

The Objective View

Newsletter of the Northern Colorado Astronomical Society

March 2008

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Cheyenne Astronomical Society March 21 7 pm

Cheyenne Botanic Garden

<http://home.bresnan.net/~curranm/>

Chamberlin Observatory Open House, dusk to 10 pm

Mar 15, Ap 12, May 10, Jun 7, Jul 12, Aug 9, Sep 6 303 871
5172 <http://www.du.edu/~rstencil/Chamberlin/>

Longmont Astronomical Society March 20 7 pm John

Figoski, Quickbird Imaging Satellite

FRCC, 2121 Miller Rd <http://www.longmontastro.org/>

Next Meeting: March 6 7:30 pm

New Horizons Mission to Pluto

Professor Fran Bagenal

University of Colorado, Boulder

Club Business at 7:15 pm

Discovery Science Center

703 E Prospect Ave, Fort Collins

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

NCAS Programs

April 3 Solar System in 3D Nick Schneider

Dark Energy/Galaxy Clusters Erica Ellingson

May 1 TBD

Discovery Sci Ctr Starwatch, 703 E Prospect, Ft Collins

March 14 7:30 pm

April 11 8:00 pm

May 9 8:15 pm

Dark Sky Observing Opportunities, Roland's Astro Corral

March 1, 7-8. Check club-news that site is accessible.

Other Events

Little Thompson Observatory Star Night:

March 21 7:30 pm Meredith Wills-Davey, How to Make a

Sundial <http://www.starkids.org>

CSU Madison Macdonald Observatory Public Nights

On East Drive, north of Pitkin Street

Tuesdays 8 pm if clear, when class is in session

Feb 7 Program

**Cosmic Ray Astronomy with the Auger Observatory: A
New Window to the Extreme Universe, by Dr. Pablo
Bauleo, CSU**

Cosmic rays are electrons and protons raining from outside the planet. In 1912 Victor Hess was plotting charged particles in the atmosphere as a function of altitude. He expected them to be produced by radioactive decay on the Earth's surface, and was surprised to detect an increase at 15000 feet. In 1938 Pierre Auger discovered extended air showers. A cascade of particles would cover a few square miles. In 1962 Penzias and Wilson discovered the cosmic microwave background. It interferes with the cosmic ray particles. If particles have greater than 5×10^{19} eV, they must originate within 100 Mpc away. Pablo showed a movie of a model of an air shower. These protons pack the energy of a tennis ball at 40 mph. Cosmic rays with extreme energy are rare. At 10^{20} eV, the flux is a few particles per square km per century. The solution is to construct a detector spread over a few thousand square km. What process could achieve such acceleration? No convincing process is known in supernovae, quasars, or neutron stars. The highest-energy cosmic rays should point back to their source. The project is a massive collaboration of 65 institutions in 19 countries. Auger Observatory South has been built by a small town on the high plains in the Andes. There are two types of detector. An array 1657 tanks detect the shower by the Cerenkov emission. There are 24 telescopes with UV detectors which can operate on clear moonless nights. The arrival angle of the shower can be deduced by its propagation through the tank array. A shower takes 30 to 100 microseconds. The time of arrival between tanks is 1 or 2 microseconds. The time resolution in the tank is 17 nanoseconds. Pablo showed the layout with a Google Earth animation. The area is home to ranching, loosely defined. To get there it takes 13 hours from the US East to Buenos Aires. A 2 hour cab ride reaches Mendoza. Then 6 hours by bus covers another 300 miles. A car rental then takes you 4 hours driving to reach the town of Malargue. From the first sight of tanks, you must drive another 1.5 hours. If an event triggers 10 or 20 detectors, there is enough to reconstruct it. 18 months ago 1 shower swept across the whole array. The tanks are light-tight so can work around the clock. Each has 12 tons of purified water. It has three 9 inch photomultiplier tubes.

