

Astronomy Day Handbook, 7th edition



By David H. Levy

with contributions by
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Use of This Handbook

This Handbook was designed to assist institutions, organizations, individuals and combinations thereof to plan and execute special events for Astronomy Day. Therefore, groups hosting Astronomy Day events have permission to:

- Print out this entire Handbook
- Duplicate all or part of this Handbook for local Astronomy Day volunteers

For any other use, contact the Astronomical League and/or *Sky & Telescope*.

About the Authors and Editors

David H. Levy is one of the most successful comet discoverers in history, discovering 21 comets, eight of them using his own backyard telescopes. With Eugene and Carolyn Shoemaker at Palomar Observatory in California he discovered Shoemaker-Levy 9, the comet that collided with Jupiter in 1994. That episode produced the most spectacular explosions ever witnessed in the solar system. Levy, the author of more than 30 books, is an Emmy Award winner and former Science Editor for *Parade* magazine who has reached almost a quarter of the population of the United States. A longtime contributor to *Sky & Telescope* magazine, he has appeared on many television programs, such as *The Today Show*, *Good Morning America*, and *ABC's World News Tonight*, where he and the Shoemakers were named Persons of the Week for July 22, 1994. From 2000 to 2010 he and his wife, Wendee, hosted a weekly radio

show available worldwide at letstalkstars.com. Asteroid 3673 (Levy) was named in his honor. Levy resides in Vail, Arizona.

Gary Tomlinson is a retired astronomy educator from the Chaffee Planetarium in Grand Rapids, Michigan, winner of the first Astronomy Day award, and author of the first two editions of this Handbook. He was SIPCA agent for the Harvard-Smithsonian Center for Astrophysics, has been Astronomy Day Coordinator since June 1983, and has been on the Board of Directors (including 2 years as President) of the Great Lakes Planetarium Association since 1984. He is also a member of $\Sigma\pi\Sigma$ (national physics honorary) and ΣZ (national science and math honorary). He was designated a “Hoosier Scholar” by the Governor of Indiana and has spent his entire professional career promoting astronomy as well as being the recipient of several awards and honors.

Robert Horgan, an amateur astronomer, currently resides in Japan.

J. Kelly Beatty, a *Sky & Telescope* Senior Editor, writes many of the feature articles and news items found in the magazine and on its website. He joined the staff of Sky Publishing in 1974 and served as the editor of *Night Sky*, a magazine for beginning stargazers, in 2004-07. Kelly is active nationally in the fight against light pollution, and he serves on the board of Directors of the International Dark-Sky Association.

Dr. W. Maynard Pittendreigh has published in *Sky & Telescope* and *Astronomy* magazines. He discovered the Astronomical League (AL) as a teenager in 1970 when he was seeking help to prepare him for observing his first solar eclipse. Having been an amateur astronomer for over 50 years, he has had time to earn over 40 certificates in the League’s various observing programs, including earning the Master Observer in 2009. He is a Life Member of the AL and is currently a member of the Brevard Astronomy Society on Florida’s Space Coast. Dr. Pittendreigh is a Presbyterian pastor by profession and has lectured and written frequently on science and faith.

Al Lamperti has been involved in amateur astronomy since 1984 and is an accomplished observer having received over 35 observing certificates (including Master Observer) from the Astronomical League. He has published and lectured extensively on astronomy. He is also a member of the Astronomical Society of the Pacific’s Project ASTRO and the Delaware Valley Amateur Astronomers.

Bryan Tobias has been an astronomer for over 40 years and currently runs the Curtis Vaughan Observatory at the University of Texas at San Antonio. He is also working on his degree in astrophysics.

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What is the Astronomical League?

Plans to establish the Astronomical League began in the 1930s, and in November 1941, the League's first bylaws were published in *Sky and Telescope* magazine. World War II delayed incorporation until 1947. At that time, the League had 31 member societies with about 1,500 members. As of 2016, the Astronomical League included over 295 societies and 16,500 members, and it is the largest amateur astronomy organization in the world. The Astronomical League is a nonprofit federation of amateur astronomical societies and individuals who promote the science of astronomy:

- * By fostering astronomical education.
- * By providing incentives for astronomical observation and research, and
- * By assisting communications among amateur astronomical societies.

Benefits of Astronomical League Membership are:

- *The Reflector*, the League's colorful, award-winning magazine
- 10% off list price on many astronomy books
- Young astronomer awards and scholarships, including the National Young Astronomer Award and the Horkheimer Youth Awards
- An award-winning website featuring a wide variety of astronomical information
- Resources for teaching an astronomy class or giving presentations
- Helping control light pollution and restoring our vanishing night skies.
- Dozens of astronomical observing programs and certificates
- Members are eligible for a number of national awards such as the *Newsletter Editor of the Year* and the *Webmaster of the Year* awards.
- Annual conventions, often jointly hosted by other international astronomical organizations
- Affordable liability insurance
- League Sales and Publications – observing handbooks and many other products are available at discount prices

In late 2003, the Astronomical League opened its very first national office. For more information about these services or membership contact:

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Astronomy Day Cosponsors

Astronomy Day is cosponsored by 14 astronomical and educational organizations:

ASTRONOMICAL LEAGUE astroleague.org

The Astronomical League bylaws were ratified in 1941 but not incorporated until 1947 because of World War II. It is a nonprofit federation of nearly 300 amateur astronomy clubs and over 16,000 individuals. Individual and international membership in the Astronomical League is also possible.

SKY & TELESCOPE skyandtelescope.com

Founded in 1941, *Sky & Telescope* magazine has the most experienced editorial staff of any astronomy magazine in the world. The magazine also maintains an online library with thousands of freely accessible articles about all aspect of astronomical science and observing the night sky.

ASTRONOMICAL SOCIETY OF THE PACIFIC astrosociety.org

The Astronomical Society of the Pacific, founded in 1889, has become the largest general astronomy society in the world, with members from over 70 nations. The Society offers programs and activities for each unique part of their membership. The ASP has also developed into the recognized leader in the field of astronomy education, offering many programs for astronomers and teachers alike.

ROYAL ASTRONOMICAL SOCIETY OF CANADA rasc.ca

The beginnings of the “Royal Astronomical Society of Canada” (RASC) go back to the middle of the 19th century. The Society was incorporated within the province of Ontario in 1890, received its Royal Charter from King Edward VII in 1903, and was federally incorporated in 1968. Today there are 28 Centres across Canada with over 4,900 members worldwide.

AMERICAN ASTRONOMICAL SOCIETY aas.org

The American Astronomical Society, established in 1899, is the major organization of professional astronomers in North America. The AAS promotes the advancement of astronomy and closely related branches of science. Its roughly 6,500 members have diverse research interests that lie within the broad spectrum of subjects now comprising contemporary astronomy.

ASTRONOMICAL ASSOCIATION OF NORTHERN CALIFORNIA

sites.google.com/site/aancsite/home

AANC is an association of astronomy clubs in the northern California area and the founding organization of Astronomy Day.

WESTERN AMATEUR ASTRONOMERS waa.av.org

The Western Amateur Astronomers was formed as a regional group of local astronomy clubs to combine their efforts to establish a better understanding of the field of astronomy.

AMERICAN ASSOCIATION OF PHYSICS TEACHERS aapt.org

AAPT was established in 1930 with the goal of ensuring the “dissemination of knowledge of physics, particularly by way of teaching.” In addition to helping members learn about traditional teaching methods, AAPT promotes new methods and use of modern technology to entice students with the wonders of science.

ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS alpo-astronomy.org

The Association of Lunar and Planetary Observers (A.L.P.O.) was founded by the late Walter H. Haas in 1947, and incorporated in 1990, as a medium for advancing and conducting astronomical work by both professional and amateur astronomers who share an interest in solar system observations. Its goals are to stimulate, coordinate, and generally promote the study of these bodies using methods and instruments that are available within the communities of both amateur and professional astronomers.

AMERICAN METEOR SOCIETY amsmeteors.org

The American Meteor Society, Ltd., is a nonprofit scientific organization established to encourage and support the research activities of both amateur and professional astronomers who are interested in the fascinating field of meteor astronomy. Its affiliates observe, monitor, collect data on, study, and report on meteors, meteor showers, meteoric fireballs, and related meteoric phenomena.

AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS aavso.org

The AAVSO was founded in 1911 at Harvard College Observatory to coordinate variable star observations made largely by amateur astronomers. In 1954, the AAVSO became an independent, private research organization. Today it has members in more than 40 countries, with over 10 million observations to date. It is the world's largest association of variable-star observers.

THE PLANETARY SOCIETY planetary.org

The Planetary Society is the largest nonprofit, nongovernmental, space-advocacy group on Earth. Funded entirely by individuals, the Society helps to make space exploration happen in many different ways.

NATIONAL SPACE SOCIETY www.nss.org

The National Space Society (NSS) is an independent, international, educational, grassroots nonprofit 501(c)3 organization dedicated to the creation of a spacefaring civilization. The NSS has more than 22,000 members and 75 chapters in the United States, Canada, Mexico, Australia, Germany, Ireland, and the United Kingdom. The NSS, founded in 1974 by Wernher von Braun, is widely acknowledged as the preeminent citizen's voice on space.

INTERNATIONAL PLANETARIUM SOCIETY ips-planetarium.org

The International Planetarium Society (IPS) is the largest organization of professional planetarians in the world. It is made up of members from almost every continent, and has nearly 20 smaller affiliate organizations.

In addition, the **INTERNATIONAL ASTRONOMICAL UNION** iau.org, a worldwide group of professional astronomers, endorses the concept of Astronomy Day.

Preface

Note to Educators

Astronomy Day is a great tool for educators. Teachers have taken their entire classes to Astronomy Day events. Whole classes and /or schools have entered poster or art contests held for Astronomy Day. The Zavala Magnet School (Odessa, TX) hosted a whole weeklong series of events including astronomy workshops for teachers, special family and public activities plus several other activities that involved the whole school. And the list goes on.

Teachers can use Astronomy Day as a tool to educate about astronomy or to have astronomy enthusiasts come into their classroom. In addition, many sections of this Handbook should be useful to teachers desiring resources and ideas for teaching astronomy. Of particular interest to educators are these sections: Model of the Solar System, Astronomy Day for Children, Astronomy Day for Teachers, Sky-Q Quiz, Astronomical Art Contest, Lectures, NASA Lectures & Astronauts, Moon Rocks — plus Resource Addresses and the Teacher Resource Guide in the Appendix.

Using Other Organizations in Your Area

Astronomy Day is supposed to be fun — fun for you, fun for your organization, and certainly fun for the public. This Handbook is filled with all sorts of suggestions designed to make Astronomy Day a success. As you read through it, keep your organization in mind. Plan an event that your members can coordinate and enjoy. Remember that on a Saturday afternoon the public wants to be entertained as much as educated. If people leave your event not quite remembering what a pulsar is, that is not important. But if they leave remembering that they did astronomy and had fun, you have succeeded in your goal.

Most of the information in this Handbook comes from experience gained by hosting Astronomy Day celebrations over the past several years. In this Handbook, we have tried to cover everything you might want to know about how to mount a successful Astronomy Day program. You can make Astronomy Day as simple or as complicated as your club's resources and enthusiasm allow, from a few telescopes set up on a street corner to a mall display and multiple events going on all over town.

Besides providing an opportunity to set up telescopes that people can look through, Astronomy Day can have a very important impact on teachers. Although astronomy is a favorite subject with children, many elementary-school teachers know very little about the subject. By showing teachers that there are people and resources out there willing to help, Astronomy Day can lead to better astronomy exposure in the schools. Invite teachers to bring their classes to your displays and events.

We strongly encourage organizations to band together to cosponsor events and involve all astronomical organizations in the area. A local club might join with a planetarium, museum, library or college astronomy or physics department, resulting in a bigger and better event.

History of Astronomy Day

San Francisco has long been in the forefront of bringing astronomy to the public. Early in 1974, amateur astronomer David Levy was visiting Golden Gate Park when he saw a whole set of telescopes pointed at the Sun, complete with adequate precautions. John Dobson was in charge of the display; he had built all the telescopes himself with the sole purpose of showing off the sky from locations as diverse as downtown sidewalks and remote mountaintops. Levy was surprised to see that the telescopes were attracting dozens of people; “I’ve seen telescopes in stores before,” smiled one onlooker, “but this is the first time I’ve ever had the chance to look through one. Especially a big one.”

Astronomy clubs have long offered public events. During the 1950s and 1960s, for example, one group held an annual Star Night near the time of first-quarter Moon each September in a large city park. Members set up their telescopes at specifically planned spots and kept them trained on assigned objects; depending on a telescope’s strengths it might be assigned the Moon, one of the planets, a double star, a globular cluster, or the Andromeda Galaxy. Because the park was located next to a large artificial skating rink, the entire event could be moved indoors in bad weather, on a few hours’ notice.

In San Francisco, John Dobson’s approach was to set up anywhere and anytime, and to do this he founded an informal band of stargazers called the San Francisco Sidewalk Astronomers sfsidewalkastronomers.org. At about the same time Doug Berger, a well-known amateur astronomer also from the Bay Area, was looking from a different angle at the problem of spreading the joy of astronomy. Why not get everyone organized around a single day, he thought, concentrating in the heavily populated urban areas — “Bringing Astronomy to the People” rather than the other way around? This event could then be used to promote the more traditional public events held later in the year. Thus, in 1973, Doug Berger and the Astronomical Association of Northern California (AANC) held the first Astronomy Day.

The event soon spread to the point where it was beyond the scope of the AANC’s region. That’s when the Astronomical League started coordinating the event and promoting it across North America. As Astronomy Day spread outside North America to become International Astronomy Day, the League continued to coordinate the event but now other national and international astronomy and astronomy-education organizations joined the League as cosponsors. So now Astronomy Day, having been held at hundreds of North American locations and more than a dozen foreign countries, is truly international in scope.

Latest Astronomy Day Information

The Astronomical League’s website, astroleague.org/al/astroday/astroday.html, contains the latest information about the current Astronomy Day along with important reminders, resources, activities and other important announcements. Some years will have a special theme (in addition to the standard theme: “Bringing Astronomy to the People”). **Be sure** to check this website at least once a year (more often is better). More importantly, this website also allows groups to input local Astronomy Day events for the whole world to see including media and the general population. This is the only place that records all Astronomy Day events in one spot. **Be sure** to list your Astronomy Day event each and every year!

PART I: Your Objectives

What is Astronomy Day?

What exactly is Astronomy Day? It is one day set aside each spring and fall for astronomy clubs, planetariums, and other groups of sky lovers to band together to show the public how much fun astronomy can be. “To promote the forerunner of all scientific endeavors and to provide information, resources, and encouragement in all facets of astronomy” is the official reading, but showing that astronomy is fun is really what it’s all about. “Taking astronomy to the people,” “Astronomy is fun!,” “Watch the sky,” and “Look up!” are all slogans that have been used successfully on Astronomy Day, as well as the official slogan: “Bringing Astronomy to the People.” Some astronomy clubs have expanded the celebration into an entire “Astronomy Week.”

When is Astronomy Day?

Spring Astronomy Day is usually celebrated between mid-April and mid-May, on the Saturday closest to the first-quarter Moon. Fall Astronomy Day is celebrated sometime between mid-September and mid-October. You can host events on either or both dates.

You should, however, host events when they best suit your needs. The table below shows the dates for Astronomy Day and its more ambitious relative, Astronomy Week, for the next few years. For the most up-to date listing of dates consult the League’s Astronomy Day web page: astroleague.org/astronomyday/facts.

The exact formula for determining the date for Astronomy Day is to first determine the date of the first-quarter Moon during the appropriate time period and then choose the closest Saturday to this date such that the Moon is visible in the evening sky. This is achieved by starting with the date of the first-quarter Moon. If that is a Sunday, Monday or Tuesday, the preceding Saturday is selected. If that is a Wednesday, Thursday or Friday, then the next Saturday is selected.

Astronomy Week is the week containing Astronomy Day starting on the preceding Monday and ending on the following Sunday. Choosing Astronomy Week in this fashion allows for some groups to hold an Astronomy Weekend. Some local Astronomy Week celebrations have actually been longer than just one week.

Dates of Astronomy Day are as follows:

<i>Year</i>	<i>1st quarter Moon</i>	<i>Astronomy Day</i>	<i>Days from New Moon</i>	<i>Astronomy Week</i>	<i>Theme**</i>
2017, Spring	Tue, 5/2	4/29	4	4/24-30	Total Solar Eclipse
2017, Fall	Wed, 9/27	9/30	10	9/25-10/1	
2018, Spring	Sun, 4/22	4/21	6	4/16-4/22	
2018, Fall	Tue, 10/16	10/13	4	10/8-10/14	
2019, Spring	Sat, 5/11	5/11*	7	5/6-5/12	
2019, Fall	Sat, 10/5	10/5	7	9/30-10/6	
2020, Spring	Thur, 4/20	5/2	9	4/27-5/3	
2020, Fall	Wed, 9/23	9/26	10	9/21-9/27	

<i>Year</i>	<i>1st quarter Moon</i>	<i>Astronomy Day</i>	<i>Days from New Moon</i>	<i>Astronomy Week</i>	<i>Theme**</i>
2021, Spring	Wed, 5/19	5/15	10	5/10-5/16	
2021, Fall	Tue, 10/12	10/9	4	10/4-10/10	
2022, Spring	Sun, 5/8	5/7*	6	5/2-5/8	
2022, Fall	Sun, 10/2	10/1	6	9/26-10/2	
2023, Spring	Thur, 4/27	4/29	9	4/24-4/30	
2023, Fall	Fri, 9/22	9/22	8	9/18-9/24	
2024, Spring	Wed, 5/15	5/18	10	5/13-5/19	
2024, Fall	Wed, 10/10	10/12	10	10/7-10/13	
2025, Spring	Sun, 5/4	5/3	6	4/28-5/3	
2025, Fall	Mon, 9/2	9/27	5	9/22-9/28	

**Mother's Day weekend in the U.S.*

***The theme of Astronomy Day is "Bringing Astronomy to the People," but on occasion there is an additional theme (but not always) when conditions warrant. This additional theme is often decided just a few months prior to Astronomy Day, so be sure to check the Astronomical League's website www.astroleague.org/al/astroday/astroday.html for any additional theme.*

Why is There a Spring and Fall Astronomy Day — and Both with a First-Quarter Moon?

