Journal Roundup: Cosmology
By Scott Jorgensen

This month there has been a lot of cosmology news. Possibly, the column should be renamed The Cosmology Corner.... There were two interesting solar system articles appearing in Science. The first piece deals with magnetic storm warnings. Most of us believe (and are thankful!) that magnetic storms come from flares on the Sun; they eventually lead to auroras here on Earth. However, there are a few bad effects associated with magnetic storms. Ask the six million people who lost power in Quebec, Canada during the storm of March 1989. Frequently there are radiation alarms tripped on high flying aircraft and the military can lose track of dozens or even hundreds of pieces of space debris during a magnetic storm. So, everyone was a bit shocked at the emerging picture that magnetic storms actually do not require a flare at all. Instead, coronal mass ejections, where huge blobs of coronal plasma escape into space, seem to be the culprit. These surges in the solar wind - surges that can actually lead to shock waves hitting the Earth's protective magnetosphere - cause huge fluctuations in the magnetic field at ground level and thus massive currents in very long power lines. But there is a hitch: the Sun's field must be opposite the Earth's for the particles and field flux to link up and give us an aurora and the power company conniption fits.

In the 60s and 70s everyone was sure that solar flares caused both the warping in the solar magnetic field and also injected the required charged particles into space. And indeed one or two days after a big flare there is often a nice aurora. But some times huge bubbles of plasma lift off the Sun without any flare. These glowing blobs were first seen by SkyLab. They are often the size of the Sun and can contain 10 million tons of material moving at up to 1,200 kilometers per second! A flare does not always occur at the same time. So, instead of flares, the best tip of an impending magnetic storm is actually prominences that lift off the surface of the Sun rapidly and are directed at Earth.

A prominence is detectable by amateurs with H-alpha filters, though the speed of lift-off is not available to us. Sadly, the pros can't get that information either, at least not yet.

One idea to get this information is to launch a satellite into solar orbit one quarter year ahead of Earth so we can see the prominences lifting off the Sun and measure their speeds. But even without that, magnetic storm prediction has improved because the location of prominences are being taken into account in the prediction, not just flares.

Farther out into space, the Ulysses solar polar orbit satellite just flew by Jupiter bagging the last data on that planet we are likely to get before Galileo arrives in '95. It turns out that there were magnetic surprises there as well. Jupiter has a magnetic field just as Earth does, but much more powerful. When Ulysses arrived at Jupiter to get a gravity boost into polar orbit, NASA/JPL staff turned on the instruments and found that the field had grown to be twice as big as it was during the Voyager era! Actually, when the Pioneer spacecraft flew by it was big, too, but apparently people had written that off to error. No chance of error this time; these are some of the best instruments ever flown.

So why does the magnetic field change so much? One reason may be that Jupiter has a moon with active volcanoes. At the March Cranbrook meeting, Alan Rothenberg told us about Io's volcanoes. They erupt a mixture of sulfur and sodium compounds. As much as one ton of sulfur dioxide per second is blown out at escape velocity and leaves the moon forever to orbit Jupiter in a ring of ions that shares Io's orbit. Jupiter's large and superintense radiation belts quickly ionize the gas to a plasma which interacts with the magnetic field. In years when the solar wind has a low pressure and 10 is not active, the field can grow to be large; in years when the solar wind pressure is high, the field shrinks. But when 10 is active, as it was when Voyager visited, the increased ion concentration apparently can interact with the magnetic field and cause it to contract.

It is interesting to note that 10 is 400,000 kilometers out from Jupiter, not too different from the distance between Earth and our moon. Imagine the auroras if the Moon had active volcanoes.... An interesting editorial appeared in the Scientific American recently. The piece discussed the decidedly nonscientific attitude most professional scientists take to Big Bang cosmology. Authored by some very big names, including Arp and Hoyle, it showed that there is — or at least should be — room for alternate theories about the universe. About a year back, this column featured Scientific American's review of the state of cosmology. The standard story is that the universe exploded out of a point and has expanded ever

(Continued on page 6)
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2nd Vice President: Jeff Bondono 731-4706
Secretary: Kathy Charla 334-5406
Treasurer: Ed Cressman 645-1837
Librarian: Don Mick 779-2784

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:
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  Sky and Telescope $18.00 (12 monthly 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 articles to the editor:
Douglas E. Goudie 680-0434
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 776-9720
Cosmology: Mike O'Dowd 268-7125
Deep Sky: Doug Bock 730-0273
Lunar / Planetary: Alan Rothenberg 624-9339
Solar: Ed Cressman 645-1837
Telescope making: Jim Houser 294-1952

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 then 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 477-0546.
Computer Chatter
By Larry F. Kalinowski

Comet Shoemaker-Levy (1991al), reported here a few months ago, is becoming well placed for northern observers through May and June. The comet will be a circumpolar object about sixth magnitude during the middle of July.

