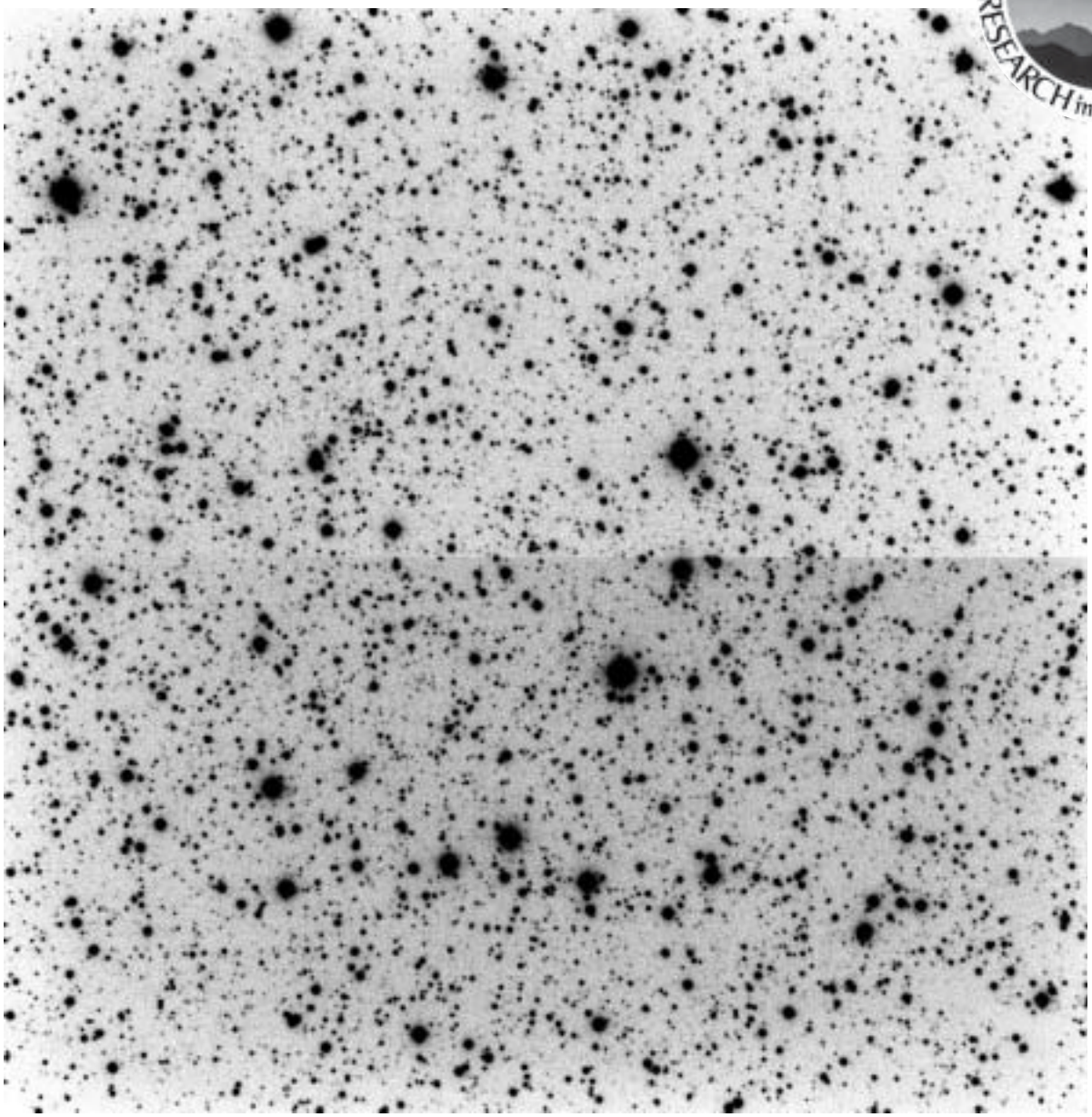
WINTER 2009
VOLUME 32, NO. 4

MIRA NEWSLETTER



A Million Stars, a Million Planets, and a Million Mysteries

A rich star field imaged with the MIRA 36-inch telescope. See "On the Cover," p. 7.

