

The Objective View

June 2009

Newsletter of the Northern Colorado Astronomical Society

Robert Michael, President

pres@ 970 482 3615

Dan Laszlo, VP and Newsletter Editor

objview@ Office 970 498 9226

Chad Moore, Secretary

sec@

John Caldwell, Treasurer

treas@

Greg Halac, Web Editor

web-edit@ 970 223 7210

Dave Chamness, AL Correspondent 970 482 1794

add ncastro.org to complete email address

Little Thompson Observatory, Berthoud Suzanne Traub-Metlay, Bad Behavior in Space. June 19 7:30 pm
<http://www.starkids.org>

CSU Madison Macdonald Observatory Public Nights
On East Drive, north of Pitkin Street
Tuesdays after dusk if clear, when class is in session

Cheyenne Astronomical Society June 19, 20
Camp Jack Star Party
<http://home.bresnan.net/~curranm/>

Chamberlin Observatory Open House, 7 to 10 pm
June 27, July 25, Aug 29 303 871 5172
<http://www.du.edu/~rstencil/Chamberlin/>

Longmont Astronomical Society May 21 7 to 9 pm Suzanne Traub-Metlay, NEOs & Satellites and more, FRCC, 2190 Miller Rd
<http://www.longmontastro.org/>

Next Meeting: June 4 7:30 pm

Black Holes, a Q & A Session. Bring your questions!

Gavin Polhemus, Ph.D., CSU

May 7 Program: Astrophotography for Non-Millionaires, by Allen Jeter

Club Business at 7:15 pm

Discovery Science Center

703 E Prospect Ave, Fort Collins

<http://www.ncastro.org/Sites/DiscoveryCtr.htm>

Club Brochure: http://www.ncastro.org/Contrib/2009_Brochure.pdf

NCAS Programs

July 2 TBA

City of Fort Collins Natural Area Program at Sunset

Bobcat Ridge: Jun 25, Jul 23, Aug 27, Sep 24, Oct 22

Rocky Mountain National Park Starwatching

Meet at dusk at the Upper Beaver Meadows trailhead. June 12, 26; July 10, 24; Aug 14, 28

<http://www.ncastro.org/Sites/RockyMtnNP.htm>

Dark Site Observing Dates

June 19-21 Foxpark WY, ask FRAC

Other Events

Allen brings a professional photographer's eye to astrophotography. He has direct personal experience with equipment choices without breaking the bank. With targets that are faint and distant, aspiring skyshooters can anticipate lots of long exposures. A major component for success is the mount. Tracking is a must for most subjects. Accuracy and stability are prime virtues. Fork mounts are more prone to vibrate than german equatorials. Fine constellation photos can be made with a "barn door" mount and regular camera lens. See www.cloudbait.com/projects/barndoor.html

The focal length of a lens determines its field of view and which targets are appropriate. Bigger aperture gives better resolution, but is more sensitive to atmospheric seeing. The lower the f/ratio, the shorter the exposure can be. Fast lenses of less than f/4 will be limited to rather short exposures if there is any light pollution. Many targets in the sky are small, and need a long focal length to show. Errors are magnified. Allen is using 3 scopes, an 80mm f/5 refractor, a 6 inch Newtonian he uses the most, and an 8 inch SCT for planets and small DSOs. The Orion Atlas mount holds 40 lb. When using a separate guide scope, it needs a rigid attachment to avoid flexure. Stars should be round over almost all the field. He uses a Baader Coma Corrector. Software can help. The Star Rounder plug in only fixes one direction though. A lightweight portable setup he can carry to dark sites is a Canon Digital Rebel XS or XSi, the EF f/1.8 50mm lens. The TC80N3 remote is a time saver for long exposures (Ed., need an adapter cable to connect). The newer cameras allow Live View for framing and focusing at up to 10x, really handy. Or you can attach an external monitor to focus. Purists will think of modifying the IR filter over the camera chip, this doubles the hydrogen alpha sensitivity. It is then necessary to use a filter to correct the color balance in daylight shots. The Astrotrac TT320 and the Kenko Skymemo are other single axis drives. He estimates the accuracy of a cheap german eq