Don't forget that our new meeting place for the Computer Group will be Gary Gathen's house in May. The meetings will start at 7:30 p.m. Gary proposes to hold the meetings for the next six months. Gary's home is located three blocks south of Ten Mile Road and about a half block west of Woodward at 21 Elm Park in Pleasant Ridge. His number is 543-3366.

The P5 project at Intel is really a 586 processor project. Rumors say that the 586 will come out when AMD introduces their 486 chip. It'll be Intel's way of upping AMD and stealing their glory. More rumors say that Intel's introduction to the 586 processor will really be a 386SX. I'll have a 64-bit internal bus and a 32-bit external bus. The real 586, with 64-bit external bus, won't be out sometime after the introduction of the 386SX.

Ken Kelly's new address is HCR 32, Box 1011, Pahrump, Nevada 89041-9804. I'm sure he'll welcome a letter or two from some of the club members. Ken is out in the wilderness were the skies are great. If I remember right, he's somewhere between Las Vegas and Death Valley, very near the California Border. The elevation is 2660 feet with no telephone and maybe some electricity by now. Ken says he does have some neighbors and one of them is an astronomy buff.

The computer market seems to be the most volatile market in the world. New models are coming out just as fast as new companies. The laptop market is now steadily declining and the notebook market has doubled every year for the last three years. New versions of the 486 processor are making heads reel. With talk about the 586 coming to fruition, the newcomer to computers must be lost in a sea of technical mumbo-jumbo.

More major advances have been made in the laser printer field by an American company called Kyocera Electronics, Inc. Their model FS-1500A doesn't use a normal toner cartridge. A long-lasting amorphous silicon drum and light emitting diode scanning system is used. Copy speed is 10 pages per minute at 300 dots per inch. The company invented a new toner that uses ceramic particles. Copies will cost less than one cent each compared to the three cent cost of standard copies.

According to a major software test made in California, the three top presentation graphics programs are Freelance for Windows, Harvard Graphics for Windows and Aldus' Persuasion, in that order.

Another visitor from space makes a close approach to Earth on May 1st It's Comet Tanaka-Machholz (1992b). The comet's brilliance never gets brighter than 8.7, according to the ephemeris I have. It does become circumpolar later in the spring, making it well-placed for those who have the right kind of sky to observe it. The revised orbital elements from IAU Circular No. 5506 are:

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<td>Equinox:</td>
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There will be two computer shows in early June. One on Saturday, June 6, and one on Sunday, June 7. The Saturday show will be at the Wayne-Ford Civic League, 1645 Wayne Road, one block south of Ford Road in Westland. The Sunday show will be at the Southfield Civic Center, 26000 Evergreen, Southfield, Michigan. Both shows have a $4.00 admission fee.

The next meeting of the Computer Group will be on May 28. See you at Gary's place. Clear skies

Star Party at the Hawthorn Hollow Observing Site
Saturday, May 30, 1992, 9:30 p.m. - 8:00 a.m.

All club members who wish to attend are welcome, provided that you notify either Bob Halsall or Jeff Bondono by May 21. When you do so, you will be given a map to Hawthorn Hollow and a listing of the Site Rules if you don't already have them. Please be sure to follow the rules completely. If the weather looks poor on the day of the star party, call Jeff (731-4706) to find out if the star party will be held. There will be a recorded message if Jeff is not home.

