Computer Chatter
By Larry F. Kalinowski

DOS 6.0 is here and it's settled into the computer of some of our members. The word, so far, is excellent! One of our members, with a 320 megabyte hard drive, doubled the disk to over 600 megabytes. His remark: "...Best investment I ever made! I saved the price of another hard drive by buying DOS 6." The Dblspace program allows the user to nearly double the size of any partition on the hard drive. You can double the entire disk if you wish. There is one word of caution: Some of the programs that were developed before DOS 6 was brought into the world may not work with the Dblspace option. The program is easy to implement, but it's tough eliminating it if you can't use it. It doesn't have an automatic undo function like some of the other features. The best feature is Memmaker. It's an automatic program shuffler that moves everything it can above 640 kilobytes, leaving lots of free memory.

Watch out for those Perseids. This year's shower could be a humdinger if the predictions pan out. With the recovery of the parent comet, Swift - Tuttle, there's a good likelihood that the Earth will pass through a meteor swarm this year. It could be as active as last year or it could be one of those once-in-a-lifetime meteor storms. The night of August 11 and 12 is the usual best time for the Perseids, but watchers should be prepared for a couple days before and after that date, just in case.

According to a local tabloid, about five percent of all industrial energy is used by personal computers. If a computer is left running 24 hours a day, each year it will consume about $70 worth of electricity during the 16 hours per day it isn't used. American Airlines calculated that it could save more than $83 million if the 47,000 computers it used were shutdown during their unused time. You and I would probably save more than $70 because our home-based computers wouldn't be getting a special industrial rate for our electricity.

Windows NT might be the slow death of DOS. It's a 32-bit operating system that operates with DOS. Like the Macintosh, it has no 640 kilobyte barrier. There's no need for extended or expanded memory. All memory is considered one type. You can still run DOS programs. NT is smart enough to emulate the DOS system. You might say that Microsoft is biting its own hand. Older computers won't be able to install it so they'll have to stick with a DOS system. As good as the NT system sounds, there still isn't an introduction date for it. In fact, there's talk of a Windows4.0 version.

Almost 300 people attended the Apollo Rendezvous during June 11 - 13. It was their 23rd season. The convention keeps getting bigger and bigger. There were 62 awards and door prizes given away. The value of the prizes were over $3100. With speakers like Jack Newton and Richard Berry, it's easy to understand why it's so popular. The Miami Valley Astronomical Society deserves a lot of credit for keeping the show as great as it is.

It looks like Astronomy magazine has raised its newsstand price. I had to pay $3.95 for my last issue.

The Computer Group meetings are back at the home of Gary Gathen, 21 Elm Park in Pleasant Ridge. Take 1696 to Woodward Avenue and turn south. Make a right turn at the third street and go down about half a block. Meetings start at 7:30 p.m. every fourth Thursday of the month. The next meetings will be July 22 and August 26.
The WASP
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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 $15.00

Among the many benefits of membership are:
• Discount magazine subscriptions: 
  Astronomy $16.00 (12 monthly issues)
  Sky and Telescope $20.00 (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 membership applications and dues to: 268-7125
Mike O'Dowd
4734 Brockham Way
Sterling Heights, Michigan 48310

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.

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Disclaimer: The articles presented herein represent the opinions of the their authors and are not necessarily the opinions of the Warren Astronomical Society or its editor. The WASP reserves the right to edit or deny publication of any submissions.

STARGATE OBSERVATORY
The observatory is owned and operated by the Society. 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
Lunar / Planetary: Riyad Matti 548-7511
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 Marty Kunz at 477-0546.
Mission Status

Galileo

May 27, 1993 — The spacecraft is now en route to Jupiter, scheduled to enter orbit December 7, 1995. Spacecraft performance and condition are excellent except that the high gain antenna is only partly deployed; science and engineering data are being transmitted via the low-gain antenna. The mission team is planning to use the low-gain antenna for the Jupiter mission and for the encounter August 28, 1993 with asteroid Ida. Galileo was launched October 18, 1989, flew by Venus in 1990 and Earth in 1990 and 1992 for gravity assists, and flew by asteroid Gaspra in October 1991 for scientific observation.

Trajectory

As of noon Thursday, June 3, 1993, the Galileo Spacecraft trajectory status was as follows:

- Distance from Earth: 287,221,300 km (1.92AU)
- Distance from Sun: 341,692,100 km (2.29AU)
- Heliocentric Speed: 80,000 km per hour
- Distance from Jupiter: 475,188,300 km
- Round Trip Light Time: 32 minutes, 2 seconds

Magellan

June 28, 1993 — The Magellan Transition Experiment to circularize the spacecraft's orbit by lowering it into the top of the Venusian atmosphere to create drag is going very well, project officials said today.