They have a solar panel and battery power supply. Vandalism is almost unheard of, and once a battery disappeared but was returned discharged and the fresh replacement taken. Each of the 1657 tanks has a name. The ultrapure water might support 3 to 6 weeks of bacterial growth, then they die or sporulate and there is not further growth. Students submitted names in a contest. Maintenance is needed on about 1 or 2 tanks a month. They can stand 1 inch hail, 100 mph wind, and were modified to resist cows. The last tank will be installed soon, and its name is secret to date. The fluorescence telescope subsystem is targeting UV lines emitted by nitrogen and range between 300 and 400 nm wavelength. The telescope primary is a 6 x 6 array of 3.4 meter segments. The camera is an array of 440 pixels and has 100 nanosecond time resolution. The camera can distinguish muons from electrons, as muons leave a larger signature. The correlation of the highest energy cosmic rays with nearby extragalactic objects was a top story for 2007 in Nature magazine. Science (2007, 318:938) reported it with its top 3 stories of the year and it made the cover. The American Physical Society considered it in the top 2 discoveries. The distribution of events is a good match for active galactic nuclei. Galaxies with a massive black hole in the center and luminous jets are the candidates. They emit in radio, visible, x-rays and gamma rays. Jets are associated with the black hole axis. Depending on the orientation, the object could appear as a blazer, quasar, or (15 of 24) a Seyfert galaxy. Of the 27 highest energy events, only 3 do not align with a known AGN. These three are by the plane of the Milky Way, so it is most likely their sources are AGN obscured by our galaxy. Another feature linking extreme cosmic rays to AGN is their distribution within the supergalactic plane. This is defined by the location of galaxies in our local supercluster. Two events were traced to Centaurus A, NGC 5128. It had the only radio-loud event. The instrument will be used to study anisotropies of the sky, gamma ray burster studies, and tau neutrino analysis. After the striking success to date, the Auger team's reaction has been the typical scientist lament that the instrument is not big enough. A northern companion has been planned, with site criteria including a large flat area, complementary latitude, appropriate altitude and sky clarity. Good infrastructure is a plus. The site for a 3 to 7 times larger array is the Colorado plains between Lamar and Springfield. It will have 400-500 tanks spaced by 1 mile and another 40000 spaced by 1.41 miles. They will fit in the corner of a land section. Land owners receive a tax credit. The instrument is to be ecologically "green." Two tanks have been named: Pierre's Dream, at Lamar Community College, and Cosmo at the Bent County Fairgrounds. It will be a \$50,000,000 installation, shared by the 19 countries.

Dr. Pablo Bauleo studies high energy physics at Colorado State University in Fort Collins.

See: www.auger.org

Science abstract:

<http://www.sciencemag.org/cgi/content/abstract/318/5852/938?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=auger+collaboration&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT>



Dawson Wiedrich and Bailey Huffman named the detector in Las Animas. From the CSU Physics Newsletter

February 7 NCAS Business

President Nate Perkins called the meeting to order. The calendar of observing events was announced. The Treasurer's Report was given by Bob Michael, club funds stand at \$798.79. Our Winter speakers were announced. The Astronomical League convention for 2008 is in Des Moines IA this summer. The GLOBE at Night sky brightness survey is scheduled worldwide for the end of Feb-early March. Andrea Schweitzer is giving a training session at LTO.

From Tom Fay:

For those of you who didn't get enough merging galaxy images in my talk in January, there's now a 38 minute musical video presenting a series of merging galaxy images, one every 4 seconds, done by 'SMacB', one of the Galaxy Zoo contributors. That works out to over 500 images...and a pretty big file! All the images were picked out from the Sloan Digital Sky Survey by Galaxy Zoo contributors.

Here's the link:

http://www.macalchemist.net/G_Zoo_images/mergers.htm

From Tom Teters:

Is this the most informative astronomy site on the web? you be the judge.

<http://www.sky-map.org/>

Check out LPOD Feb 2,

<http://the-moon.wikispaces.com/LPOD+Feb+2%2C+2008> they have an image that explains libration in a very unique way.

From SLHolder1 at aol.com

Jim's Excellent Arizona Astronomy Vacation

This is a really long posting that includes a rundown of lodgings and observations. It is the same thing I posted to the DAS except that the formatting may be better here.

Sarah and I took a driving vacation to southern Arizona from Saturday, Jan 26 through Sunday, Feb 10.

VLA

Our first astronomy related stop was to visit the Very Large Array, which is west of Socorro, New Mexico on Hwy 60. The Very Large Array (or VLA) is an array of radio astronomy dishes that are used to observe astronomical objects in the radio frequency range as opposed to the visual light range or other electromagnetic frequencies (such as infrared) used by astronomers. They have a nice visitor's center and gift shop. We took the self-guided walking tour of their facility, which is very impressive.

