

# The Objective View

Newsletter of the Northern Colorado Astronomical Society

November 2008

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Chamberlin Observatory Open House, dusk to 10 pm

Nov 8, Dec 6, Jan 3, Jan 31, Mar 7, Ap 4, 303 871 5172

<http://www.du.edu/~rstencil/Chamberlin/>

Longmont Astronomical Society Nov 20 7 pm FRCC on

2121 Miller Road <http://longmontastro.org/>

**October 2 Program by Chad Moore. The following article appeared in the Fall 2008 CIRA Newsletter and is reproduced with permission of the author. Ed.**

**Next Meeting: November 6 7:30 PM**

**Northern Colorado Rocketry**

**By Joe Hinton and Art Hoag**

**Discovery Science Center, Ft Collins**

**Club Business and Announcements at 7:15 PM**

**Meeting directions Discovery Science Center**

**703 East Prospect Rd, Fort Collins**

<http://www.dcsm.org/index.html>

In Fort Collins, from the intersection of College Ave and Prospect Rd, head East about 1/2 mile. See the Discovery Center sign to the South. Enter the West Wing at the NE corner. From I-25, take Exit 268, West to Lemay Ave, continue West 1/2 mile, see Discovery Center on the left.

## NCAS Programs

December 4 Dr Joel Parker UIT, Rosetta, and LRO

January 8 Elections

## NCAS Public Starwatch, Discovery Science Center

November 7 6:30 pm

December 5 6:30 pm

## Dark Site Observing Nights

November 28, 29 Consult FRAC for updates

## Other Events

Little Thompson Observatory Star Night

November 21 7:30 pm Dr Andrea Schweitzer, Intl Year of

Astronomy <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

Cheyenne Astronomical Society, Cheyenne Botanical Garden

November 21 7 pm

<http://home.bresnan.net/%7Ecurranm/index.html>

## Investigating the Link Between Air Quality and Night Sky Visibility

*Teresa G. Jiles<sup>1</sup> and Chad Moore<sup>2</sup>*

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<sup>2</sup> Air Resources Division, National Park Service, Fort Collins, CO 80523-1375, [moore@cira.colostate.edu](mailto:moore@cira.colostate.edu)

The National Park Service was created “to conserve the scenery, the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations”. An element of scenery has recently come to include the view of a starry night sky. In response to the degradation of night time visibility by light pollution the National Park Service Night Sky Program was initiated to investigate the influence of artificial lights upon the nocturnal lightscape. The Night Sky Program (NSP) has developed instrumentation to inventory night sky quality which has been used at over 60 individual parks. Using Charged-Coupled Device (CCD) cameras to image the entire celestial hemisphere, a panoramic map of precise sky brightness values is generated. Since 1999 a database of over 300 photometric observations has been collected; site locations range from remote parks, protected as Class I Airsheds, to brightly lit suburban parks. In many data sets the NSP team has observed variation in sky brightness and the character of urban light domes from night to night. The likely cause of this variation is due to changing aerosol and particulate content in the atmosphere. The link between scattering and light pollution was characterized by Roy Garstang in 1986, however little data has been previously available to test this model. The NSP collection of all sky brightness maps provides an opportunity to test existing models. Models predicting visibility and daytime conditions have been well established and verified in publications. However, these daytime models cannot be directly applied to the night time environment for several reasons. At night, light propagates from numerous artificial light sources near ground level shining up into the

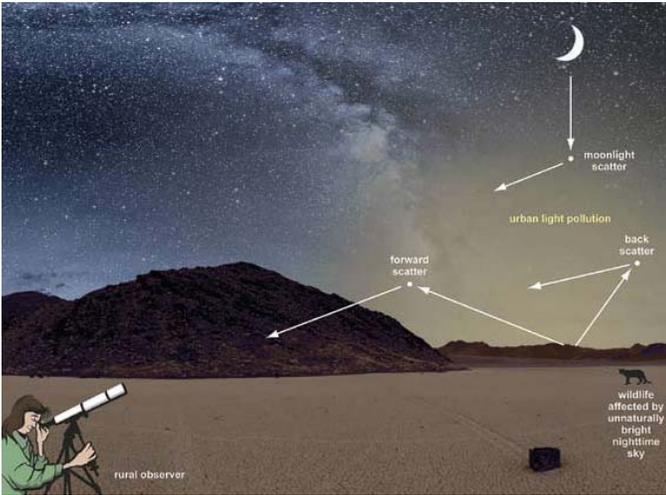


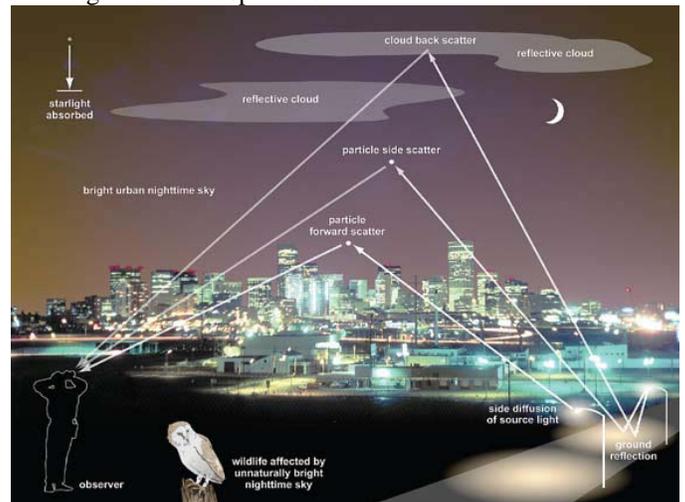
Figure 1. A night sky observer in a non-urban setting sees less of the Milky Way as the light pollution from the distant city(aka a light dome) brightens the horizon and artificial light invades nocturnal wildlife habitat.