mount to be about an arcminute. He can recommend a Celestron CG5 since it has an autoguider port. He likes the cost/performance ratio of a Canon EF 400mm f/5.6 L lens. He considers it the best \$1000 80mm apo refractor, and it has fluorite and ED elements, autofocus and a field flattener. For less, an achromatic refractor and minus violet filter might work. A permanent mount on a pier is great to eliminate the chore of polar alignment. The Skyshed Pod is shown with his C8 and is cost-effective shelter. He thinks of a used Celestron CG 5 with autoguider port a bargain. Other mounts to look at at higher cost are the Orion Sirius EQG with Equimod, Celestron CGEM, Losmandy GM8, Vixen Sphinx, or the AP 3600 GTO El Capitan if you have a massive setup and \$19.9 K to spend. Affordable apo refractors start at about \$400 for a Celestron Onyx, \$489 for an Orion 80 ED, more for the EON and its better focuser. William Optics has offerings, and Skywatcher Pro has 80mm, 102mm, and 110mm scopes which look cost effective. The Orion 6" f/5 imaging Newtonian is cost-effective at \$535, and can save some with the DIY approach. The Orion f/ 5.3 Mak/Newtonian at \$1300 is sharp but needs antedewing measures. There are new affordable R/C optics from AstroTech, 6" f/9 for \$795 and 8" f/8 for \$1400. Common SCTs need mods to address mount vibration, mount accuracy, focus shift and mirror movement with long exposures. Gary Honis and Hap Griffin are sources for DSLR modification. Allen is ready to try a whole-camera DSLR cooler to reduce noise. There are lots of CCD camera options from Orion, Meade, QHY, and Atik. He had great results with his Kwik-Guide, a guiding chip on an 8x50 finderscope for \$350. Narrowband filters allow you to image dim objects from light-polluted neighborhoods. There are lots of software options. Nebulosity V2 is good. PHD guiding is simple and effective. Deep Sky Stacker is free and does not run out of memory. Pleiades PixInsight older versions are free. Photoshop Elements is cheap but has limited 16 bit capability. GIMP only does 8 bit files. Allen then showed some impressive images. His Pleiades shot had great structure. He did the Orion Nebula by compositing stacks of 3 different exposures to manage the extreme range of brightness. He illustrated the use of his focusing aid.

From our speaker: I have been involved with astronomy and the astronomy community since about 1995. I am a professional photographer by trade and I run a small astrophotography accessories business (lumensa.com <<http://lumensa.com>>). I decided to last year to get serious about astrophotography and have done fairly well with it. People are often surprised at the results I get with mass produced equipment. My background as a professional photographer gave me a strong foundation for making the leap to astrophotography.

Alan's talk is available at:
<http://www.allenjeter.com/a4nm-bass.pdf>

Recommended websites:

Jerry Lodriguss's Website www.astropix.com

Hutech pre IR modded DSLRS
<http://www.hutech.com/AstroCamera.htm>

Hap Griffin DSLR IR filter mod service
<http://www.hapg.org/camera%20mods.htm>

Gary Honis DSLR IR filter DIY mod how-to instructions
<http://ghonis2.ho8.com/rebelmod450d1.html>

Gary Honis IR filter mod service
<http://ghonis2.ho8.com/rebelmod450d17.html>

Andy's Shotglass <http://www.andysshotglass.com/>
The new CCD astronomy website cool CCD calc app http://www.newastro.com/book_new/camera_app.php

Digital Astro yahoo group astrophotography with DSLRS
http://tech.groups.yahoo.com/group/digital_astro/

IYA Photography Contests, from Andrea Schweitzer

Earth and Sky Photo Contest
Photographs must be taken during 2009, the International Year of Astronomy. Photographs must be submitted by September 21, 2009. Winners will be announced on October 31, 2009. Entries must combine elements of both Earth and Night Sky -- i.e., landscape astrophotography.
<http://www.darks skiesawareness.org/photo-contest.php>

----- Forwarded message -----

Smithsonian Photography Initiative
Celebrates the International
Year of Astronomy in May and June

During May and June, the Smithsonian Photography Initiative offers three ways to celebrate both the International Year of Astronomy and the 400th anniversary of the first recorded astronomical observation with a telescope by Galileo Galilei.

See details at:
http://photography.si.edu/upload/News/80_File.pdf

Call for Entries

The Smithsonian Photography Initiative invites the public to contribute images and stories to "click! photography changes everything" (<http://click.si.edu>), an online exhibit that explores how photography influences every aspect of people's lives. This month's focus is "Seeing Other Worlds":

- The public may submit their photo and story about how photography influences the ability to see people, places and things "unseen" or "unfamiliar" through the contribute link on the "click!" Web site at <http://www.click.si.edu/Contribute.aspx>. Contributors may also share their thoughts about photos of the universe from the Chandra X-ray Observatory images

available on the Smithsonian Institution's photostream at The Commons on Flickr.