Pie Town

A short distance west of the VLA on highway 60 is Pie Town. We stopped at The Daily Pie Café (www.dailypie.com) and chatted for a while with Michael Robinson, a pie town resident, astronomer and astro-artist who organized the star party in Pie Town last June. Pie Town is the absolute darkest location I have yet found but since we weren't up for camping and it was pretty cloudy, we didn't stay. Kathy makes the pies and owns the restaurant along with Stanley who plays the bass. Very nice people. Maybe I can get someone to tow a camper there for me to sleep in at the next Pie Town star party. Michael says he is planning it for next October.

Flooding

We stayed in a small mountain town called Glenwood on hwy 180 SW of Pie Town. It rained pretty hard all night and by morning whitewater creek had overflowed its banks, but didn't flood our room. That morning we forded one wash across road 78 on our way to Three Way, NM and into Arizona. But the second wash at Mule Creek was too much for us to attempt (some high-clearance diesels were making it through but it looked too risky to us) so we detoured back through Silver City.

Tucson Monday the 28th we stayed with relatives in Tucson, AZ and had a small star party for some neighbors. They do a fairly good job with controlling lighting in their city and we could even see a few galaxies.

Astronomer's Inn, Benson AZ

Tuesday the 29th through Friday night, Feb 1st we stayed at this amazing little place just outside Benson Arizona, called The Astronomer's Inn. There must have been some more light pollution since Ed Ting wrote his review in Cloudy Nights, because he made it sound darker than our dark site at Deer Trail. But even with the sky glow, we extended our stay from the two nights we had reserved to four nights, since I knew

darker skies awaited us in Portal and Astronomer's Inn was so much fun. The Astronomer's Inn is a wonderful place and we had it all to ourselves the first three nights. We only paid about a hundred a night for both of us, which included really good breakfasts. They upgraded us to the "Egyptian Room" for no extra cost until our last night but the Astronomer's Studio was plenty adequate. We used their high speed internet, huge TV with satellite channels. A roadrunner nests on one of the porches at night and we could watch him through a window if we were quiet about it. In the computer room they also have an extensive astronomy and general science library. Since we brought our own telescope, we set up on an upper deck where they also have a 16" dob for rent and some monster binoculars mounted that we used for free. There is a lake on their property with rowboats and an island we could visit. There is also a complete kitchen available for us to prepare our other meals and they set out coffee and cookies as late night snacks for breaks from astronomy. The other guests paid extra for use of their roll-roof observatory and an astronomer from a local club came to help them work the telescopes and operate the roof. There are also two domes available for a fee, including a nice 20" Schmidt Cassegrain with optional CCD for people who like that type of thing. Other than the high deck (where we set up) everything is on one level and wheelchair accessible. The Egyptian room, where we stayed for 3 nights, has a big walk-in shower that would make it easy for a handicapped person to use. Sarah is not into astronomy nearly as much as I am, and this was a place where she was able to really enjoy herself. Most kids would probably enjoy it as well even if they are not astronomy fanatics. The website (www.astronomersinn.com) has lots of pictures and full information.

Bisbee AZ

Bisbee Arizona is where we spent one night visiting some friends. This is no place for people in wheelchairs. The floors of some houses were level with the rooftops of adjacent houses with nothing but stairs in between. We did a little sidewalk astronomy under a streetlight because I didn't want to lose our parking spot or climb a lot of stairs carrying the telescope. They had lots of little tourist shops. You couldn't go more than a few blocks without walking through cigarette smoke. I didn't like it very much but it was kind of interesting and there was some great hippie food to be had. There might have been other types of smoking going on as well.

Birders B&B, Portal AZ

Next stop Birders B&B in Portal Arizona. Birders is in a lush riparian area in the Chiricahua Mountains with tons of wildlife and birds just a few miles from the desert lowlands. Birders is run by an interesting older couple and a rambunctious full size poodle named Ben. Astronomy is a little more effort at Birders than some other places we stayed. But once we set up at the South corner of the property and figured out how to unplug the garage door opener which lit up spontaneously throughout the night, the stargazing was marvelous. The setup was a good distance from the cottage we stayed in, so we used walkie-talkies to be sure that I hadn't been eaten by the javelena, quatumundi, or perhaps chupacabra. There was

also the occasional floodlight from the main house for watching the nighttime visits from the wild ringtail that came to eat from the feeders. Roberta made wonderful breakfasts including fresh baked breads and her husband had great stories from doing field research in Alaska. The trees and high rocks around the property limited the horizon views, but we could easily view to a little below Lepus.