In a survey the Astronomical League did back in the 1980s, four out of five respondents preferred a spring date, so for many years there was only a spring Astronomy Day. In 2007, a fall Astronomy Day was added. Groups are encouraged to choose the one that best fits their local circumstances. Of course, groups are free to celebrate both spring and fall dates. An evening with a near first-quarter Moon filled with craters is one of the most impressive celestial sights visible from all urban areas.

If holding Astronomy Day during a bright Moon is of concern, you may, of course, choose another date, but keep in mind that you don't have to show deep-sky objects to celebrate Astronomy Day. Since deep-sky objects are best viewed at new Moon anyway, why not entice Astronomy Day visitors to visit your dark-sky location at a later date? Use Astronomy Day as the hook to capture their attention.

Why Sponsor Astronomy Day?

Astronomy Day is a great way to put your organization(s) before the community. Having the public look through a telescope and view your displays can generate a good deal of publicity, especially if the press gets involved. It spreads the word and joy of astronomy throughout the community, and could also add to your membership roster. Perhaps most important, Astronomy Day is fun and a good boost of morale for your club's members. It brings them together for a day of sharing their love of the sky with other people. Plus, it is an opening to talk about light pollution. When \$2 billion a year is spent to light up the underbellies of airplanes and birds, this issue should concern everyone.

Where to Get Help for Your Astronomy Day Event

The first place to look is the Astronomical League's website for Astronomy Day, astroleague.org/al/astroday/astroday.html. There are several pages on this site, so be sure to check them all.

Joining with other nonprofit organizations, like museums and planetariums, other astronomy clubs, and pro-space groups, can enhance your event. Your local university's astronomy or physics department should be interested, as well as science clubs in your local high school. The organizations listed at the back of this book might also have a few suggestions. The more people and groups that are brought into this event, the better your chances are for good publicity and a large turnout. Sponsors can help with financial contributions, providing free exhibit space or audiovisual equipment, helping with publicity — any of a number of things to bring larger crowds and make the event more successful. Besides, it would be a service to the local community to have every organization involved in astronomy represented — sort of like one-stop shopping for local astronomical resources.

Other possible sources of help could be local governments, parks, nature centers, libraries, zoos, and/or military bases. They can provide locations for stargazing nights as well as assist with mundane but important items like security.

Commercial sponsors, such as camera stores and telescope dealers, can also provide the same needed resources. Real-estate companies, grocery stores, or any type of retail outlet may welcome the good PR that comes from being either a sponsor (providing a service or funds) or a host (providing a location). The Berks County Amateur Astronomical Society (Kutztown, PA) hosts Astronomy Day at the local Sam's Club. Not only do club members have telescopes set up, but they also have a bake sale, and Sam's Club matches dollar-for-dollar what they raise.

Of course, getting too many commercial sponsors can give you a big headache if you end up spending your time trying to please everybody. Our suggestion is to try for as many sponsors as the club needs, and as many that feels right for your club. Inviting one telescope store to participate and ignoring the competitor could generate some bad feelings and nasty letters if the left-out dealer thinks its business is being hurt. If you suspect this could be a problem, it might be better to avoid both dealers. Remember, Astronomy Day is supposed to be fun.

At any rate, it is best to put all arrangements in writing to all involved to avoid misunderstandings and to prevent any problems before they form.

Enter the Astronomy Day Award

The best way to share new ideas with others is to enter the Astronomy Day Award astroleague.org/files/astroday/AD%20award%20entry%20form%202016.pdf. Not only does it help spread the word, it might result in some well-deserved recognition and even a little money. All entries must be submitted via e-mail, and up to \$550.00 in five different categories is awarded each year.

PART II: Your Event(s)

Introduction

If you are showcasing an expensive speaker, you might need to charge admission; however, we believe that such fees are mostly inappropriate on Astronomy Day. Writer David Levy remembers when, at age 12, he walked down to his first Star Night. He had only 6 cents in his pocket, just enough for his bus ticket home. “What if the admission fee is six cents?” he thought. You can imagine his palpable relief when he arrived to see friendly faces, not moneyboxes.

Funding Your Event(s)

Astronomy Day is worthy of funding by your club treasury; however, if you can find a sponsor for the whole event or even a specific event (e.g. astronaut lecture) that can go a long way at freeing up funds to expand Astronomy Day events or to fund next year’s Astronomy Day. Selling astronomical items, if permitted by the venue (e.g. eclipse glasses, mugs, hats, etc.) is another idea. Donations are another possibility. The Jackson County Astronomical Society printed up tickets for Astronomy Day listing “donation 25 cents.” In reality, they just gave the tickets away for weeks ahead of time free of charge (this also served as publicity). They didn’t charge anyone to get into Astronomy Day activities, but the fact that people got something for nothing made them feel good. It also made people more willing to donate money (see the sample included in the Appendices).

Where to Host Astronomy Day Events

Places where people are already gathered (i.e. they are not there just because of Astronomy Day, they would be there anyway) are excellent places to host events:

- Shopping malls
- Large retailers (e.g. Sam’s Club, Lowes, etc.)
- Established events (e.g. Art in the Park, sports events, conventions, trade shows, etc.)
- Beaches (if it is in a warm climate)

Places where you have to publicize heavily to bring in people:

- Science Centers and Planetariums
- Nature Centers
- Parks
- City Hall
- Fire Departments
- Libraries
- Observatories

Dealing with the Public

Sometimes it is not easy dealing with the public (but it’s always a lot of fun). They can come up with unusual ideas and on top of that, they expect you to keep them entertained. To that end, listed below are articles everyone should read:

- “A Lesson from Hollywood”, Bob Berman, *Astronomy*, October, 1997, pp. 76-79.
- “A Common Sense Guide to Cosmic Nonsense”, Phil Plait, *Sky & Telescope*, May 2004, pp. 38-43. See also badastronomy.com.

Advertising Posters & Signs

If you want to create your own poster, you can have it professionally created and printed but that is usually quite expensive. The size of a sign or poster that will fit into typical poster stanchions in the U.S. is 22 by 28 inches.

To construct a poster on your own, take any astronomy poster (see the section on posters as well as the Appendix for some sources of astronomical posters) and mount it on a piece of poster board with spray glue, then use computer graphics and signage applied onto the face of the poster.

An even better way in this computer age is to design your own poster and have it printed. Many copy stores can produce your poster from most electronic media.

If you are doing a lot of poster design, you might consider visiting your local college art, communication or advertising department, where you might find students wishing to add to their portfolios. They will probably be delighted to work with you, and they might get some credit for themselves in the process. Again, see the Appendices and the section on posters for sources of astronomical posters.

Observing at Business Sites

Set up daytime or evening outdoor observing at local businesses such as a car dealership, etc. especially one that might provide financial support for Astronomy Day activities. You would be providing the company with some publicity in return for its money. This idea might also help persuade a reluctant firm to become a major sponsor.

Neighborhood Star Parties (Sky Nights)

This is an activity that can be part of a larger event (i.e. just one event of many) or as an individual event when no other Astronomy Day events are planned. Set up a telescope at houses in local neighborhoods and invite the neighbors over for a star party. Individuals have set up in front of their own house (this really is a grass route movement). Every Halloween, Gene Zajac from Ohio sets up his telescope for all the kids (and families) who trick or treat. You could do a similar event for Astronomy Day. In Evansville, Indiana, they set up telescopes at multiple locations across the city such that no one was more than a few miles from an observing site.

Sample Single Programs

A Simple 4-Stage One-Day Program

This Handbook contains a lot of detailed suggestions for varied Astronomy Day programs. Don't let the detail put you off. If you find that a far simpler program would be better, try the

model below, which is based on one by the Royal Astronomical Society of Canada's Montreal Centre. It holds its main event on one day only.

Stage 1:

One month before Astronomy Day, club members approach the media and put up posters around town.

Stage 2:

On Astronomy Day, the club joins with other local astronomy-related groups and sets up a display at the local Dow Planetarium. The room looks like a trade show or exposition. It is impressive to see 10 booths, each with telescopes and displays and paraphernalia; there is a lot to see. The planetarium, with its special Astronomy Day show, is a main drawing card.

The display is quite interactive, with videos, a light pollution PowerPoint show, and a computer. People are attracted to well-arranged, interactive displays. The setup also includes posters, photographs, and a big display on light pollution. During the day they draw up to 1,000 people.

After Astronomy Day is over, club members pack all the exhibits into boxes and store them for next year. After the initial investment of building the displays and planning the exhibits, managing the event from year to year is not difficult. "Once the displays are built," president Louie Bernstein says, "they need little updating from year to year, and future Astronomy Days are quite easy to set up."

Stage 3:

A few weeks after Astronomy Day, the group offers a follow-up visit to their observatory. For Montreal's northern climate, having an observatory session later in the spring makes a lot of sense. "Ten percent of membership is out there for each event," Bernstein says. "We found that 12 reliable volunteers, working eight at a time on partially overlapping shifts, works very well."

Stage 4:

An Open House is held at the observatory at the end of the summer.

A seven-hour drive to the southwest, the RASC's Toronto Centre has an Astronomy Week. They have telescopes set up every night of the week at three or four locations around the city. Part of the program involves displays and booths at Ontario Science Center and a local shopping mall. With 1,000 members, it can handle such an extensive program.

A Simpler Two-Stage Program

If this four-stage process is still too much for your organization, here is an even simpler two-stage process:

Stage 1:

Obtain publicity for the event.

Stage 2:

Put up a couple of telescopes at a central location.

Displays: Sites & Topics

Major Display

The following ideas are useful for several, self-contained events or as part of one large display such as an indoor shopping mall. Hosting Astronomy Day at a well-attended public space, such as an indoor shopping mall or other retail venue, is what Astronomy Day is all about — Bringing Astronomy to the People. There are people already there. These are the people you want to reach — ones who may not realize a hidden interest in astronomy. With all the pre-publicity you generate, you may bring in additional people who already recognize an interest in astronomy — and the venue will be grateful.

You might set up all activities at Site A, or you could have mirror-grinding demonstrations at Site A, telescopes set up to look at the Sun (safely) at Site B, and posters and other exhibits at Site C. Some groups (those with no lack of volunteers) set up duplicates of everything at two or three sites.

When you design a display, keep in mind that the optimum viewing height is between 3 and 6 feet (about 1 to 2 meters). Labels or signs should be large enough to be readable from several yards (meters) away. Use an easy-to-read sans-serif letter style, using both upper and lower case. Keep the explanations short and to the point, like the following example that describes an old refracting telescope:

MEET BETELGEUSE, a refracting telescope from another time and place. Telescopes can help us unlock secrets of the universe of which we are a part. Refractors like this one use an objective lens at the front to gather light from planets, stars, and other objects in space. The light is bent as it travels down the tube, until it reaches a focus at the back. We look through an eyepiece placed at this focus point.

Betelgeuse was built around 1900 by the French firm of Bardou, whose telescopes were popular and respected throughout Europe and North America. This telescope is part of the Jarnac Observatory collection.

Exhibit & Display Ideas for Astronomy Day

Each cosponsoring institution should be given an opportunity to make a display. It should show the extent of astronomical activity in your area, including your organization and any local planetarium. A local observatory, for example, might want to make up its own display and even send its own people to staff it, but be sure the display meets your (and the venue's) quality standards! You might write up guidelines and requirements to ensure that each organization uses the same style, thus causing the displays to have a consistent look.

Large Dobsonian telescopes attract attention like the dinosaur room in a museum. Different types of telescopes belong in such a display, including historical refractors and perhaps a model of a radio telescope. Behind each kind of telescope there should be a poster detailing how it works and picturing larger models of its type.

With the possible exception of the antique brass refractor, these telescopes are not there just to be looked at. Have them set up to look at a distant store sign or at an astronomical postcard taped to a far-off wall.

Photographic displays usually work well — especially dramatic photos of total eclipses. Comet photos, including demonstrations of the orbit of a comet compared to that of the Earth, often attract considerable attention. A large three-dimensional model of a black hole, perhaps using fancy fiber optics to simulate in-falling matter, would be a challenge for club members to prepare, but would attract a great deal of attention.

Astronomy Careers

The American Astronomical Society has a brochure on astronomical careers (aas.org/files/resources/careers-in-astronomy.pdf). Young people might be especially drawn to such an exhibit, so be clear in your description of what astronomers do and what preparation is involved. Don't be too starry-eyed, nor too pessimistic. The best way to do this is to get a local professional to lead a workshop and be available to answer questions. Be sure to highlight local educational institutions with astronomy courses.

Telescope Making & Clinics

Why not grind a mirror from start to finish on Astronomy Day? You could also conduct a telescope clinic. People could bring their telescopes in for advice on how to use or repair them.

Computers & Apps

Computers running astronomical software and smartphone apps have become popular for many people and can be used for Astronomy Day displays. Programs describing the sky at night, complete with motions of the planets and comets, are probably the most appropriate. A satellite-tracking program is also a possibility. Having the Sky-Q Quiz (see page 47) running on a computer also can make a fun activity. Downloading Hubble or other images from the Internet draws a lot of attention too. See, for example:

heritage.stsci.edu/gallery/galindex.html
antwrp.gsfc.nasa.gov/apod/astropix.html
hubblesite.org/newscenter/

If there is a computer store in the mall, perhaps you can get it to loan you some equipment or a Wi-Fi connection.

Starry Bumper Stickers

- Turn off your lights!
- Turn on to astronomy!
- I would rather see starlight than streetlights!

The Astronomical League (store.astroleague.org; click on “Patches & More”) and the Astronomical Society of the Pacific (astrosociety.org/astroshop) offer astronomical bumper stickers that you can buy in quantity and then sell to the public on Astronomy Day. But do make sure the venue will let you sell items. If not, just display them.

Astronomical Postage Stamps

Many nations have issued stamps that relate to astronomy or space. The U.S. Postal Service has two space stamp packets, and some stamp collecting companies have first day covers. If you want more information on stamp collecting, see the following articles: *Mercury*, Jan./Feb. 1977, pp.17-19, and *Sky & Telescope*, Nov. 1977, p. 336; Jan. 1978, pp. 23-26; Mar. 1978, pp. 207-210; May 1978, pp. 391-394; and Jul. 1978, pp. 15-18.

Astronomy & the Arts

This exhibit offers a way to involve the arts in astronomy. Stained glass, hooked rugs, and quilts can add immeasurably to the tone of your display. So can a performance of astronomically oriented music like the *Halley's Comet Rag* or Holtz's *The Planets*. Having a live musical group on-site performing astronomical music would add a lot to any display. An off-site special performance by the local high school or college band or local orchestra would be another great Astronomy Day event.

The Great Lakes Planetarium Association (GLPA) glpa.org/tips has published three booklets of interest here:

- Anthology of Astronomical poetry (TIPS booklet 12). This is a compilation of over 450 astronomical poems along with references to over 40 other sources for poems including whole books of astronomical poems. Poems published in *Sky & Telescope* are also listed (but unfortunately were not able to be reprinted).
- Astronomical Poems (TIPS booklet 13b). This reprints over 275 additional poems and sayings that were missed in the first booklet above.
- Music for the Planetarium (for TIPS booklet 20). This lists over 1500 astronomical songs both lyrical and instrumental along with references to astronomical themed performers.

GLPA members can download each of the above booklets free of charge but you must be a member of GLPA; However membership is open to anybody and is only \$20 (as of 2016).

Involving (months ahead of time) the local quilter's club, stained-glass club, even a garden club (to plant astronomical themed flower beds, etc.) could help both with publicity and staffing. These groups might also help hand out items at your Astronomy Day display.

Solar System Scale Models

If you have a large indoor venue, why not construct a scale model of the solar system, with Neptune at one end and the Sun at other? At each planet's location, place a display (this could be as simple as a poster) about the planet plus directions on how to get to the main Astronomy Day display area. This way, you use the entire venue to advertise your location.

Portable Planetariums

A few companies, such as Science First starlab.com produce simple but surprisingly effective planetariums made to fit in a portable dome. With one of these you could arrange a special demonstration for teachers or the general public. To be put into contact with an owner of a portable dome (e.g. Starlab) in your area, contact:

Science First Starlab
86473 Gene Lasserre Blvd.
Yulee, FL 32097
800-875-3214

Other companies include ePlanetarium eplanetarium.com and Digitalis Education Solutions digitaliseducation.com. Contact them at:

ePlanetarium
P.O. Box 271344
Houston, TX 77277
855-DISC-DOME (347-2366)
info@DigitalisEducation.com

Digitalis Education Solutions
817 Pacific Ave.
Bremerton WA 98337
360-616-8915
info@digitaliseducation.com

Also check your local school system, colleges, planetariums or science centers to see if they have a portable planetarium.

Astrophotos

Today, amateur astrophotos are getting so good, it is often difficult to tell them from the professional. Displaying some of the best, perhaps alongside the professional to illustrate what can be done with home equipment would make an interesting display.

Posters

Displaying large photographs or posters of astronomical objects is an attention getting strategy. If you get an image from the web, just be sure you have permission to reproduce and display the image. Besides *Sky & Telescope* skyandtelescope.com, here are some other picture/poster sources:

- Astronomy Picture of the Day antwrp.gsfc.nasa.gov/apod/astropix.html
- Hubble Space Telescope: stsci.edu
- Space photos and posters: spaceshots.com
- Astrographics: astrographics.com
- Space Images: spaceimages.com

Benefits of the Space Program

Sometimes the general public forgets or is unaware of the return on its space investment dollars. This is an extremely difficult subject to present effectively. People often hear of the vast amounts of money being spent on the space program and believe that money would be better spent “closer to home.” A display reminding them of what they are getting out of the space program might be helpful.

The United States is one of the biggest spenders on space. Although actual budget figures vary from year to year, often times the percentage of federal budget remain close to the same. With a little Internet research, you could calculate the federal budget percentages like these:

US Budget percentages by category (FY2016)

63% Social Security, Welfare, Medicare

6% Interest on National Debt

21% Defense

10% Roads, Education and Everything Else

0.5% Entire NASA budget

Each year NASA publishes a booklet about NASA technology that has been utilized for the public good entitled, “Spinoffs” spinoff.nasa.gov/

Bad Astronomy

There has been a lot written in the past few years about astronomical misconceptions (but that’s a whole other topic). Sometimes people with these misconceptions present their misconceptions as facts or sometimes they just plain misinterpret media reports of scientific findings. One website that everyone should visit is Phil Plait’s Bad Astronomy badastronomy.com. It points out some incorrect conclusions that are often generally accepted. Doing a display on some of the bad science in print, movies, and TV would be an interesting, attention drawing event.

