

OBSERVER

Messier Month is Here!



The Triangulum Galaxy (M33) in Triangulum

This lovely spiral will be on the list for all Messier object hunters this month. It was taken with an ST-2000XM ccd camera on an 8-inch f/4.5 Newtonian telescope on December 27 and 28, 2008 at the DAS EGK site. It's a mosaic of four sharp images, each of 30/20/20/20-minute LRGB taken in five-minute increments.

Image copyright 2008 Joe Gafford

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10..... Full moon

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26..... New moon

MARCH SKIES *by Dennis Cochran*

“ All night long . . .” as the rockers say, will Saturn be up this month, with rings tilted two to three degrees. Because of the near edge-on aspect of both the rings and the plane of the orbits of Saturn’s moons, two Titan-shadow transits occur in March: in the pre-dawn hours at 3:34 on the 12th and again at 2:25 on the 28th. “Few have seen it,” said Hiccupus the Elder. Or was it Tycho the Terrible? Anyway.

Our evening companion Venus, brighter than a landing airliner, brighter than a circling saucer, gets lower all month until she makes the crossover from Evening to Morning Star at inferior conjunction on the 27th. Watch her get bigger from pole to pole yet with a thinner and thinner crescent as she nears the Earth. Then she

passes a mere 33 million miles from the Earth, showing us her dark side as she disappears like the new moon does in its monthly cycle, to finally rise just 50 minutes ahead of the sun on the 31st.

If you happen to be up in the pre-dawn you might see Jupiter’s photo-op on the 22nd just four degrees below the crescent moon. Mars is a dawn object too, and is really faint.

You are probably starting your observing sessions with M42 in Orion. If you ooze up to Betelgeuse, the Hunter’s left hand or arm or something, lefthand in the sky, anyway, you can follow a fainter line of stars that continues on up and then cocks over to the right to end at

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PRESIDENT'S CORNER



Newly Elected Officers

From left to right: Ron Pearson, David Shouldice, Dan Wray, Jack Eastman, Ron Mickle, Joe Gafford, Ginny Kramer, Frank Mancini, Tim Pimentel, Steve Solon, Wayne Green, Keith Pool and Brad Gilman.

Photo by Bill Ormsby

The elections are completed, and we're looking towards the Banquet.

Thanks to all that contacted Brad Gilman or Darrell Dodge to shift your newsletter from the mailed paper form to just downloading the PDF from the WEB site. Next month, your new President, Mr. Ron Mickle, will take the helm—and I know I can join with you in offering our congratulations to the new board.

—Wayne Green

BIG THANKS!

Thank you to Steve Solon for producing last month's *Observer* so that I could move, and see my son, Zack, married to his beautiful Amy. Some of you old-timers may remember my Zack growing up in the star-party fields. He's still pretty good behind the eyepiece. Time flies! Below is Zack with his new family, Amy and Henry!—Patti Kurtz



Society Directory

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- Vice President:**
Keith Pool (303) 718-7273
- Secretary:**
Ron Pearson (303) 670-1299
- Treasurer:**
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- | | |
|----------------------------------|-----------------|
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| Frank Mancini | Dan Wray |
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Denver, Colorado 80210

The Executive Board conducts the business of the DAS at 7:30 p.m. at Chamberlin Observatory. Please see the Schedule of Events for meeting dates. All members are welcome.

www.denverastro.org



HEY! HOW ABOUT A LADIES NIGHT OUT?

by Wayne Kaaz

Since some of our DAS gal members, wives, daughters (and girlfriends) may not have an interest in some of the programs at the DAS General Meetings, except at banquets and the like, how about this?

Since one of my other hobbies is Dollhouse Miniatures, I could provide a presentation on the subject, with the following items:

1. A Power Point Slide Show. (Steve Solon has offered his expertise in doing the digital photos of the Dollhouse)
2. Five static displays.
 - a. The Conservatory and Garden.
 - b. A wedding scene using the St. Chappel Chapel in Paris, France, as a backdrop, with 13 dolls.
 - c. A room box with a living room Xmas setting display.
 - d. Three displays of 18th/19th century carriages with horses.
3. Various magazines and catalogs.