Rick Beno's Observatory, Portal AZ

We visited Rick and Vicki Beno who have a nice house and "Conferring with the Sky" observatory (conferringwiththesky.org) in the Astronomy Village (arizonaskyvillage.com) just outside Portal. We ran into Jerry Day (darkskydreams.com) and other astronomers just going to the local restaurant and public library in Portal.

Quailway Cottage, Portal AZ

After Birders we stayed at a place called Quailway Cottage (quailwaycottage.com), which was the absolute best for astronomy and the best overall place we stayed. (Astronomer's Inn was also the best place we stayed.) Quailway Cottage is in the desert, although just a few miles east of Birders B&B. We set up the telescope just outside the bedroom door, draped a spare blanket over the window and taped a towel over the small window in the door to make the observing area completely dark. A few lights from nearby Rodeo New Mexico were visible and every once in a while some headlights would filter through the trees, but not very much. Views were clear down to the Southern horizon. In summer I might need to be a bit more careful of scorpion and snakes. When the pecan trees have something to offer, javelena may be a concern. But since it was February, the only nocturnal wildlife besides myself were some coyotes singing very nearby but never got close enough for any concern....they are very sensible canids, after all.

Portal AZ surrounding area

Besides the library, post office, wildlife research station, and local restaurant in Portal, there were some wonderful people in nearby Rodeo NM. The local cowboy bar has shrimp night on Wednesdays and pizza on Thursdays. A natural food store and REI-style outfitter store is just opening up a little north of Rodeo. There is also an ultra-light aircraft training facility and coffee/smoothie bar/yoga studio in the area. Some of the astronomers are unhappy with the lights that have the wrong-pressure sodium, but at least they are full cut-off either by design or adaptation. Some of the local bird people get upset when the hang-gliders with lawnmower motors fly too far up the canyon. But for the most part this is a great place where desert-rats, hippies, cowboys, yoga/baristas, fly boys, bug hunters, dry land farmers, and overeducated/overfinanced white folks all get along.

Here is a bit of a summary of the lodgings where we stayed and some others in the area where we didn't:

Astronomer's Inn Benson AZ breakfast kitchen TV phone internet \$105 or \$149 credit cards

Birders B&B Portal AZ breakfast kitchen phone \$120 check
 Quailway Cottage Portal AZ no meals kitchen TV \$90 check
 Sunglow Ranch Sunizona AZ breakfast, dinner astronomy pads w/ power \$282.50
 Cochise Stronghold Pearce AZ breakfast kitchen phone internet ?TV \$179
 Starhill Inn Sapello NM no meals kitchen internet warming hut \$170 (incl scope) credit cards

Arizona Vacation Jan and Feb 2008

Location	Date	Time	Object	obj type	const	notes
Ast Inn	1/29/2008	9:20 PM	n1535	PN	Eri	Definite round bright PN
Ast Inn	1/29/2008	9:20 PM	n1538	GX		Unable to Locate
Ast Inn	1/29/2008	9:44 PM	n2090	GX	Col	Fairly easy ~2:1 elongation N to S
Ast Inn	1/29/2008	11:25 PM	n2841	GX	?UMa?	Big bright looks like mini M31 star @ edge
Ast Inn	1/29/2008	11:34 PM	M65,66,n3628	GXs	Leo	Beautiful group..also M95,95,M105,n3384,9
Ast Inn	1/30/2008	12:04 AM	2007 TU 24			asteroid And.Per Failed to find asteroid despite good info
Ast Inn	1/30/2008	12:15 AM	V Hya	red *	Hya	stoplight red. Visible in finder
Ast Inn	1/30/2008	12:20 AM	n3242	PN	Hya	Easy bright, fairly big even @ 58x
Ast Inn	1/30/2008	12:48 AM	n3132	PN	Vel/Ant	Fairly bright PN definite core and umbra
Ast Inn	1/30/2008	12:52 AM	n3201	glob	Vel	Nice little glob; shows well, hope for omega cen
Ast Inn	1/30/2008	1:00 AM	M51 gxys	CVn		a little spiral structure visible
Ast Inn	1/30/2008	1:05 AM	M104,ncc1701	GX,ast	Vir	it does look like a sombrero and a spaceship
Ast Inn	1/30/2008	1:13 AM	M68 glob	Crv		very nice little globular
Ast Inn	1/30/2008	1:15 AM	M81,82 gxys		Uma	beautiful, high....Moonrise, time for bed
Ast Inn	1/31/2008	early AM	Omega cen	glob	Cen	wonderful view but too much skyglow for Cen A
Ast Inn	1/31/2008	8:57 PM	n2090	GX	Col	nice little gxy
Ast Inn	1/31/2008	9:04 PM	n2188	GX	Col	may be just detecting too much sky glow
Ast Inn	2/1/2008	7:10 PM	n1851	glob	Col	Bright little glob central concentration, looser out
Ast Inn	2/1/2008	7:19 AM	n1808	GX	col	nice elongated smudge
Ast Inn	2/1/2008	8:40 PM	e206-20A	GX	Car	Carina dwarf location found but Gxy not detected