As of Friday, June 25, the spacecraft had made 260 atmospheric drag passes and the apoapsis, or furthest point from the planet, had been lowered below 5,300 kilometers (3,286 miles) from its original orbital apoapsis of 8,540 kilometers (5,294 miles).

The spacecraft's closest point to the planet, or periapsis, is being maintained at between 138 and 140 kilometers altitude (about 86 to 88 miles).

The spacecraft also is being maintained in a specific corridor on its closest passes to the planet. Plans were being made to execute a corridor orbit trim maneuver, or COTM, Thursday to slightly raise the altitude at periapsis and maintain a steady course during the upcoming July 4th holiday weekend.

It is expected the orbit will be sufficiently changed by early August so that only fine-tuning the orbit will be needed to achieve the desired, nearly circular orbit required for high resolution gravity studies of Venus.

This is the first time a spacecraft's orbit has been changed at another planet by "aerobraking," or using the planet's atmosphere to create drag.

Mars Observer

May 27, 1993 — Spacecraft health and performance are normal, after several episodes in which it entered contingency mode, a safe state triggered by the spacecraft computer because of attitude-reference anomalies. A software fix has solved the problem. Mars Observer is scheduled to enter Mars orbit August 24, 1993; it will be moved into a mapping orbit by November 8 and science operations are planned to start November 22. Mars Observer was launched September 25, 1992.

TOPEX/Poseidon

May 27, 1993 — The satellite is healthy, and all scientific instruments are performing normally, typically providing three playbacks per day. The mission is mapping ocean circulation. TOPEX/Poseidon was launched August 10, 1992.

Ulysses

June 14, 1993 — On 9th June the Ulysses spacecraft entered unexplored regions of the solar system as it crossed the highest ever achieved heliographic latitude of more than 32 degrees south. (The Voyager 1 spacecraft is currently 32 degrees north of the Sun's equator).

An average of 89.64% data recovery was achieved during the reporting period. The low percentage data recovery is due to the continued mechanical problem with the 34-meter antenna at Madrid. In addition on 13th June a telemetry processor restart at Goldstone caused a small loss of real time and playback data.

Extensive rescheduling of station passes for this reporting period took place to reduce as much as possible the data loss.

During this week much of the data on board was recorded at 256 bps to permit shorter playback periods. A return to 512 bps recording has been planned for future weeks.

The 34-meter antenna at Madrid is not expected to be operational again until early in August.

Orbital Data

- Data taken at 00:00:00 UTC on 14th June
- Distance from Earth: 731,842,840 Ian.
- Velocity relative to the Earth: 78,700 km / hr.
- Velocity relative to the Sun: 39,393 km / hr.
- Ecliptic latitude: 25.4 deg / south
- Heliographic latitude: 32.1 deg / south

Voyager 1 and 2

May 27, 1993 — The two Voyager spacecraft have detected low-frequency radio emissions believed to originate at the boundary between the solar wind and the interstellar medium, called the heliopause. Detection and measurement of this boundary is the principal goal of the Voyager Interstellar Mission. Voyager 1, launched September 5, 1977, is currently 7.8 billion kilometers (4.8 billion miles) from the Sun after flying by Jupiter and Saturn in 1979 and 1980; Voyager 2, launched August 20, 1977, to fly by Jupiter (1979), Saturn (1981), Uranus (1986) and Neptune (1989), is now six billion kilometers (3.7 billion miles) from the Sun.
Scientists Locate New Radiation Belt Around Earth
By Paula Cleggett-Haleim, Headquarters, Washington, D.C.; Michael Finneran, Goddard Space Flight Center, Greenbelt, Maryland and Jay Aller, California Institute of Technology, Pasadena, California

May 25, 1993—The location of a radiation belt of cosmic rays—particles from beyond the solar system—has been pinpointed several hundred miles above the Earth, according to scientists from the California Institute of Technology, Pasadena, and NASA's Goddard Space Flight Center, Greenbelt, Maryland.