Is there any astronomy association with this show? Yes! There is a 12 1/2-inch f/8 Cassegrain telescope on an equatorial mount and Chamberlin has contributed to the dollhouse itself.

I would like to get an idea from the members and their ladies if there is an interest in this presentation. Please contact the DAS officers or E-Board members with your comments or E-mail me at kaazmos@msn.com.

MARCH SKIES (CONTINUED FROM PAGE 1)

Orion's northern two stars Chi (X) 1&2. Now you'll be below the feet of Castor the northern twin of Gemini. A line between the feet of Castor and the Chi stars of Orion forms the base of a nice little triangle whose apex to the northwest is M35, a beautiful star cluster with a companion, cluster NGC 2158. Although close in the sky, they are unconnected, since M35 is close while 2158 is near the edge of the galaxy.

If you can stand observing at this near-zenith angle you could drift towards Auriga's near side, away from Capella, to encounter cluster M37 outside this constellation's five-sided figure. Inside the figure are cluster M36 & 38, which I have had trouble seeing from Chamberlin. You may need darker skies for these objects. Speaking of Gemini, if you go southeast from Castor to Pollux you will be headed towards faint Cancer the Crab. Near the middle of its upside-down Y (if you're looking south) is the Beehive Cluster M44, known as Praesepe, the manger, which contains many multiple stars. Sliding down the left leg of the inverted Y to the alpha star of Cancer, and then slightly to its right you will find cluster M67. Then, if you're still observing a

while later, look farther east on the ecliptic to find Regulus, the heart of Leo the Lion. Just below where the body line of Leo meets the rear-end triangle is the famous galaxy pair M65 & 66, with fainter spirals NGC 3593 & 3628.

March has important events: the Open House Saturday the 7th, and the DAS Banquet on Saturday the 14th at Darrell's Unitarian Church. For the latter you'll need tickets at \$25 per person from DAS Banquet Tix, 2930 E. Warren Ave, Denver CO 80210. Find a PDF reservation form on the website. The banquet takes the place of the March General Meeting. The day before that is the Vernal Equinox! Don't forget to go to Stonehenge to sacrifice a chicken, or if you like animals, eat a vegetarian Indian meal whilst contemplating a chicken.



The Great Orion Nebula (M42)

This object is easy pickins' for Messier hunters this month. Visible naked-eye, it's the brightest star-forming diffuse nebula in the sky. It's also one of the brightest deepsky objects that can be seen. This image was made by April's guest speaker, Philip Good.

Photo copyright Philip Good

Or go to Chaco Canyon and do this with a roadrunner. But I digress. Early in April is another Open House on Saturday the 4th.

ARCHAEOASTRONOMY OF THE CHACOAN PUEBLO: PART TWO

by Ron Mickle

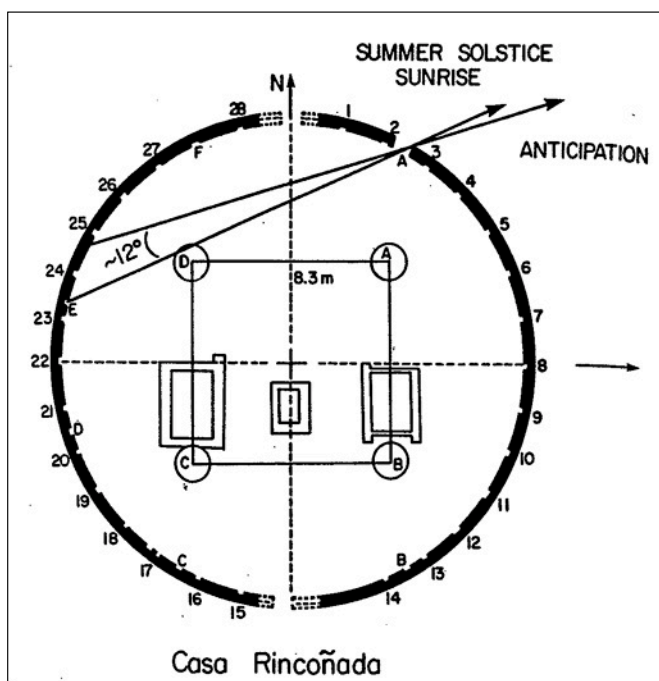
Herein begins Part Two of Ron's excellent article. Ron used numerous citations and references. Please contact him if you're interested in seeing them.—Ed.