Ast Inn 2/2/2008 1:48 AM n3132 PN Vel 8-burst neb similar to eskimo (also 1-30 AM)

Arizona Vacation Jan and Feb 2008 (continued)

Location Date Time Object obj type const notes

Ast Inn 2/2/2008 1:56 AM n3201 glob Vel loose, distinct somewhat rectangular (also 1-30)

Ast Inn 2/2/2008 2:24 AM n3228 OC Vel very loose confederation of stars

Ast Inn 2/2/2008 2:30 AM n4945 GX Cen just detecting; big long skinny; light pollution

Bisbee alley 2-2-08 early PM M42 neb Ori not bad for this close to a streetlamp

Bisbee alley 2-2-08 early PM Mars planet Tau sidewalk astronomers see some surface details

Birders 2/3/2008 7:00 PM n1535 PN Eri nice little circle

Birders 2/3/2008 7:25 PM n253 GX Scl nice and distinct; down close to mountain ridge

Birders 2/3/2008 7:30 PM n1977/3/5 neb Ori running man neb very distinct much darker sky

Birders 2/3/2008 7:45 PM u3714 GX Cam fairly obvious bright gxy

Birders 2/3/2008 7:45 PM u3697 GX Cam integral sign barely detected @ 83x seeing bad

Birders 2/3/2008 8:57 PM i2118 neb Ori witch head neb only just detected 80mm achromat
31 nagler 2" amici diagonal no filter

Quailway 2/6/2008 7:20 PM n1049 glob For brightest glob in fornax dwarf gxy fairly obvious

Quailway 2/6/2008 Fornax 4 glob For 13.6 mag glob in FDG

Quailway 2/6/2008 Fornax 2 glob For 13.5 mag glob near S edge of FDG

Quailway 2/6/2008 Fornax 5 glob For 13.4 mag E end of FGD

Quailway 2/6/2008 7:45 PM Fornax 6 glob For very compact glob btwn F4 and n1049

Quailway 2/6/2008 note: failed to detect Fornax 1 (15.6 magnitude globular)

Quailway 2/7/2008 1:45 AM n3115 GX Hya bright central buldge w/delicate and sharp extensions. Dark lane above (south) and glow below sharp extensions (owls hooting)

Quailway 2/7/2008 2:10 AM W Cen glob Cen big bright; oh my god beautiful

Quailway 2/7/2008 2:26 AM n5128 GX Cen not as bright as expected. Dark lane very distinct

Quailway 2/7/2008 2:51 AM Gacrux star Crx star ~57°S

Quailway 2/7/2008 2:57 AM M83 GX Hya big w/ slightly flat bottom (N); brt compact core

Quailway 2/7/2008 3:09 AM n4105,6 gxys Hya two gxys form figure "8", nearby star above 127x

Quailway 2/7/2008 3:50 AM n4945 GX Cen beautiful long and ghostly down & rt from W Cen

Quailway 2/7/2008 3:50 AM n4976 GX Cen small gxy in FOV with n4945

Quailway 2/7/2008 4:20 AM e270-21 GX Cen F..cade-Fig. difficult & only just detected; star chain

Quailway 2/7/2008 4:36 AM M51 GX CVn lots of spiral structure visible even w/ direct vision

Quailway 2/8/2008 4:00 AM n5139 glob Cen W Cen is monstrous and 3 dimensional

Quailway 2/8/2008 4:45 AM n4945 GX Cen long ghost of a gxy w/little friend

Quailway 2/8/2008 5:04 AM b228 dark Sco able to trace an area lacking stars under head of

Quailway 2/8/2008 Sco. 26 nagler in 80mm f/6 ?4° FOV

Quailway 2/8/2008 5:14 AM n4697 GX Vir plus another bright gxy in eyepiece

Quailway 2/8/2008 5:25 AM Loud, prolonged coyote song. One very close north; large group of singers east

Quailway 2/8/2008 5:30 AM zodiacal light quite distinct as milky way rises naked eye star clouds visible

