Briggs) Thursday (Trauger)

Did you find the location convenient? Yes No

Was the time convenient? Yes No

Would you attend similar events in the future? Yes No May be

Did you find the lectures interesting and understandable? Yes!! No Somewhat

The Division of Planetary Sciences (American Astronomical Society) will hold its 30th Annual Meeting in Madison in October, 1998. Approximately 800 scientists involved in Solar System research are expected to attend. What sort of public outreach and K-12 educational activities would you envision supporting or participating in or help arrange?

Lectures Exhibition School Visits Interaction in small groups Other (please explain)

Comments about the current series of lectures, speakers and/or topics:

WONDERFUL!

WSGC WORKSHOP EVALUATION
Summer 1996

Please let us know how you enjoyed (or didn't) each section of the agenda and if you would recommend we include it in next year's Workshop

Session
FRIDAY JULY 26, 1996

Enjoy Greatly (Agree)	Somewhat Enjoyed (Agree)	No Opinion	Didn't Enjoy (Disagree)	Strongly Didn't Enjoy (Disagree)
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1. Weather for Breakfast: Forecasting Weather	18	4	3	1
2. Groundwater Presentation	6	10	1	7
3. Earthquake Presentation	13	9	2	2
4. Visit to the Geology Museum	19	9		1

OVERALL WORKSHOP EVALUATION

1. Sessions on Meteorology	18	6	1	1
2. Sessions on Land Remote Sensing (Tuesday)	10	8	4	4
3. Sessions on Engineering (Tuesday)	8	12	2	4
4. Sessions on Geology and Geophysics	15	7	1	2
5. Session on Astronomy	22	4		
6. I would recommend this Workshop to others	26			

(Please tell us why you did or did not enjoy the Workshop, and add any other comments (use back of page).)

Feedback on Resources for Astronomy and Space Science Education Sessions
5th Workshop on Atmospheric, Earth, and Space Science
Space Science & Engineering Center
University of Wisconsin-Madison

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Name (Optional): Doris Dubielzig
Grades Taught: Elementary Middle High School
 K 1 2 3 4 5 6 7 8 9 10 11 12

Where did you learn about the Workshop: Through WSGC mailings and Sanjay Limaye.

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful

Comments: I liked the standards and Vivian's expertise. She understands the relationship between the content and making it a learning experience for students.

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful

Comments: Jan Wee is a tremendous font of reference information, and her enthusiasm is infectious. I will follow up with contacting some of her projects, esp. Life from Mars, for my classes.

Remote Observing: Not Very Useful Somewhat Useful Very Useful

Comments: I was attracted to this workshop by this activity. At this point, there are too many technical difficulties for me to embrace this activity with a classroom of 8th grade students.

Web Resources: Not Very Useful Somewhat Useful Very Useful

Comments: will use !!

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful

Comments: Marianne's presentation - geared towards elementary education, was excellent, and really addressed how to teach content and concepts. Loved it!!

Handouts: Not Very Useful Somewhat Useful Very Useful

Comments:
 ① Thanks for all of the good stuff!
 ② Should have a computer lab available & computer available for each person.

Please provide general comments on the back →

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Name (Optional):

Grades Taught: **Elementary** **Middle** **High School**
 K 1 2 3 4 5 **6 7 8** **9 10 11 12**

Where did you learn about the Workshop: SANJAY

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful

Comments: BETTER TOWARDS END OF PRESENTATION. NEAT MATERIAL

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful

Comments: EXCELLENT PRESENTATION - WELL WORTH THE TIME

Remote Observing: Not Very Useful Somewhat Useful Very Useful

Comments: I HAVE TO ADMIT I WAS DISAPPOINTED - NOT WITH WEATHER, BUT THAT LINK UP HADN'T BEEN TRIED OUT BEFORE OBSERVATION TIME

Web Resources: Not Very Useful Somewhat Useful Very Useful

Comments: NOT MUCH TIME GIVEN TO THIS, BUT I APPRECIATED ALL THE ADDRESSES

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful

Comments: WELL PRESENTED
 SOME GOOD IDEAS

Handouts: Not Very Useful Somewhat Useful Very Useful

Comments: THANKS FOR ALL THE WONDERFUL INFO!

