**A Telescope Alternative**

By Joel Wise

Binoculars offer many advantages to a person who is just getting into the exciting hobby of astronomy. One advantage is that they can be purchased at a very reasonable cost. Another is that they are the most portable observatory there is, next to your eyes. But, unlike your eyes, they gather much more light. Even a small pair will offer a much more spectacular view of the heavens than your eyes ever could. Because you see through them with both eyes, fainter objects can be seen and color and contrast are better.

The optical mechanics of binoculars are quite easy to understand. If you have a pair of 7x35 binoculars, the seven means that it brings an object seven times closer. The 35 is the diameter of each objective or front lens. The field of view is stated in degrees at a certain distance. Lower power binoculars have a wider field of view than higher powers.

Binoculars up to the 7x50 size can be hand-held. Sizes above that should be mounted on a tripod. Many devices are available to do this. One type allows the observer to look up 90 degrees and because of the parallelogram-type of construction, you can keep an object in the field of view as you lower the binoculars to allow someone shorter than you to see it.

Because of the wide field of view, many objects are more impressive in binoculars than in telescopes. For example, the Pleiades and the Hyades star clusters are spectacular. Many Messier objects are within the power of binoculars. In fact, with a pair of 10x80s, you can see a total of 120 Messier objects under good seeing conditions. The Astronomical League offers a Binocular Messier Club Certificate.

Whatever type of binoculars you have or choose to buy, you will be rewarded with one of the best ways available to increase your knowledge of astronomy.

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**Journal Roundup**

By Scott Jorgensen

If you have access to *Scientific American* at a local library, you might want to look up the May and June editions. In them, you will find quite nice articles on the work done so far with the Hubble Space Telescope and on planetary nebulae.

If you ever need to shut up someone complaining about the cost of the space telescope, there is plenty of ammunition in the June *Scientific American*. Even with the famous problems (Ken Strom gave us the technical details a few months ago), the space telescope takes incredible pictures - with the right computer processing. One rather interesting point is that while the space probes gave us better pictures of the planets than Hubble can (or will) the space telescope can provide exceptional images of ANY object. Thus the Hubble is being used to study some objects that you don't hear much about except in amateur circles. For example, this article includes spectacular photos of the Orion Nebula. All sorts of interesting wisps and filaments are present that literally have never been seen before. Some seem to emerge from newly formed stars. All this was unseen before, even in the best earth bound scopes, because of atmospheric interference. It is certainly something to reflect on when we look at that old stand by in our own scopes.

The mirror problems don't hold up the study of our neighbor planets either. The coming and going of Jupiter’s south equatorial band and several of its spots have all fallen under Hubble’s gaze. The great white spot on Saturn got some attention, too. Since it can routinely make images of those planets as detailed and crisp as the Voyager photos taken a few days prior to closest approach, the space telescope allows astronomers to keep on studying the changing weather on those planets at a level of detail nearly the same as that given to us by the space probes. It also gives us the ability to take photos of Pluto and Charon that totally separate the moon from the planet. This ability is essential if precise mass and composition measurements are to be made for this odd and distant pair. Hopefully, this will finally allow a clear determination of how they came to be. Many people no longer feel Pluto is a proper planet, a leftover from the age of planetesimal accretion in the early days of the sun’s life. Instead, it is argued that Pluto / Charon is the result of a comet that flew too near one of the gas giants and eventually settled into its current, highly inclined orbit.

(Continued on page 6)
The WASP  
Volume 24, Number 4 — April 1992

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Warren Astronomical Society, Inc.  
P.O. Box 1505  
Warren, Michigan 48090-1505

1991 OFFICERS  
President: Robert Halsall  
1st Vice President: Frank McCullough  
2nd Vice President: Jeff Bondono  
Secretary: Kathy Charla  
Treasurer: Ed Cressman  
Librarian: Don Mick

The Warren Astronomical Society, Inc. is a local, non-profit organization of amateur astronomers. The Society holds meetings on the first and third Thursdays of each month, starting at 7:30 p.m.