Moon Rocks

Contact the education officer at the NASA center serving your area nasa.gov/offices/education/centers/index.html to see if it would be possible to arrange for a loan of a Moon rock. There are two types of Moon rocks that NASA loans. One is a museum-quality display in a pyramid-shaped plastic encasement. These require high security and are available to qualified individuals or organizations without special training (contact your regional NASA center-see Resources in the Appendices). The other type contains five small samples in a cylinder-shaped plastic encasement. These require less security (they can be mailed; the other type cannot) but require special training. These are designed to be used with a microscope in the classroom. Check to see if a local teacher has had this special training. If so, he or she can contact the Johnson Space Center on behalf of your club. Also, you could do a display on meteorites or make a comet using dry ice and some other common ingredients noao.edu/education/crecipe.html.

Light & Spectra

An exhibit on one of the most important tools in astronomy must not be overlooked. A display detailing that astronomy uses all frequencies of light (not just visible light) to investigate the Universe can be made quite interesting by using “down-to-Earth” applications of different frequencies of light such as using an infrared (IR) thermometer. NASA has several posters on spectra and utilizing different frequencies of light. Also, your local fire department uses IR devices in firefighting (as do some energy conservation, home insulations and utility — gas and electric — companies) so they might participate as well. Other things we use in everyday life that utilizes light at non-visible frequencies include:

- TV & Radios
- Walkie talkies
- Microwaves (cooking)
- Cell phones
- X-rays
- GPS

Demonstrations of spectral discharge tubes and a diffraction grating will also make an interesting activity.

Project STAR holographic diffraction grating (available from Science First, see appendix) is more efficient than most other gratings. If you don't have access to spectral discharge tubes, you can construct a Spectrum Projector as described below.

To demonstrate the Doppler effect, construct a Doppler Ball as below

Build a Doppler Ball

(from an idea from Dee Drake, Huron High School, Ann Arbor, MI)

While not a color activity per say, the Doppler ball is a very effective and fun demonstration of the Doppler Effect.

Materials needed:

- One sponge-rubber ball like a Nerf ball
- One 12-volt battery
- One piezo buzzer (3-20 volts DC, e.g. RadioShack #2730059)
- One 12-volt battery holder
- One SPST slide switch

You can get everything above (except for the Nerf ball) at RadioShack radioshack.com

Procedure for making a Doppler Ball

1. Make a small incision into the nerf ball and hollow out enough room for the buzzer and battery.
2. Solder the wires from the battery holder to the buzzer inserting the switch into one of the wire leads
3. Attach the 12-volt battery and insert into the nerf ball with the switch on top

Using the Doppler Ball

By throwing the ball from person to person, people can easily hear the Doppler Effect.

Build a Spectrum Projector

(from "Handling Color: Preconception-Based, Hands-On Spectrum Activities," a workshop presented at AAPT, 1990 by Anne G. Young & Andrew MacFadyen for Project STAR)

You've all heard of ROY G BIV — although there is some conservancy about "I." So how many colors are there? Most people say 7. Here is a way to explore that misconception. There are two secrets to this activity. One using the Project STAR diffraction grating fishersci.com,

which more efficient than the gratings you might get elsewhere. And two is using a colorometer, but first, the spectrum projector.

You can use the spectrum projector to create four separate lab stations per projector to investigate a variety of topics including:

- Continuous spectra
- Effect of filters on light
- Addition of colors of light
- Absorption spectra

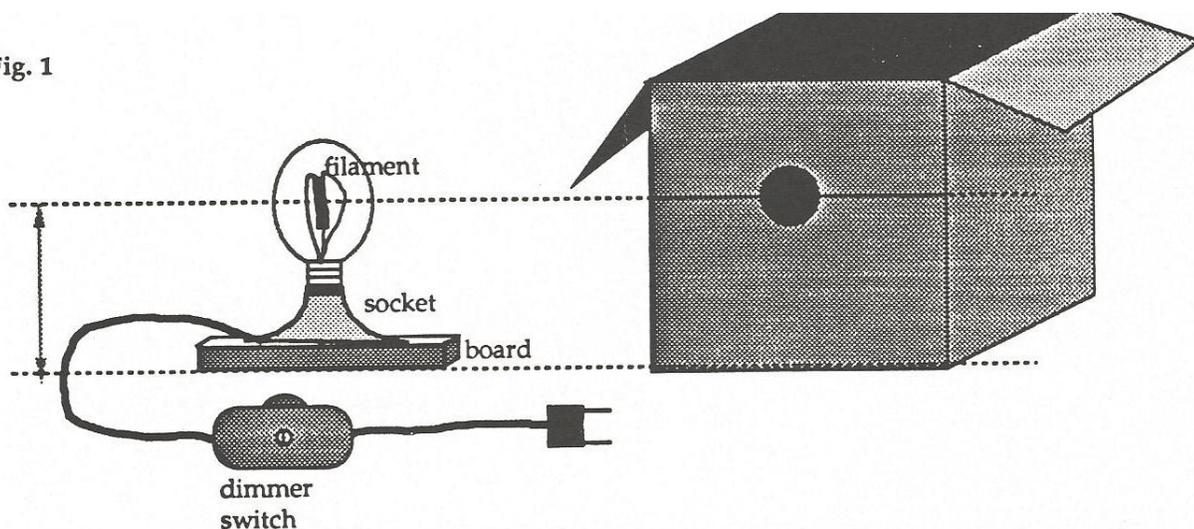
Materials needed:

- One large cardboard box
- One clear 200-watt incandescent light bulb with straight vertical filament
- One light socket and cord
- Two paper towel tubes
- Two double convex lenses 38-mm diameter and 100 mm focal length, available from Science First shop.sciencefirst.com, catalog #614-0310
- Two 4-inch-square pieces of cardboard
- Two pieces of holographic diffraction grating (about 2 inches square) available from Science First, catalog #614-0066
- A piece of white cardboard about 8 by 10 inches
- Felt blackboard erasers
- Colored cellophane or colored gels (Roscolux: 27 red, 83 blue, 91 green; obtain at a theater-supply store)
- Several toy blocks or cubes of wood
- Several mirror squares (check hobby stores or Amazon)

Procedure for making a spectrum projector:

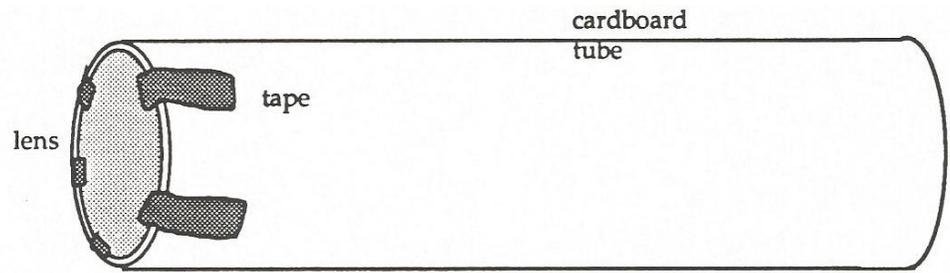
1. Using an X-acto knife, cut a round hole in each end of the cardboard box the same size as the paper towel tube and at the same height as the center of the lamp filament.

Fig. 1



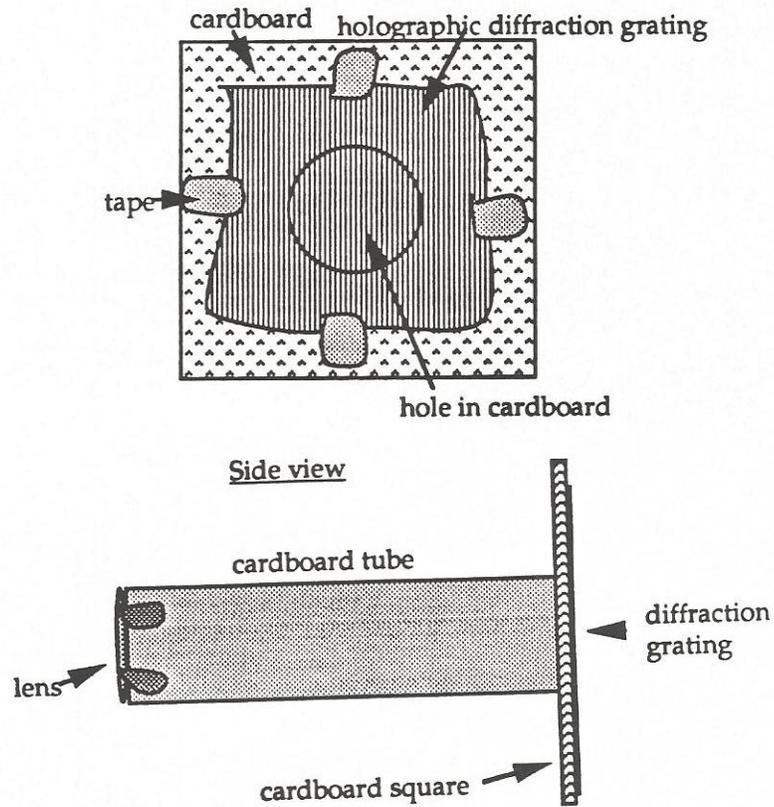
2. Tape a lens on the end of the paper towel tube

Fig. 2

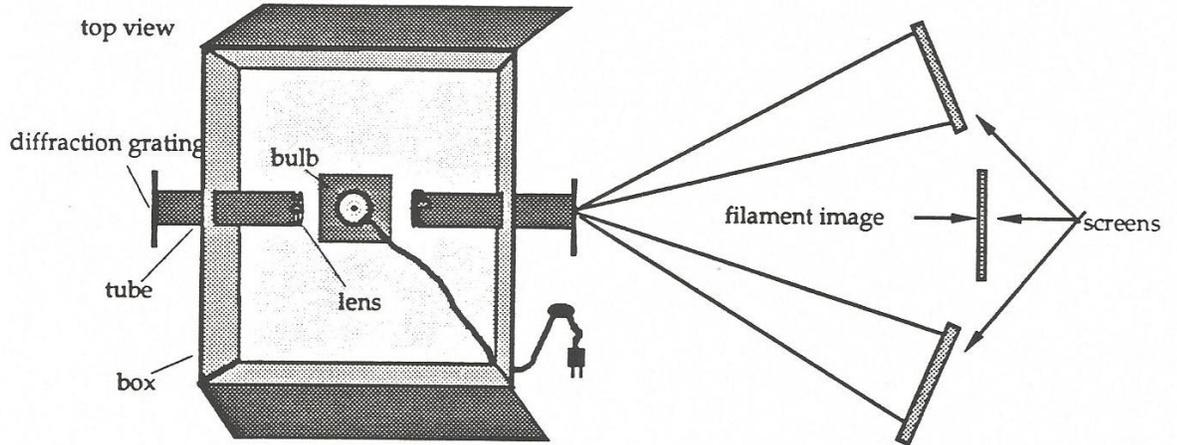


3. Cut a hole in the center of the 4-inch cardboard squares the same size as the paper towel tube and attach a diffraction grating. Then press fit the 4-inch square onto the paper towel tube (opposite end from the lens).

Fig. 3



- Place the lamp and socket inside the box and insert (lens end first) the paper towel tube into the holes in the side of the box



- Make windows from 3 of the 8-by-10-inch pieces of cardboard by cutting out the center and tape the appropriate size of colored jells (1 of each color).
- Affix (glue) a mirror square onto one side of each of the toy blocks.

Using the Spectrum Projector

Procedure:

- Turn on the 200-watt light bulb and focus the projector onto white cardboard held in the felt eraser (you may need to place the eraser on top of books to adjust to the proper height).
- Now locate the continuous spectrum (see diagram).

Spectrum Projector

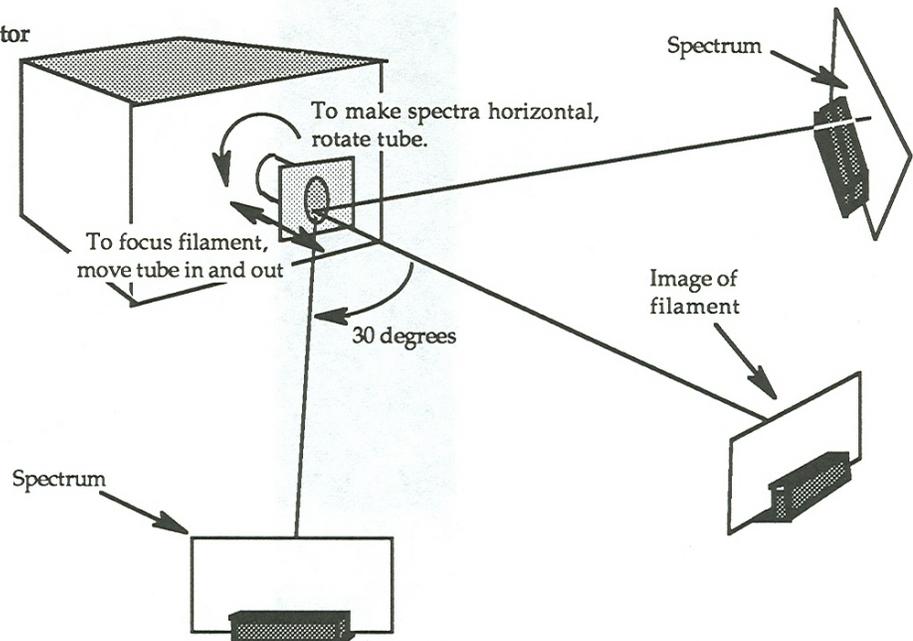


Diagram 1

Combining colors of the Spectrum

- Now place 2 mirrors into the colored (spectra) light. Aim the reflected colors onto the side of the projector. Tape a piece of white paper onto the side where the 2 colored reflected lights converge (see diagram). “Mix” several pairs of colors and note the resultant color.

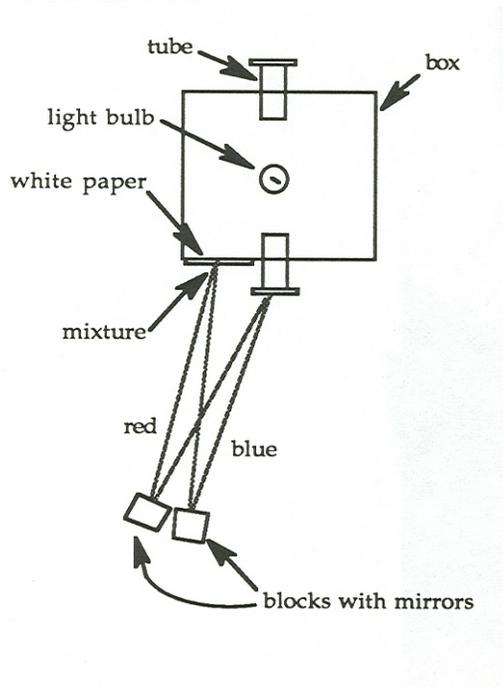
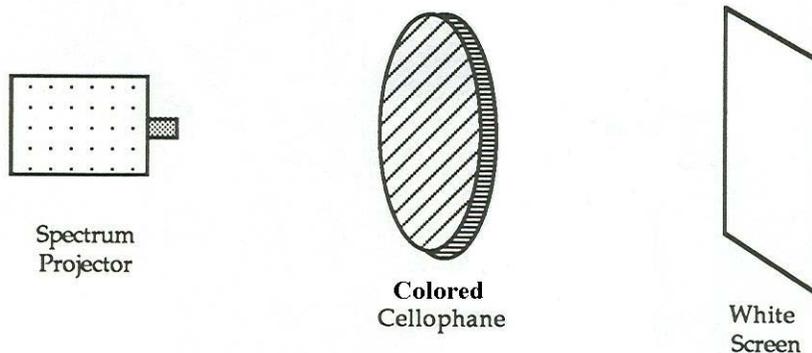


Diagram 2

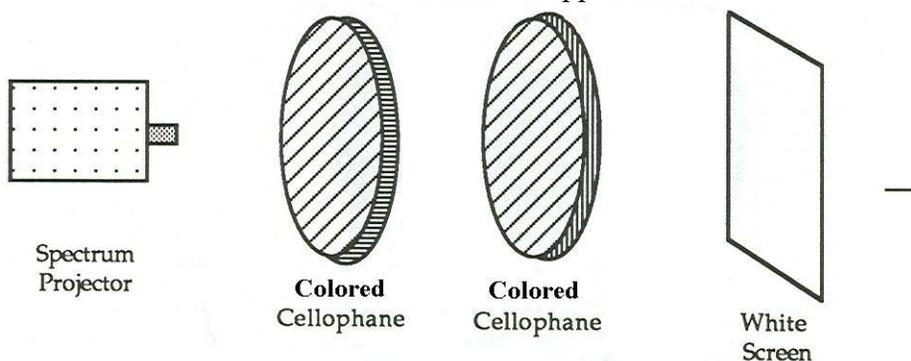
- If the intensity of the 2 colors is not the same, take another mirror and reflect the dimmer color twice. If more adjustment is needed use a neutral density filter(s) on the brighter color.
- Now use 3 mirrors and mix 3 colors.
- Now using as many mirrors as necessary, try to recombine all the colors of the spectrum. Notice as you add more colors, the resultant color becomes more white.
- Now remove all the mirrors

Subtracting Colors from the Spectrum

- Now place a piece of colored cellophane between the grating and the screen. Note the white cardboard is not straight in from of the leans assembly but offset about 30° — see diagram 1. Note what happened to the color.



- Now use 2 different color filters and note what happens.



Background Information

Good filters can cost hundreds of dollars each and would be better suited to the above experiment. Since we use cheap filters, some “incorrect” observations were made. A good filter will only let through a very specific color. Likewise, objects of a true color will only reflect only that one color of light. Using good filters and colored objects, you would have observed the following:

- A red filter lets through only red light; red objects only reflect red light
- A green filter lets through only green light; green objects only reflect green light
- A blue filter lets through only blue light; blue objects only reflect blue light

Therefore, using a red filter (which only lets through red light) & shining this light upon a perfectly blue car (which only reflects blue light) would show a black (absence of light) car as there is no blue light to reflect. Similarly, a green car under any color of light other than green would also look black. In real life, cars are not pure color. You may have noticed that some parking lot lights are yellowish in color and cars look vastly different under that light—so much so that people have not been able to find their cars even when they were standing right next to them.