Please provide general comments on the back →

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Name (Optional): T. ADAS
Grades Taught: Elementary Middle High School
 K 1 2 3 4 5 6 7 8 9 10 11 12

Where did you learn about the Workshop: PREVIOUS EXPERIENCE / DISCUSSION WITH SANJAY LIMAYE

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful

Comments:
 VERY INTERESTING
 WILL TRY TO ATTEND THEIR WORKSHOP

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful

Comments:
 GOOD INFO

Remote Observing: Not Very Useful Somewhat Useful Very Useful

Comments:
 COST? / WILL TRY FOR IT.

Web Resources: Not Very Useful Somewhat Useful Very Useful

Comments:
 NOT NEW INFO
 I USE WEB ALREADY

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful

Comments:
 MANY EXCELLENT IDEAS

Handouts: Not Very Useful Somewhat Useful Very Useful

Comments:
 LOTS OF GOOD INFO
 POTENTIAL FOR CLASSROOM USE.

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Name (Optional):

Grades Taught: **Elementary** **Middle** **High School**
 K 1 2 3 4 5 **6 7 8** **9 10 11 12**

Where did you learn about the Workshop:

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful
Comments:

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful
Comments:

Remote Observing: Not Very Useful Somewhat Useful Very Useful
Comments:

Web Resources: Not Very Useful Somewhat Useful Very Useful
Comments:

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful
Comments:

Handouts: Not Very Useful Somewhat Useful Very Useful
Comments:

Please provide general comments on the back→

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Name (Optional):

Grades Taught: **Elementary** **Middle** **High School**
 K 1 2 3 4 **5** 6 7 8 9 10 11 12

Where did you learn about the Workshop:

Hands-on- Universe: Not Very Useful Somewhat Useful Very Useful

Comments:
Enjoyed the activity with star cards

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful

Comments:
Enjoyed her enthusiasm and ideas

Remote Observing: Not Very Useful Somewhat Useful Very Useful

Comments:

Web Resources: Not Very Useful Somewhat Useful Very Useful

Comments:
Always looking for quick sites

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful

Comments:
Excellent ideas - Super presenter

Handouts: Not Very Useful Somewhat Useful Very Useful

Comments:
I find them very informative

Please provide general comments on the back →

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Name (Optional):

Grades Taught: **Elementary** **Middle** **High School**
 K 1 2 3 4 5 **6 7 8** **9 10 11 12**

Where did you learn about the Workshop:

FROM BILL SMITH

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful

Comments:

Very good - interesting + exciting

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful

Comments:

Good

Remote Observing: Not Very Useful Somewhat Useful Very Useful

Comments:

Seeing how its done was good its too bad there were so many technological problems

Web Resources: Not Very Useful Somewhat Useful Very Useful

Comments:

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful

Comments:

Too low level (elementary) for me

Handouts: Not Very Useful Somewhat Useful Very Useful

Comments:

Please provide general comments on the back→

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Name (Optional):

Grades Taught: Elementary Middle High School
 K 1 2 3 4 5 6 7 8 9 10 11 12

Where did you learn about the Workshop:

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful

Comments:

It would have been useful, if she had shown us the capabilities of the ^{computer} system 1st, then let us manipulate it and the info

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful

Comments:

*well sequenced -
 disconcerting that our technology did not work so that we could "see" its capability*

Remote Observing: Not Very Useful Somewhat Useful Very Useful

Comments:

information overload

Web Resources: Not Very Useful Somewhat Useful Very Useful

Comments:

I need more experience with the use of the Web.

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful

Comments:

more variety in this presentation helpful at end of day.

Handouts: Not Very Useful Somewhat Useful Very Useful

Comments:

*seem to be very helpful
 have not read through them.*

Please provide general comments on the back →

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Name (Optional):

Grades Taught: Elementary Middle High School
 ~~K 1 2 3 4 5~~ 6 7 8 9 10 11 12

Where did you learn about the Workshop: *school handout*

Hands-on-Universe: Not Very Useful Somewhat Useful Very Useful
Comments:

Passport to Knowledge: Not Very Useful Somewhat Useful Very Useful
Comments:

We should each have our own computer to truly explore + understand programs

Remote Observing: Not Very Useful Somewhat Useful Very Useful
Comments:

Web Resources: Not Very Useful Somewhat Useful Very Useful
Comments:

Universe in the Classroom: Not Very Useful Somewhat Useful Very Useful
Comments:

Handouts: Not Very Useful Somewhat Useful Very Useful
Comments:

Please provide general comments on the back →