Contents

Calendar of Events

Saturday, 23 January, 7:30pm The 22nd Annual Bonestell Lecture: "Emergent Worlds: The Radical Shift in 20th-Century Cosmology," by Dr. Kai Woehler, Naval Postgraduate School. Monterey Peninsula College Lecture Forum.

Frugality in Current Times at MIRA

The end of the year approaches and, like many folks, we start looking at our financial situation. Our small endowment has not been damaged much from the economic conditions because we took a very conservative investment approach early last year. While we didn't lose very much, we were not in any position to take advantage of recent market rebounds, either.

When the Friends of MIRA make contributions to our education and research work, we treat them as a trust that we have the obligation to spend on the purposes for which they were given. Losing funds in stock market speculation does not seem to be one of those purposes. The potential of growing your donation to twice its original value is trumped by the unacceptable option that your contribution to our programs vanishes in a twist of the economic markets.

Finally, we're as frugal as we can be in our spending; for example, delaying capital costs until they are fully funded whenever possible. Contrary to the approaches of governments and other large organizations, we do not spend money that we do not have in hand. It is surprising to me that loans are available for organizations such as MIRA but I can never imagine myself asking you, the Friends of MIRA, for a contribution to retire debt.

Any funds you donate go to the primary MIRA functions. Overhead costs are covered from such sources as investment income from our small endowment. Our astronomers donate their time for the educational functions. And we are frugal with every penny; we're more frugal with the MIRA budget than with our personal ones. For example, this summer, with considerable effort by one of our volunteers, we revived a set of three old computers for use with the interns. This is a temporary solution, of course, but gives us the time to seek specific grants for this purpose.

A more dramatic case is the OOS wind turbine. We've been nursing it along for several years now but, like the Oliver Wendell Holmes' "one-hoss shay," almost all its parts have reached the end of their lifetimes. Critical to the Observatory power system, the expense of replacing it can no longer be deferred.

So please help us prepare for another great year of educational events for Central Coast residents of all ages, our intensive intern program, and our research into the mysteries of the Cosmos. All of your donation – 100% – goes to those purposes.

Thanks again for your support.

Bruce Weaver

Friends' Night at the Oliver Observing Station

Above MIRA staff and Friends await sunset. Below, a young stargazer catches 40 winks on her way down the hill.

Q&A

This feature is inspired by the questions we have received over the years from interested readers. If you have a question about an astronomical topic, please send it to us.

Mrs. Patsy Fish writes,

I thought that I would write to you about an experience that I had a few years ago.

One night I went up on the rocks above my cabin to watch the sun go down. I was lying on my back facing south when I noticed a white dot just above the tree line. I kept watching it for a while. It didn't move much. I thought it might be a weather balloon. After about a half an hour the sun set, and suddenly my weather balloon turned into a star!

I came down to the cabin and got a mattress from the chaise longue by the pool and my sleeping bag, and went back up on the rocks and spent the night there. In the morning the huge morning star came up. I think it was Venus. I kept watching it. I backed down the trail watching it all the time until I reached my porch. Still watching it, I pulled a chair to the right spot on the porch and lined the star up with the 2x4s that held up my awning so I could find it again if I looked away. I sat in that chair and watched it until 2:30 in the afternoon when it went over the roof line. I was so excited that I had actually seen that star *all day*!

I've never found it again.

Dr. Whitney Shane replies,

Although the two events in your account took place within a period of less than 24 hours, they appear to be entirely unrelated. I find the first one hard to explain. As you know, weather balloons do not turn into stars at sunset. The explanation that suggests itself is that you were indeed watching a weather balloon, or some such object. A little after sunset the balloon would have entered the shadow of the Earth and disappeared from view. About the same time the first stars would have appeared in the twilight sky, so it is possible that, in a rare moment of inattention, you might have missed the disappearance of the balloon and the almost simultaneous appearance of a bright star in approximately the same position.