Hoping to see you there....
Jeff Bondono, Observatory Chairman

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.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeff Bondono</td>
<td>Ed Cressman</td>
</tr>
<tr>
<td>Steve Hughes</td>
<td>Bob Halsall</td>
</tr>
<tr>
<td>Riyad Matti</td>
<td>Scott Jorgensen</td>
</tr>
<tr>
<td>Frank McCullough</td>
<td>Marty Kunz</td>
</tr>
<tr>
<td>Mike O'Dowl</td>
<td>Nancy Rowe</td>
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Schedule

<table>
<thead>
<tr>
<th>Date</th>
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<tr>
<td>June 6, 1992</td>
<td>10:00 p.m.</td>
<td>Group 2</td>
</tr>
<tr>
<td>July 11, 1992</td>
<td>10:00 p.m.</td>
<td>Group 1</td>
</tr>
<tr>
<td>August 8, 1992</td>
<td>9:30 p.m.</td>
<td>Group 2</td>
</tr>
<tr>
<td>September 12, 1992</td>
<td>9:00 p.m.</td>
<td>Group 1</td>
</tr>
<tr>
<td>October 3, 1992</td>
<td>8:30 p.m.</td>
<td>Group 2</td>
</tr>
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Hubble Space Telescope
Monthly Status Report
March 1992

The Hubble Space Telescope continues to perform normal operations, engineering activities, and science programs. Scientific efficiency is currently at 30% and increasing toward the mission goal of 35%. Operational experience has led to refinements in procedures and changes in both the ground and flight software that contribute to the more efficient operations. The Goddard High Resolution Spectrograph (GHRS) side 2 was returned to routine scheduling of observations after a curtailed operations period of about eight months, during which the Project and instrument Teams investigated an intermittent open circuit in the electronics.

Extensive testing and analysis showed that the intermittent failure was temperature sensitive and that maintaining the temperature of the electronics at values above +five degrees Centigrade has the effect of closing the circuit. A modification to operational procedures has allowed the thermal environment within the instrument to be controlled sufficiently to support reliable operation of side 2.

Using this procedure, operations with side 2 have been run on an experimental basis since November 1991 without experiencing a communications failure. Only routine operations with side 2 will be scheduled while the Project investigates additional steps that may be able to restore full operation to side 1.

The Wide Field Planetary Camera (WFPC) is experiencing some residual contamination effects on the detectors. When operated at low temperatures, the instrument detectors experience a contamination buildup.

The corrective procedure is to occasionally warm the detectors to temperatures at which the substance evaporates. In February, after a routine clean-up procedure, it was found that the major contaminant film had been removed but there remained a mottled residual.

It is currently believed that the residual contamination most likely resulted from an exceptionally heavy build-up of contaminant material over a protracted period of time between decontamination procedures (six months). Observations with the WFPC are proceeding at their normal frequency while an in-depth assessment is made of the situation. The residual contaminant is expected to have only minor effects on the data.

April 1992

On April 24, 1992, the Hubble Space Telescope celebrated the second anniversary of its launch to orbit aboard the Shuttle Discovery. The beginning of HST's third year of operations saw announcements of a wealth of new astronomical discoveries, increasingly successful science operations, progress towards greater scientific efficiency and energetic planning for the 1993 Servicing Mission. The anniversary was marked by the port of HSTs discovery of a potential black hole at the center of a nearby galaxy (M32), the hottest known star (NGC2440), and images of Jupiter's aurora.

On April 7, an amateur astronomer in New Zealand detected the rapid brightening of the dwarf nova OY Carinae. Because only the Faint Object Spectrograph (FOS) on HST is able to resolve both the rapid variations of light during the outburst and provide the important spectrographic data, a target of opportunity observation was requested. Science and Mission Operations personnel were able to respond quickly and had the first observation scheduled within five days of notification. Approximately 13 observations of OY Car are being planned over the next two months to monitor the changing phases of the event. Other observing programs that were displaced by the target of opportunity were rescheduled to a later date with minimal impact to the programs.

The Solar Array Gain Augmentation (SAGA) II software was installed successfully onboard the spacecraft on April 15. SAGA II is an upgrade to the software that currently is being used to attenuate the jitter caused by the solar array panels. The upgrade is designed to compensate for the jitter mode at 0.6 Hz. Preliminary results indicate significant improvement. Flight data will be collected over the next month to evaluate performance further.

The first HST Servicing Mission (STS-61) is manifested for December 1993 and the project is working enthusiastically towards a November 1993 launch readiness.