With Casa Rinconada there are four features which play a possible role in astronomy: (1) the opening in the northeast corner of the wall, labeled 'A' in Figure 4; (2) the adjacent rooms just outside the wall; (3) the six large niches on the inside of the wall, labeled A-F; and (4) the four holes for the support post labeled A-D. In its present day configuration, Casa Rinconada can be used as a calendrical predictor for the summer solstice (Zeilik 1983, 1984).

During the summer solstice, sunlight enters through opening 'A' and illuminates niche 'E'. As a predictor of the coming solstice, sunlight enters opening 'A' about seven weeks prior to the solstice illuminating the wall near niche 25. Over the coming weeks, the sun tracks south until it illuminates niche 24 approximately four weeks prior to the summer solstice (Zeilik 1983, 1984).

However, the U.S. National Park Service restored the northeast opening and wall in the 1930's, so the original size and placement of the opening is unknown. Early photographs and drawings from the 1930's and 1965 show eight large gaps in the wall, two of which are the north and south entrances. Prereconstruction photos

Figure 4. Schematic drawing of the ground plan showing the sunlight path approximately 10 weeks prior to the summer solstice. (Zeilik adopted this drawing from Williamson's study in 1982.)



show the west wall intact, but the east wall (vicinity of niche 'A') has been completely rebuilt (Vivian & Reiter 1965; ORACLE). The width of the opening 'A' would be extremely important. If the opening were only half its size, no sunlight during the summer solstice would enter and illuminate the northwest wall (Charbonneau et al.).

In addition to the questions concerning the opening 'A', it is uncertain whether a wall existed outside the window. According to Zeilik, a previous study conducted by Vivian and Reiter (1962) refers to the opening 'A' as a window or door leading to an adjacent room on the northeast. Such rooms exist in the great kiva in Chetro Ketl and, at Aztec, it is completely surrounded on the periphery by rooms, allowing no sunlight to enter. Other studies indicate there was a room constructed outside the opening, but it was not known if the room existed throughout the kiva's use (Malville & Putnam 1993). While Zeilik credits Williamson (1982) with finding field notes of Casa Rinconada prior to reconstruction, he does take issue with Williamson's (Williamson et al. 1977) assertion that the northeast window served as a sacred showing of the sun, but also as a calendrical marker (Zeilik 1983, 1984). The artist Anna Sofaer of the Solstice Project references Williamson as support for the solstice alignment. Also, she references Zeilik as a source for the solstice alignment (Sofaer 1994, 1997), however, Zeilik's 1984 Archeoastronomy article makes a counter argument to Williamson's assertion, therefore, does not support either Williamson or Sofaer.

Even if the opening 'A' was not obstructed by another room and the reconstruction of the window opening were in concert with the original layout, the roof post 'D' (Fig. 3) would have obstructed the sunlight from striking the northwest wall. The roof post would only need a diameter of 16-inches or larger to have blocked incoming sunlight. Considering the posts used in Chetro Ketl were over 26-inches in diameter (Malville & Putnam 1993), this is not unreasonable (Charbonneau et al.).