Absorption Spectra

Absorption spectra or dark line spectra are seldom demonstrated or observed except by scientists. By placing a Didymium lens (glass blowers often use this type of lens and may give you one if you ask) in front of the Spectrum Projector’s spectra, you can show a broad absorption spectrum.

Build a Colorometer

You can use the colorometer to show a dramatic demonstration.

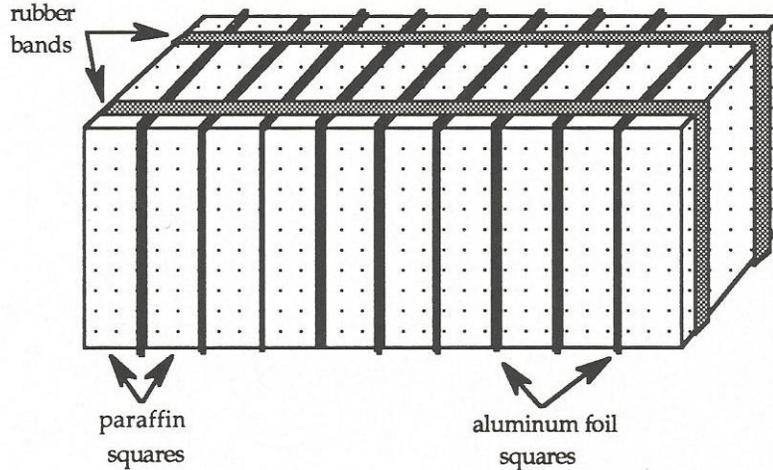
Materials needed:

- One 1-pound box of paraffin
- Nine pieces of aluminum foil (the same size as the paraffin blocks)
- Two large rubber bands
- One piece of cardboard (the same size as the paraffin blocks) cut in half.

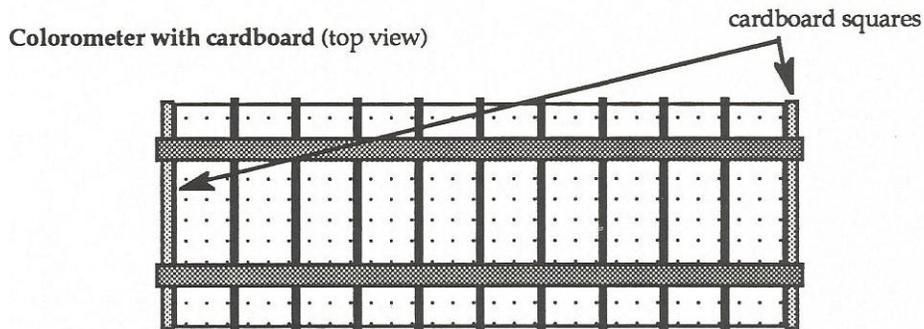
Procedure for making the Colorometer

1. Cut each paraffin block in half to make 10 paraffin squares
2. Fold each piece of aluminum foil in half (to make it equally shiny on each side)
3. Place the aluminum foil between each square of paraffin and place a piece of cardboard on each end

Fig. 1



4. Warp with the rubber bands to hold together.



Using the Colorometer

By moving the Colorometer in front of the Spectrum Projector's spectra, you can easily demonstrate there are not just seven ROY G BIV colors. People really like to explore the spectrum using the Colorometer.

Booklets and Handouts

Why not have a special newsletter or booklet about your organization describing how to observe the night sky in your area? Abrams Planetarium has granted permission for anyone hosting an Astronomy Day event to reprint the Sky Calendar for the month containing Astronomy Day. This can be downloaded from the web at www.pa.msu.edu/abrams/SkyCalendar/. Scroll down and check on sample. For copies of all other monthly Sky Calendars you must have a subscription. Another source for sky maps is skymaps.com

Don't forget the free handouts that you can get from the major astronomical societies (including yours) and companies. *Sky & Telescope* has some nifty little publications that you can download and duplicate. skyandtelescope.com

Astronomy magazine also has some booklets for Astronomy Day as well as for star parties and other outreach events. Go to astronomy.com/donations.

Don't forget about your local library. Its staff might be willing to produce a flyer listing their astronomical books and videos for distribution on Astronomy Day.

Astronomy vs. Astrology and Other Pseudosciences

Pointing out the difference between astronomy and astrology is certainly an important thing to do. Pointing out fallacies, while being respectful, is what education is all about-causing people to think for themselves. Having someone to guide them in that process is where your expertise comes in. A good book on astrology is *The Gemini Syndrome* by R. B. Culver.

It is important to realize that believing in pseudoscience is not a reflection upon the believer; rather it may be a better indicator of educators not being successful at causing people to think for themselves and to know when to question information. For example, on February 15, 2001, the Fox television network aired a "documentary" entitled *Conspiracy Theory: Did We Land on the Moon?* At first glance, the information (and support for a Moon Hoax) seems reasonable — so much so that any intelligent adult might question if we really went to the Moon (we did). You can use part of this video (available the Internet) to illustrate that sometimes things that appear, at first glance, to make sense may not upon further examination (illustrating how science works).

One organization that has taken on pseudoscience is the Committee for Skeptical Inquiry (CSI, formally the Committee for Scientific Investigation of the Paranormal), csicop.org. It publishes a scholarly bimonthly journal: *The Skeptical Inquirer*.

So what does science have to say about astrology? Phil Plait (an astronomer, not astrologer) summarizes his scientific opinions as follows:

- There is no force, known or unknown that could possibly affect us here on Earth the way astrologers claim. Known forces weaken too fast, letting one source utterly dominate (the Moon for gravity, the Sun for electromagnetism). An unknown force would allow asteroids and extrasolar planets to totally overwhelm the nearby planets.
- Like psychics, astrologers tend to rely on human's ability to remember "hits" and forget "misses" — a form of selective bias. Even accurate predictions may be due to simple chance.
- Study after study has shown that claims and predictions made by astrologers have no merit. They are indistinguishable from chance, which means astrologers cannot claim to have some ability to predict anyone's life's path or destiny.
- There is harm in astrology. It weakens people's ability to rationally look at the world, an ability we need now more than ever.

Logical problems with horoscopes and astrology:

1. Since Earth's spin axis precesses slightly, the constellations shift by at 1° every 72 years. Over time, roughly 2,000 years, the signs of the zodiac actually get shifted over by one. So what's your sign? It should actually be shifted one over from what you think it is . . . that is, you should be reading the horoscope from the star sign before yours!

2. Horoscopes are cast from the time of birth, not from the time of conception. What is considered the time of birth? When the water breaks? When the head appears? When the feet are out? What about a c-section? You would think that the planets would begin their influence on the unborn fetus for the duration of its development.
3. When you read your horoscope, you're sharing it with roughly 1/12 of the world's population. Doesn't it seem strange that so many people from across the entire planet should share the same fate on any given day?
4. Why are people born on the same day each year so different? Surely, if the gods or planets or whatever had some sort of true influence, then anyone born on the same day each year should be very, very similar.
5. The traditional planets of our solar system (i.e. none of the recently discovered planetary candidates) were named after Roman gods. This assignment was completely arbitrary. There might have been some logic behind it (Mars is red, war has blood, etc.), but overall there is no real reason to think that just because Venus was named after the goddess of love, that it should hold any sway over one's relationships. If the "effects" of the planets on people, had any real relationship to the planets themselves, then Venus should be the ruler of bad gas, not love.
6. Many astrological terms are holdovers from a time when the Earth was believed to be the center of the universe. We are clearly not at the center of the universe.
7. What about Uranus or Neptune, which were only discovered within the past 250 years? In ancient times, these outer planets were unobservable with the naked eye. Astrologer's based their system and equations upon the seven planets they believed revolved around the Earth. If the position of the planets has an influence upon human behavior and events, then how could any of the beliefs have been correct, if these celestial objects were missing from the "equation"?
8. Here's a logical fallacy: the appeal to tradition. Just because lots of people practice a tradition, like astrology, says nothing of its viability. Simply because many people may believe something says nothing about the fact of that something. For example, many people during the Black plague believed that demons caused disease. The number of believers said nothing at all about the actual cause of disease.

Maybe you can devise a game that will cause people to start questioning the validity of astrology. One possibility would be to cut the current horoscope out of the newspaper, removing the "signs" and arranging them in random order. Then ask people to choose the one horoscope that most closely fits the day they are having so far. It should soon be very obvious that just guessing would produce equally valid results.

Another interesting experiment would be to ask a group of people their birthdates and tell them you are going to cast their individual horoscopes. After a few minutes give each person their personal horoscope and ask how close you came. In reality, you gave each person the exact SAME horoscope. Just make sure the horoscope is general and vague (just like all other horoscopes) in nature.

Here is a sample horoscope that you can give the group in the paragraph above.

Your Personal Horoscope

- *You have a great need for other people to like and admire you.*
- *You have a tendency to be critical of yourself.*
- *You have a great deal of unused capacity which you have not turned to your advantage.*

- *While you have some personality weaknesses, you are generally able to compensate for them.*
- *Disciplined and self-controlled outside, you tend to be worrisome and insecure inside.*
- *At times you have serious doubts as to whether you have made the right decision or done the right thing.*
- *You prefer a certain amount of change and variety and become dissatisfied when hemmed in by restrictions and limitations.*
- *You pride yourself as an independent thinker and do not accept others' statements without satisfactory proof.*
- *You have found it unwise to be too frank in revealing yourself to others.*
- *At times you are extroverted, affable, and sociable, while at other times you are introverted, wary, and reserved.*
- *Some of your aspirations tend to be pretty unrealistic.*
- *Security is one of your major goals in life.*

The Astronomical Society of the Pacific also has some very useful resources on astrology. astrosociety.org

Some interesting facts about astrology:

- Several millions of dollars are spent each year on astrology in the US
- According to the Internet (so it must be true 😊) around 30% of Americans believe in astrology
- The earliest known horoscopes date to about 400 BC

Here are some more interesting thoughts to ponder about astrology:

1. If two babies were born in the same hospital 5 minutes apart would you expect
 - Their horoscopes to be so similar that their lives would feature substantial parallels?
 or
 - Their horoscopes to be so different that their lives would have few parallels?
2. Consider the above for
 - Twins born a few minutes apart
 - Non-related babies born at the same time in the same or nearby delivery rooms
3. In war battles, tens of thousands of people died on the same day. Would you expect their horoscopes to be similar?
4. What would the horoscope of a child born on Mars be like? How would the Earth influence the life of that child?
5. Since the “sign” rising at the moment of birth is so important, what happens to a child born at the Earth’s North Pole where no “sign” would be rising?
6. Is mass of celestial objects important in a horoscope? If it is, why isn’t Jupiter the most important planet? If not, why aren’t each of the thousands of asteroids, minor planets and comets considered in the horoscope?
7. Should horoscopes be based on the moment of birth or the moment of conception?
8. Are the astrological signs or the constellations more fundamental? If it is the sign, why was it when astrology first “got its start” (about 2000 years ago) that the signs and the constellations just happened to line up?

Light Pollution

Of all the topics contained in this Handbook, none can be more directly influenced by everyday people than light pollution — from making sure their own lighting is appropriate to influencing legislation to ensure their own community does the same.

Light pollution is becoming a greater and greater problem each and every year. More and more lights for streets, sidewalks and building outshine the stars.

One of the great amateur observers of his generation, Leslie Peltier, wrote the following words in his book *Starlight Nights* in 1965:

“I was returning home after dark from a lecture in a nearby town. At the crossroads where the highway spans the river I turned off on the old country road and drove the quarter mile north with a sudden desire to see what the home farm still looked like late at night. A couple of minutes later I stopped the car on the deserted road in front of the house. I turned off the motor and the car lights and then just sat there, for a time, utterly bewildered by what I saw. Night no longer came to the farm!”

“Not two hundred yards from the spot where my old observatory once stood a powerful light atop a high pole flooded the surrounding acres with a bluish glare. I got out of the car and looked around. From where I stood I could see five other lights on other farms all spilling out their garish glow. Here at my pasture observatory, during the years when it was the center of my little universe, this midnight sky was seldom shattered by a single ray of man-made light. Today, as evening falls, a sinuous constellation of farm floodlights, like some incandescent Hydra, wraps its coils about the skyline, and glows with baleful eyes throughout the night.

“I recalled that years ago I sometimes drove past these same farm homes late at night. To me each seemed like a tiny village with its house, its barn, and all its odd array of smaller buildings. But whether I saw it by starlight or underneath the Moon, it always impressed me how gently and how peacefully each village slept.

“The Moon and the stars no longer come to the farm. The farmer has exchanged his birthright in them for the wattage of his all-night sun. His children will never know the blessed dark of night.”

We are another generation now, a generation whose little towns have become big cities, and light pollution is now a major problem. The Astronomical League has created the Dark Sky Advocate Award astroleague.org/al/obsclubs/darkskyadvocate/darkskyadvocate.html to acknowledge League members who help combat light pollution.

The undisputed leader in this effort is the International Dark-Sky Association (IDA), darksky.org. Its website offers dozens of downloadable documents, videos, posters, brochures, PowerPoint presentations, kids activities, and displays — plus many ideas to reduce light pollution and how to spread the word. Many of the IDA’s most popular handouts are available at darksky.org/resources/public-outreach-materials.

Of special note is a video titled *Losing the Dark*, IDA’s informative 6-minute introduction to light pollution that can either be streamed online or downloaded onto your computer. It can be

displayed either on a monitor or in a full-dome (planetarium version), and it has been translated into 14 other languages. For details see darksky.org/resources/losing-the-dark.

And just because this section of the Handbook is modest, that does not mean your presentation about light pollution should be. It's just that IDA's website has so many resources, it is unnecessary to duplicate them here.

A big poster showing North America or the entire Earth at night (available from NASA nasa.gov/mission_pages/NPP/news/earth-at-night.html or from Space Images spaceimages.com) could provide the focal point for a display on light pollution. You could also display a before-and-after set of photos (1960 and 2010, for instance) of your city at night to show the dramatic change that has occurred. Making this environmental issue a big thrust of your Astronomy Day display is a good idea, for it could point out ideas for safe, glare-free lighting that will benefit everyone.

Some of the topics you should be sure to cover include:

- Light pollution robs us of the starry skies that are a part of human heritage
- Incorrect lighting wastes energy and costs more money than appropriate lighting does
- Light at night disrupts nocturnal wildlife and interferes with bird migrations
- Poorly designed lights create glare that interferes with driving and pedestrian safety
- Emerging research shows that excessive light at night affects human health

Consider combining your Astronomy Day activities with participation in “Globe at Night” (globeatnight.org), an international citizen-science campaign to raise public awareness of the impact of light pollution by inviting citizen-scientists to measure & submit their night sky brightness observations. It's easy to get involved — all you need is computer or smart phone. This activity is especially well suited for groups such as families or a class of young students.

Finally, the National Optical Astronomy Observatory (NOAO) has created a “Quality Lighting Teaching Kit” (noao.edu/education/qltkit.php) that explores concepts and practices of quality lighting through problem-based learning, hands-on/minds-on activities, as well as assessment probes. The six activities use quality lighting to solve realistic cases on how light pollution affects wildlife, the night sky, our eyes, energy consumption, safety and light trespass into buildings.

Astronomy Day for Children

Astronomy Day is for all ages, but it can be especially meaningful for children. You will be getting a lot of children at your displays and Star Nights. They should be encouraged with enthusiasm and patience, their questions answered with clarity, for it is vital that their generation catch the bug of astronomy. Most of the children visiting your display and Star Nights will be with families, so your display should be appropriate for all ages. You could have a special session for children, in which you offer them talks about the sky, using members with a special disposition for working with children.

The Royal Astronomical Society's Kingston Centre had a special telescope to greet children — a folded refractor housed in a speaker box. “Hello,” the telescope welcomed them, “my name is Mintaka, and I am a talking telescope.” The voice explained how telescopes work, and then went on, in a one-minute astronomy and history lesson, to show how to use a telescope to find Jupiter:

“And now let's search for a bright object like Jupiter. First, use my finder, which is mounted beside my eyepiece focuser. Sight along the finder and then center Jupiter in the finder's eyepiece. Now look through the eyepiece of the main telescope. Jupiter should be there, along with the moons of Galileo. You are looking at a planet 10 times the size of Earth and at least 400 million miles away. The moons you see were discovered by Galileo in 1609, almost 400 years ago, and because they revolve around Jupiter, they helped persuade Galileo that Earth was not the center of the universe. Because he expounded on these beliefs, Galileo was threatened with torture and forced to recant. Take a good look at these moons. They take us back to an earlier, darker time in our history, and yet now a spacecraft, also named Galileo, is exploring them.”

It is often times difficult to maintain a child's excitement for astronomy with only a single day of events. For children in elementary schools, every day should be Astronomy Day. If you can, take advantage of a teacher's interest by offering to come to class to talk about the stars for a half hour.

The Astronomical League has downloadable masters that you can duplicate for children to color and/or construct as part of your Astronomy Day activities.

Jupiter	astroleague.org/al/astroday/jupiter.jpg
Saturn	astroleague.org/al/astroday/saturn.jpg
Mars	astroleague.org/al/astroday/mars.jpg
Solar System Mobile	astroleague.org/al/astroday/solsystem.jpg

Other on-site children's activities have included: Solar Bingo, Astronomical Cookie making, Astronomical bean bag toss, face painting, etc.

Having some space toys for children to play with might be another opportunity to attract attention spacetoys.com. See “Toddlers at the Telescope” by Alice Altair Enevoldsen, *Sky & Telescope*, August 2014, pp. 34-37.

Astronomy Day for Teachers

The Center for Astronomy & Physics Education Research (caperteam.com), a nonprofit entity, is a leader in researching how people learn astronomy and how best to teach it. It is changing how astronomy is taught and do a variety of workshops for teachers. Hosting an area wide teacher workshop and then having a public lecture for Astronomy Day would be a great event.