General meeting on first Thursdays:  
Cranbrook Institute of Science  
500 Lone Pine Road  
Bloomfield Hills, Michigan

Business meeting on third Thursdays:  
Macomb Community College  
South Campus, Building B, Room 209  
14500 Twelve Mile Road  
Warren, Michigan

MEMBERSHIP AND DUES
Membership in the Society is open to all. Annual dues are:
- Student $12.00
- College $17.00
- Individual $25.00
- Additional Family members $5.00 per person
- Senior Citizen $17.00

Among the many benefits of membership are:
- Discount magazine subscriptions:  
  - Astronomy $16.00 (12 monthly issues)
  - Deep Sky $10.00 (4 quarterly issues)
  - Sky and Telescope $18.00 (12 monthly issues)
  - Telescope Making $10.00 (4 quarterly issues)
- Free copy of each WASP newsletter.
- Free use of Stargate Observatory.
- Special interest subgroups. (See subgroup chairpersons.)
- Call list - don't miss unexpected events.
- Free membership in Astronomical League.
- Free copy of Reflector (Astronomical League newsletter).
- Free use of W.A.S. library. (See Librarian.)
- Rental telescopes. (See Observatory Chairperson.)

Send membership applications and dues to:  
Ed Cressman  
30540 Pierce Road  
Southfield, Michigan 48076

WARREN ASTRONOMICAL SOCIETY PAPER
The WASP is the official monthly publication of the Society. Each new issue of the WASP is made available at the Macomb meeting on the third Thursday. Non-members will be charged $1.00 for each new issue. Back issues, when available, are free. Requests by other clubs to receive the WASP and other correspondence should be addressed to the editor.

Articles for inclusion in the WASP are strongly encouraged and should be submitted to the editor on or before the first Thursday of each month. For further information on contribution, see the "Instructions for Authors" box on page 4 of Volume 23, Number 5.

Send articles to the editor:  
Douglas E. Goudie  
2420 Alexander  
Troy, Michigan 48083-2405

Disclaimer: The articles presented herein represent the opinions of their authors and are not necessarily the opinions of the Warren Astronomical Society or this editor.

STARGATE OBSERVATORY
The observatory is owned and operated by the Society in conjunction with Rotary International. Located on the grounds of Camp Rotary on 29 Mile Road, 1.8 miles east of Romeo Plank Road, Stargate features a 12.5 inch f/17 club-built Cassegrainian telescope under a steel dome. The observatory is open to all club members in accordance to the "Stargate Observatory Rules:" Those wishing to use the observatory must call the Observatory Chairperson (2nd Vice President) by 7:00 p.m. on the evening of the session.

LIBRARY
The Society maintains a library of astronomy-related books and periodicals at the Macomb County Community College meeting room. See the Librarian for rules or to check out a book.

SUBGROUPS
Special interest subgroups exist for those interested in specialized areas of astronomy. Contact the chairperson of each subgroup for more information on that group.
- Computers: Larry Kalinowski
- Cosmology: Mike O'Dowd
- Deep Sky: Doug Bock
- Lunar / Planetary: Alan Rothenberg
- Solar: Ed Cressman
- Telescope making: Jim Houser

CALL LIST
The Call List is a list of people who wish to be alerted of spectacular and unexpected astronomical events. Anyone who notices such an event calls the next person on the call list. That person in turn calls the next person, etc. A call list member can restrict callings to certain available times. Any Society member is welcome to join the call list.

To join the call list, please notify Marty Kunz at
Upcoming Astronomy Conventions
By Marty Kunz
S.M.U.R.F.S. Convention

The third annual Southern Michigan Universal Festival of Stargazers will be held at the River Valley Campground near Clare, Michigan on August 7 - 9. This is an informal gathering of local amateurs in a dark sky location and an opportunity for you to talk to other amateur astronomers with similar interests. There is no charge to attend (donations are accepted) unless you camp on-site: $14.00 per site per night (multiple tents per site). For more information see the flyer at the club meetings or contact:

Richard Walker
1220 Merkle Street
Ortonville, Michigan 48462

Hidden Hollow '92 and the Astronomical League Great Lakes Regional Convention

This year's Hidden Hollow / GreatCon will be on September 25 - 26. Speakers such as Richard Berry, Stephen O'Meara and others will be there. The convention site is limited to 400 people so sign up early if you want to attend. There is an astrophotography and amateur telescope making contest. The League is sponsoring an award for a local amateur that has made an outstanding contribution to astronomy. The League is also sponsoring a national award for a young astronomer under the age of nineteen. Again, see the flyer at the club meeting for more information.