- Selected entries will be added to the "click!" Web site, which features photos and stories from innovators, writers and public figures across multiple disciplines.

- Entries selected for the "click!" Web site will be eligible to receive a copy of the book "At First Sight: Photography and the Smithsonian," an intriguing glimpse into the Smithsonian's more than 700 photographic collections.

Blog Interaction

Visit the Smithsonian's photography blog, "THE BIGGER PICTURE" at <http://blog.photography.si.edu> which presents an inside look at the Smithsonian's photography collections and invites audiences to engage in an online discussion with guest contributors from the Smithsonian about photography's powerful impact on the world. Throughout May and June, the blog discussions will focus on photography, astronomy and the broader notion of exploring "other worlds" to celebrate the beginning of the International Year of Astronomy. Guest bloggers will include staff from the National Museum of American History's, National Air and Space, Smithsonian magazine and the Smithsonian Astrophysical Observatory.

Visit Flickr Commons

In honor of the International Year of Astronomy, new images are being added to the Smithsonian Institution's photostream at The Commons on Flickr. The Chandra X-ray Observatory set features images made by NASA's Chandra X-ray Observatory, which was launched and deployed by the Space Shuttle Columbia July 23, 1999, and is the most sophisticated X-ray observatory built to date. Chandra has the largest, most-precisely shaped and aligned and smoothest mirrors ever constructed. It is helping scientists better understand the hot, turbulent regions of space and answer fundamental questions about origin, evolution and destiny of the universe. Chandra's images are 25 times sharper than the best previous X-ray telescope. NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Chandra program for NASA's Science Mission Directorate in Washington, D.C. The Smithsonian Astrophysical Observatory controls Chandra science and flight operations from the Chandra X-ray Center in Cambridge, Mass.

About the Smithsonian Photography Initiative

The Smithsonian Photography Initiative exists to increase public understanding of the photography collections from the Smithsonian's museums, research centers and the National Zoo. Leveraging emerging new media, SPI seeks to create new opportunities for research and scholarship about the cultural impact of photographs. Through interactive online exhibitions, publications and educational outreach, SPI is dedicated to engaging new and

existing Smithsonian audiences in a dialogue about the nature and meaning of images today.

The Very Long Mystery of Epsilon Aurigae, by Robert Stencel

See Sky and Telescope, May 2009
<http://mysite.du.edu/~rstencel/epsaur.htm>

Observing Report from Coonabarabran From Mike Roos

Something to consider for next year:

Coonabarabran Observing Report – May 20-27, 2009

I blew off Texas Star Party and its limited view of the southern skies to attend the Deepest South Texas Star Safari in Coonabarabran, NSW. There were 18 people from the United States, and 7 from Australia in attendance. Scopes present for some or all of the nights included four regular 18 inch Obsessions, one 18 inch Ultra Compact Obsession, two 25 inch Obsessions, a 22 inch binocular telescope, a pair of 25x150 Fujinon binoculars, and a 30 inch Obsession clone. The Three Rivers Foundation in Texas owns most of the scopes.

The 3RF scopes had Argo Navis and ServoCat, although we did not make much use of the tracking. Argo Navis is similar to the new Sky Commander with 29000 objects. The PK planetary catalog is not in the computer, which dampened our enthusiasm for these objects. They can be added to the user catalog. There were a lot of differences of opinion for object magnitudes between the Argo Navis and NSOG Vol. 3, with the Argo Navis usually having the brighter magnitude estimates.

One of the Australians was Andrew Murrell, who discovered the planetary nebula Murrell 1. He showed us another object he called the "Southern Crab" and claimed that only tens of people had ever seen it. It was very faint and fuzzy. He also poked fun at Barbara Wilson from the Houston club as they constantly challenge each other's observing skills. Barbara has yet to attend one of the Australia events. Another of the Australians was Gary Kopff, inventor of the Argo Navis digital setting circles.

Since this was a new experience for almost everyone, there was intense competition the first few nights to control the telescopes. Some people were very hard-core and spent every possible minute on a scope while others were less intense. We had clear skies for at least part of 7 of the 8 nights. A recommendation for future participants would be to bring some of their own eyepieces and UHC and O3 filters since were only 2 or 3 eyepieces provided per scope and not enough filters for 1 of each per scope. One 13 Ethos and one 17 Ethos were present as well as the 14 mm Explore Scientific 100 degree eyepiece. I did not get a chance to use the Explore

Scientific, however the owner is soliciting reports from those who did. I had to move my head around to see all of the field in the Ethos.