If you were to argue that this would require an improbable combination of coincidences then I would have to agree with you, but I can think of no more plausible explanation. The fixed stars are not bright enough to be seen with the unaided eye during daylight, except for very rare and spectacular objects like extremely bright novae. The planet Venus, as you discovered, can be seen during daylight, as well as Mercury and Jupiter under extremely favorable conditions, but the location of the object which you saw was not in a part of the sky where planets can be found, and as you noted on the following morning, Venus was then a morning, not an evening object.

Your second adventure, if I may call it so, was an exercise in Venus watching, and one whose equal it would be hard to find. After spending the night up on the rocks, you walked down the trail backwards while watching Venus all the time. I gather that the sun had already risen, since you had to keep watching Venus in order not to lose it. You then did what a good observer would do, sitting in a place where Venus lined up with some fixed object, and then moving around to maintain the alignment. I have no statistics on the subject, but you may well have set a record for Venus watching. Although it is not difficult to see Venus during daylight, the problem is finding it and getting the eyes properly focused for the infinite distance when there is nothing in the neighborhood upon which to focus. The best opportunity is when Venus appears close to the moon.

The account of your observations reminds me of a story my father used to tell. He spent the war years working on the Manhattan Project, the last period at Los Alamos. The Japanese were unable to launch an attack on the continental U.S., so for a time they sent over balloons carrying bombs which they hoped would land somewhere where they would do some damage. Actually they never did anything more than raise a few little clouds of dust in the desert. However, they were a potential threat, and the last thing they wanted at Los Alamos was one of these things landing on the laboratory. One day someone spotted what he took to be just such an object, so to be on the safe side they notified the Air Force which sent up a fighter to shoot it down. The fighter was unable to reach the required altitude, so they sent up a special high-altitude fighter, but even this was unable to go high enough. By this time it was sunset, and the threat was soon identified as Venus. My father thought that this might have been the most serious effort ever made to shoot down Venus.

Thank you for your letter. I enjoyed sharing your experiences and trying to explain your observations. Please accept my compliments for your accuracy and your tenacity. Not many astronomers, who are supposed to be used to this kind of thing, would have had the patience to do what you did.

2012?

by Dr. Wm. Bruce Weaver

A few weeks ago, Adriana Frederick, a news reporter for KSMS-TV, asked:

Will the world end when the Mayan calendar runs out in 2012? Will the planetary alignment at that time harm the earth?

Calendars are important tools for any civilization but they are not easy to construct. The problem lies in the fact that there are not an integer (whole number) number of days in the time it takes the earth to go around the sun exactly once. It takes 365.2422... days for the earth to complete an orbit. The "..." means that the fractional part doesn't stop there but keeps on going. Eventually, any calendar design will be off by more than a day. In the case of the current Gregorian calendar, it takes about 3300 years before we're a day off.

So it is always interesting to see how different, independent civilizations try to solve the problem. To get close to the right answer, one needs to do careful astronomical observations for many years and to have some way to approximate fractions. For the best results, a way to work with decimal places is needed.

It appears that the Maya had multiple calendars, but there was one, the Long Count calendar, that corresponds to what we normally think of as an annual calendar. One year ("tun") had 18 months ("uinals") of 20 days ("kins"). This accounts for only 360 days, so they had to tack on five days at the end of this cycle to get close to the correct number of whole days in a year.

We break our calendar into weeks, months, years, and groups of years divisible by ten (decades, centuries, etc.). In a similar manner the Mayan calendar is broken into pieces starting with one kin, then a uinal, then a tun, then a katun (20 tuns).

The fifth part, baktun, of length 144,000 days (a little over 394 years or 20 katuns), was the last commonly-used division. Baktun 12 ends and 13 begins on 21 December 2012. Notice that 13 baktuns[1] is over 5128 years and the starting point for this cycle, and the world, was around 11 August 3114 BC – before any Mayans were around to start devising calendars, which probably happened between 400 and 500 BC. That estimate seems similar to James Ussher's biblical calculation of 23 October, 4004 BC or Judaism's 3760 BC for the beginning of the world.

