In 1916, at least 100 globular clusters were cataloged, but their exact relationship to the Milky Way was not clear. A year later, Harlow Shapley made an interesting observation: He noted that the globulars' distribution in space was symmetrical about the Milky Way's plane. They tended to center around a very bright portion of the Milky Way, located in the direction of the constellation Sagittarius. Shapley assumed these globulars were the "bony frame" of the Milky Way, with the center of their distribution locating the center of the Milky Way itself. His estimate for the sun's distance from the galactic center was large, thus making the Milky Way some 300,000 light-years in extent and approximately three times its presently accepted diameter. This great size made it difficult, if not impossible, to perceive of anything farther away, especially if the spiral nebulae seen were as large as the Milky Way. On this scale, the Andromeda nebula would have been 10,000,000 light-years away. Shapley argued that this couldn't be, for novae observed in Andromeda indicated that it had to be much closer. Shapley assumed that novae there were similar to novae in the Milky Way. This 'Principle of Uniformity,' a trademark of Shapley's work, is applied today in virtually all theories of the universe.

Several lines of evidence developed in the years 1917 to 1920 that questioned Shapley's views. Vesto M. Slipher of the Lowell Observatory determined from spectroscopic studies that the spiral nebulae were in rapid rotation. If the nebulae were close, rotational components should be observed across our line of sight to the spiral nebula. If the nebulae were truly distant objects, then this proper motion would not be easily apparent. Adriaan Van Maanen of Mount Wilson, however, detected what he thought were proper motions of 'knots' in the spiral arms of several nebulae, apparently conclusive evidence that spiral nebulae were nearby and not island universes. The motions Van Maanen observed are now believed to be impossible to detect; his measurements remain an open question in astronomical history.

On April 26, 1920, astronomer Heber Curtis and Shapley engaged in the "great debate" over the nature of nebulae. Held before the National Academy of Sciences, this meeting took the form of a presentation of two beliefs on the size of the Milky Way, rather than an actual debate on the nature of spiral nebulae. The event was moot since no solution to the problem was reached.

A young astronomer at Mount Wilson, Edwin Hubble, soon solved the question. Using Shapley's technique of distance determination via the period/luminosity relation of Cepheids, Hubble determined the distance to the Andromeda nebula. By taking multiple-hour exposures of the Andromeda Spiral with the 100-inch telescope, he successfully resolved the nebula into an immense sea of extremely faint stars. 'Among these stars,' he said in his book The Realm of the Nebula, 'various types were recognized which were well known among the brighter stars in the galactic systems. The intrinsic luminosities were known, accurately in some cases, approximately in others. Therefore, the apparent faintness of the stars in the nebulae indicated the distances of the nebulae .... The most reliable results were furnished by Cepheid variables.'

Hubble found that the distance between the Andromeda nebula and the Milky Way was much greater than the size of the Milky Way. By 1924, he was convinced that spirals like Andromeda were separate galaxies every bit as large as our Milky Way. Another year passed before he formally announced his work, for Van Maanen was his direct superior at Wilson. By 1925, his work was common knowledge. The 'Realm of the Nebulae' became the 'Universe of Galaxies.'

Four years later, Hubble announced an even more startling observation. Slipher and others had previously recorded very high velocities in the nebulae (now galaxies) as seen along the line of sight. Initially it was believed that these motions were random and were partially due to the Sun's motion around the center of the Milky Way. Hubble discovered these velocities correlated to the relative distances to the galaxies. He found that the fainter, more distant galaxies were moving away from us faster than the brighter, closer ones. A dedicated observer, Milton Humason spent countless hours in the following years at the Mount Wilson telescope recording spectra of galaxies that eventually confirmed Hubble's revolutionary concept of the structure and general expansion of the universe.

Hubble gave us two fundamental facts as a basis for the study of the universe. These two facts: that galaxies exist and that they are all moving away from one another, remain the only two facts we can be sure of in the modern study of cosmology.