Charlie Warren of Amateur Astronomy magazine was there and did several sky shots with a digital SLR and various lenses as well as excellent daytime photography. The Australians immortalized him in song after a kangaroo decided to commit suicide by running in front of his car at night. The lesson to be learned from this is that night time is for observing and not for driving back from a function.

Previous events were held in March. It gets dark about 5:30 in May and dinner and tours cut into observing time. Centaurus and Crux were well placed for this time of the year, while the Magellanic Clouds were low. Nighttime temperatures were in the low 40s with heavy dew. We did not have enough battery packs to run dew heaters all night.

Daytime activities included tours of Sydney and the Blue Mountains, Siding Spring Observatory, Sandstone Caves, Aboriginal lands in Warrumbungles National Park, and a trip to a radio telescope facility. Safety was not Job One at the observatory as the railing on a catwalk was not installed until after somebody fell 20 feet in total darkness. Going on all but one of the tours represented a loss of daytime sleeping and less telescope time at night. The advertised cost for economy airfare, car rental, train fare from Sydney to Dubbo, food, hotels, and tours was \$2,775, and I came in a couple hundred under the estimate. In general, eating out is more expensive than in the USA. A 20 ounce Coke was \$3 from a pop machine, but it has cane sugar instead of High Fructose Corn Syrup.

I logged about 180 different objects over seven nights, including multiple observations of Omega Centauri, Centaurus A, Eta Carinae, and the Large Magellanic Cloud. I did enough objects in total for the Astronomical League Southern Skies Telescopic pin – one of the few Mike Hotka doesn't have. Some of the best objects are listed below.

M104 – 25 inch Obsession. – Is almost overhead. The dark lane is easily visible and extends almost the entire length of the galaxy. Takes high power well. Way better than NGC 891 from the Corral. Hard to explain how the increase in elevation improves this galaxy.

Large Magellanic Cloud – In the Fujinon Binos several portions are detached from the main galaxy. NGC 2070 Tarantula Nebula easily visible as well as some of the clusters. In the 18 Obsession, the Tarantula is like M8 or M20, but bigger and brighter. One literally tripped over multiple globular and open clusters in the same field while panning the scope around the LMC, and it was low in the sky.

Omega Centauri – observed in 10x50 binos, 25x150's and the 18, 25, and 30 Obsessions. Like M13 but bigger and brighter. Sorry 47 Tucanae lovers, Omega is way better. People who looked at it in the 22 inch binoscope claimed to be able to

distinguish foreground from background stars.

NGC 5128 – Centaurus A – observed in binoculars and all 3 sizes of Obsessions. Looks like a big hamburger with the dark lanes separating the meat from the bun. Better than M82.

NGC 3242 – Ghost of Jupiter – 25 inch Obsession 400 power – didn't look like Jupiter in the eyepiece. Saw two distinct rings and a bright central star. Better than NGC 3132, which is supposedly the best planetary in the Southern Hemisphere.

Eta Carinae – Like Orion nebula except bigger and brighter. Extends several eyepiece fields. The Homunculus, which is the nebula directly surrounding the star, looked somewhat like its Hubble photographs in the 25 and 30 Obsessions.

Milky Way Galaxy from Vela to Sagittarius – much brighter than the Northern Hemisphere and didn't fade out until well into morning twilight. At least 10 naked eye open clusters, including NGC 2516, M41, NGC 3532, NGC 4755, M6 and M7.

NGC 4755 – Jewel Box cluster – visible with naked eye. Nice variety of star colors even in 10x50 binos.

Alpha Centauri – double star with components magnitude 0 and 1. Easily split at low power, even in the \$16,000 Fujinon binos, which showed chromatic aberration. Nice yellow color

Jupiter – higher in the sky than in the north. We had really good seeing before sunrise one night and could see a shadow transit of Io and detail in the bands with a 25 inch.

Antares and Arcturus. Both were low in the sky after sunset and showed intense red color. Due to the redness, Arcturus looked brighter than Alpha Centauri. Antares is visible all night. Didn't think to try splitting it during the good seeing.

Orion in late May! Orion was going down after sunset while Scorpius was rising. Whoever said you could not see them both at the same time had not been to Australia. Scorpius was straight up later in the night.