Hubble Space Telescope Monthly Status Report
June 1992

Astronomers reported that NASA's Hubble Space Telescope had detected a new class of object in the universe, gigantic and violent star-forming clusters created by the collision of two galaxies. Images of the core of the galaxy ARP 220 show that stars are produced at a furious rate from the dust and gas supplied by the interaction of the two galaxies, producing what is tantamount to a 'supernova factory'.

Meanwhile, HST mission operations were nominal during this reporting period, with operations having supported successfully science observations and normal spacecraft activities without any major problems.

In addition to the regular general observer programs, three programs from amateur astronomers were executed during the month. The amateur astronomers visited the Space Telescope Science Institute for assistance in conjunction with their observing and receipt of associated data.

The Amateur Astronomer Program on HST was announced in 1986 in recognition of the contributions of the estimated 300,000 amateur astronomers in the United States. Amateur groups are dedicated to activities such as monitoring variable stars, mapping portions of the Moon and standing nightly watch to detect new comets and supernovae events. The amateur proposals for time on HST are selected on a competitive basis similar to the professional programs.

Official Emblem of STS-50

Columbia will be launched into a 184 statute mile circular orbit inclined 28.5 degrees to the Equator from Pad 39-A. The launch window on June 25 opens at 12:07 p.m. EDT and closes at 2:37 p.m. EDT. Columbia will end its mission with a landing at Dryden Flight Research Facility, California. The mission duration is planned for 12 days, 20 hours and 29 minutes.

Hawthorn Hollow Lecture List

The desire to have club members present astronomy programs to the scouts at Hawthorn Hollow has risen to the point where we have been asked to be there on a monthly basis. To ease the lecture load, club members have been divided into two groups. These groups will alternate their scout responsibilities monthly as detailed below.

Group 1
Jeff Bondono
Steve Hughes
Riyad Matti
Frank McCullough
Mike O'Dowd

Group 2
Ed Cressman
Bob Halsall
Scott Jorgensen
Marty Kunz
Nancy Rowe

Schedule
July 11, 1992  10:00 p.m.  Group 1
August 8, 1992  9:30 p.m.  Group 2
September 12, 1992  9:00 p.m.  Group 1
October 3, 1992  8:30 p.m.  Group 2
COBE Detects Structure of Early Universe
By Paula Cleggett-Haleim, Headquarters, Washington, D.C. and Randee Exler, Goddard Space Flight Center, Greenbelt, Maryland

April 23, 1992 - Scientists announced today, at the American Physical Society's meeting held in Washington, D.C., that they have detected the long-sought variations within the glow from the Big Bang - the primeval explosion that began the universe 15 billion years ago - using NASA's Cosmic Background Explorer (COBE). This detection is a major milestone in a 25-year search and supports theories explaining how the initial expansion happened.

These variations show up as temperature fluctuations in the sky, revealed by statistical analysis of maps made by the Differential Microwave Radiometers (DMR) on the COBE satellite. The fluctuations are extremely faint, only about thirty millionths of a degree warmer or cooler than the rest of the sky, which is itself very cold - only 2.73 degrees above absolute zero. The DMR is still gathering data and the measurements are expected to become even more precise.

The Big Bang theory was initially suggested because it explains why distant galaxies are receding from us at enormous speeds, as though all galaxies started moving away from the same location a long time ago. The theory also predicts the existence of cosmic background radiation - the glow left over from the explosion itself. The Big Bang theory received its strongest confirmation when this radiation was discovered in 1964 by Arno Penzias and Robert Wilson, who later won the Nobel Prize for this discovery.