References:
Men and the Stars - Stetson
Popular Astronomy - 1926
Astronomy Comes of Age - Roberts
The WASP
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Treasurer: Jeff Bondono 731-4706
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 $10.00
College $15.00
Individual $20.00
Family $25.00
Senior Citizen $15.00

Among the many benefits of membership are:
- Discount magazine subscriptions:
  Astronomy $14.00 (12 monthly issues)
  Deep Sky $ 8.00 (4 quarterly issues)
  Sky and Telescope $18.00 (12 monthly issues)
  Telescope Making $ 8.00 (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:
Jeff Bondono 731-4706
51054 Kingwood
Shelby Township, Michigan 48316

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 680-0434
2420 Alexander
Troy, Michigan 48083-2405

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 750-0273
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 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 Jeff Bondono at 731-4706.
Computer Chatter
By Larry F. Kalinowski

Last month's meeting at Gary Gathen's home in Pleasant Ridge gave us a chance to see his unique clamshell roof observatory. Even though there were numerous clouds, we were treated to an excellent view of the Ring Nebula (M-57) through his eight-inch Meade. A stellar database is electronically coupled to both axes of the telescope and moving the scope displayed the coordinates and the proximity of the object on the display board. We were also impressed by his library - a collection of over 6,000 books acquired over many years. Gary boasted he had more books than the Pleasant Ridge Library. Even Gary's lovable Great Dane, Jake, was happy to see us drop in.

I'd like to see someone demonstrate a Macintosh for us at one of the Computer Group meetings. I know the 'Mac' can produce some superior graphics. If anyone is willing to give us a demo, give me a call at the number listed below.

Did you know that 30 percent of all the computers sold in 1991 were 286s, including laptops? That's down from 1990's 44 percent. The 286 isn't dead yet. How many XT's were sold? No figures were given.

If you or anyone in your family went to see Freddie's Dead at the local cinema, I hope you saved your 3-D glasses. If you did, bring them to the computer meeting. If you're still planning to go, grab an extra pair or two for the Computer Group.

Did anyone see the Space Shuttle Discovery? The 7:11 p.m. launch and large inclination gave Detroiters an excellent chance to see the vehicle as it passed over the state. It supposedly was visible for us every evening while it was up.

Computers are supposed to reduce paperwork. They're supposed to produce a paperless society. Guess what? They made it easier to create more forms. It's easier to create a form on a computer because of word processors and special programs to create forms.

If you've been holding off buying a computer because you wanted something faster, then it should be here by the end of the year. I'm talking about Intel's new 50 megahertz 486 chip. Both Blue Star and Micro Express have mentioned the fact that they are ready for the new chip and will have a computer to offer the public as soon as the chip is released. I don't think the other companies have been twiddling their thumbs either. The cost? Who knows... I guarantee it won't be cheap.

The newly decorated science rooms at Macomb County Community College made quite an impression on me at the last business meeting. They were almost too new to use. I was afraid I was going to mar the chairs or tables if I wasn't careful. I was glad to see my tax money going for something worthwhile.

Two computer shows will be available in the Metro area in the next couple of weeks. The first one will be on Sunday, October 27 at Mercy Center, 28600 Eleven Mile Road, three blocks east of Middlebelt in Farmington Hills. The second will be on Sunday, November 10 at the United Food and Commercial Workers Hall, 876 Horace Brown Drive, one block east of 1-75 and two blocks south of Thirteen Mile Road. Both charge $4.00 admission. For additional information, call Mr. Richard Nagy at 283-1734. All sorts of software and hardware is for sale by commercial vendors that have retail outlets in the metropolitan area.

The Computer Group meets at 8:00 p.m. of the fourth Thursday each month. Call me at 776-9720 for any further information concerning the group. Clear skies, everyone.  

Business Cards Available

The Warren Astronomical Society is pleased to announce a club business card will be made available to club members. The card was developed for distribution to people outside the club who are interested in the club and may wish to join or correspond with its members.

Two versions are available: 1) A generic version giving only the club's name, post office box, city, state and zip code. These will be available to members at the cost of printing for the quantity desired. 2) A personalized version giving the above information plus the club member's name and other personal information such as the member's phone number and club office or sub-group affiliation, if desired. The personalized cards will cost the individual $1.00 for the camera-ready artwork which the individual will take to the printer of his or her choice. The individual will pay for the printing of their personalized cards.

The card is designed at standard business card size of 2 x 3 1/2 inches by the WASP editor, Doug Goudie. A matching club letterhead has also been designed for official club business.

A Call for Articles

The WASP is desperately seeking articles! Numerous suggestions for articles have been offered, but none have materialized. If you know of an event, please tell me so it can be included in these pages. If you have nothing to say, the WASP has nothing to print and will undergo a further reduction in its number of pages. Please submit!
In the Beginning, Part 4
By Frank McCullough

Note: A version of this article first appeared in the WASP around 1970. -Ed.