The Emu – a series of dark nebulae in the Milky Way from Centaurus, through the Coal Sack and extending about 90 degrees. The aborigines based some of their folklore on the dark areas rather than the bright areas. It looked like a stretched out duck to me rather than an emu. Charlie did a DSLR shot of the entire thing. I'll try to locate it unless he is going to publish it in the magazine.

Lynga 7 – a GC in Norma. The challenge was finding it. The experience and view was similar to the Palomar globulars we found last summer in Gary's 30 scope. We searched for Arp-Madore 4 and Ruprecht 106 and were not successful.

Galaxies In Centaurus – similar to scanning Virgo or Coma Berenices. Somebody claimed 19 galaxies in one eyepiece. I once found a field in Coma that has 20 galaxies down to 15.0

in a half degree, which would be a 20mm Nagler or 17mm Ethos in a 20 inch scope. I didn't claim to see all of them.

After listing all these great objects, I must say that some did not look as good as I was expecting.

47 Tucanae – was low in the sky, but still visible to the naked eye. No competition for Omega.

NGC 253 in Sculptor – the view in Gary's 30 was way better than what I saw.

NGC 55 in Sculptor – Saw it better at Okie-Tex. Should have whipped NGC 4565, but didn't.

NGC 6752 in Pavo – supposedly 4th best globular. About like M13.

NGC 3132 in Vela – Ring nebula is better.

Robert McNaught discovered another comet while we were there. Its in Virgo now.

Mike

Foxpark Observing May 18, from John Figoski

John Figoski, Matt Goodrich, and Nick Nikolai headed to Foxpark Monday night with high hopes of perfect skies per the Clear Sky Clock. Well, nothing is perfect. We were hampered by intermittent cirrus throughout the night, but we were able to get hours of good to excellent viewing in between half-hours of "fuzz out". While the evening wasn't your typical perfect Foxpark, it was the best viewing of this unpredictable spring. Matt and I got there about 5:30 (after Matt helped pull me out of a snow bank). Nick came through around 7:30. The meadow was dry and clear though there was lots of 2ft - 4ft deep snow mounds just beyond the tree line. Lots of standing water but no mosquitos yet (give it another few weeks!). Also, no other campers/ATV's. We had the place to ourselves.

Matt having been up since 5:00am that morning lasted till about 1:00am. By then the temps had dropped and the dew was forming and freezing (probably in the low 30s upper 20s). I hung out till about 3:00am and Nick made it all the way till dawn. Vern, we have a new convert (Nick) for your Coleman catalytic heater as a dew zapper for Schmidt-Cassegrains! I logged 65 galaxies (23 new ones) with my 12.5in Newtonian, but at times they were washed out or non-existent due to thin clouds.

Tuesday was cloudy all day and didn't seem worthwhile to stay for the night. So we had the one good night but I'm looking for more.

HST Servicing Mission Video, from Andrea Schweitzer

Here is a recap of Hubble's final servicing mission, as shown in pictures by the Boston Globe:

http://www.boston.com/bigpicture/2009/05/hubbles_final_servicing_mission.html

Well done mission, well done photo story!

Live Earth from DISH Network, from Randy Moench

I was channel surfing on Dish Network the other day and discovered they are now broadcasting a live view of Earth from their satellite in orbit 22,000 miles up. The picture updates about every 15 seconds. Its pretty cool. Channel 212

Wyoming Infrared Observatory Accepting Applications From Leonard Sitongia

I just saw the following announcement and am passing it along. I don't know the details.

PUBLIC OBSERVING TIME AT THE WYOMING INFRARED OBSERVATORY

As the recipient of an NSF PREST grant, the Wyoming Infrared Observatory is offering time to the community on the 2.3 m telescope between 2009 July and 2012 June. Currently available instruments include an optical prime-focus camera and an optical longslit spectrograph. Both service and visitor observing modes are available. We are also willing to entertain the possibility of visitor instruments. Although we cannot provide funding for travel or subsistence, we can offer visiting astronomers free lodging at the observatory. Proposers should consult the WIRO web page at <http://physics.uwyo.edu/observatories> and are encouraged to contact observatory director Chip Kobulnicky (chipk@uwyo.edu) for additional information prior to the quarterly proposal submission process.