Although the Big Bang theory is widely accepted, there have been several unresolved mysteries. How could all of the matter and energy in the Universe become so evenly mixed in the instant following the Big Bang? How could this evenly distributed matter then break up spontaneously into objects of all sizes, such as galaxies and clusters of galaxies? The temperature variations seen by COBE help to resolve these mysteries.

"The COBE receivers mapped the sky as it would appear if our eyes could see microwaves at the wavelengths 3.3, 5.7 and 9.6 mm, which is about 10,000 times longer than the wavelength of ordinary light," explained Dr. George Smoot, University of California, Berkeley, the leader of the team that made this discovery. "Most of the energy received from the sky at these wavelengths is from the cosmic background radiation of the Big Bang, but it is extremely faint by human standards.

"Hundreds of millions of measurements were made by the DMR over the course of a year, and then combined to make pictures of the sky. Making sure all the measurements were combined correctly required exquisitely careful computer analysis," Smoot explained.

Another COBE scientist, Dr. Charles Bennett of the Goddard Space Flight Center, Greenbelt, Maryland, explained that a major challenge for the team was to distinguish the Big Bang signals from those coming from our own Milky Way Galaxy. "The Milky Way emits microwaves that appear mostly concentrated in a narrow zone around the sky. We compared the signals at different positions and at different wavelengths to separate the radiation of the Big Bang from that of the Milky Way Galaxy," said Dr. Bennett.

The temperatures and sizes of the fluctuations in the background radiation COBE detected agree with the predictions of "inflationary cosmology," a theory that says the structure and behavior of the Universe were determined by minute fluctuations occurring when the Universe was much younger than one-trillionth of a second. The COBE results provide new evidence in support of the "inflationary" scenario.

The amount of gravity provided by these visible fluctuations was inadequate to draw together the galaxies and clusters of galaxies. Instead, astronomers conclude that the galaxies formed only because most of the material in the Universe is invisible and totally unlike ordinary matter.

This "dark matter" provides the necessary gravitational attraction for forming galaxies. The fluctuations seen by COBE are too small to explain how the visible matter in the young Universe could condense into the galaxies that now exist. According to COBE scientist Dr. Edward Wright from the University of California, Los Angeles, the COBE measurements support theories postulating large amounts of dark matter.

"These theories say that most of the matter in the Universe is invisible to us and must be a new kind of matter, not yet detected in our laboratories," he explained. "Nevertheless, we need such invisible matter to explain how galaxies formed in the early Universe and gathered themselves together into huge clusters. Ordinary matter would be attracted into regions of concentrated dark matter, and the Universe as we know it today could develop, eventually leading to the formation of galaxies, stars and planets," Wright said.

COBE was launched in November, 1989, from Vandenberg Air Force Base, Calif., aboard a Goddard-managed Delta launch vehicle. The Goddard Space Flight Center, Greenbelt, Maryland, manages COBE for NASA's Office of Space Science and Applications, Astrophysics Division, Washington, D.C.

Hubble Space Telescope Probes the Chemistry of the Early Universe
By Paula Cleggett-Haleim, Headquarters, Washington, D.C.; Ray Villard, Space Telescope Science Institute, Baltimore, Maryland and Dr. Doug Duncan, Space Telescope Science Institute, Baltimore, Maryland

January 13, 1992 - Using a unique capability of NASA's Hubble Space Telescope (HST), astronomers announced today that they have detected the rare element boron in an ancient star. This element may be "fossil" evidence of energetic events which accompanied the birth of the Milky Way.
galaxy. An alternative possibility is that this rare element may be even older, dating from the birth of our universe. If so, then the HST findings may force some modification in theories of the Big Bang itself.

Dr. Douglas Duncan of the Space Telescope Science Institute in Baltimore, Maryland and Des. David Lambert and Michael Lemke of the University of Texas, Austin announced their results today to a press conference at the 179th meeting of the American Astronomical Society in Atlanta. The research will be presented to the meeting of the society in a session for late papers on Thursday, January 16.