A NASA satellite called Solar, Anomalous and Magnetospheric Particle Explorer (SAMPEX), was orbiting 375 miles (600 kilometers) above the Earth when it measured the belt. The belt is most intense above a 5,000-mile (8,050-kilometer) strip of Atlantic Ocean between the southern tips of South America and Africa, Caltech and NASA scientists said at the annual meeting of the American Geophysical Union in Baltimore, Maryland, on Tuesday, May 25.

The belt is composed of particles known as anomalous cosmic rays, which are the result of the sun's interaction with tenuous gas that exists between the stars in the Milky Way galaxy.

"We were pretty sure the belt was there, and now we've pinned it down along with its location, which we didn't know before," said Goddard's Dr. Tycho von Rosenvinge, a member of the SAMPEX team.

The first clear evidence for such a belt of Russian and U.S. scientists in 1991 using information from a series of Russian COSMOS spacecraft.

They were unable, however, to determine directly the location of the belt, which is composed of different high-energy particles than another region of radiation, the Van Allen radiation belts discovered by James A. Van Allen in 1958 using data from NASA's Explorer 1 satellite.

The belt in which the anomalous cosmic rays collect is embedded within the inner of the two Van Allen belts. The geometry of these belts is determined by the Earth's magnetic field lines, which connect the North and South magnetic poles.

"The cosmic rays become trapped in this field, where they bounce back and forth between the poles of Earth's magnetic field," said Caltech's Dr. Richard Mewaldt, a member of the SAMPEX team along with Caltech colleagues Drs. Jay Cummings, Alan Cummings, Richard Selesnick and Edward Stone.

The rays are the most intense in the 5,000-mile (8,050-kilometer) strip between South America and Africa, Mewaldt said, because the Earth's magnetic field is not centered perfectly, and this is where it allows the trapped particles to get closest to the planet's surface.

SAMPEX scientists said trapped cosmic rays can be stored in the belt for weeks or more, so the intensity can build up over time as more arrive. More of the cosmic rays collect in the belt during periods of minimum solar activity, which follows an 11-year cycle.

The trapped radiation has doubled between August and November 1992, according to SAMPEX measurements, and now is about 100 times the intensity of the anomalous cosmic rays in interplanetary space.

"This long-term storage will give the SAMPEX team a unique opportunity to study the properties of interstellar matter right in Earth's back yard," Mewaldt said.

SAMPEX was launched in July 1992 on a Scout rocket from Vandenberg Air Force Base, California. The satellite is managed by Goddard for the Office of Space Science at NASA Headquarters in Washington, D.C.

Hubble Looks at the Heart of a Galaxy Collision
By Paula Cleggett-Haleim, Headquarters, Washington, D.C.; Jim Elliot, Goddard Space Flight Center, Greenbelt, Maryland and Ray Villard, Space Telescope Science Institute, Baltimore, Maryland

May 25, 1993 — NASA's Hubble Space Telescope has looked into the heart of a galaxy created by the collision of two galaxies and peering deeply into its nucleus, discovered a remarkable pinwheel-shaped disk of gas surrounded by clusters of young stars born as a result of the merger.

The star clusters apparently were born as a result of the collision of two disk-shaped galaxies. The galaxy merger, which occurred about one billion years ago, triggered an infall of the gas which fueled the birth of new stars around the center of the galaxy.

"This may unlock the key for understanding how all globular clusters formed in ellipticals," said Dr. Brad Whitmore of the Space Telescope Science Institute (STScI), Baltimore, Maryland. "The Hubble observation also shows how tiny disk like structures might have formed in many other galaxies."

This discovery provides some of the best evidence to date for explaining the origin of giant elliptical galaxies. For more than a half century, astronomers have theorized about how such galaxies formed. Some theories propose that ellipticals formed from collisions between disk galaxies — flattened stellar systems resembling the Milky Way galaxy.

Pinwheel of Stars and Gas
The striking Hubble -image shows a spiral pattern at the galaxy's core, surrounded by bright star clusters. "I knew I had a major result within 10seconds of looking at the Hubble picture," said Whitmore.

The pinwheel shaped disk has an uncanny resemblance to a face-on spiral galaxy, yet it is only 10 thousand light-years across - about 1/20 the size of the total galaxy. The gas and stars in the disk swirl around the nucleus, making a

(Continued on page 5)
Galaxy Collision...
(Continued from page 4)

spiral pattern like cream poured in a cup of coffee. The mini-spiral contains enough gas to make eight billion stars like the Sun. Though several of the clusters were first spotted from ground-based telescopes, their true nature was uncertain until the Hubble observations.