Club Update
By Marty Kunz

Astronomy Day was May 9 at Cranbrook Institute of Science. As usual, the weather did not fully cooperate; however, partial cloudy conditions did prevail. About 15 members brought their telescopes to the rim of the reflecting pool and occasionally the sun popped out behind the clouds every several minutes. A few sun spots were visible and a nice prominence was seen through Mike O'Dowd's hydrogen alpha filter. Later in the afternoon, the Moon could be seen between the clouds. I would like to thank everyone who participated in making our club's presence known to the public.

On Saturday, May 16, four members of our club ventured to East Lansing for the annual Astroganza Starbowl competition. As reigning champions from the past several years, we were ready to defend our title and go home with the first place prizes. NOT! This year we knew our team lacked our walking computer and master of astronomical trivia, Ken Kelly. Teleconferencing was not allowed. Our team died to the likes of E.M.U. and Capitol Area which answered questions of the most obscure nature by pooling all of their astronomical knowledge and then guessing the right answer. Unfortunately, we only took third place. But wait until next year....
Stars of Interest, Part 2
By Steve Franks
Alpha Geminorum (Castor)

Foremost of the hoard of double stars in this region is the splendid visual binary, Castor. Telescopically, this object is a triple system, consisting of two blazing white suns of magnitudes 2.0 and 2.9, presently a tight two seconds of arc apart. There is also a reddish-orange third star found 73 seconds distant which is known variously as Castor C or YY Geminorum. It is a rapid eclipsing binary with a period of just 19.5 hours. Normally a 9.1 magnitude object, it fades noticeably during eclipse to a minimum of 9.6- a full half magnitude!

The duplicity of Castor was discovered in 1718 by the English astronomer Bradley and Pound. The certainty of its orbital motions first fully convinced William Herschel of the existence of binary systems (another of his many discoveries at the eyepiece), and his son John considered it the brightest and finest of all double stars visible from the northern hemisphere.

The A-B pair revolves in a (somewhat uncertain) period of about 420 years while Castor C requires an estimated 100 centuries to make a circuit about them. From a maximum separation of more than six seconds in the late 1800s, the bright pair was closing until 1969, at which time they reached a minimum near 1.8 seconds - just beyond the reach of a two-inch telescope. It is now slowly opening toward another maximum expected about the year 2100.

Because of orbital geometry, Castor actually displays two apparent maxima and minima of angular separation during each orbital revolution.

Castor B was south of the primary in 1954 and was due east of it in 1982; presently it lies near position angle 104 degrees. The changes in both position angle and separation of the A-B pair have been noticeable in small telescopes over the past few decades - a vivid display of binary motion! The C component appears fixed near position angle 165 degrees (slightly east of south in the sky).

The close pair will become easier to split with each passing year; all three stars can presently be seen nicely with a three-inch refractor at 100 power on a steady night. Larger apertures provide a beautiful view.

Castor C is of spectral class MIO and has an unmistakable orange or ruddy cast to it. The colors of the bright pair, however, are much more subtle and difficult to pin down. Both are early A-type suns; this class is usually regarded as either blue-white or green-white in hue. Both stars appear bright white on first glance, but closer inspection will reveal the presence of definite off-white tints.

Pickering included Castor in his roster under finest white double stars. Olcott saw the bright pair as both greenish-white and called it a "beautiful object." Bernhard, Bennett and Rice also listed both as greenish-white, with the comment "very luminous pair; one of the finest doubles." Smyth noted the tints as 'bright white, pale white" Brown saw both as blue-white and Muirden saw both yellowish. The most unusual impression is that given by Barns: "beautiful orange-blue pair for small glass." And finally, Webb considered Castor an "excellent object for small telescopes," and called the faint star reddish or purple in hue.

We should remember that most of these comments were made at a time when Castor was a much wider pair than in the present.

Not only does Castor C have a close companion as mentioned above, but so too do A and B! Both objects are spectroscopic binaries having periods of about nine and three days respectively. Thus what looks to be a single bright star to the unaided eye is in reality a complex multiple system consisting of at least six suns - all in motion about each other, serenely sailing the ocean of night as a close-knit family! Only our vantage point from a distance of 45 light-years keeps us from seeing the Castor system in its full glory.

First Observing Challenge Results

Congratulations goes to club member Steve Hughes on completing the requirements for the first observing challenge offered by Jeff Bondono. Reprinted here in part is Steve's response.