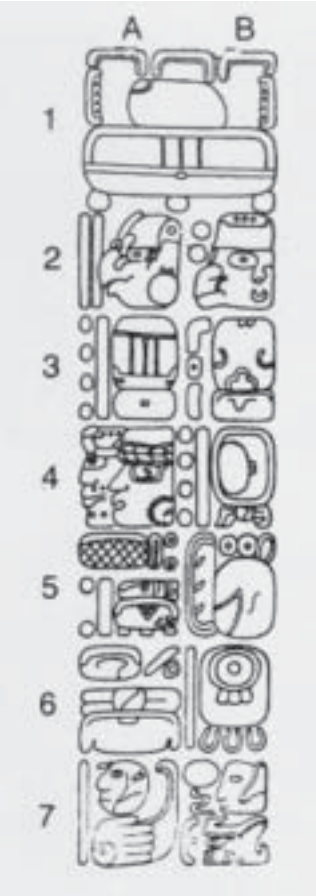
The ancient Maya would probably schedule a big-time party to celebrate getting through another baktun period but there seems to be no credible archaeological evidence that it represented to them the end of anything more significant — like the world. My guess is that, like the computer Y2K problem, the Mayan calendar makers having their current cycle go for another thousand years beyond their work day probably seemed like enough. And they also had a name for a period of 20 x 20 x 20 tuns (2,880,000 days), and 20 x 20 x 20 x 20 tuns (57,600,000 days), and even further, so they had plans for much longer cycles.

Table 1. Long Count vs. Gregorian

Long Count	Gregorian
13.0.0.0.0	11 August 3114 BC
1.0.0.0.0	13 November 2720 BC
2.0.0.0.0	16 February 2325 BC
3.0.0.0.0	21 May 1931 BC
4.0.0.0.0	23 August 1537 BC
5.0.0.0.0	26 November 1143 BC
6.0.0.0.0	28 February 748 BC
7.0.0.0.0	3 June 354 BC
8.0.0.0.0	4 September 41 AD
9.0.0.0.0	9 December 435
10.0.0.0.0	13 March 830
11.0.0.0.0	15 June 1224
12.0.0.0.0	18 September 1618
13.0.0.0.0	21 December 2012
14.0.0.0.0	26 March 2407
15.0.0.0.0	28 June 2801
16.0.0.0.0	1 October 3195
17.0.0.0.0	3 January 3590
18.0.0.0.0	7 April 3984
19.0.0.0.0	11 July 4378
1.0.0.0.0.0	13 October 4772

[1]The Mayans were pretty good at math, so they started with Baktun 0, unlike our modern calendar which skips from 1 B.C. to 1 A.D. without so much as a by-your-leave.

While this Mesoamerican culture was remarkable in many ways, including having a good calendar that would have required careful and extended observations of the heavens to develop, there is no reason to believe that they were implying something sinister would happen to the world after the completion of the "last" baktun. Just very good astronomers but, speaking for the profession, we don't have any special insights into the end of the world.



A drawing by Mayanist scholar Sylvanus G. Morley of a lintel inscription on the building known as "Temple of the Initial Series" at the Chichen Itza site in Yucatan, Mexico (from his *An Introduction to Maya Hieroglyphs*, published in 1915). The date is 10.2.9.1.9, corresponding to 30 July 878 AD.

Planetary Alignment?

How about the planetary alignment that coincides with this special date?

Compared to the sun on 21 December, 2012: Mercury, which is never far from the sun, will be 17 degrees west of the sun; Venus, also never far from the sun, will be 25 degrees west of the sun; Mars will be 29 degrees east of the sun; Jupiter, the most massive of the planets, will be 158 degrees west of the sun (almost opposite the sun in the sky); Saturn will be 54 degrees west of the sun; Uranus will be 98 degrees west of the sun, and Neptune will be 65 degrees east of the sun. This hardly seems to be an alignment!

As a side issue: how interesting are planetary alignments? Probably as interesting as when the hands of a clock align at 1:05:05. or 2:10:10, or 3:15:15, or ... Of course, when planetary alignments occur opposite the sun, they make for nice night-time shows for those of us able to escape from the seemingly ubiquitous light pollution of our cities.

Passing through the Galactic plane?

The sun orbits around the center of the Milky Way Galaxy with a period of about 250 million years. It also oscillates above and below the plane of the galaxy about four times per revolution so, about once every 80 million years it passes through the plane of the Milky Way. The apocalyptic claim is that the sun and the earth will be passing through that plane in 2021. Of course, since the Milky Way Galaxy is so huge, and a bit messy, the location of the Galactic plane is not exactly defined.