As a sidebar, during the winter solstice, sunlight enters through the south entrance and illuminates the southeast wall in the area of niches 24 and 'D' (Fig. 3), in a similar manner as previously mentioned regarding opening 'A' and niche 'E'. This is a direct result of the reconstruction and no roof covers the south entrance, as it did originally, thus reinforcing the suggestion that the light display is also an artifact of reconstruction (Zeilik 1983, 1984).

2.3 WIJJI

At the eastern most location of Chaco Canyon is probably the last of the great houses built by the Anasazi, called Wijiji (Malville & Putnam 1993). In relation to another prominent terrain feature, it is 3.25 km east by northeast of Fajada Butte. Research over the years has identified several solar observing sites within the great house and in the proximity of the settlement (Exploratorium Museum 2004). Of particular interest is a ledge approximately 1 km east of the main settlement of Wijiji that may have been used



A time lapse photo of Casa Rinconada with star paths taken December 16, 2007. Courtesy of National Park Service. Image copyright 2007 Dr. Tyler Nordgren

by Anasazi priests to anticipate the winter solstice (Zeilik 1983, 1984).

On the ledge are not only Anasazi symbols, but also Navajo sun symbols and other sacred images, suggesting that the Navajo also may have used the site to anticipate the sun's renewal (National Geographic 1982, 1990).

According to Zeilik (1983, 1984), in December 1982 his team placed observers at various points on and below the ledge to observe the winter solstice and noted from what position the sun was observed rising from behind the rock pillar some 500 meters further east on an azimuth of 1190. What they found was that any position along the ledge between the petroglyphs at both ends of the ledge would place the sun in the desired position behind the rock pillar, marking the winter solstice. Due to the obliquity of the ecliptic, the position of the observer in AD 1100 would have shifted approximately 2m north toward the large boulder with the petroglyph. Zeilik points out that research conducted by Williamson (1983) identifies the sun rising behind the rock pillar as viewed from the area of the pictograph on the ledge some 16 days prior to the solstice (Zeilik 1983, 1984).

It would be almost impossible for the observer to establish the solstice based on horizon markers. The azimuth of the sunrise shifts daily by 10 arcmin, twenty days before solstices, then 5' per day ten days later and finally less than 1' per day the last three days before solstice. Some studies have suggested that the smallest change in displacement detectable to the eye is at the most 4', which would have occurred about 8 days prior to the solstice; therefore establishing the solstice day on the day of occurrence with the naked eye would not have been possible. The best application would have been to use the sun's displacement on the horizon as a predictor two to three weeks prior to the solstice (Charbonneau et al.). The Wijiji site supports a sun watching station for sunrise and sunset used by Anasazi priests to anticipate the winter solstice, but not an exacting use as a calendrical marker. While the Pueblos observed equinoxes, they were not celebrated

and were considered less important than the solstices (Squires 1999).

Zeilik's team also witnessed the solstice sunset in the very bottom of the 'v' formed in the rock face. The 'v' notch is about 100 m to the southwest of the observer's ledge. They noted that any movement by the observer moved the sun's disk outside the 'v'. There is a narrow 5m range of the ledge where the winter solstice sets in the notch of the 'v'. For the priest to observe the winter solstice from the ledge, he would have to have traveled 1 km from Wijiji in darkness during winter, across a desert landscape and climbed a staircase leading to the ledge from where he could have made observations. All this seems unlikely at best; remembering that there were no REI outfitting stores or Starbucks back then. Unlike Fajada Butte, there is no evidence of small dwellings near the ledge for the priest to seek shelter in the weeks leading up to the solstice.

2.4 CHIMNEY ROCK

The Chimney Rock Puebloan structures have been identified as a Chacoan outlier, with its buildings similar to those found in Chaco Canyon. The twin pinnacles of Chimney Rock are quite remarkable and frame the moon during the major northern standstill (Malville & Putnam 1993).