You should now realize what a green amateur I was and how simple little things can bring the most exciting and memorable feelings. Even an astronomer or a person who has been involved with a club for some time has gone through the basics and beginnings at one time in his or her life. They, too, know how it is to be a stranger just needing a friendly 'Hello' and 'Welcome' to make them feel they belong.

The learning and friendship of other people came with time. To my friend, Dave, who came to only three or four meetings after that first one, I say 'Thank you' for giving me the break I needed to get my ambition toward astronomy on the right track. For Dave, his favorite hobby turned out to be singing in churches with a girl he was going to marry and furthering himself in religion. And me? Well, I son-of went crazy for astronomy.

I had now gone to a Warren Astronomical Society meeting and was about to participate in one of their first 'Quarter Moon Camp-Outs.' Dave and I got there on a Friday, and Mr. and Mrs. Alyea arrived later that evening. Mr. Alyea set up what I believe was an eight-inch telescope. What a monstrosity compared to my 4 1/2-inch-refractor! It looked like a giant cannon. I thought to myself how some day I would like to have a telescope of that size. Back then, that was one of the biggest telescopes owned by one of our club members. Now that I finally reached the big time, I have my eight-inch telescope - and now my follow club members own 16-inch, 14 1/2-inch, 10-inch, eight-inch, Cassegrains, etc.

That evening I remember a still, calm, dewy night with the frogs and crickets chirping. A friendly woman's voice broke the evening air. A beam of light from her flashlight funneled into the dewy night as she outlined Cygnus the Swan, showing a young group of kids the constellation. I remember her mentioning the star marking the head of the Swan as Albireo and that this star was actually a blue and gold double star in a telescope. Mr. Alyea, the woman's husband, now was showing people the double star in his telescope. I had to see if the heavens actually could display color. I ran over. When it was my turn, I saw two jewels, one blue and one gold, and I said to myself, 'There really is color!' He then showed us M-13, the globular cluster in Hercules, and M-57, the Ring Nebula in Lyra.

After I saw each object in his telescope, I ran back to my 4 1/2-inch to see if I could find them. Albireo Success! M-13... Sweep, sweep, sweep... Wait a second, go back,... yes! There it was at 45x, a lazy fuzz ball - not as spectacular as through his eight-inch, but nonetheless, I had found my first Messier object. M-57 gave me much difficulty - that small doughnut hovering in his eyepiece. If I could not see these amazing objects other amateurs were seeing, then I would not settle for second-rank observing. My eye ached, my neck ached and my telescope was starting to give me an ache some place else.

Poor Dave Atnip found Albireo, but could not find M-13. I stopped and found it in his two-inch refractor. The thing that amazed me most was the faintness of M-13 in his scope compared to mine and how much greyer the companion of Albireo appeared in his scope compared to mine.

I wiped the dew off my finder and tried again to find the Ring Nebula. Then, out of the black sky, popped what I thought appeared to be my elusive object. Carefully, with the slow motion cables, I back-tracked and there it was, fairly bright! I was so excited! I called Dave over to look. I finally felt like calling myself an amateur astronomer.

The thing I remember most was knowing I could say I was an amateur astronomer and not feel guilty about it. Dave, I'm sorry to say, lost many a clear evening with his refractor because of dew - and such was the case on our first camp-out.

We hit the hay that night, told a few jokes, wrapped the sleeping bags around us and listened to the evening's song. Quiet, peaceful, eerie and mysterious was the night. Away from everything and above our tent was that beautiful star-studded sky which revealed so much excitement that evening. I hoped the next night would be clear!

The next morning we cleaned up under ice-cold water, cooked Spam and eggs and did a little fishing. As the afternoon wore on, more cars showed up, always waiting for someone else with a telescope to arrive. We left our telescopes set up, hoping to draw these Warren Astronomical Society members into our area. Mr. and Mrs. Alyea were on the north side of our mountain with their trailer. Finally a car pulled up next to ours. Then another car came, and a tent and telescope. Nearly everyone came on our side of the mountain.

We had a kick-ball match with Martin Butley and Gene Francis, friends who would never be duplicated, smashing line-shots into the sides of our tents. A baseball game was planned and after that, another marathon game until we were whipped and exhausted.