The Astronomical Society of the Pacific (astrosociety.org) is a wealth of information for teachers and conducts several programs and activities useful for teachers including

Project ASTRO astrosociety.org/education/k12-educators/project-astro

Family ASTRO astrosociety.org/edu/family.html

Astronomy from the Ground Up www.afguonline.org

NASA Night Sky Network nightsky.jpl.nasa.gov

Astronomy Day is an opportunity to tell teachers about how scintillating astronomy can be in a classroom. If they bite, offer to go to their classes for more.

Remember, your presence and enthusiasm could offer an alternative to the following “Five Easy Steps to Kill an Interest in Astronomy.” Adapted from David Levy’s *The Universe for Children*, these steps represent things with which you might be familiar.

Things not to do:

1. In school, try including astronomy as a 10-minute segment during a geography unit. Many schools have done and continue to do just this, leaving generations of children thinking that the universe is a minor offshoot of the Earth.
2. Lock your children up during an eclipse in a dark room with curtains drawn. This will keep the evil solar spirits away from them.
3. Make the children observe through a telescope that has a wobbly mount and inferior optics. This will form the impression that all astronomers ever do is look at weird things that aren’t attractive and mean nothing. Corollary: Have no idea what the telescope is pointing at in the first place.
4. Put tiny holes in the end of a shoe box and shine a flashlight through it. Make sure the shoebox is painted black inside to simulate night, and then explain that these are what constellations look like. If the kids don’t develop a dislike of observing, at least they might acquire allergies to paint.
5. Keep astronomy in the vacuum of space, as an entity unrelated to the everyday joys and cares of children. Especially try to resurrect the 1960s image of the “mad scientist” or the absent-minded professor that caused so many laughs and so many people to turn away from careers in science.

These points are designed to show teachers and parents how bankrupt the traditional school approaches to astronomy are. Astronomy Day is the antithesis of this approach. Levy’s book, in fact, contains other ideas that might help bring the universe to the children. One has to do with making weather reports on other planets. “This is radio station M-A-R-S,” you might say, “with the forecast for today. A high of about 60°, pretty warm, but windy. However, make

sure you're leaning on the ground, because that warmth is only on the equator, and if you are taller than a foot or so the temperature drops rapidly. And it will get to well below freezing tonight, though there is no water here to freeze!"

The Great Lakes Planetarium Association (GLPA; glpa.org), one of the leading astronomy education organizations in the U.S., has produced a resource document for teachers entitled, "Astronomy Literacy: Essential Concepts for a K-12 Curriculum" (glpa.org/k12concepts). This is a wealth of information for the K-12 teacher concerning what concepts to teach and when to teach them.

Screening educational videos for teachers or setting up a workshop for teachers, is an activity you could do on Astronomy Day (or leading up to it). The Astronomical Society of the Pacific astrosociety.org and regional NASA centers have a good selection of space-oriented videos.

The Astronomy Day Headquarters has produced a special flyer for you to duplicate and distribute to classroom teachers on Astronomy Day (see appendix. It is also available on the Astronomy Day web page: astroleague.org/al/astroday/astrodayform.html).

Many classroom teachers are lacking in any astronomy course work and as such would be extremely grateful for any assistance you could offer, e.g. offering to visit their classroom, do a night sky presentation, etc. Assisting teachers would be one of the most important activities your organization could do.

Building a Display

You can borrow, rent, buy, or build display stands or cases. If you are doing a mall display, ask for assistance.

Making a display case is difficult. Before you accept a member's offer to build one, make sure that he or she knows what is involved, lest you end up with a piece of work that you cannot use. The simplest display setup, of course, is a table on which you mount your exhibit. Be sure to have tablecloths and skirts to cover the tabletop and front to hide any unsightly boxes and supplies.

Making a surface to display flat work (posters, photos, etc.) is easier. Office supply and hobby supply stores carry a 4-by-3-foot foldable science-fair display cardboard that can easily be used for table top displays. Other corrugated cardboard will work, if your display area is not too large, but plywood is better. Two sheets of plywood connected along the long edges with regular door hinges makes a transportable display that can stand like an open book. For a bigger display you can put hinges on both sides of each board, thus connecting several sheets in any number of shapes.

To finish plywood, you can paint it or cover it with contact paper or cork. If you're going to paint it, buy smooth "birch plywood". To secure the visuals to the display panel, use picture hangers, thumbtacks, double-stick tape, or spray glue. The problem with all these is that they will damage the visuals somewhat when you try to remove them — in fact, the glue is considered permanent. For temporary displays, you might try Velcro. This way you can easily position and transfer displays and quickly tear them down when the event is over. This is especially useful if you've covered the panels with cloth (e.g. felt) that accepts Velcro. 3M

Command Strips will allow you to attach items to surfaces without damage to either the item or the display surface.

You can also use giant mural astronomical wallpaper available from local wallpaper stores or from Space Toys spacetoys.com to create a fairly attractive display environment.

An Internet search can lead to several display board and exhibit options but they are usually very expensive

Keeping up with the latest trends in exhibits actually requires a magazine, and there is one: *Exhibit Builder* exhibitbuilder.net.

Attracting Attention to Your Display

Now that you have displays built, you have to get people to look at them. Adding showy things to your display will attract attention more effectively. Holograms, optic mirage mirrors, plasma sculptures, chase lights, revolving police lights and even moving holiday decorative lights are examples. Nowadays RGB LED lights are relative inexpensive and are great at attracting attentions. A Google search of “RGB LED Lights” will result in many options.

Events & Activities for Astronomy Day

Astronomy Day events can be as simple or as complicated as your wishes and resources allow. What follows are some ideas that have worked in the past.

Video Presentations

There are a variety of sources for DVDs including your local library. Short videos like *Powers of Ten* with Philip Morrison, or the National Film Board of Canada’s *Universe* with William Shatner could easily be rented and shown repeatedly as part of a mall display. *Losing the Dark* is an excellent introduction to light pollution from the IDA (see page 32).

Lectures

Astronomy talks by famous astronomers or astronauts can be a big part of your program. The key to choosing a good speaker lies in a combination of an interesting speaker plus an interesting subject. Some speakers are so good that they could talk about the manufacture of clothing and still keep the audience at the edge of its seat.

The best way to get a good lecturer is by reputation. Do you know anyone who has attended a national convention and heard a fabulous speaker? There are a dozen or so really excellent speakers across the United States; speakers good enough to bring tears to your eyes and make you want to rush out and embrace the night sky. These speakers deservedly charge for their appearances; a fee of a few hundred dollars plus expenses is typical. Authors of astronomy books would usually love to come, lecture, and sell their books. Authors, too, vary in their fees and in the quality of their presentations.

For clubs on a budget, the American Astronomical Society has its Harlow Shapley Visiting Lectureship program, aas.org/outreach/harlow-shapley-visiting-lectureships-astronomy, which

sends an astronomer to talk to local college students and the public. This program is available only to colleges without astronomy programs, and its typical cost is in a few hundred-dollar range. According to the society's membership directory, the Shapley lectures bring the excitement of modern astronomy and astrophysics to colleges. Often a public lecture using the Shapley Lecturer can be arranged.

Tips for Videos & Lectures

If you plan to host a talk on Astronomy Day, the following hints might prove helpful. They are adapted from an article written by the late amateur astronomer Jim Loudon, a highly successful speaker who could hold his audience's attention for hours.

1. Take care choosing a topic. People are interested in subjects like black holes, volcanoes on Io, how many hydrogen bombs it would take to cover the Moon with 50-mile-wide craters, or how Venus came to be covered with clouds of sulfuric acid.
2. Select a room of appropriate size. Loudon suggested always getting a bigger room than you think you need. However, what if your room is so large that it contains just a handful of people scattered about? It is hard to decide on this. One suggestion: sell tickets for the lecture — \$1 in advance, \$3 at the door. Besides the money you can use to help fund Astronomy Day, it will give you an idea on the size of the room you need. If possible, arrange for two rooms, a big one and small one. A few days before the lecture, pick and pay for the most appropriate one.
3. Preview the lecture hall. Make sure the sound system works; avoid humming or intolerable feedback. Test the projectors, remote controls, and light switches.
4. Appoint someone to your committee who will be fully in charge of the speaker's needs: airport greetings, special-needs dining, and a glass of water or juice at the lecture hall. Most lecturers appreciate a "no hassle" journey to your city as compensation for taking time out of their busy schedules.
5. Giving a talk is actually a very complicated process. We have heard people say that the trick is to concentrate on one or two people in the audience. **WRONG!** Imagine the consternation of the poor people in the audience you are staring at for an hour. You are talking to everyone, not just two people. There is no trick to giving a good talk, short of developing confidence in yourself and your subject. David Levy — who has been in high demand as a speaker ever since he co-discovered the "pearls on a string" comet that crashed into Jupiter in July 1994 — finds that at the height of a talk, his mind is busy with four things at once: what he is saying, the audience's reaction to what he is saying, how that reaction should affect what he says next, and how the clock is affecting what's left in the talk. He has added or eliminated whole sections based on split-second decisions made at such moments.
6. Encourage questions during appropriate parts of the talk. And remember that the only stupid question is the one that is never asked. Answer every question with dignity; never make the questioner feel stupid.

NASA Lectures & Astronauts

Although some astronauts are excellent lecturers, you should keep in mind that astronauts are chosen for certain skills, of which public speaking is not at the top. Astronaut speakers may be requested through the Astronaut Appearances Office of NASA's Office of Astronaut Appearances at the Johnson Space Center at 281-244-8863. NASA speakers (scientists, engineers, etc.) from the Kennedy Space Center may be requested at 321-861-5216. Other NASA centers operate a non-astronaut speaker's bureau as well. Contact your regional NASA center www.nasa.gov/about/speakers/nasa-speakers-howto.html

Sky Observations

Observing the Sun

Shopping-mall parking lots, the bane of light-pollution activists, are actually good sites for star parties, especially if your telescopes are set up right next to a major entrance. No matter how many lights there are, the waxing quarter Moon presents a fine target, as do any bright planets that might be up. The following thoughts on observing the Sun and Moon are adapted from David Levy's *The Sky: A User's Guide*, published by Cambridge University Press in 1991 and used with their permission.

Safe Sun

Whether we worship it, plan our lives by its schedule, tan ourselves by its light, bask in its warmth, or study it, this type-G2 star called the Sun has an importance that cannot be overstated. Close and always here, the Sun is convenient to study. It is so easy to find that we take it for granted, spending our nights observing the stars at great distance, while during the day this brightest star of all shines, ignored by most astronomers.

The key to pleasant solar study is to do it in safety. Direct solar viewing is safe if you use the appropriate filters. Eclipse glasses (should read "safe for direct solar viewing") are available from Rainbow Symphony www.rainbowsymphony.com, American Plastic Products www.amerplastic.com, and other companies (do an Internet search). Just be sure of their quality control; safe solar filters should meet the ISO 12312-2 international safety standard.

Do you own a small refractor with a Sun filter that attaches to its eyepiece? You do? Then, put this book down, find a hammer, and destroy the filter! Eyepiece filters are dangerous because they work where the Sun's focused rays are hottest. All that concentration of light is likely to break the filter sooner or later, probably at the moment your eye is next to it. The resulting eyeful of Sun will injure you permanently in an instant.

A good way to demonstrate the danger of a direct eyeful of Sun is to use a cheap plastic garbage bag (they, and the human eye, are damaged faster than the expensive ones). Ask the audience members to imagine that their eyes are the equivalent of the bag. Then move the bag to the focus point of the eyepiece, the place where the Sun's rays are hottest (and the spot where the observing eye is placed) and ask them to count the seconds until the bag ignites. Especially if the sky is not hazy or covered with light clouds, the plastic should ignite almost instantly, burning a clean hole. You can even carve someone's initials into the material and offer it as a souvenir. When the experiment is over, ask if anyone still wants to look directly

into the unprotected eyepiece. “Are you crazy?” the people should inquire, and you know that their lesson is learned.

How do you safely find the Sun? First, do not use a finderscope. Make sure, in fact, that the telescope’s finder is either covered or removed so that no one accidentally looks through it. Find the Sun by moving the telescope until its shadow is as small as possible. The Sun should then be close to shining its rays straight down the tube.

There are only two safe ways to look at the Sun with a telescope: via projection and via direct viewing with a filter that covers your telescope’s front end. With projection, you point your telescope toward the Sun and allow the rays to project through the eyepiece onto a piece of white cardboard or white paper at the bottom of a cardboard box. This way you can achieve an image of the Sun quite a few inches in diameter, which several people can then observe at once. The advantage for teachers is obvious. Children can see the projected image all at the same time, and the whole process need not take more than five minutes of their time. As well, it can be repeated day after day as visible spots march across the Sun’s surface.

The other safe way is to use a filter placed not at the eyepiece but at the front end of the telescope, blocking off most of the Sun’s light before it even begins to be focused. With this approach, remember that the filter must be placed at the front end of the telescope tube, before the Sun’s rays hit the mirror or objective lens and see any magnification. The advantage of the filter method is that the telescope’s optics doesn’t get at all hot, and if the filter is of good quality it will deliver an image of the Sun that you can view safely and comfortably through your eyepiece.

Make certain that the filter material is of good quality. The major astronomical magazines carry advertisements by several companies that sell filters, some of glass, others of aluminized Mylar. Although we have tested some and find the Mylar to be comfortable, the material can yield an oddly blue solar image. The glass filters are safe too and produce a more pleasing yellow or orange Sun. No matter what filter you choose, be very careful. If the material is torn, or the coating on the glass is scratched, do not use it. If you look through a filter that has worked well and suddenly lets in too much light, discard it. Once again: the only safe filters are those designed to fit over the front end of your telescope. Those that fit at the eyepiece of an otherwise unprotected telescope are not safe.

What to See on the Sun

The most obvious solar features are the *sunspots*, magnetic storms on the solar surface that appear dark because they are cooler than the rest of the surface. These spots usually appear in groups, and if you look carefully around these groups, you may notice some brighter regions called *faculae*, especially near the Sun’s limb, or edge.

Exactly what constitutes a sunspot group? Although in most cases it is not difficult to determine where one group ends and another begins, when groups become large and complex, the answer is not straightforward. A sunspot group is normally characterized by at least two large spots, known as preceding and following spots. Sunspot groups also have a number of smaller tag-alongs.

A group evolves from the smallest detectable solar feature, a *granule*, which, as it begins to darken, becomes a pore. If a pore continues to darken and expands, it becomes what is known

as an umbral sunspot. With further growth, a lighter penumbra will form around it. Often several nearby pores darken concurrently, in an elliptical cluster. As the pores form sunspots, they often divide into two regions, the preceding one forming faster than the following one.

At the height of its development a sunspot group, with its two major sets of giant spots, can be quite a sight. As the group begins to fade, the following spot dissolves first, while the preceding one becomes round, loses its penumbra, and eventually disappears as well.

When you get a good look at the active Sun you may be treated to much more than simple sunspots. On a very clear day with steady air and a quality telescope you may see the Sun take on a mottled appearance. This is called *granulation*; the Sun's surface is covered with convective cells that are separated from each other by slightly darker intergranular material. These cells are always being replaced with others, as each individual granule rarely lives longer than 10 or 15 minutes. When a granule is as dark as its surrounding material, it becomes a pore, a possible precursor to a sunspot.

On the Sun's limb and around a sunspot group, look for obviously brighter patches or spots; these *faculae* often exist before a sunspot group is formed, and they outlast a group as well. Sometimes faculae may actually cross the surface of a spot, forming a light bridge. Occasionally a very bright spot appears on the Sun's surface near a major spot group. Those who have seen these *flares* assure the rest of us that you cannot miss such an event if it is taking place when you look at the Sun through your telescope. As seen in ordinary white light, these eruptions are very rare, reported once or twice each sunspot cycle, and they do not last more than a few minutes.

Hydrogen-alpha ($H\alpha$) filters open up a whole new world of Sun viewing. Attached near the telescope's eyepiece, these filters pass only the red light of the hydrogen atom and let us see prominences, solar flares, and other features that are normally invisible in white light.

Observing the Moon

We see the Moon as poetry, the way we were taught when we were young. Its phases elicit moods, its light shines off clouds to paint beautiful pictures of night, and its eclipses are wonderful. With the smallest telescope, we can climb its mountains and explore its craters from our backyards. With huge plains called Serenity, Tranquility, Clouds (Mare Nubium), and Storms (Oceanus Procellarum), the Moon is indeed a poetic place.

Questions like "how much later does the Moon rise each night?" are not as simple to answer as they might seem. Although the average is some 50 minutes, the real answer depends on your latitude, on how far north or south the Moon is on its ecliptic path, and on where the Moon is in its elliptical orbit around the Earth. In the northern hemisphere, the late-summer Moon may rise less than 15 minutes later than it did the night before. And on winter mornings it may rise more than an hour later each successive night.

These phases allow you to observe the Moon on its own terms night after night. Because the Moon rotates and revolves at the same rate, we can only see about half of the Moon; the other half, known as the far side, always points away from Earth. When a crater or mountain range is fully sunlit, there is little contrast to show it clearly. However, when the Sun rises or sets on the Moon, it creates beautiful shadows that accentuate these features. The changing border between the light and dark sides of the Moon is called the terminator, and it provides the most

dramatic views of anything on the Moon. You can follow the terminator as it marches across the Moon's face, taking you on a tour of the Moon's most scenic features.

Day-to-Day Notes for the Moon Near First Quarter

If you check the Astronomy Day schedule in Part I, you will see that the event falls between 3 and 9 days from new Moon. Below are descriptions of the Moon on these days, plus days 10 and 11; these descriptions will make more sense if you read them while consulting a Moon map.

Day 3: Mare Crisium is almost completely visible. Can you see any "ghost craters" on its floor? These are ancient impact sites that have been partly covered by younger lava flows. Crisium's southern neighbor, Mare Fecunditatis, is now making its debut. Although Fecunditatis is considerably larger than Crisium, it is less conspicuous because it lacks high mountain borders. An extension of Fecunditatis passes just west of the craters Vendelinus and Petavius. For the first time tonight we also get a good look at a chain of features: the large, walled plain Cleomedes; the high-walled crater Burckhardt; the crater Geminus; and the harder-to-see Messala.

Day 4: Mare Crisium is now fully visible, and what an area it has turned out to be! Surrounded by a host of beautiful and different craters, it is truly a sight. If we "drive" around the shores of this mare, we stop by crater Proclus (lying just outside the mare) and even take a look at Picard, which stands out like an island in Crisium. Picard is named for a prominent 17th-century observer, known particularly for his observations of Comet Halley in 1682 and for his suggestion that a great observatory be established in Paris. Toward the north is another "island," the crater named Peirce. One of the oldest lunar features is prominent tonight: Janssen, a walled plain whose early history has been overwritten by more recent impacts. Janssen's walls have been shattered in several places, so that it no longer appears as a completely formed feature.