In August 1988, a team of researchers confirmed their predictions that the major lunar standstill rose between the gap of the two pinnacles of Chimney Rock. Furthermore, the major standstills of the latter part of the eleventh century were AD March 1057, October 1075, and June 1094. The last two dates correspond to the construction dates of the Chimney Rock Pueblo (Malville & Putnam 1993).

When the Great House Pueblo was built on the mesa in AD 1076, the moon was rising between the rock towers. Also, it is estimated that in AD 1077 the moon appeared between the twin pinnacles more than 40 times. The Great House was expanded in AD 1093-94 when the moon was again rising between the rock towers. Some have suggested this may be nothing more than a coincidence, but archaeoastronomers, such as Malville, et al., have demonstrated the lunar alignment during the standstills (Malville & Putnam 1993; Sofaer 1994, 1997). Furthermore, during AD 1076 and 1093-94, lunar standstills occurred. I believe the Puebloan celebrated these events as suggested by Malville (Chimney Rock 2005). Two of the major standstills of the latter part of the eleventh century were AD October 1075 and June 1094. An addition a second floor was added to the kiva in 1093. The logs used have been dated to the summer of 1093 and it was very unusual for construction to be undertaken during the growing

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CHACOAN ARCHAEOASTRONOMY (CONTINUED FROM PAGE 5)

season. From the roof tops of the kivas people could have observed the moonrise between the twin pinnacles (Malville & Putnam 1993).

As stated earlier, predicting the solar solstice and equinox required the priest to anticipate several weeks in advance of the event, and to anticipate a lunar standstill required several years advance planning. Malville tells us that anticipatory lunar observations at the start of each northern standstill were possible and the advance yearly planning would not have been necessary. Furthermore, even though the lunar standstills were clearly marked on the three-slab site of Fajada Butte, there was skepticism as to its validity since no other lunar marker was available. With the discovery of the lunar observing site of Chimney Rock, there have been suggestions that Chimney Rock inspired the markings on Fajada Butte (Malville & Putnam 1993).

3. CRITIQUE OF FINDINGS

With regard to the Sun Dagger on Fajada Butte, there is no doubt that the solstices, equinoxes and standstills are well marked by the three-slab observation port. This has been observed by many research teams and individuals on the exact dates and documented. What is more difficult to explain and interpret is the reason for the 19 grooves in the spiral petroglyph. If the spiral had been cut with any number of grooves other than 19, and positioned on the rock face so the shadows of the sun and moon bisected or touched the edge or bracketed the spiral, it would serve the same purpose. If the Anasazi did have an understanding of the Metonic cycle or the standstills, it would have been remarkable. I choose to believe they understood the basics of the lunar standstills and the halfway point between minor and major standstills.

But was the three-slab site used as a calendrical instrument, anticipatory site or neither? I believe the site was used to predict the coming of the solstices during the final 2-4 weeks. The amount of movement of the sun's shadow on the spiral during those final weeks is very small, resulting in less than 2mm movement within the last week. The human eye cannot detect this small displacement. For the sun priest, the horizon calendar would have provided the annual date to within a month of the

solstice and the three-slab site would have refined that down to the final weeks. The Fajada Butte as a solar site is an excellent predictor for the solstice.

When considering Casa Rinconada as a predictor of the summer solstice, it is easy to speak of demonstrated use. Year after year, the summer sunshine projects its rays onto the wall and moves to the specific niche on the day of the solstice. However, an in-depth review of documents concerning Casa Rinconada tells us that there was significant reconstruction to the great kiva, enough that size and adjacent surrounding of opening 'A' are in question. And even if there were no obstructions to the opening, then the roof post 'D' would have blocked the light from illuminating the west wall. While the cardinality of Casa Rinconada is precise in its north-south and east-west alignments, I believe there is enough evidence against its use as a solstice marker.