The facts: The sun is about 40 light years (somewhere between 32 and 65 light years) above the Galactic plane and, the worse for the doom-mongers, is moving away from the plane at 7.2 kilometers per second (about 16,000 miles per hour). It will be tens of millions of years before we are in the vicinity of the Galactic plane again.

An alignment of the earth, sun and Galactic center on 21 December, 2012?

On 21 December, 2012, the sun will appear as far south in the sky as it goes for the year. For folks who crave longer days, the corner has been turned and the days will start to be longer. That's why a lot of cultures end the year around that date and have lots of celebrations.

The Galactic center is located on the sky in the constellation of Sagittarius. The path of the sun on the sky does take it close to the Galactic center. However, it seems closest around the 18th of December but still about five degrees away. Most importantly, the relative positions on the sky of the sun and the Galactic center are essentially the same every year at the same times. So there is nothing special about 2012 in this regard.

The Winter Sky

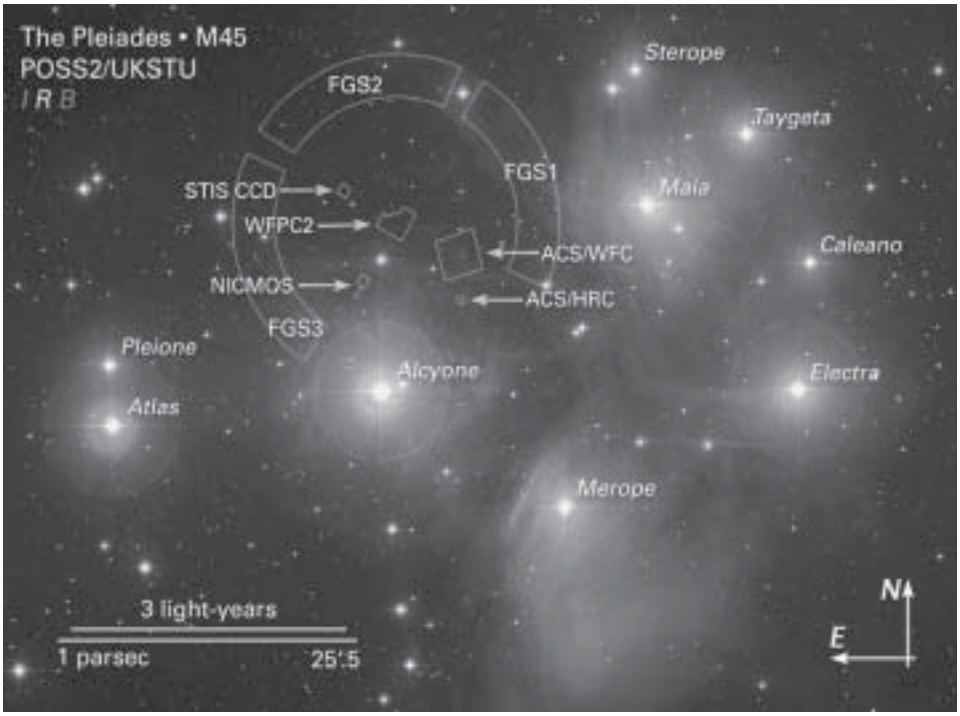
by Rod Norden

The cold and crisp winter evenings are great for observing, as the sun is setting very early giving us longer nights. The stars of winter, dominated by the brilliant constellation Orion, are well up in the sky all evening.

For naked-eye observers, February and March provide the best time to see two faint glows caused by sunlight reflecting from meteoroid dust in the plane of the solar system.

Just after sunset, look to the west for the zodiacal light which looks like a faint separated section of the Milky Way running along the ecliptic.

Near midnight, look at the highest part of the ecliptic to find the very faint gegenschein (German for "counterglow"), located directly opposite the sun in the sky. Both of these phenomena require a very dark, transparent sky and dark-adapted eyes.



M45, the Pleiades. NASA, ESA, and AURA/Caltech. The areas outlined and labeled are fields observed by the Hubble Space Telescope's various instruments.