Hubble's resolution is so good that the astronomers can measure the diameters (0.04 arc seconds, the apparent size of a dime at a distance of 80 miles) of the bright star clusters seen in the same image as the spiral disk. They turn out to be about 60 light years across, the same size as globular-clusters that orbit the Milky Way galaxy.

The globular clusters found in NGC 7252 are considered the progenitors of similar clusters that orbit the Milky Way galaxy. Since globular clusters normally contain ancient red giant stars, they provide a fossil record of the formation and evolution of galaxies. Globular clusters contain about one million stars each, arranged in a tight, spherical swarm and generally are found to be about 15 billion years old.

However, the "ultra-luminous clusters" found in NGC 7252 contain hot bluish stars. Because these blue stars are short-lived, the clusters in NGC 7252 are estimated to be mostly between 50 and 500 million years old.

The blue stars make the globular clusters up to several hundred times brighter than the clusters that orbit the Milky Way galaxy. If the Milky Way's globular clusters were as bright, they could be seen with the naked-eye and would be brighter than the stars in the Big Dipper.

In the 1920s, American astronomer Edwin Hubble classified galaxies according to their spiral or elliptical shape. A key difference is that stars are concentrated in a disk in spirals, but are distributed in a diffuse, roughly spherical distribution in ellipticals.

Since Edwin Hubble's time, astronomers have sought an explanation for why there are two different types of galaxies. During the past decade, the hypothesis that spiral galaxies can collide and merge to form elliptical galaxies has become increasingly popular.

Located 300 million light-years away in the constellation Aquarius, NGC 7252 has been considered the prototypical example of a merger between two disk-shaped galaxies. The galaxy has a pair of long tails that are unambiguous evidence of the effects of gravitational tidal forces from a galaxy merger.

The galaxy NGC 7252 is nicknamed the "Atoms-for-Peace" galaxy because its stars form a bizarre loop-like structure that resembles a schematic diagram of an electron orbiting and an atomic nucleus. (In December 1953, U.S. President Dwight D. Eisenhower made his "Atoms for Peace" speech to foster peaceful applications of nuclear energy.)

If globular clusters can be born during galaxy collisions, it reinforces the theory that disk galaxies merge to make giant elliptical galaxies. One argument against this theory is that elliptical galaxies have more globular clusters than expected if disk galaxies were simply combined. Since disk galaxies have relatively few clusters.

Hubble Picture Helps to Solve Mystery

The new Hubble Space Telescope observation solves this dilemma by showing that when disk galaxies collide they can form new globular clusters. Rather than being a problem for the merger scenario, an increase in the number of globular clusters is a natural consequence of galaxy mergers.

The existence of a "mini-disk" also fits with the merger scenario since similar disk-like features appear to exist in many elliptical galaxies. Another clear indication that the material originated from the collision of two galaxies is that the mini-spiral is rotating in a direction opposite to the rest of the galaxy.

This discovery is the latest in a series of disk-like structures that Hubble has uncovered at the cores of galaxies. Previously, HST found a giant disk of cool dust and gas orbiting a suspected black hole in the active galaxy NGC 4261 and discovered an edge-on "donut" of dust in the spiral galaxy M51.

The astronomers predict that in a few billion years the gas in NGC 7252 will be exhausted. The galaxy will look like a normal elliptical galaxy with a small inner disk.

Magellan Aerobraking, Gravity Studies Underway

By Paula Cleggett-Haleim, Headquarters, Washington, D.C. and Franklin O'Donnell, Jet Propulsion Laboratory, Pasadena, California

May 26, 1993 — Having successfully completed its original mission of radar-mapping the planet Venus, NASA's Magellan spacecraft is embarking on a new experiment that will give scientists glimpses into the planet's interior and a better understanding of its atmosphere.

On May 25, the spacecraft completed its fourth eight-month cycle of orbiting Venus. during which it collected data on the planet's gravity field, particularly close to the equator.

On that same day, Magellan executed the first in a series of aerobraking maneuvers to be conducted over the next 70 days in which Magellan dips into Venus' atmosphere, taking advantage of drag on the spacecraft to lower its orbit. The maneuvers are designed to place Magellan in a circular orbit, allowing it to get better gravity data at the planet's north and south poles.

"This experiment is a scientific bonus for what is already a highly successful mission," said Dr. R. Stephen Saunders, Magellan Project Scientist at NASA's Jet Propulsion Laboratory, Pasadena, California.

According to Saunders, the gravity data that Magellan is collecting allow scientists to "see" into the interior of the planet because they can gauge the density of the material underlying various parts of the planet.