During the research on Wijiji, I found at least three teams or institutions that had conducted either on-site research or academic appraisals of available material. All concluded that the ledge served as a sun watching station to predict the winter solstice. As previously mentioned, the eye could not have detected the small displacements of the sun as it approached the solstice on the horizon at sunrise. The more logical and demonstrated use would have been as a predictor two to three weeks prior to the winter solstice.

The Chacoan outlier of Chimney Rock is unique in that it is over 160 km from Chaco Canyon, it is built high above the canyon floor using the same construction techniques, and it required the same large amounts of labor as Chaco Canyon Pueblo. Chimney Rock is one of the few settlements that seem to emphasize the major lunar standstill. It has been demonstrated that during the major standstill, the moon rises between the twin pinnacles as viewed from the Great House Pueblo. In AD 1057 there was a major standstill with the moon rising between the pinnacles. The next two standstills correspond to construction of the Great House in AD 1075 and 1094. When the Great House Pueblo was built in AD 1076, the moon was rising between the twin pinnacles and it is estimated that the moon appeared between the pinnacles

ABOUT THE DAS

Membership in the Denver Astronomical Society is open to anyone wishing to join. The DAS provides trained volunteers who host educational and public outreach events at the **University of Denver's Historic Chamberlin Observatory**, which the DAS helped place on the National Register of Historic Places. First light at Chamberlin in 1894 was a public night of viewing, a tradi-



tion the DAS has helped maintain since its founding in 1952.

The DAS is a long-time member in good standing of the **Astronomical League** and the **International Dark Sky Association**. The DAS' mission is to provide its members a forum for increasing and sharing their knowledge of astronomy, to promote astronomical education to the public, and to preserve Historic Chamberlin Observatory and its telescope in cooperation with the University of Denver.

The DAS is 501 (c)(3) tax-exempt corporation and has established three tax-deductible funds: the Van Nattan-Hansen Scholarship Fund, the Public Outreach Fund and the Edmund G. Kline Dark Site Fund. To contribute, please see the bottom of the membership form for details (found on the DAS website: thedas.org).

More information about the DAS, its activities and the special tax-deductible funds is available on the DAS website at www.denverastro.org.

at least 40 times in AD 1077. In 1093-94, the Great House was expanded, which also coincided with the moon rising over Chimney Rock. From Chimney Rock, anticipatory lunar observations were possible, negating the need for planning several years in advance. It is plausible that the standstills at Chimney Rock inspired the markings on Fajada Butte.

The ancestral Pueblo had no written language and left no clear records of their thoughts or beliefs. We have to ask ourselves, did the Anasazi keep track of the lunar standstills because of some spiritual significance, or was it just a beautiful celestial event occurring in the sky?

4. SUMMARY

Many research teams and individuals have demonstrated that the Sun Dagger on Fajada Butte marked the solstices, equinoxes and standstills. The evidence also shows that the combination of spiral petroglyphs and the three-slab stone structure captured the rays of the sun or moon at the exact dates of those celestial events. Quite the opposite holds true for Casa Rinconada. The alignment created by a window opening and the summer solstice sunlight creates the impression of a solstice marker. While at present day this is easily demonstrated and observed during the summer solstice, analysis casts a different light on the plausible intent and use by the Anasazi. Prereconstruction evidence shows that another room existed outside the opening used to allow sunlight to enter and the size of the opening itself is uncertain. Combining this with the roof posts blocking the sunlight from illuminating the niche, I seriously doubt the use of the kiva as a solstice marker.

It has been demonstrated that the two sites, Wijiji and Chimney Rock, served as observing ports for the winter solstice and the major standstill. From the ledge close to Wijiji, the priest would make his observations looking east toward a large rock pillar, and determine the approximate time for the winter solstice. While the survey of the Wijiji site demonstrates it may be used in this

fashion, the specific location the observer or priest placed himself could vary several feet and still place the sun in the particular spot relative to the rock pillar, therefore, the accuracy as a calendar is extremely low. Thus, the site was probably used as a sun shrine and an anticipator of the winter solstice. Chimney Rock is a Pueblo site that captures the major lunar standstills between twin pinnacles. Not only has this been demonstrated, but also the construction dates of the Great House Pueblo correspond to two successive standstills.