The light from boron only appears in the ultraviolet part of the spectrum and so does not penetrate Earth’s atmosphere. “That’s why no one was able to make this discovery before,” says Dr. Duncan. “Having a powerful telescope high above Earth’s absorbing atmosphere has given scientists a new window on the universe. This was always considered to be one of the most important reasons for building the Space Telescope.”

Using HST’s Goddard High Resolution Spectrograph, the researchers detected traces of boron in a yellow 7th magnitude star called HD 140283, located 100 light-years away in the constellation Libra. At an estimated age of 15 billion years, the star is one of the oldest known.

Because it was among the first stars to form in the Milky Way galaxy, HD 140283 should contain elements which were incorporated into the star long ago. Preserved in the star for billions of years, such material offers clues to conditions of the early universe when the star formed.

Predictably, HD 140283 contains mostly primordial elements synthesized in the Big Bang, such as hydrogen, helium and traces of lithium. Heavier elements such as carbon, nitrogen, oxygen and others found in the Sun, the Earth and Solar System planets are thought to have been built up during the lifetime of the galaxy by nuclear reactions in successive generations of stars.

The discovery of boron comes as a surprise, however. Previously, another rare element, beryllium, had been detected in the star with ground-based telescopes.

The key question is from where did the beryllium and boron come. Scientists know that today, beryllium and boron are produced by cosmic rays, high-speed and extremely energetic particles which occasionally collide with atoms in interstellar space and split them apart into lighter elements. If substantial amounts of beryllium and boron, the fourth and fifth lightest elements, were formed very rapidly early in the history of the Milky Way, swarms of energetic particles may have been present at the birth of the galaxy. The cosmic rays could have been produced by supernovas or other highly energetic events which occurred early in the life of the Milky Way.

However, the astronomers found slightly different relative proportions of beryllium and boron than what is expected from cosmic ray production. This offers the alternative possibility that beryllium and boron were synthesized in the first moments of the universe's creation.

The currently accepted version of the Big Bang says that the early universe was uniformly hot and dense. However, more recent theories suggest that the Big Bang developed some structure even during the first few minutes. These new theories differ from the traditional one in predicting that small but detectable amounts of beryllium and boron might be created.

To confirm these results, the astronomers plan additional HST observations of an even older star later this year. If the boron was produced by cosmic rays within the young Milky Way, it should diminish the farther back in time the astronomers look, hence closer to the birth of the galaxy. If, instead, astronomers find the same amount of boron in the older star, rather than less, the finding will support the alternative explanation that boron was produced in the Big Bang.

“Either way, this will be an exciting test to show which of the possible explanations is correct,” concludes Duncan. “We know that our picture of the beginning of the galaxy and the beginning of the universe is undoubtedly oversimplified, and it is satisfying to be able to add a little more detail.”
The article includes an absolutely stunning photo of Eta Carinae taken with the Hubble. It shows lots of fine, filamentous structure when all other photos just show a blur. Also, they printed the picture of supernova SN1987a with the illuminated matter ring around it. In this photo we are actually seeing the material from the previous solar wind being heated by UV radiation. The ring may have a very short life. In a few years the supernova ejecta should catch the ring and rip it apart. If so, Hubble will be watching - that will surely be a magnificent event.

When you see the really amazing things that are done with the Hubble, even though the mirror is flawed and the whole thing goes into paroxysms every time it ventures in or out of the earth’s shadow, it really makes you wish all these things were fixed. What wonders we would see!

The May Scientific American is worth a fast look, if only for the COLOR composite picture of nine different planetary nebulae. Planetary nebula are the leftovers from the final phase of a star’s life. As a star (such as our Sun) ages, it sheds a large amount of matter in the form of a strong solar wind. In the red giant phase, this wind can increase by a factor of nearly a million. Larger stars like Mira may drive this strong wind via cosmologically rapid changes in size and temperature as the core changes from burning hydrogen to helium to carbon, oxygen and nitrogen. When some of these large stars reach the final part of the giant phase, a superwind' carries off material at the rate of one solar mass every 10,000 years! After all the shedding is over, the remnant star in the center of the nebula is almost always 0.6 solar masses. This is due to the fact the larger stars have larger mass losses, too. A few thousand years after the superwind stops flowing, the remaining core has collapsed under its own weight until it reaches a temperature in the area of 25,000 degrees. At that point, it gives off enough high energy radiation that it ionizes the shell of gas it blew off as the superwind and solar wind. This shell shines as the stripped electrons recombine, giving off light. Eventually the central star will cool and the planetary nebula will no longer be ionized. At that point, it vanishes from our telescopes, though it should still be visible for a while at infrared or radio wavelengths. Not to worry though, this takes thousands of years - the Dumbbell and Owl will be around as long as we are.