In recent weeks, for example, Magellan passed over a region dominated by three volcanoes - Hathor, Innini and Ushas. "They occupy a broad swelling of the Venusian crust believed to result from upwelling of hot material from the deep interior, a phenomenon known on Earth as a 'hot spot'," Saunders added. In other ways, Venus seems to be...
Voyager Spacecraft Find Clue to Another Solar System Mystery

By Paula Cleggett-Halem, Headquarters, Washington, D.C. and Mary A. Hardin, Jet Propulsion Laboratory, Pasadena, California

May 26, 1993 — Nearly 15 years after they left home, the Voyager 1 and 2 spacecraft have discovered the first direct evidence of the long-sought-after heliopause - the boundary that separates Earth’s solar system from interstellar space.

"This discovery is an exciting indication that still more discoveries and surprises lie ahead for the Voyagers as they continue their journey to the outer reaches of our solar system," said Dr. Edward C. Stone, Director of the Jet Propulsion Laboratory (JPL), Pasadena, California, and Voyager Project Scientist.

Since August 1992, the radio antennas on the spacecraft, called the plasma wave subsystem, have been recording intense low-frequency radio emissions coming from beyond the solar system. For months the source of these radio emissions remained a mystery.

"Our interpretation now is that these radio signals are created as a cloud of electrically charged gas, called a plasma, expands from the Sun and interacts with the cold interstellar gas beyond the heliopause," said Dr. Don Gurnett, Principal Investigator of the Voyager plasma wave subsystem and a professor at the University of Iowa.

The Sun is the center of our solar system. The solar wind is a stream of electrically charged particles that flows steadily away from the Sun. As the solar wind moves out into space, it creates a magnetized bubble of hot plasma around the Sun, called the heliosphere. Eventually, the expanding solar wind encounters the charged particles and magnetic field in the interstellar gas. The boundary created between the solar wind and interstellar gas is the heliopause.

"These radio emissions are probably the most powerful radio source in our solar system," said Gurnett "We’ve estimated the total power radiated by the signals to be more than 10 trillion watts. However, these radio signals are at such low frequencies, only two to three kilohertz, that they can’t be detected from Earth."

In May and June 1992, the Sun experienced a period of intense solar activity which emitted a cloud of rapidly moving charged particles. When this cloud of plasma arrived at the heliopause, the particles interacted violently with the interstellar plasma and produced the radio emissions, according to Gurnett. "We’ve seen the frequency of these radio emissions rise over time. Our assumption that this is the heliopause is based on the fact that there is no other known structure out there that could be causing these signals," Gurnett continued.

Because of the Voyagers’ unique positions in space, they serendipitously detected and recorded the radio emissions. "Earth-bound scientists would not know this phenomenon was occurring if it weren’t for the Voyager spacecraft," Gurnett added.

Exactly where the heliopause is remains one of the great unanswered questions in space physics.

"It’s this Voyager radio data combined with the plasma measurements taken at the spacecraft that give us a better guess about where the heliopause is. Based on the solar wind speed, the time that has elapsed since the mid-1992 solar event and the strength of the radio emissions, my best guess for the upper limit of the heliopause currently is about 90 to 120 astronomical units (AU) from the Sun," said Dr. Ralph McNutt, a co-investigator on the Voyager plasma science experiment and a researcher at the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. (One AU is equal to 93 million miles (150 million kilometers) or the mean distance from the Earth to the Sun.)
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 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 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 check your sky conditions and telescope performance. At right is a detailed chart of the area including enough stars to "star-hop" to the doubles. Inset is a low-scale star chart showing the general region of sky.

Happy viewing!
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<td>July 23-24</td>
<td><strong>Open House</strong> at the 24-inch observatory of MSU, E. Lansing.</td>
<td>For further information, contact Kim Dyer.</td>
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<td>August 5</td>
<td><strong>General meeting</strong> at Cranbrook Institute of Science. Speaker:</td>
<td>Tom McLaney on &quot;The Moon.&quot;</td>
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<td>August 11-15</td>
<td><strong>Perseid Meteor Shower Star Party</strong> at Port Crescent.</td>
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<td>August 20-22</td>
<td><strong>Southern Michigan Universal Regional Festival of Stargazers</strong></td>
<td>near Clare, Michigan. Contact: Richard Walker, 1220 Merkle Street, Ortonville, MI 48462; (313) 627-9524.</td>
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