I remember Mrs. Alyea coming over to talk to Martin and Gene. She looked at my shirtless body and said I was a red as a beet and had better put a shirt on. As she mildly chewed me out for letting myself roat that long, she rubbed on this white goo that felt like ice. I hardly know the lady and I guess I was a little embarrassed that she pampered me like that, yet I thought it was pretty nice of her to do that for me. I told her Thank you and she went her way and I went mine.

As the Sun got low in the sky, everyone started to get their scopes ready. Then the mosquitoes came. We who played the marathon games walked around like human salt licks. Like something out of the movie The Birds, the mosquitoes buzzed, landed and sampled our blood. The hissing of Off broke the late afternoon air and the clouds moved in. The Moon and Jupiter were viewed briefly, but not many scopes were manned that night. Sleep was the only thing anyone had on their minds. I know I slept like a rock.

I was quite sad to see the weekend come to an end, but Dave and I said we would return. And we did!
Observing Double Stars

The ability to see both components of a double star depends on a combination of two factors: atmospheric steadiness ("seeing") and the aperture of the optical instrument. Poor seeing can merely jiggle star images around or completely blur them. The aperture of a telescope or pair of binoculars determines the fineness of the detail it can see - its resolution.

This is figured by the simple formula \( \frac{4.6}{A} = R \) where \( A \) is the instrument's aperture in inches and \( R \) is its resolution in seconds of arc. Double stars whose components are separated by 4.6 I seconds should be split by an instrument with a one-inch aperture, a two-inch telescope should separate double stars 2.3 seconds apart and so forth. This formula is not absolute and stars that exceed the predicted limit can sometimes be viewed under excellent conditions.

Here are three double stars that will allow you to quickly check your sky conditions and telescope performance. At right is a detailed chart of the area including enough stars to allow one to "star-hop" to the doubles. Inset is a low-scale star chart showing the general region of sky. Happy viewing!

### November 1991

<table>
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<tr>
<th>Sunday</th>
<th>Monday</th>
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<td></td>
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<td></td>
<td></td>
<td>1 - Moon is 6° south of Jupiter</td>
<td>2 - Venus is at greatest western elongation</td>
<td>3 - Moon is 6° south of Jupiter</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6 - New Moon</td>
<td>7 - 0.7° south of Mercury</td>
<td>8 - Mars is in conjunction with the Sun</td>
<td>9 - 0.7° south of Venus</td>
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<td>7:09 - 17:24</td>
<td>7:10 - 17:22</td>
<td>7:11 - 17:21</td>
<td>7:13 - 17:20</td>
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<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14 - First quarter Moon</td>
<td>15 - 0.4° north of Uranus</td>
<td>16 - 0.4° north of Uranus</td>
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<td>22 - Moon is 2° north of Antares</td>
<td>2 - Mercury is at apogee</td>
<td>3 - Moon is at apogee</td>
<td>17 - Moon is 2° north of Saturn</td>
<td>9 - First quarter Moon</td>
<td>7:18 - 17:16</td>
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<tr>
<td>22 - Moon is 0.4° north of Uranus</td>
<td>7:18 - 17:16</td>
<td>7:19 - 17:15</td>
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<tr>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21 - Full Moon</td>
<td>22 - 21 - Moon is at perigee</td>
<td>23 - 21 - Moon is at perigee</td>
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<td>Leonid meteor shower peaks</td>
<td>7:27 - 17:09</td>
<td>7:28 - 17:08</td>
<td>7:29 - 17:07</td>
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<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28 - Last quarter Moon</td>
<td>29 - 0.4° north of Spica</td>
<td>30 - 0.4° north of Spica</td>
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<td>24 - 7:35 - 17:04</td>
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Warren Astronomical Society Calendar 1991

Sunday Afternoons

- **Solar Group** at Ed Cressman's house when the weather is clear.
- **General meeting** at Cranbrook Institute of Science.
- **Deep Sky Group** meeting at Doug Bock's house.
- **Cosmology Group** meeting at Ridgewood Recreation Center.
- **Royal Astronomical Society of Canada - Windsor Centre** annual meeting, Room 186, Essex Hall, University of Windsor. Guest speaker: Steve Dodson of Science North (Sudbury) on astronomy projects at Science North. Contact: C. Joady Ulrich, (519)945-3132.
- **Business meeting** at Macomb Community College.
- **Computer Group** meeting at Larry Kalinowski's house.
- **Holiday Banquet** at the Warren Chateau
- **Astronomy Day**.

**Warren Astronomical Society, Inc.**
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