If you have viewed planetary nebulae, you know they all look different. Some are round, but most are interesting shapes with knots and twists. Even the famous Ring has a sort of lopsided nature. Some of the more elliptical planetaries form due to a stronger solar wind at the equator of the star, this stretches out the shell in that area and builds a sort of egg-shaped shell which looks like an ellipse from Earth. If the star has a partner, the complex gravity field of the binary pair twists the planetary nebula into a butterfly shape; NGC 650-1 and 2346 are examples. The Helix nebula is another example of an odd shape. It almost looks like two planetaries superimposed. This is the result of the outflowing material compressing the interstellar medium, which forms a second glowing arc.

In a more exotic vein that may appeal to Sci-Fi fans, there has been a major change of view about the tidal forces surrounding black holes. Black holes, of course, are the remains of very large stars that went through supernova explosions and then collapsed all their mass to a mathematical point (in theory). Fortunately, if you are like me and can't accurately picture several thousand solar masses taking up virtually no volume, there is a nice big event horizon around a black hole. This is an area from which no information can be obtained because even light can't get out. The standard picture of a space ship going down a black hole is that it speeds up as it goes (though time slows down for those on board), and the difference in the gravitational field between astronauts' heads and feet rips them apart. In essence its a pretty ugly death, being torn apart by gravity over an extremely long time from your own perspective.

This was a real let down to Sci-Fi writers who used black holes as tunnels to other universes or other parts of our universe. Well, take heart. Workers in Alberta have done new calculations that show that the tidal forces are Not that great between the event horizon and the inner boundary. The inner boundary is a place where not only does no information get out to the outside world, but no information gets in either. This is because it takes an infinite amount of time for the light to get there. It is not clear how the space ship would get there either, actually. But it is good news for authors that their heros are not going to get shredded inside the event horizon. One added benefit: inside the event horizon, time in the outside universe appears to speed up, so, as you near the inner boundary, all of the future 'passes before your eyes'! What a boon to crystal ball readers, eh?

Finally, you may or may not have read about gamma ray bursters. There were several articles in Astronomy over the last three years by amateur groups that feel they have seen the optical accompaniment to these enigmatic, high energy events. That may not be so, but there is no doubt that the Compton gamma ray satellite is seeing the gamma rays - and they are not doing what was expected. What little had been puzzled out about these objects was that they might have to do with the huge magnetic fields around neutron stars in our own galaxy. But the nearly random distribution of the first year's worth of data strongly indicates that the source can not be neutron stars in our galaxy. Never held back by being wrong before, the theorists have whipped up a new batch of theories. One is that the bursts come from the merging of binary pairs of neutron stars in other galaxies. That is also the sort of event that is first expected to be detectable with gravity wave devices. Hopefully someone at LIGO will think of this, too, and the first detection of gravity perturbations will also solve the mystery of gamma ray bursters.

In the mean time... Clear skies!
Catch a Comet
Comet Shoemaker-Levy (1991al)

Of the half dozen or so comets discovered each year, many remain disappointingly faint, blurry blobs of light as they drift across the background stars. However, every now and then a comet appears whose orbit brings it close enough to the Sun that it may brighten appreciably - sometimes to the point of naked eye visibility - and it might even develop a tail. Comet Shoemaker-Levy may be just such a comet.