Another naked-eye object is the small tight group of bright stars called the Pleiades (M45), located in Taurus, about ten degrees from Aldebaran and the Hyades (an even closer and younger open cluster). The Pleiades are hard to miss high in the winter sky. It is fun to count how many stars you can see under various conditions of dark sky. There are ten stars brighter than sixth magnitude, but most people can see only between six and nine of them, depending on visual acuity and dark adaptation of the eyes. Excellent observers in a very dark sky can see up to 14 stars.

The Pleiades is also known as the Seven Sisters, and the cluster has been mentioned historically as far back as 750 BC by Homer in both his *Iliad* and *Odyssey*. There may be older references as well. The Japanese know this cluster as "Subaru," and the modern car company logo is supposed to represent this group of stars.

The Pleiades are especially nice in binoculars at almost two degrees across with all the fainter stars in the group becoming visible, including a very difficult eighth-magnitude close double star in the "bowl." This close double star is visible in our illustration, just below the "ACS/HRC" label. All the brighter stars are hot large blue-white stars which are rotating very rapidly. These stars are rotating so rapidly that they sometimes throw off shells of hot gas. Pleione does this every few decades and MIRA astronomer Bruce Weaver recently caught it starting a new shell phase. His spectroscopic observations show that multiple shells of different temperatures are being ejected.

When observed with a wide-field telescope, the brightest nebulosity near Merope becomes visible with care. It was discovered visually with a four-inch refractor in 1859. Nebulosity surrounding other stars might be observed, but it was discovered photographically. V. M. Slipher in 1912 proved the spectra of the nebulosity matched that of the neighboring star, indicating these were reflection nebulae. When the radial velocities (toward or away from the earth) of the stars and nebulosity were measured, they were found to be different by 11km/sec. This proves the nebulosity is not left over from stellar birth, but rather is part of dust in an interstellar molecular cloud, which happened to cross the cluster's path.

As for distance to the cluster, the accepted value after careful study is determined to be 440 (+/- 6) light years, and the cluster appears to be only 100 million years old. The cluster's main radius is about eight light years, and it may contain more than 1,000 stars. Some of these stars are very peculiar as well. The cluster contains several brown dwarfs, which are stars of less than 10% of the sun's mass, not heavy enough for nuclear reactions to start in their cores and become proper stars. These dwarfs also have detectible lithium, which is destroyed in the nuclear reactions of hotter normal stars.

I'm going to look at the Pleiades in a whole new light from now on, and I hope you will also.

Planets

The sun reaches Vernal Equinox on 20 March at 10:32 AM PDT. The sun crosses the celestial equator on its way north, and is visible directly overhead for observers on the equator. This is six days after we move clocks ahead one hour on Sunday, 14 March. Under our new law, we spend 65% of the year on this "false" time.

Mercury reaches maximum morning elongation from the sun on 27 January, and gradually moves back towards the sun. It reappears in the evening sky in late March, with best evening views near mid-April close to Venus.

Venus will pass below and beyond the sun on 11 January and very gradually reappear low in the evening sky. Venus and Jupiter will be about one-half degree apart just a few degrees above the western horizon on 16 February and may become visible about 20 minutes after sunset as the sky darkens. A perfect horizon is required and binoculars may help the view as the pair is only nine degrees from the Sun.

Earth is closest to the sun (at perihelion) on 2 January at 4:00 PM PST.

The moon is full on 29 January about 3 hours before perigee. It will be the "largest" full moon of the year.

Mars will be at opposition on 29 January this year, but it is almost as far from the earth at opposition as it can be in its elongated orbit. Only the next opposition in 2012 is worse! The maximum angular diameter this year is just over 14 seconds of arc, just more than half of what we experienced back in 2001. Details on the surface will be visible until its angular diameter shrinks to 9" which occurs in late March.

Jupiter should be observed as early in January as possible, since it will be in conjunction with the sun on 28 February and lost in the glare of the sun for most of the period.