Mare Fecunditatis is also fully visible, and we now turn our attention to some of the other emerging maria. Mare Tranquillitatis, the Sea of Tranquility, and Mare Nectaris are just beginning to yield to sunrise. We also get to see the sharply defined crater Taruntius, whose walls act as a border crossing between Fecunditatis and Tranquillitatis.

Day 5: The "star" of this day is the huge crater Theophilus, easily found right where Mare Nectaris, fully visible tonight, meets Mare Tranquillitatis. Theophilus is one of the Moon's finest craters, displaying a high central peak consisting of several mountains. It forms an interesting pair with its neighbor Cyrillus, a crater whose boundary looks so square that it is hard to define it as a crater. South of Theophilus is the Altai Scarp, just beginning its day as a curved fault line right against a darker surface background. It parallels the shore of Mare Nectaris so closely that it must have been formed at the same time. At the scarp's southeast end is Piccolomini, a sharp, deeply cut feature. Mare Nectaris is also easily visible tonight.

Fracastorius may have been a complete crater once, but today all that is left is an indentation on the south end of Mare Nectaris. Here is a place where a chapter of the Moon's evolution is written in clear language for us. Where is the north wall? When the lava flows that built Mare Nectaris reached the old crater, their forces eroded much of it down to some rounded ridges and hills.

Day 6: As the Moon approaches its first quarter, Maurolycus is just beginning to show its large dimensions. Like Theophilus, this crater has a complex central peak. On this night, Mare Serenitatis is completely seen. The Haemus Mountains, acting as the southwest border of Serenitatis, are also beginning to appear, complete with Menelaus, a small but sharply defined crater. The Caucasus mountains are still mostly hidden, but two sharp craters on their border are visible, Eudoxus and Aristoteles.

Day 7: First quarter. Although the Caucasus and Haemus Mountains are fully visible, the special crater to see tonight is Hipparchus, for it shows up well only on the night the terminator passes across its face. Inside its ancient walls are some newer craters, particularly Horrocks and Halley. Two plains have also appeared — Mare Vaporum and Sinus Medii — as well as Albategnius, an oval, walled plain. Sunrise has also hit Piton, the most prominent of the Moon's isolated peaks. Tonight is the best night to see its sharp summit right on the terminator.

Day 8: Perhaps the most interesting night of the lunar month, this is a night for mountains, craters, and the Straight Wall. The Alps and Alpine Valley are visible. The Moon's finest range, the Apennines, shows its full glory. Also, the best known of the plains, Mare Imbrium, is becoming prominent as the rising Sun exposes more of its surface. Archimedes is also in sunlight now, forming a beautiful triangle with two other craters, Aristillus, the larger one, and Autolycus. Nearby we can see the Spitzbergen Mountains. We can also get our first good look at Plato, a huge, oval, walled plain whose dark floor is always easily found. South of this giant crater the peak of the large mountain Pico lights up the terminator.

On this magnificent night, we get our first good look at Alphonsus, whose central peak has been the object of some strange reports. This is also the night we see the Straight Wall, a ridge that is probably a fault line. It looks like a cliff with a vertical drop, but actually it's more of a steep slope, angling about 45°. Nearby is the crater Ptolemaeus.

Can you see Deslandres and Walter, a pair of features representing events at different times in the history of that area?

Deslandres is a huge, walled plain, but a very old one whose eastern wall had been tromped on by the meteorite fall that formed Walter. On the eastern floor of Deslandres, near Walter's wall, is a strange brightening first seen by the 17th-century Italian-French astronomer Giovanni Cassini and now known as Cassini's bright spot. If you don't see it very well tonight, it will become easier as the Sun shines more strongly on it in the next few nights. Probably related to Tycho's ray system, it is likely more recent than Walter. On the other side of Deslandres is a small crater we should look at, if only because it is named for an astronomer and clergyman named Hell.

Day 9: This is the night of Copernicus and Tycho, as both craters dominate the terminator. Both craters are fabulous sights throughout their two-week day. When Tycho is near the terminator, the rays near it are not easily visible, although the ones farther away are seen. Named for the late-16th-century astronomers who so radically changed our thinking about the universe, these craters honor Nicolaus Copernicus, the Polish scientist who devised the Sun-centered theory of the solar system, and Tycho Brahe, whose observations of the supernova of 1672 called into serious question the unchanging nature of the "heavenly sphere" of stars.

Named for the astronomer of Cyrene who, around 240 BC, made the first observational estimate of the size of the Earth, the crater Eratosthenes is almost fully visible tonight. It is

sharp and deep, though nearby Copernicus tends to draw our attention from it. North of Copernicus is a small but sharply defined crater called Pytheas, and still farther north is the larger but less well defined Lambert. South of Tycho is the walled plain Clavius. This is a huge feature, its long side being some 160 miles wide. It is named for the Bavarian Jesuit astronomer Christopher Clavius, who in the late 16th century helped prepare the Gregorian calendar.

Notice how well Plato shows up this night, along with the Teneriffe Mountains that are near its border with Mare Imbrium. North of Plato is Mare Frigoris, an often ignored plain which is larger in area and longer than any other observable mare except Oceanus Procellarum.

Day 10: Tonight's highlights are mountain and ridge peaks rather than craters. A group of mountains known as the Straight Range, as well as the Jura Mountains, Sinus Iridium, and the Laplace and Heraclides promontories, are all prominent tonight. Promontory is a good word; you can see how these features protrude into Mare Imbrium. Southwest of Copernicus a small, bright crater called Lansberg is coming into view, and even farther to the southwest is the Rhiphaeus Range. Finally, west of Clavius and just receiving the first rays of Sun, is Scheiner, a large, walled plain.

Day 11: As the Moon continues to wax into a strongly gibbous phase, the rest of the sky is brightening up remarkably. However, the Moon's brightness is still less than half what it will be on the night of full phase! We are already losing our chance to observe deep-sky objects, so we observe the Moon and notice that the features that looked so obvious just a few nights ago are now difficult to see as they are now fully lit by sunlight.

This is a night of maria, and the largest of the lunar plains, Oceanus Procellarum, is showing more of itself with each night. Not far from the terminator is Kepler, now almost fully bathed in sunlight. Although it is only about 20 miles wide, it is a complex crater with a bright system of rays. Johannes Kepler, of course, was the great astronomer and mathematician who determined from Tycho's observations that the orbits of the planets follow ellipses. He was also the discoverer of the great supernova of 1604.

North and west of Kepler is Aristarchus. Named for Aristarchus of Samos, who estimated the relative sizes of the Earth, the Moon, and the Sun, Aristarchus is the brightest spot on the Moon. Like Alphonsus, it is suspected of occasionally showing a dull red glow. Hidden in the glare of Aristarchus is Herodotus, a crater with a bright rim but not given its due because of its proximity to bright Aristarchus. North of Aristarchus lies Schröter's Valley. Resembling a snake, its southern end is known as the Cobra's Head.

Observing Artificial Satellites

People are fascinated by seeing an artificial satellite, and the International Space Station (ISS) is a nice bright one that holds a lot of public interest. A very good website that will calculate visibility information for your particular location for not only the ISS but other satellites, Iridium flares, etc. is heavens-above.com

The Astronomical League also has many observing programs including the Earth Orbiting Satellite Program csastro.org/eosoc.

Observing Other Objects

If you are having a full Star Night, assign observers to objects based on their experience and the nature of their telescopes. Small reflectors should be assigned to the Moon, a planet, or a bright double star like Albireo (Beta Cygni), and larger telescopes, with their presumably more experienced operators, to the globular clusters, planetary nebulae, and bright galaxies.

Label each telescope so that the viewers know what they are looking at. The telescope operators should stick to their assigned objects, unless clouds or some other problem send them off to the Moon. If someone stands in line to see Jupiter and gets the Dumbbell Nebula, then the new observer might not be happy about it, as they may have just viewed the Dumbbell at the previous telescope.

You should have a cloudy-night PowerPoint program that can be shown nearby. Also, an “ask the astronomer” program would allow viewers to interact with program leaders. Remember that most visitors’ questions will be basic and that there is no such thing as a stupid question. It might be worthwhile to have an audio program running alongside telescopes where the wait is long. A taped presentation about observing, or astronomy club members available to answer questions, would show visitors that you have not just abandoned their queue.

Birthday Stars

Showing a person a star that is the same number of light years away as that person is old, would not only have more meaning to the person but would also educate people that space is three dimensional. The problem, of course, is to find naked-eye stars that are visible early on Astronomy Day. The following list is for the Northern Hemisphere (apologies to the Southern Hemisphere) and is, of course missing several “years.” Just pick out the closest one to the person’s age. Note that the list contains only fairly bright (greater than magnitude 2.6) stars since Astronomy Day always occurs with a moonlit sky.

An article that describes a computer program that does a similar thing along with additional stars (although fainter) was printed in *Sky & Telescope* entitled: “Stellar Guides for Your Birthday,” by Jeff A. Farinacci, *Sky & Telescope*, November 2001, pp. 63-66.

“Birthday” Stars

Distance (Light years)	Star Name	Apparent Magnitude
8	Alpha Canis Majoris (Sirius)	-1.5
11	Alpha Canis Minoris (Procyon)	+0.4
26	Alpha Lyrae (Vega)	+0.0
35	Beta Geminorum (Pollux)	+1.2
36	Alpha Boötis (Arcturus)	-0.1
42	Beta Leonis (Denebola)	+2.1
46	Beta Cassiopeiae (Caph)	+2.3
46	Alpha Aurigae (Capella)	+0.1
46	Alpha Geminorum (Castor)	+1.6
48	Alpha Ophiuchi (Ras-Alhague)	+2.1

49	Alpha Cephei (Alderamin)	+2.4
58	Delta Leonis (Zosma)	+2.6
69	Eta Ophiuchi (Sabik)	+2.4
75	Alpha Coronae Borealis (Alphecca)	+2.4
78	Zeta Ursae Majoris (Mizar)	+2.1
79	Alpha Leonis (Regulus)	+1.3
79	Beta Ursae Majoris (Merak)	+2.4
81	Beta Aurigae (Menkalinan)	+1.9
82	Epsilon Ursae Majoris (Alioth)	+1.8

Note: Each star's Greek (Bayer) designation is followed by its common name in parentheses.

Other Event Activities

Events to Attract the Public's Attention

In addition to designing the display and activities that take place during Astronomy Day, give some thought to planning other activities that will attract attention. Prize drawings, for example, are invariably a lot of fun. You could get a sponsor to donate a small prize, or even a big one, like a pair of good binoculars. Your club could award a year of free membership, or free tickets to the local planetarium for a group. Giveaways are another way to publicize Astronomy Day. Companies that make items named after astronomical objects might be enticed to donate their products. Who knows, you might get a Saturn car!

Securing a radio station on-air host with that station doing a remote on site broadcast from the Astronomy Day display or have the local TV meteorologist broadcast his/her weather segment live from your event can assist in getting the word out. Having the meteorologist do a weather forecast for other planets (e.g. Mars) would not only be memorable but would also garner publicity for your event.

Astronomical Art Contest

Create an Astronomy Day art contest with the local schools. A project similar to this is conducted on an annual basis in Oklahoma City. With students all over the area taking part, the hundreds of entries are superb. They are displayed at a major, high-profile annual event. A citywide astronomical art contest is not a small event, by the way; it takes a lot of coordination, logistical work, and judging, but it can be a good way to both involve schools and generate publicity for Astronomy Day.

Rocket Launches

Launching model rockets is a definite attention-getter. Handled by professionals, it can be a lot of fun. It is also dangerous and should not be tried without the proper safeguards. Your local hobby store or the National Association of Rocketry www.nar.org might be able to help.

Sky-Q Quiz

Why not have fun testing the public's Sky-Q? The questions on this test were developed by Sheldon Schafer of the Lakeview Museum. Don't overdo the competitive aspect of this quiz. It is supposed to be fun.

Have a copy with the correct answers below and be sure to have someone there who can discuss the concepts with the quiz takers.

Answers:

1-d	8-b	15-c	22-a
2-a	9-c	16-b	23-d
3-c	10-d	17-a	24-d
4-d	11-a	18-d	25-b
5-a	12-c	19-b	26-e
6-c	13-c	20-d	27-c
7-a	14-d	21-c	

The Sky-Q Quiz itself is on the next four pages.

Sky-Q Quiz

1. On which day(s) of the year is the Sun directly overhead from locations in the continental United States?

- a. March 21 and September 23
- b. June 21
- c. every day
- d. never

2. On which day(s) of the year does the Sun rise due east?

- a. March 21 and September 23
- b. June 21
- c. every day
- d. never

3. How does the Sun produce its energy?

- a. by reflecting light from other stars
- b. by chemically burning its fuels
- c. by fusing hydrogen into helium
- d. by explosive chemical reactions near its surface

4. If the Sun were the size of a quarter, and the rest of space sized accordingly, where would the nearest star be?

- a. about 3 feet away
- b. about 33 feet away
- c. about 3300 feet away
- d. more than 60 miles away

5. What is the brightest star in the night sky at any time?

- a. Sirius
- b. Polaris, the North Star
- c. Orion
- d. Venus

6. Of the stars we normally see in the night sky, how many are part of the Milky Way galaxy?

- a. just the brightest
- b. all of the faint stars
- c. all those visible
- d. none of those visible

7. About how many stars are in our galaxy?
- a. over 100 billion
 - b. 200 thousand
 - c. 2 million
 - d. 2.000
8. Why does our Sun look so different from the stars seen at night?
- a. because it really is much larger than they are
 - b. because it is much closer than they are
 - c. it is altogether different from them
 - d. it is much hotter than they are
9. What is the difference between an astronomer and an astrologer?
- a. not very much; in the long run, both study the stars
 - b. an astronomer predicts the future; an astrologer studies the stars
 - c. an astronomer scientifically studies the universe; an astrologer casts horoscopes
 - d. an astronomer studies the galaxy; an astrologer studies the planets
10. Which planet is closest to the Sun?
- a. Mars
 - b. Venus
 - c. Earth
 - d. Mercury
11. Which planet has a surface and atmosphere most like the Earth?
- a. Mars
 - b. Venus
 - c. Jupiter
 - d. Mercury
12. Which is most like the Sun in terms of composition?
- a. Mars
 - b. Venus
 - c. Jupiter
 - d. Mercury
13. Which planets are known to have rings?
- a. only Saturn
 - b. Mars and Saturn
 - c. Jupiter, Saturn, Uranus, and Neptune
 - d. Venus

14. Which of these planets is the smallest?
- Mars
 - Jupiter
 - Saturn
 - Mercury
15. Where do stars go in the daytime?
- to the other side of the Earth
 - their light automatically dims
 - they are still there but their light is too feeble to be seen
 - there are stars only on one side of the Earth at a time
16. Which best describes the Sun?
- it is a bright planet
 - it is an average size star
 - it is similar to the Moon but brighter
 - it is a bigger-than-average star
17. Which best describes a comet?
- a large, dirty snowball
 - a flaming ball of gas
 - a star streaking across the sky
 - a rock burning up in the atmosphere
18. When can the Moon be seen in the daytime?
- only right after sunset
 - never
 - only during an eclipse
 - nearly as often as it can be seen at night
19. Based on their average distance from the Sun, what is the order of these Solar System objects?
- Venus, Earth, Mars, Mercury, Saturn, Jupiter, Neptune, Uranus
 - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
 - Mercury, Venus, Mars, Earth, Jupiter, Saturn, Uranus, Neptune
 - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Neptune, Uranus
20. Which best describes a “falling star”?
- a large dirty snowball
 - a flaming ball of gas
 - a star streaking across the sky near the Earth
 - a tiny rock vaporizing as it enters the Earth’s atmosphere

21. What is the Moon's period of revolution around the Earth?
- a. 1 day
 - b. 1 week
 - c. 1 month
 - d. 1 year
22. What is the Earth's period of rotation?
- a. 1 day
 - b. 1 week
 - c. 1 month
 - d. 1 year
23. What is the Earth's period of revolution around the Sun?
- a. 1 day
 - b. 1 week
 - c. 1 month
 - d. 1 year
24. What is the order of these Solar System objects based on their size, largest to smallest?
- a. Jupiter, Saturn, Uranus, Neptune, Mars, Venus, Earth, Mercury
 - b. Jupiter, Saturn, Uranus, Neptune, Venus, Mars, Earth, Mercury
 - c. Jupiter, Saturn, Uranus, Neptune, Mercury, Earth, Venus, Mars
 - d. Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury
25. The first day of summer in the United States happens when
- a. the Earth is closest to the Sun
 - b. the northern hemisphere is tilted toward the Sun as far as it will go
 - c. the Sun is directly overhead at noon
 - d. both a and c
26. The reason the Earth experiences changing seasons is
- a. the Earth is closest to the Sun in the summer
 - b. the Earth is tilted on its axis
 - c. the Earth is closest to the Sun in the winter
 - d. the Earth orbits (revolves) around the Sun
 - e. both b and d
27. When it is summer in the US, what season is it in Australia?
- a. summer
 - b. fall
 - c. winter
 - d. spring

Thank you for taking the Sky-Q Quiz

PART III: Your Volunteers

Introduction

Planning an Astronomy Day event requires a considerable amount of advance planning. For one thing, getting on a venue's (e.g. shopping mall) schedule is something that needs to be done months in advance. The better such planning is, the fewer last-minute problems you'll encounter. Everyone should have written responsibilities.

Some venues might view an Astronomy Day event as publicity for their venue, and might even pay for it. This has not been the common experience, as many venues feel that they are doing you a favor. To make them see things the other way around requires some negotiating skill. At the very least, you have to show the venue that you can do the job; usually one year's experience will do that. They also have to see a benefit for them — hopefully Astronomy Day will bring more people into their venue. In Grand Rapids, Michigan, the mall provided \$500 for posters and radio ads, in addition to all the free publicity the club generated.

Your publicity should be professional in appearance. In this computer age, hand lettering is generally not recommended. But if there is an artist among your members, why not?