Jeff: Here are the notes for the "observing challenge." As you know, all objects were found on March 1 between 9:00 p.m. and 11:00 p.m. out at the Imlay City site with an eight-inch f/10 and a 32mm eyepiece (60x). It was fun except for trying to write down with cold hands on a lawn chair with my paper blowing around.... Why don't we put a dome out there?

[Following were his observational notes of seven objects.]

World's Largest Paper Airplane Record

The Guinness Book of World Records for the world's largest paper airplane was broken by high school students on March 25 at NASA Langley Research Center. The previous record was an airplane with a 16.4 feet wingspan and flew 84 feet from a 10 foot high podium.

The new record is a paper airplane with a 30.6 feet wingspan and flew 114.9 feet from a 10 foot high podium.

The airplane project was an educational initiative of NASA LaRC, the AIAA Hampton Roads Section, the Hampton City Public Schools, and the Virginia Air and Space Center.
since, accounting for the homogenous microwave background and the red shift of distant galaxies. But there are troubles: the microwave background is too smooth to explain the structure of super-clusters of galaxies, the inflation period is not clearly justified and some groups of very old stars seem to be as old or possibly older than the age of the universe. While Hoyle and Arp can not explain anything either, it is instructive that a day may come when people wonder how anyone ever bought into the current inflationary Big Bang theory.

Keep your thinking caps on. The March \textit{Scientific American} had two articles that might appeal to cosmology buffs. A review article on gravity wave detectors appeared at the end of the issue. It appears that the current generation of detectors will not see much, but the LIGO detector (in the planning stage now) may be able to see gravity waves from some exotic events, such as collisions of black holes, stellar collapse and fusion of neutron star binary pairs. While hardly common, this last event happens often enough that the scientists in charge feel they should see a couple of events per year with the LIGO. The LIGO must be able to detect events 650 million light years distant, which they anticipate will be possible when it is in ‘phase two’ where it will be more sensitive. If these folks succeed, they will give further support to the general theory of relativity and also for the first time actually measure space expanding and contracting the objects, including us, that reside within it.

The other cosmology article deals with an alternate to the inflation portion of the Big Bang theory. Instead of the somewhat arbitrary inflationary period, two theorists at Princeton suppose that "defects" in space called \textit{textures} are the original source of galaxy formation. Textures arise out of ‘symmetry breaking,’ a process from particle physics. The idea is that things which appear different become indistinguishable at high temperatures. For example, the strong force that works inside the atom and the electric force that can extend for miles, can become indistinguishable. As things cool they separate out, like rock candy forming out of hot supersaturated sugar water. Initially, the hot sugar water is all one homogenous fluid. But, as it cools, sugar crystals separate from the still fluid water. In the Textures theory, the new universe starts very smooth so the microwave background is smooth, but as it cools, defects start to occur in an assumed Higgs field. The Higgs field is sort of like an electric field, but for the base energy of space instead of electric charges. About 10,000 years after the Big Bang, these defects act as starting places for galaxies. While the current form of the Textures model can give a good match to the galaxy distribution, it does have adjustable parameters, too. So stay tuned. The last word is far from out in the intriguing field of cosmology.

"Til then, clear skies.

\* \* \* \*

\section*{The Third Observing Challenge}

\textbf{Grand Prize: Celestron Ultima II (11-inch Schmidt-Cassegrain telescope, fully loaded*)}

By Jeff Bondono

Ten objects are listed in the table below. If you observe seven of them, you will receive a ‘Certificate of Accomplishment’ from the club. To qualify for the certificate, you must

- Observe any seven of the 10 objects and write down what you see.
- Turn in your descriptions to Jeff Bondono by September 31, 1992.

Everything you submit will be returned to you.

One of the objects, Beta Lyra, is a variable star. An ‘observation’ of this object is a little different from the other objects on the list. To qualify as an observation, you must estimate the magnitude of this star on five different nights. This may sound like a lot of work, but really it is quite easy. Beta Lyra is a naked-eye star - a chart showing that star appears below. Three other stars on the chart are labelled with their magnitudes. To estimate the magnitude of Beta Lyra, simply walk outside during a commercial you've seen before, estimate there Beta fits in brightness between the three labelled stars, then write down the date, time and magnitude estimate. You should be back inside before the commercial ends. For example, if Beta appears to be halfway between the 3.2 magnitude star and the 4.0 magnitude star, your estimate should be 3.6. Five of these estimates qualify you for having observed Beta Lyra.