Saturn rises before midnight in early January and reaches opposition on 21 March, when it rises at sunset and is visible all night long. Since our seeing conditions along the coast are often steadiest after midnight, the period provides many good opportunities to see Saturn high above the horizon after midnight. We are now looking down on the northern hemisphere of Saturn. The fantastic rings begin the year open almost five degrees, but the tilt lessens to less than two degrees in May due to our relative orbital motions. The year ends with the rings opening to more than ten degrees.

Uranus is lost in the solar glare after the first weeks of January, being in conjunction with the sun on 16 March.

Neptune is lost in the solar glare during the period, being in conjunction with the sun on 14 February.

Pluto reappears in the early morning before sunrise and will be much better placed for observation later in the warmer months of the year. Use your favorite planetarium software to produce very detailed finder charts, since the 13.9 magnitude planet is at the edge of M24, the large, very rich star cloud in Sagittarius.

Meteor Showers

There is one major shower during the winter months, and the nearly full moon is going to interfere this year. On the early morning of 3 January, the Quadrantids will peak. The maximum is due before dawn with the radiant in northern Boötes. The shower is named after the constellation Quadrans Muralis.

Comets

There are a few faint comets in the winter sky this year. Comet C/2007 Q3 (Siding Spring) begins January northeast of Arcturus at ninth magnitude and moves toward Draco during the period. Comet C/2009 O2 (Catalina) begins January in Aquila very faint and is expected to brighten to ninth magnitude by the end of March as it passes above M31. Please be aware that overall comet magnitudes are averaged over the area of the coma and nucleus of the comet, so it may appear as a slightly fainter smudge on the sky.

Eclipses

There will be no eclipses visible from Central Coastal California this winter.

On the Cover

The cover image of a field in the Cygnus Star Cloud was made recently by Arthur Babcock. The line between the upper and lower halves of the image is an instrumental artefact.

Friends of MIRA Membership

I would like to become a Friend of MIRA and receive the quarterly MIRA Newsletter.
Enclosed is my membership donation of $_____
In addition, I am making a special contribution of _____

$2500 Associates Circle	$100 Sponsor
$1000 Associate	$50 Family
$500 Patron	$35 Member
$250 Sustaining	$15 Student

MIRA *welcomes corporate and business members. Contributions are tax deductible as allowed by law.*

Name_____

Address_____

City, State, Zip_____

Phone/e-mail_____

The MIRA Board of Directors

Gordon Jones, Chairman
Dr. Wm. Bruce Weaver, President
Patti Compton, Secretary
Laura Zehm, Treasurer
Homer Bosserman
Dr. Craig Chester
Ron Gaasch
Gary Love

Welcome to our new Friends

Dr. and Mrs. Richard Grey

Thanks!

Staff

Gordon Jones, Chair, Board of Directors
Dr. Wm. Bruce Weaver, Astronomer & Director
Tami Huntley, Administrator
Dr. Arthur Babcock, Astronomer
Bill Bishop, Volunteer Systems Administrator
Dr. Craig Chester, Astronomer
Dr. Martin Cohen, Astronomer
Donna Dulo, Docent
Dr. James Eagle, Docent
Steve Evans, Volunteer
Brian Jacobson, Docent
Gary Love, Physicist
Jim Neeland, Volunteer Systems Administrator
Walter Owen, OOS Caretaker
Claas Shane, Librarian
Dr. Whitney Shane, Astronomer & Charles Hitchcock Adams Fellow
Dr. Russell Walker, Astronomer

* * *

The Monterey Institute for Research in Astronomy owns and operates the Oliver Observing Station under permit from the U.S. Dept. of Agriculture-Forest Service.

* * *

The Monterey Institute for Research in Astronomy owns and operates the Richard W. Hamming Astronomy Center and the Ralph Knox Shops through an arrangement with the U.S. Dept. of Education.

Visit our Web site and *Field Trips to the Stars:*
www.mira.org
E-mail us at mira@mira.org

Monterey Institute for Research in Astronomy
200 Eighth Street
Marina, CA 93933

(831) 883-1000
(fax) (831) 883-1031
www.mira.org

NON-PROFIT ORG.
U.S. POSTAGE
PAID
PERMIT NO. 16
MARINA, CA 93933

RETURN SERVICE
REQUESTED