A common problem is that your volunteers might forget why they are there. Animated personal conversations among your members about the latest astronomical discoveries are fine, so long as they do not supersede paying attention to the general public. You don't need to tackle shoppers as they pass by, but if they stop to look at the display, smile at them. Know the talents and abilities of your volunteers. Make sure each person wears a name tag at all events so that the public can tell who is who. You could also have Astronomy Day hats, shirts, or aprons. Astronomy Day aprons are quite handy, as they can hold flyers and brochures for handing out.

Make sure that all staff and volunteers wear some form of official identification (e.g. name tags, tee shirts, hats, aprons, etc.). Not only does this imply professionalism but also allows the public to identify them.

Committees for Astronomy Day

For your program, you will need people for some or all of the following tasks.

Astronomy Day Chairperson

This is a difficult position with ultimate responsibility for everything. Being a good manager of people as well as being good at making public contacts is important. He or she needs to be on top of the details of all events going on and be cognizant of the duties/capabilities of all the volunteers. The chairperson should walk around the event, insuring that things are running smoothly and safely, filling in briefly when someone needs to leave as well as making notes on how to improve events next year.

Possibly most important, the chairperson should know how to delegate. We know of one Astronomy Day chairperson who glanced through an earlier edition of this Handbook and was

appalled to find that she was doing virtually all the tasks of every member of the committee. Depending upon the situation, duties can be combined or held by the same person.

Specific duties:

1. Select the other committee members.
2. Secure the location for each event.
3. Set up a written timetable for when arrangements have to be completed, and make sure they are completed.
4. Put all commitments (whether for a particular task, items to display, or working at a certain event, etc.) in writing. This ensures that everyone knows what is expected.
5. Make sure that everyone has the materials they need to do their tasks.
6. After the events, meet to review what worked and what did not. Take notes for next year.
7. Enter the Astronomy Day Award competition astroleague.org/al/astroday/astrodayform.html and click on “Astronomy Day Award Application”)

It is important that the Astronomy Day Chairperson understand that an event such as Astronomy Day is a fluid and things change, often at the last minute. Be prepared for such things and adapt! This may even include stopping or cancelling a portion of an event you had planned. The key point is that everyone has a good time and learning and education takes place.

Secretary-Treasurer

This person must be good at note-taking and with management of money. Money could either “run” through a cosponsor with an existing nonprofit status, or you may wish to open a checking account specifically for Astronomy Day.

Specific duties:

1. Prepare minutes of each Astronomy Day committee meeting.
2. Prepare a budget, using information from other committee members (i.e., printing, postage, name badges, etc.)
3. Make sure all members know how much money they have left to spend.
4. Pay the bills.
5. Write thank-you notes to the volunteers and the other participants.

Event Coordinator

This person could also be labeled “Assistant Astronomy Day Coordinator.”

Specific Duties

1. Make contact with the facilities (malls, museums, etc.) to arrange specific requirements for space, security, electricity, hours of operation, lighting control.
2. State all agreements in writing, being specific and noting names and phone numbers of facility people who can be contacted if there is a problem.
3. Select assistants to supervise various events (if more than one event).

Volunteer Coordinator

Specific Duties:

1. Find volunteers to build the displays, operate media, set up and take down the exhibits, and handle a variety of other tasks.
2. Schedule each volunteer according to where the needs are, and also according to the skills of that volunteer. Make sure that each volunteer has a written copy of the schedule.
3. Telephone each volunteer in advance to remind them of their duties.
4. Be prepared with replacements if needed.

Safety Officer

Specific Duties:

1. Examine all risk areas; for example, make sure that all power cords are tied down with duct tape, check that holes or depressions in the ground are roped off.
2. Make sure that telescope operators are conscious of dangers to viewers, like protruding tripod legs.
3. Know who to contact in an emergency.
4. Inform all volunteers where the fire exits are and, for star parties, where the emergency (e.g. weather) shelters are (weather can change quickly).

Security Officer

Someone should be responsible for making sure that expensive displays are properly protected, like telescopes, computers, and photographs, during the day and in locked areas overnight.

Media Relations

Specific Duties:

1. The person in charge of media relations has to make sure that the word gets out, that the public knows about all Astronomy Day events. This includes sending out news releases, following up with phone calls, and arranging interviews.
2. Design posters, flyers, and/or brochures and arrange for their distribution.
3. Prepare public service announcements (PSAs) for radio, television, and cable TV. Stations should not charge for PSAs. Remember that sending a news release does not mean that the right person, or the most interested person, will get it. If you know of a media person who is especially interested in science, send him or her a special copy of the release. Remember meteorologists are your friend.
4. As stated earlier in this section, send e-mails to as many press contacts as you can, such as newscasters, and media meteorologists. Each station should have a “news desk” contact to submit event announcements to. E-mails are easy to compose and cost nothing but a few keystrokes.
5. Follow up with increased news coverage the week before and the day of Astronomy Day. Some radio stations might do live remote broadcasts without charge, or local PBS stations might do an astronomy special the week of Astronomy Day. One of your club members could appear on a local call-in radio (or TV) program during the week prior to Astronomy Day (of course mention your upcoming events on the air).
6. Photograph everything for your club’s archives, for media work next year and for entering the Astronomy Day Award competition.
7. Invite a local political figure to participate in Astronomy Day.
8. Ask politicians to issue Astronomy Day proclamations (examples are included in the Appendices).
9. Use social media such as Facebook and Twitter to promote your event. This is a great way to get your younger members involved as they are usually very savvy in this area.

How to Compose a News Release

- a. Should be no more than two single-sided pages, double-spaced.
- b. Write down the date the news should be released (e.g., FOR IMMEDIATE RELEASE).
- c. Include your name as contact person, so that the news media can reach you during normal business hours.
- d. If your release is longer than one page, write “more . . .” at the bottom center of the first page. At the end of the release put the symbol “. . . ” at the bottom center.
- e. Include photographs of club events and astronomical objects. Lick Observatory, for example, has granted permission for any Astronomy Day host to use any of its photographs for the purpose of promoting Astronomy Day (see below).
- f. Include the “five Ws”: Who, what, where, why, and when.

Adding astronomical photographs to any news release helps capture attention. If you have some good photos from previous Astronomy Days or astrophotos of objects that are going to be visible this Astronomy Day, be sure to include them. You might find photographs on the web (be sure you have permission to use it), but be careful not to mislead the public. If you use a Hubble photo, the public might think they will be able to see that object though the telescopes you have set up

Lick Observatory web.ucolick.org has granted any Astronomy Day site permission to use its archived photographs digitalcollections.ucsc.edu/cdm/landingpage/collection/p265101coll10 in promoting Astronomy Day. You **MUST** however credit each photo used as “Lick Observatory Photograph.” To obtain permission for specific Lick photographs, write to:

Special Collections and Archives
Lick Observatory
University of California
Santa Cruz, CA 95064
speccoll@library.ucsc.edu

Lick Observatory would appreciate getting a copy of anything containing its photographs.

Fundraising

The person in charge of fundraising goes into the community to solicit financial support. Contact local businesses to donate small sums of money for Astronomy Day. Some businesses may be willing to pay for ads that also advertise their business (examples are included in the Appendix). One group sold sponsorships — one for each exhibit. In return, the exhibits had large signs stating that they were sponsored by the business that purchased the sponsorship. Businesses should certainly be more receptive if you plan to hold one of the events at their place of business.

Fundraising experts know that if an organization looks professional, it might have a better chance of getting funds. Use letterhead and don't hand write. Give background information on what you are planning. State exactly what you want from the people to whom you are

writing, and explain how helping you will also help them. Get several members of your group to look the letter over for good writing, punctuation and spelling. There's nothing worse than a poorly written letter to guarantee failure.

Major Display Supervisor (subcommittee of Event Coordinator)

Someone should take charge of a particular major event, like a mall display. Making sure that all the positions are staffed, that the mall's rules are followed, and arranging for overnight storage of the materials are the prime responsibilities.

If your mall display is particularly large, you might wish to appoint people to be in charge of specific sections, like the poster area, the telescopes, and any media. For a display that lasts a full day, you would need shifts, changing perhaps every few hours.

Display Designer

The complicated task of designing a display, laying out the placement of telescopes, posters and photographs, and video or slide displays falls to this talented person.

1. Work with the people at the facility to understand the layout of the space assigned to your organization.
2. Assign space to each display area, considering both the needs of each display as well as the general flow of people through it.
3. See that the exhibits are built, or borrowed, and stored or returned afterward.
4. Sketch or photograph the display once it is set up. You will now have a record of what worked, and what did not, for next year.
5. Assemble a group to set up and take down the display. This is best done when the mall or museum is closed; in fact, most malls insist that setups be done after public hours.

Star Party Supervisor

1. If telescopes are pointed at the Sun, make sure that no one observes the Sun without proper precautions (see the section on Safe Sun).
2. Watch for people who might trip over telescopes.
3. Secure electrical lines with duct tape.
4. It might be a good idea to have a portable megaphone to let people know what telescopes are pointed at, and to make specific announcements (“Attention Sky Shoppers: No waiting at telescope No. 3 right now, providing a great view of Saturn.”)
5. Assign volunteers to run specific telescopes, training them on appropriate objects.

Legal Concerns

It is hard to imagine that having fun on Astronomy Day can land you in court. But we do live in a litigious society, and small, unincorporated clubs can put their members at risk. If one or more of your Astronomy Day sponsors already carries liability insurance, they might be willing to include your event under their umbrella. Shopping malls or zoos might have special insurance arrangements for events taking place on their property. Some malls require groups using their facilities to carry their own liability coverage. One million dollars of coverage is typical. The Astronomical League, a large federation of astronomy clubs in the United States, offers an insurance policy for its member clubs. For more information about the Astronomical League, go to its web site and/or see *Sky & Telescope*, October 1983, pp. 345-347, *Mercury*, January/February 1996 pp. 32-33, and *Astronomy*, August, 2004, pp. 84-87. If your club is not a member of the League, it might be worth it to join just to have access to reasonable liability insurance; see astroleague.org.

Your club could consider incorporating itself. This way, your members will no longer be individually liable for guests who trip over your exhibit table. Another advantage is that incorporated not-for-profit groups can accept tax-deductible donations. However, getting incorporated is a big endeavor requiring lots of government forms and an annual report.

In any event, we do suggest that your club appoint a Safety Officer, whose job it would be to check that the exhibit is safe with no dangerous metal corners or chairs in bad places. Additionally, everyone helping out at Astronomy Day should keep an eye open for potential problems. Before the event is opened to the public, double-check for possible hazards.

PART IV: Miscellaneous

Related Events

Astronomy Day is just one of several annual events designed to promote awareness of the sky and outer space. It might be possible to host a joint event with Astronomy Day and one of the events listed below if the dates happen to coincide or you could do separate events using the first one to occur to promote the later ones. At the very least, the events listed below may have materials that could be useful in hosting Astronomy Day events, so it might be very beneficial to “check them out.”

Global Astronomy Month astronomerswithoutborders.org

Organized each April by Astronomers Without Borders, Global Astronomy Month (GAM) is the world's largest global celebration of astronomy. GAM brings new ideas and new opportunities, again bringing enthusiasts together worldwide to celebrate Astronomers Without Borders' motto One People, One Sky.

International Dark-Sky Week darksky.org/dark-sky-week-2017

Created in 2003 by high-school student Jennifer Barlow, International Dark Sky Week has grown to become a worldwide event and a key component of Global Astronomy Month. Each year it is held in April around Earth Day and Astronomy Day. In 2017 celebrations begin Saturday, April 22nd (Earth Day!) and run through Friday, April 28nd.

World Space Week www.worldspaceweek.org

Space Week is an international celebration of science and technology, and their contribution to the betterment of the human condition. The United Nations General Assembly declared in 1999 that World Space Week will be held each year from October 4-10. These dates commemorate two events:

- October 4, 1957 — Launch of the first human-made Earth satellite, Sputnik 1, thus opening the way for space exploration
- October 10, 1967 — The signing of the Treaty on Principles Governing the Activities of States in the Exploration and Peaceful Uses of Outer Space, including the Moon and Other Celestial Bodies.

This event used to be held during the week containing the first Moon landing of July 20, but in 1999, the dates were changed to October.

Sun-Earth Day sunearthday.nasa.gov/index.php

Lunched in conjunction with Astronomy Day in 2001, Sun-Earth Day is now held near the Vernal Equinox each year and administered by NASA's Sun Earth Connection Forum. The goal of Sun-Earth Day is that participants of our program will benefit from the following key understandings:

- The Sun is a dynamic, magnetic star that impacts the Earth and other planets in our solar system

- Understanding the mysteries of the Sun has been a primary motivator for Sun watchers over time
- Human beings use technology (past, present, and future) to understand the Sun and the Universe beyond
- Light has always provided a means of investigating the Universe
- Human beings from diverse cultures have viewed the Sun as the source of life

The Sun-Earth Day web site always has lots of information and activities that are also useful for Astronomy Day.

More Information About Astronomy Day Past Events & History

More ideas about Astronomy Day activities can be obtained by reading the articles below:

Sky & Telescope:

July 1978, p. 35-39	May 1991, p. 536-537
December 1978, p. 527	May 1992, p. 573-575
August 1979, p. 167-169	April 1995, p. 91-92
August 1980, p. 149-153	April 1996, p. 84-86
December 1980, p. 524	April 1997, p. 99-100
September 1981, p. 265-267	May 1998, p. 74-75
September 1982, p. 272-274	May 1999, p. 92
December 1983, p. 551	May 2000, p. 92
March 1985, p. 259	April 2001, p. 82
March 1986, p. 297-298	April 2002, p. 68-72
August 1988, p. 191	May 2003, p. 78-79
January 1989, p. 89-90	October 2004, p. 114
April 1990, p. 431-433	

Astronomy:

May 1981, p. 59 (the Presidential proclamation never came to pass)
 March 1991, p. 26
 May 1992, p. 30
 May 1993, p. 23
 April 1994, p. 22

Mercury:

May/June 1976, p. 28-29
 March/April 1981, p. 45

Part V: Appendices

Resource Addresses

(all addresses are in the USA unless otherwise noted). Mailing addresses are given for organizations that have a permanent location.

Abrams Planetarium (Sky Calendar)
Michigan State University, Dept. GT
East Lansing, MI 48824
www.pa.msu.edu/abrams/Index.html

American Association for the Advancement of Science
1200 New York Ave NW
Washington, DC 20005
www.aas.org/

American Association of Physics Teachers
One Physics Ellipse
College Park, MD 20740
www.aapt.org/

American Association of Variable Star Observers
49 Bay State Road
Cambridge, MA 02138
www.aavso.org/

American Astronomical Society (resource people, booklet on astronomical careers)
2000 Florida Ave. NW, Suite 400
Washington, DC 20009
www.aas.org

American Lunar Society
www.amlunsoc.org/

American Meteor Society
www.amsmeteors.org

AMSAT (Radio Amateur Satellite Corp.)
www.amsat.org/amsat-new/index.php

Association of Astronomy Educators
www.facebook.com/AstroEd

Association of Lunar and Planetary Observers
www.alpo-astronomy.org/

Association of Science and Technology Centers
818 Connecticut Ave NW, 7th Floor
Washington, DC 20006
www.astc.org/

Astronomical Association of Northern California
sites.google.com/site/aancsite/home

Astronomical League (book discounts, liability insurance, observing programs & more)
9201 Ward Parkway
Suite 100
Kansas City, MO 64114
www.astroleague.org

Astronomical Society of the Pacific (dozens of resources for educators, books, videos,
390 Ashton Ave. free web based teacher newsletter, monthly
San Francisco, CA 94112 magazine plus much more)
www.astrosociety.org

Astronomy (monthly astronomy magazine)
www.astronomy.com

Astronomy Day Coordinator (your one-stop shopping for Astronomy Day information)
Gary Tomlinson
30 Stargazer Lane
Comstock Park MI 49321
(616) 784-9518
gtomlins@sbcglobal.net
www.astroleague.org/al/astroday/astroday.html

Center for Astronomy & Physics Education Research (CAPER)
www.caperteam.com

Challenger Center
www.challenger.org

Everything in the Universe (unusual and hard to find items)
www.everythingintheuniv.com

Exhibit Builder (monthly magazine on building exhibits)
www.exhibitbuilder.net

International Dark-Sky Association
www.darksky.org

International Meteor Organization
www.imo.net

International Occultation Timing Association
www.lunar-occultations.com/iota/iotandx.htm

International Planetarium Society
www.ips-planetarium.org

Lick Observatory (source of photographs for Astronomy Day publicity)
web.ucolick.org

MMI Space Science Corp. (lots of astronomy education materials)
www.mmicorporation.com

Mercury magazine: see Astronomical Society of the Pacific

Meteorite Collector (lists of meteorite dealers and hunters)
www.meteoritecollector.org/dealers.html

Meteoritical Society
www.meteoriticalsociety.org

NASA Educational Resources
www.nasa.gov/education/materials

NASA Educator Resource Centers
www.nasa.gov/offices/education/programs/national/ercn/home/index.html

National Association of Rocketry
www.nar.org

National Science Teachers Association
1840 Wilson Blvd.
Arlington, VA 22201
www.nsta.org

National Space Club & Foundation
204 E Street NE
Washington, DC 20002
www.spaceclub.org

National Space Society
P.O. Box 98106
Washington, DC 20090
www.nss.org

Night Sky Network
nightsky.jpl.nasa.gov

Planetary Society
60 South Los Robles Ave.
Pasadena, CA 91101
www.planetary.org

Royal Astronomical Society
Burlington House
Piccadilly
London W1J 0BQ, United Kingdom
www.ras.org.uk

Royal Astronomical Society of Canada
203-4920 Dundas Street West
Toronto, Ontario M9A 1B7, Canada
www.rasc.ca

Science First/Starlab (portable planetariums & educational supplies)
Project STAR Materials
86475 Gene Lasserre Blvd.
Yulee, FL 32097
www.starlab.com

Sky & Telescope (monthly astronomy magazine, globes, dozens of other products)
90 Sherman St.
Cambridge, MA 02140
skyandtelescope.com

Society of Amateur Radio Astronomers
radio-astronomy.org

Space Frontier Foundation
16 First Avenue
Nyack, NY 10960
www.space-frontier.org

Space Studies Institute
16922 Airport Blvd. #24
Mojave, CA 93501
www.ssi.org

Trippensee Planetarium Co. (produces astronomical models for education/display)
c/o 1st Stop Travel Store
317 East Dodds St.
Bloomington, IN 47401
www.1ststoptravelstore.com/trippensee.html