From this site, the Anasazi could not only observe the standstill, they could also predict the event, which would have been remarkable for these prehistoric people.

Fajada Butte with Orion taken December 6, 2007. Courtesy of National Park Service.

Image copyright 2007
Dr. Tyler Nordgren



AL CORNER

Darrell Dodge, DAS ALcor

MESSIER MARATHON 2009

The apparent appearance of two EG Kline Dark Site Weekends in this month's calendar is really a hedge to allow us to have primary and backup Messier Marathons this year. The first, March 20-21, will have a crescent moon in the early morning hours, flirting with the last few Messier objects (M75, M73, M72, and M30, etc.) in the rising light of dawn. This means that the evening hours, when M74, M77 and other early Messiers are setting, will be totally moonless. The second, March 27-28, will feature a crescent moon in the evening, and a slightly lower M74 to pick out of the evening twilight.

Either way, the bulk of the Messiers will be well-placed for viewing at this

remarkable time of year—the favorite of many for observing.

REGISTRATIONS DUE

Procrastinators Alert! We will be closing the book on the contents of our new printed annual membership roster around about March 1st. If you haven't renewed your membership for 2009 yet, you'll have to be penciled in when you finally do sign-up.

AL OBSERVING PROGRAMS

Check out the new Astronomical League Galileo Observing Program on the AL Web site at www.astroleague.org/observing.html. It's a great first observing program, and many of the projects can be done right now (Jupiter, Saturn, comet, Praesepe, Pleiades, Moon, Neptune etc.).

COME ONE, COME ALL!

The **DAS Spring Banquet** will be held on **Saturday, March 14th** at Columbine Unitarian Universalist Church, 6724 S. Webster Street in Littleton. The church is located several blocks east of Wadsworth, on the south side of Coal Mine Road. **Dr. Roger Clark** will be our speaker!

Romano's Italian Restaurant will once again cater the banquet which runs from **6-9 p.m.** The cost per person is \$25.00. Checks and orders should be submitted to Wayne Green.

Specifics and sign-up form are available on the DAS website. See you there!

S&S OPTIKA HAS MOVED TO:

6579 SO. BROADWAY
LITTLETON, CO. 80121
(~1 1/2 blocks NORTH of
Arapahoe Road on the
WEST side of South
Broadway)

(303) 789-1089
www.sandsoptika.com

DAS SCHEDULE

MARCH

- 7 Open House at Chamberlin Observatory (Begins at 5:00 P.M.)
- 8 Daylight Savings Time begins
- 13 E-Board meeting at Chamberlin Observatory (Begins at 7:30 P.M.)
- 14 DAS Spring Banquet (See Page 7)
- 20-21 EGK Dark Sky weekend (Messier Marathon)
- 27-28 EGK Dark Sky weekend

APRIL

- 4 Open House at Chamberlin Observatory (Begins at 5:00 P.M.)
- 10 General Meeting at D.U.'s Olin Hall (Begins at 7:30 P.M.)
- 12 Easter
- 17 E-Board meeting at Chamberlin Observatory (Begins at 7:30 P.M.)
- 19-26 Texas Star Party
- 24-25 EGK Dark Sky weekend

Public nights are held at Chamberlin Observatory every Tuesday and Thursday evenings

beginning at the following times:

March 9 - April 14 at 8:00 p.m.

April 15 - September 1 at 8:30 p.m.

September 2 - March 8 at 7:00 p.m.

Costs to non-members are: \$3.00 adults, \$2.00 children.

Please make reservations via our website (www.denverastro.org) or call (303) 871-5172.



The Denver Astronomical Society
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