The detail chart at right was generated using the orbital elements reported in the Computer Chatter column of the June 1992 WASP. It shows the path of the comet as it passes through Ursa Major when it is expected to be at its brightest. This will probably happen between July 10 and 15 when the comet will be about 30 degrees above the northern horizon. Each dot along the comet's trail shows the position of the comet at two-hour intervals while each arrow points to midnight of the indicated date. Inset is a low-scale map showing the general region of sky.

Hopefully Shoemaker-Levy will be a great chance to show a comet to the public ... Happy viewing!

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**July 1992**

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<th>Sunday</th>
<th>Monday</th>
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<td></td>
<td></td>
<td>21 - Moon is at perigee</td>
<td>6 - Moon is 4° south of Mercury</td>
<td>8 - Earth is at aphelion</td>
<td>16 - Moon is 7° south of Jupiter</td>
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<tr>
<td>5</td>
<td>Mercury at greatest eastern elongation</td>
<td>23 - First quarter Moon</td>
<td>19 - Uranus is at opposition</td>
<td>8</td>
<td>10</td>
<td>11</td>
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<td>6:00 - 21:11</td>
<td>6:00 - 21:11</td>
<td>6:01 - 21:10</td>
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<td>6:03 - 21:09</td>
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<td>2 - Moon is 1.8° north of Uranus</td>
<td>19 - Moon is 5° north of Saturn</td>
<td>19 - Moon is 5° north of Saturn</td>
<td>7 - Moon is at apogee</td>
<td>23 - Mercury is stationary</td>
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<td>19</td>
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<td>22</td>
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<tr>
<td>18 - Last quarter Moon</td>
<td>4 - Moon is at perigee</td>
<td>6:12 - 21:01</td>
<td>6:13 - 21:00</td>
<td>6:14 - 20:59</td>
<td>6:15 - 20:58</td>
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</table>
### Warren Astronomical Society Calendar 1992

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td></td>
<td></td>
<td><strong>Solar Group</strong> at Ed Cressman's house when the weather is clear.</td>
</tr>
<tr>
<td>Monday</td>
<td>June 22</td>
<td>7:30 p.m.</td>
<td><strong>Board Meeting</strong> at Frank McCullough's house.</td>
</tr>
<tr>
<td>Thursday</td>
<td>July 2</td>
<td>7:30 p.m.</td>
<td><strong>General meeting</strong> at Cranbrook Institute of Science.</td>
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<td></td>
<td>July 10-11</td>
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<td><strong>MSU Observatory Open House.</strong></td>
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<tr>
<td>Saturday</td>
<td>July 11</td>
<td>10:00 p.m.</td>
<td><strong>Hawthorn Hollow Girl Scout Astronomy Lecture</strong> given by Group 1. Bring telescopes. Contact: Jeff Bondono.</td>
</tr>
<tr>
<td>Thursday</td>
<td>July 16</td>
<td>7:30 p.m.</td>
<td><strong>Business meeting</strong> at Macomb Community College.</td>
</tr>
<tr>
<td>Thursday</td>
<td>July 23</td>
<td>8:00 p.m.</td>
<td><strong>Computer Group</strong> meeting at Larry Kalinowski's house.</td>
</tr>
<tr>
<td>Monday</td>
<td>August 3</td>
<td>7:30 p.m.</td>
<td><strong>Board Meeting</strong> at Jeff Bondono's house.</td>
</tr>
<tr>
<td></td>
<td>August 7-9</td>
<td></td>
<td><strong>Southern Michigan Universal Regional Festival of Stargazers</strong> near Clare, Michigan. Contact: Richard Walker, 1220 Merkle Street, Ortonville, MI 48462; (313) 627-9524.</td>
</tr>
<tr>
<td>August 28-29</td>
<td></td>
<td></td>
<td><strong>Southeastern Michigan Star Party</strong> through Eastern Michigan University. Register by August 21. Contact: Kevin Dehne, 39576 Ronayton, Novi, MI 48377; (313) 347-3844</td>
</tr>
<tr>
<td>September 25-26</td>
<td></td>
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<td><strong>Hidden Hollow '92 I GreatCon '92</strong>. Register by September 5. Contact: Hidden Hollow '92, P.O. Box 653, Ashland, OH 44805.</td>
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