Quailway 2/8/2008 5:34 AM n4361 PN Crv celestial Jellyfish bright and squiggly

Quailway 2/8/2008 5:35 AM another big chorus of the coyote's song reminding me to look at the false dawn

Quailway 2/8/2008 5:40 AM venus rising just N of Sgr teapot, which is up

Quailway 2/8/2008 6:56 PM n1316 GX For Fornax A just dark enough to detect

Quailway 2/8/2008 7:01 PM n1365 GX For detecting core still not fully dark moon almost set mtn

Quailway 2/8/2008 7:05 PM n1399 GX For min 7 gxys in FOV

Quailway 2/8/2008 7:14 PM n1493 GX Hor dim, low

Quailway 2/8/2008 7:26 PM n1494 GX Hor vague glow found not certain it is the gxy

Quailway 2/8/2008 7:35 PM n1512 GX Hor bright core, big dim halo

Quailway 2/8/2008 7:40 PM n1527 GX Hor tight little bright core w/ iso tri asterism pointed at it

Quailway 2/8/2008 7:45 PM n1531/2 GX Eri beautiful gxy pair, long delicate extensions on 31

Quailway 2/8/2008 7:54 PM n1808 GX Col 2.5:1 L-W ratio core seems ~10° off PA of halo with ?foreground star near core?

Quailway 2/8/2008 8:03 PM n2188 GX Col long slender delicate elegant best in 18mmRad

Quailway 2/8/2008 8:25 PM n1535 PN Eri big easy bright obvious

Quailway 2/8/2008 8:25 PM n1538 GX Eri very subtle @ edge of perception but location certain

Daytime occultation of Venus by the Moon March 5

About 1325 to 1402 MST for Fort Collins.

<http://www.lunar-occultations.com/iota/iotandx.htm>

From Wayne Green:

I downloaded the new Occult 4.0 software and there appears to be a graze of Venus North of Casper WY 2008-03-05 20:44:xxUT. This is about 1:44 PM local time. The moon is 5%.

Those interested (and cursed with Windows machines only!) can download Occult 4 from the IOTA web site, and have at it. Mercury gets nailed too, but only seen from South America. Cant be in two places , yadda yadda Boom!

However, Mercury is very close to the event in the sky and could make for a very interesting picture.

Best Looks

Moon By Jupiter 3/2,3; by Mercury and Venus 3/5
by Mars 3/14 by Saturn 3/18, 19
Mercury By Venus all month, best chance 1st week
ESE in dawn glow
Mars By M35 3/10
Jupiter In S at dawn
Saturn Highest late evening



Impending Totality. 2001 MST Feb 20 2008. Dan Laszlo. Buffalo WY. Canon 20D ISO 100 5 sec TMB 175 f/8 1400 mm

Confirm passes after STS-123 launch due March 11

Date	Mag	Starts			Max. <u>altitude</u>			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
4 Mar	-2.2	05:20:07	32	W	05:21:10	56	NW	05:24:00	10	NE
5 Mar	0.8	04:10:58	16	ENE	04:10:58	16	ENE	04:11:43	10	ENE
5 Mar	-0.8	05:42:21	13	WNW	05:44:11	23	NNW	05:46:33	10	NNE
6 Mar	-0.4	04:33:03	27	NE	04:33:03	27	NE	04:34:36	10	NE
6 Mar	0.0	06:05:50	10	NW	06:07:20	13	NNW	06:08:50	10	NNE
7 Mar	-0.6	04:55:00	22	NNW	04:55:00	22	NNW	04:57:04	10	NNE
8 Mar	0.1	05:16:50	12	NW	05:17:44	13	NNW	05:19:16	10	NNE
9 Mar	1.0	05:07:13	11	NNE	05:07:13	11	NNE	05:07:24	10	NNE
10 Mar	0.5	05:28:53	12	N	05:28:53	12	N	05:29:30	10	NNE
13 Mar	0.6	06:35:47	10	NNW	06:37:02	12	NNE	06:38:15	10	NE
14 Mar	0.0	06:57:40	10	NNW	06:59:51	19	NNE	07:02:01	10	ENE
15 Mar	0.7	05:45:37	10	N	05:46:47	12	NNE	05:47:56	10	NE
16 Mar	0.1	06:07:21	10	NNW	06:09:30	19	NNE	06:11:38	10	ENE
17 Mar	0.9	04:56:44	11	NNE	04:56:44	11	NNE	04:57:27	10	NE

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