Chasing CALIPSO, Catching A-Train From Greg Hendry

I went out the morning of 5/28 to observe and photograph laser beams from CALIPSO and set up at a location 500 meters east of the predicted LIDAR track (1430 meters east of the sub-satellite track). Humidity at ground level was high but the atmosphere was clear. A second or so before the LIDAR pass I saw a disappointing small green flash near zenith typical of clear atmosphere passes seen from off track. About a second later however a nice sweep of 6 or more pale green beams filled my field of view to the west. The beams were at least 30 degrees long.

Unfortunately the camera did not record any beams or spots in the atmosphere but did pick up two separate flashes coincident with the satellite track. ISO 6400 at f/2.8 is not fast enough to

capture beams in a clean, clear atmosphere, 500 meters off track..

As a consolation, the A-Train constellation of satellites was illuminated and tracks from both CloudSat and CALIPSO can be teased out of the same 30 X 50 degree image containing the flashes. Neither satellite was seen by eye but I easily noticed Aqua passing over about a minute ahead of the CALIPSO event.

Images from the event can be seen at:
<http://picasaweb.google.com/Gregg.Hendry/CloudSatAndCALIPSO20090528?feat=directlink>

The LIDAR track was from:
<http://www-calipso.larc.nasa.gov/tools/overpass/coords/>

Eta Aquariid Meteor Shower AM May 6

Best Looks

- Moon By; by Jupiter Jun 15; by Venus and Mars Jun 18-19
By Saturn Jun 28
- Mercury In E last 2 weeks; by Pleiades Jun 20
- Venus In E predawn
- Mars Low in E predawn; closest to Venus Jun 21
- Jupiter In S predawn
- Saturn High in S evenings.
- Uranus In SE predawn in Pisces
- Neptune By Jupiter all month in Aquarius

International Space Station Passes for Loveland – Fort Collins

June 2009

Date	Mag	Starts			Max. altitude			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
18 Jun	0.5	04:42:47	10	SSE	04:43:52	12	SE	04:44:57	10	ESE
19 Jun	-1.3	05:05:41	10	SSW	05:08:25	38	SE	05:11:08	10	ENE
20 Jun	0.3	03:57:06	10	SSE	03:58:16	12	SE	03:59:35	10	ESE
21 Jun	-1.5	04:20:53	17	SSW	04:22:46	41	SE	04:25:31	10	ENE
22 Jun	0.3	03:13:06	13	ESE	03:13:06	13	ESE	03:14:00	10	E
22 Jun	-1.8	04:44:36	10	WSW	04:47:27	53	NNW	04:50:17	10	NE
23 Jun	-1.8	03:36:42	42	SSE	03:36:58	44	SE	03:39:45	10	ENE
23 Jun	-0.3	05:09:58	10	WNW	05:12:19	22	NNW	05:14:39	10	NNE
24 Jun	-1.7	04:00:13	25	W	04:01:36	50	NNW	04:04:26	10	NE
25 Jun	-0.6	02:52:11	29	E	02:52:11	29	E	02:53:52	10	ENE
25 Jun	-0.2	04:24:07	10	WNW	04:26:25	21	NNW	04:28:43	10	NNE
26 Jun	-1.6	03:15:32	47	NW	03:15:37	47	NNW	03:18:27	10	NE
26 Jun	0.6	04:50:01	10	NW	04:51:23	13	NNW	04:52:46	10	NNE
27 Jun	0.6	02:07:21	14	ENE	02:07:21	14	ENE	02:07:50	10	ENE
27 Jun	0.0	03:38:48	14	WNW	03:40:23	20	NNW	03:42:39	10	NNE
28 Jun	-0.3	02:30:33	30	NNE	02:30:33	30	NNE	02:32:20	10	NE
28 Jun	0.8	04:03:57	10	NW	04:05:18	12	NNW	04:06:39	10	NNE
29 Jun	0.1	02:53:40	19	NW	02:54:13	20	NNW	02:56:28	10	NNE
30 Jun	0.6	01:45:17	17	NE	01:45:17	17	NE	01:46:05	10	NE
30 Jun	0.9	03:17:46	10	NW	03:19:04	12	NNW	03:20:22	10	NNE
30 Jun	1.2	04:54:44	10	N	04:55:18	10	N	04:55:52	10	NNE
1 Jul	0.4	02:08:15	19	NNW	02:08:15	19	NNW	02:10:08	10	NNE

<http://www.heavens-above.com/main.aspx?lat=40.4997&lng=-105.05736&loc=Fort+Collins+CO+USA&alt=0&tz=MST>