World Spaceweek Headquarters
957 NASA Parkway, Suite 350
Houston, TX 77058
www.spaceweek.org

United States Space Foundation
4425 Arrowswest Drive
Colorado Springs, CO 80907
www.spacefoundation.org

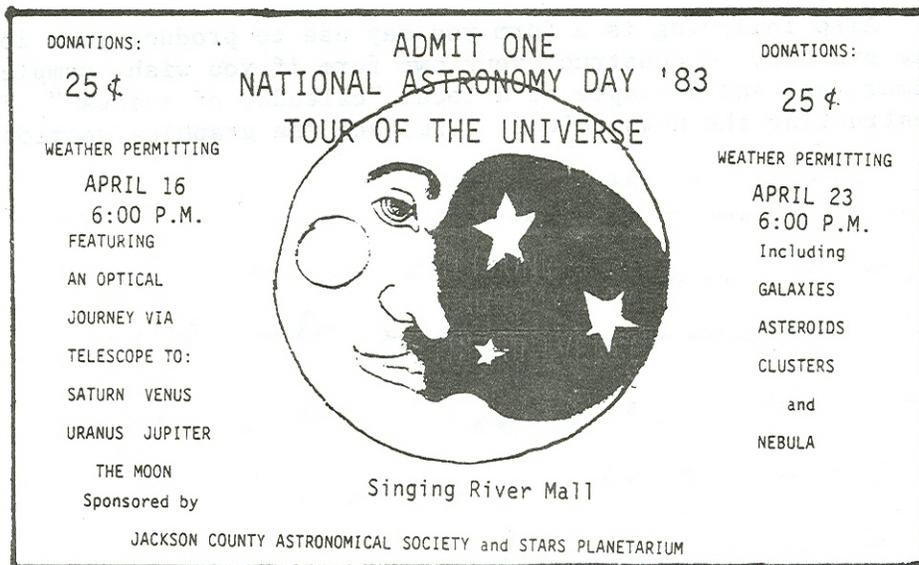
Visual Satellite Observer's Home Page
www.satobs.org

Western Amateur Astronomers
www.waa.av.org

Sample Graphics & Proclamations



Astronomy Day Name Tag



Astronomy Day Ticket



S P A C E W E E K

GALLERY-QUALITY SPACEWEEK '81 PRINT

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AVAILABLE AT THE FOLLOWING LOCATIONS

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- SUN REALTY, 17633 El Camino Real
- JOHNSON SPACE CENTER EXCHANGE STORE, JSC Bldg. 11

ATTEND SPACEWEEK '81 EVENTS AND FIND OUT WHY "Space is America's New Wealth"

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City of Grand Rapids
Michigan

OFFICE OF THE MAYOR

ABE L. DRASIN
MAYOR

P R O C L A M A T I O N

WHEREAS, Astronomy, the scientific study of celestial bodies and phenomena, is one of the oldest sciences known to humanity, and

WHEREAS, nationally, astronomy has become a fascinating pastime, as well as a crucial key to the discovery of the origins of the universe, and

WHEREAS, Grand Rapids' Chaffee Planetarium and Veen Observatory serve as the major facilities for astronomy interests in West Michigan, and

WHEREAS, a special week has been designated for the coordination of various activities by the local astronomical community aimed at educating the public;

NOW, THEREFORE, I, Abe L. Drasin, Mayor of the City of Grand Rapids, Michigan, do hereby proclaim April 26 through May 2, 1982 as

ASTRONOMY WEEK

in Grand Rapids, and urge all citizens to learn more about Astronomy through the various programs available through the Chaffee Planetarium and Veen Observatory.



Abe L. Drasin
MAYOR

Mayoral Proclamation

William G. Milliken
Governor of the State of Michigan

presents this

Executive Declaration

in Observance of

April 26, 1980

as

ASTRONOMY DAY

Astronomy, the science of the celestial bodies, is one of the oldest sciences known to humanity. Although it is a pure science, research in pure science often leads to practical benefits.

The state of Michigan is blessed with many natural areas which are ideal for astronomical observations. At the professional level, many of our colleges and universities are recognized nationally and internationally for their scientific research in the field of astronomy.

Amateur astronomers and their organizations throughout the state contribute significantly to public education in astronomy. Michigan has many professional, university and amateur observatories and a large number of museums and planetariums which offer programs and courses for students and the public throughout the year.

On Saturday, April 26, 1980, many of our state's astronomy clubs, educational institutions, planetariums, museums, parks and recreation centers will offer programs designed to interpret the sky for the public and to make our citizens more aware of this often overlooked aspect of Michigan's natural environment.

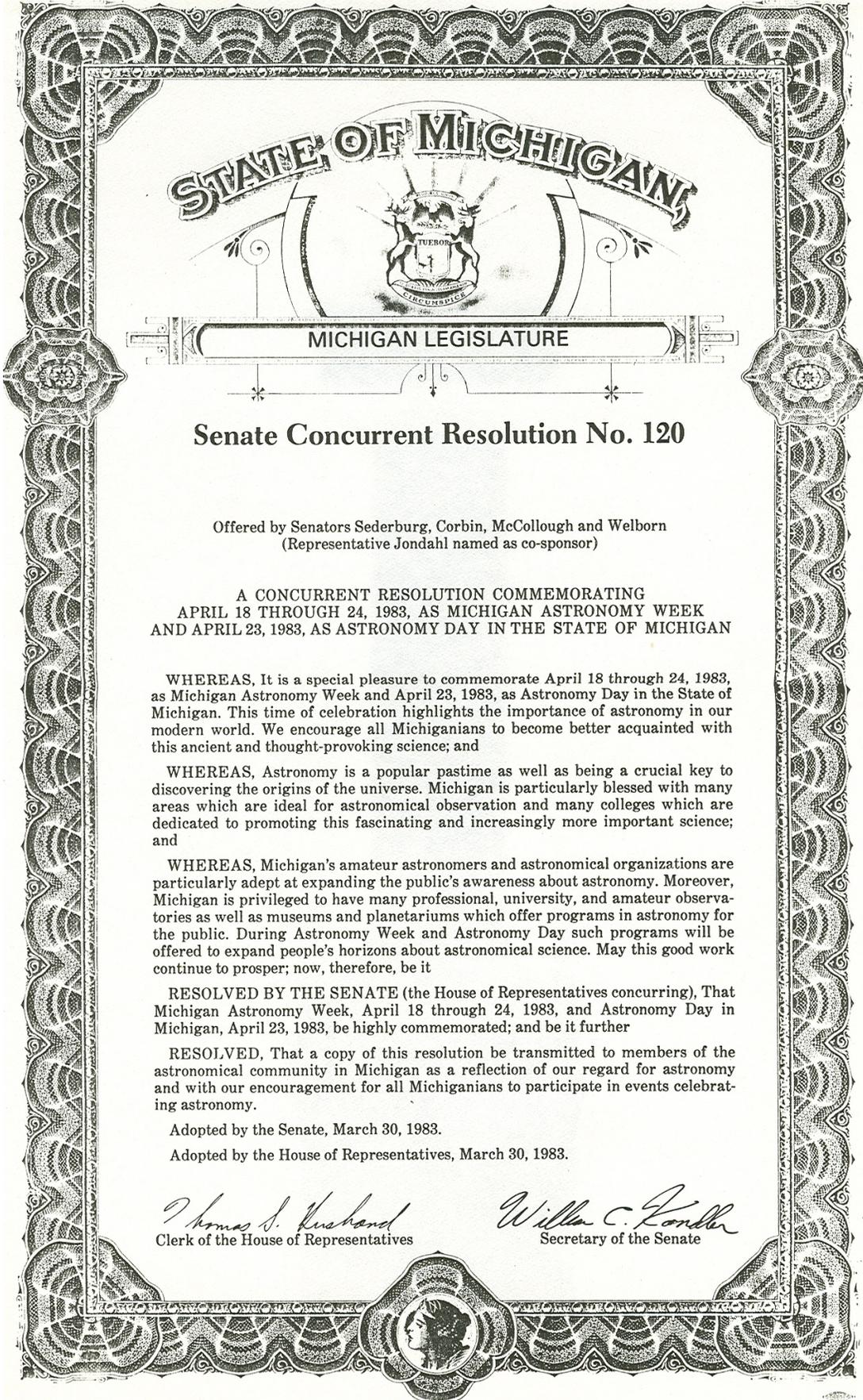
Therefore, I, William G. Milliken, Governor of the State of Michigan, do hereby declare April 26, 1980, as Astronomy Day in Michigan, and urge all our citizens to become aware of the many programs and activities relating to astronomy which are available in our state.

Given under my hand on this twentieth day of February in the year of Our Lord one thousand nine hundred eighty and of the Commonwealth one hundred forty-fourth.



William G. Milliken
GOVERNOR

Gubernatorial Proclamation



STATE OF MICHIGAN

MICHIGAN LEGISLATURE

Senate Concurrent Resolution No. 120

Offered by Senators Sederburg, Corbin, McCollough and Welborn
(Representative Jondahl named as co-sponsor)

A CONCURRENT RESOLUTION COMMEMORATING
APRIL 18 THROUGH 24, 1983, AS MICHIGAN ASTRONOMY WEEK
AND APRIL 23, 1983, AS ASTRONOMY DAY IN THE STATE OF MICHIGAN

WHEREAS, It is a special pleasure to commemorate April 18 through 24, 1983, as Michigan Astronomy Week and April 23, 1983, as Astronomy Day in the State of Michigan. This time of celebration highlights the importance of astronomy in our modern world. We encourage all Michigianians to become better acquainted with this ancient and thought-provoking science; and

WHEREAS, Astronomy is a popular pastime as well as being a crucial key to discovering the origins of the universe. Michigan is particularly blessed with many areas which are ideal for astronomical observation and many colleges which are dedicated to promoting this fascinating and increasingly more important science; and

WHEREAS, Michigan's amateur astronomers and astronomical organizations are particularly adept at expanding the public's awareness about astronomy. Moreover, Michigan is privileged to have many professional, university, and amateur observatories as well as museums and planetariums which offer programs in astronomy for the public. During Astronomy Week and Astronomy Day such programs will be offered to expand people's horizons about astronomical science. May this good work continue to prosper; now, therefore, be it

RESOLVED BY THE SENATE (the House of Representatives concurring), That Michigan Astronomy Week, April 18 through 24, 1983, and Astronomy Day in Michigan, April 23, 1983, be highly commemorated; and be it further

RESOLVED, That a copy of this resolution be transmitted to members of the astronomical community in Michigan as a reflection of our regard for astronomy and with our encouragement for all Michigianians to participate in events celebrating astronomy.

Adopted by the Senate, March 30, 1983.

Adopted by the House of Representatives, March 30, 1983.

Thomas S. Husband
Clerk of the House of Representatives

Willie C. Zondler
Secretary of the Senate

State Congressional Proclamation

Astronomy Day Award

*Cosponsored by Sky & Telescope, the American Astronomical Society,
and the Astronomical League*

The Astronomy Day award began in 1980 and is award to the group(s) that best exemplifies the concept of Astronomy Day, “Bringing Astronomy to the People,” through special event programming. The award is judged by the Astronomical League. For a list of past winners, go to astroleague.org/al/astroday/astrowinners.html

The rules are simple. They are:

1. All entries must be submitted electronically by June 13th of each year.
2. Three primary prizewinners may be awarded, one each for population size categories (\$150 each): Large, Medium & Small.
3. Two secondary \$50 awards may be given as follows:
 - Best new idea
 - The organization that does quality events year after year (determined by previous entries)
4. Honorable Mention(s) may be awarded to those groups in final contention for the award.
5. Not all awards may be presented each year.
6. All entries will be judged on the following:
 - a. Originality and effort
 - b. Effectiveness of the sponsored events
 - c. Most productive use of local resources
 - d. Uniqueness of local events
 - e. Carrying out the primary theme of Astronomy Day (Bringing Astronomy to the People)
 - f. Carrying out any secondary annual theme that may exist
7. Eligibility is open to any nonprofit organization which promotes astronomy or space science. Planetariums and science museums, astronomy clubs, universities, and observatories or combinations thereof are all eligible. Organizations may not enter as part of a larger group and individually.
8. Electronic entries must be formatted in the same order as this entry form. Attachments must be able to be opened by MS Word, MS Photo Editor and/or as PDFs.
9. All entries become property of the Astronomical League. Submitting photographs constitutes permission to publish and must comply with the guidelines under “Helpful Hints.”

The winners will be notified by July 31st, and awards will be announced at the Astronomical League’s summer convention.

Helpful hints for entering the award

1. Involving all astronomy-related groups in the area is viewed as very positive as well as promoting any special theme for the year (There won't always be a special theme).
2. Previous primary award winners must be extraordinary to win the same award again in subsequent years. However winning one award doesn't preclude an organization from winning a different award in the same or a different year.
3. Submit a few well composed photographs. There is nothing wrong with posing a picture. Each photograph must be labeled with where, when, who took and who is in the photograph.
4. You will receive an acknowledgement of your entry shortly after the entry is submitted by e-mail. If you do not receive an acknowledgement, contact the Astronomy Day Coordinator. Be sure to put: "Astronomy Day Award Entry" in the subject line of your e-mail.
5. To ensure that you format your entry correctly, download the word version of this form. You must format and order your entry the same manner as this entry form with all questions answered. You may include additional information at the end of you entry if it does not fit within one of the categories. This could include a summary. Scan and attach the required flyers to your entry.
6. Hosting the event on a different day than the "official" date will not preclude you from winning.
7. The contest will be judged by the Astronomical League and not *Sky & Telescope* (i.e. you can mention *Astronomy* magazine).
8. A co-sponsor is an organization that helped in set up and planning. A participant is an organization who used space at your Astronomy Day event to promote themselves.

Good luck! If you don't win this year, please try again next year.

List any other local organizations/institutions involved (e.g. the local planetarium, the local telescope store, none, etc.):

List any other local astronomical organizations/institution NOT involved (e.g. the local planetarium choose not to participate, the other local astronomy club wanted to do their own event, none, etc.):

Event Details

Please describe the programs and events held by your organization(s) during Astronomy Day. Your entry will be judged by the responses you provide as well as included flyers or photographs.

1. List all planned events and type of location your group hosted for Astronomy Day including the dates and times they occurred (see example). Describe any unconventional events, exhibits, displays, and other activities. Include any flyers or brochures produced for this event.

Sample Event Information

<i>Date</i>	<i>Hours</i>	<i>Event</i>	<i>Type of Location</i>	<i>Attendance</i>
4/16	9 am-9pm	Mall Display	Indoor shopping mall	About 250
4/16	9 am-9 pm	Solar, Lunar & Saturn telescopic viewing	Outside indoor shopping mall	About 42
4/16	7 pm-10 pm	Telescopic viewing	City Park	Rained out
4/16	Noon- 5pm	Planetarium shows	Museum	184



Astronomy Day Teacher Resource Guide



This Resource Guide was specifically designed for classroom teachers looking for both activities, content and methodology for teaching astronomy.

What astronomical concepts do I teach and at what grade level?

The Great Lakes Planetarium Association (GLPA), one of the leaders in astronomy education in the US, has put together a wonderful 16-page document that details grade specific concepts (and its free to download) entitled: **Astronomy Literacy: Essential Concepts for a K-12 Curriculum** glpa.org/k12concepts

Where can I find some hands-on activities to help teach those concepts?

Here is a list of publications that are full of hands-on activities:

- *Where We Are in Space and Time*, a Project STAR book published by the Harvard-Smithsonian Center for Astrophysics, available from Science First, sciencefirst.com
- *The Universe at Your Fingertips*, Astronomical Society of the Pacific, 1995 astrosociety.org
- *More Universe at Your Fingertips*, Astronomical Society of the Pacific, 2000 astrosociety.org

Where can I find help in how to teach astronomy?

PhysPort

PhysPort supports faculty in implementing research-based teaching practices in their classrooms, by providing expert recommendations about teaching methods, assessment, and results from educational research. They have made enormous advances in developing a variety of tools that dramatically improve student learning including research supported teaching strategies that include 8 verified astronomy related diagnostic tests:

- Astronomy Diagnostic Test 2.0 (ADT2)
- Star Properties Concept Inventory (SPCI)
- Light and Spectroscopy Concept Inventory (LSCI)
- Greenhouse Effect Concept Inventory (GECI)
- Newtonian Gravity Concept Inventory (NGCI)
- Test of Astronomy Standards (TOAST)
- Lunar Phases Concept Inventory (LPCI)
- Astronomical Misconceptions Survey (AMS)

Teachers have to be verified and certain protocols must be followed in order to administer the above tests. PhysPort is a service of the American Association of Physics Teachers (AAPT) and they have several physics diagnostic tests as well. physport.org

Center for Astronomy Education (CAE)

While largely for college, the Center for Astronomy Education (CAE) has many materials that are useful to the K-12 level as well. The CAE is devoted to improving teaching and learning in general education, college-level Earth, Astronomy and Space Science by conducting fundamental research on student beliefs and reasoning difficulties related to astronomy, and instructor implementation difficulties related to teaching astronomy. We use the results of our research to inform the development of research-validated curriculum and assessment materials for use in the classroom as well as:

- Expert Recommendations
- Teaching Guides
- Assessment Guides.
- Assessment Data Explorer
- Video Workshops

Their mission is to empower faculty to use effective research-based teaching so that every student had the opportunity to learn. astronomy101.jpl.nasa.gov/

Where do I turn for more help?

For starters, talk to the people giving you this flyer. They know lots about local astronomical resource's and personnel.

Contact your local planetarium director. To find a planetarium in your area go to ips-planetarium.org/?page=dir

Contact your local astronomy club skyandtelescope.com/astronomy-clubs-organizations/

The Astronomical Society of the Pacific astrosociety.org has many programs and recourses for teachers including:

- *The Universe in the Classroom*, a single topic bimonthly classroom information and activity newsletter
- Project ASTRO, pairs amateur and profession astronomers with local educators
- Astronomy from the Ground UP. Provides informal science educators and interpreters
- List of single topic resource guides
- Night Sky Network, astronomy clubs that share time and telescopes with the public (and have several hands-on activities)