\begin{table}[h]
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\begin{tabular}{|c|c|c|c|c|}
\hline
\textbf{Coordinates} & \textbf{Type} & \textbf{Mag.} & \textbf{Size/Per Const.} \\
\hline
(2000.0) & & & \\
1741.9+7209 & double Psi Dra & 5.9 & 6.1 & 30.3* & Dra \\
1749.5+7009 & galaxy NGC6503 & 10 & 7' x 3' & Dra \\
1758.6+6638 & plan. neb. NGC6543 & 8.8 & 22" x 18" & Dra \\
1827.7+0634 & open clus. NGC6633 & 4.6 & 27" & Oph \\
1839.0+0527 & open clus. IC4756 & 5.4 & 52" & Ser \\
1850.1+3322 & variable Beta Lyr & 3.3-4.3 & 12.9days & Lyr \\
1905.0-0402 & double 15 AQI & 5.5 & 7.2 & 38.4" & Aql \\
1944.8+5031 & plan. neb. NGC6826 & 9.8 & 27"x24" & Cyg \\
1952.2+2925 & open clus. NGC6834 & 7.8 & 5" & Cyg \\
2023.1+4047 & open clus. NGC6910 & 7.4 & 8" & Cyg \\
\hline
\end{tabular}
\end{table}

*(This is the small print...) To qualify for the Celestron Ultima II Grand Prize: In addition to the above requirements, you must travel to two of the objects and return a sample from each of them to the Earth. Deliver this sample to Jeff Bondono for verification before September 31, 1992. In case two or more people fuller the Grand Prize requirement, a drawing will be held to award the Grand Prize.

\* \* \* \*
Open Star Clusters

Sometimes called galactic clusters because they are found in the concentrated plane of stars around the Milky Way's equator, the individual stars in open clusters are usually widely separated and easily resolved through telescopes. Generally, open clusters contain from several dozen to several hundred stars in a space of less than 10 parsecs in diameter. A few open clusters contain more than 1000 stars—notably M-67. These stars are not so clumped together as globular clusters, showing a loose or "open" appearance—hence their name. Open clusters are often associated with interstellar matter.

There are more than 1000 known open star clusters. Some of the best known clusters include the Pleiades and Hyades in Taurus, the double cluster in Perseus and the Praesepe ("Beehive") in Cancer.

Use these star charts to find some open clusters. At right is a detailed chart showing enough stars to "star-hop" to the clusters. Inset is a low-scale chart showing the general region of sky. Happy viewing.

### June 1992

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<td>0—New Moon</td>
<td>2</td>
<td>3—Moon is at perigee</td>
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<tr>
<td>7</td>
<td>3—Moon is 7° south of Jupiter</td>
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<td>9—First quarter Moon</td>
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<td>12</td>
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<tr>
<td>15</td>
<td>1—Full moon — Eclipse</td>
<td>21—Moon is 1.9° north of Uranus</td>
<td>0—Moon is 0.9° north of Neptune</td>
<td>19—Pallas is at opposition</td>
<td>15—Moon is 5° north of Saturn</td>
<td>16—Moon is at apogee</td>
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</tbody>
</table>

Eastern Daylight Savings Time. Sunrise and sunset data are based on the coordinates of the Hawthorn Hollow observing site, latitude 42° 32' 30" N, longitude 82° 31' 30" W. Times are reasonably accurate for the entire metropolitan Detroit area.
Warren Astronomical Society Calendar 1992

Sunday Afternoons

Solar Group meeting at Ed Cressman's house when the weather is clear.

Thursday June 4 7:30 p.m.
June 5-6

General meeting at Cranbrook Institute of Science.

Saturday June 6 10:00 p.m.


Wednesday June 10 7:00 p.m.
June 12-13

Cosmology Group meeting at Ridgewood Recreation Center.

Apollo Rendezvous '92 at Dayton Museum of Natural History, Dayton, Ohio. Contact Ian Dumbauld at (513) 837-4600.

Thursday June 18 7:30 p.m.
June 20-25

Business meeting at Macomb Community College.

Universe '92 at the University of Wisconsin, Madison. For information, call (415) 337-1100 or fax (415) 337-5205.

Thursday June 27 8:00 p.m.
July 10-11

Computer Group meeting at Larry Kalinowski's house.

MSU Observatory Open House.