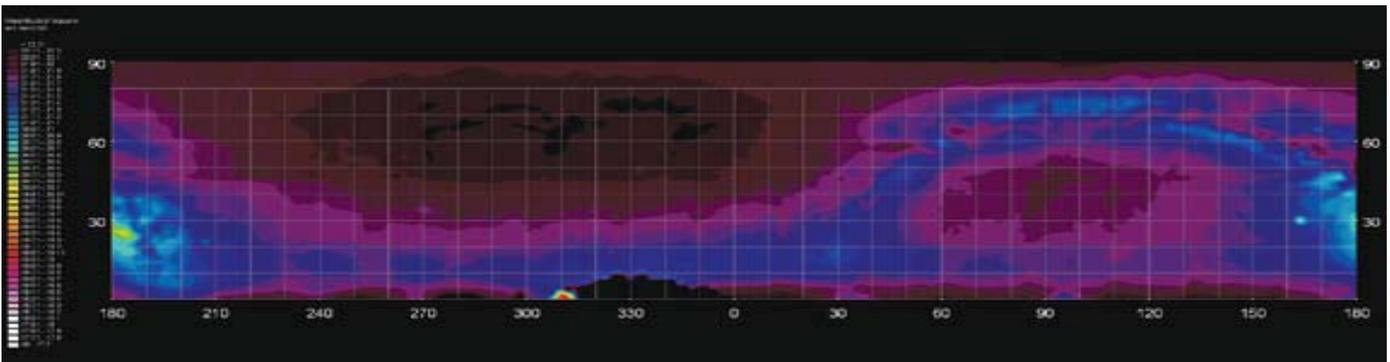
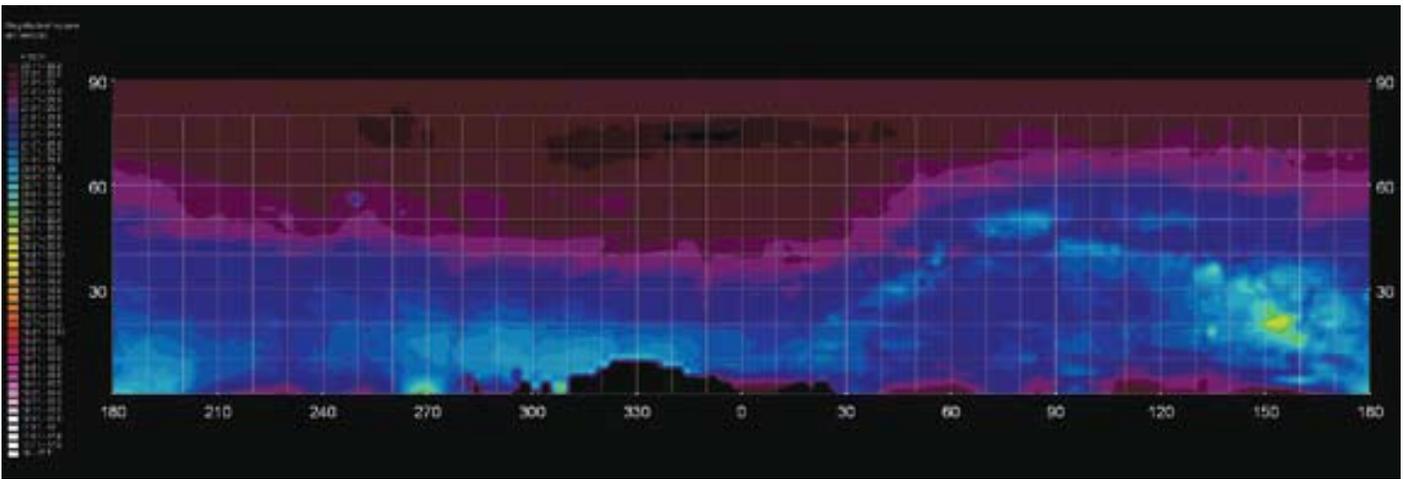
atmosphere as opposed to sunlight radiating from above. Additionally, the night lightscape is 5 to 7 orders of magnitude dimmer than in the day and characterized by subtle contrast of extended features and the visibility of faint starlight against a dark background, its luminance levels near the sensitivity limit of the human eye. In a rural or remote park setting, night sky visibility depends on how light is being scattered or absorbed through the atmosphere (Fig. 1). In a dark sky with minimal scattering aerosols, faint stars can be observed down to the horizon and diffuse features, like the Milky Way, have enough contrast to be easily seen with the naked eye. In areas such as the American Southwest, with its clear and dry conditions, the scattered light from distant cities can be seen up to 300 km away. This is frequently called a “light dome,” which may be small and only extend across a few degrees of angle, or a light dome may completely dominate the celestial hemisphere. Increasing aerosols that scatter and absorb are hypothesized by some to suppress the light of distant light domes while diminishing the visibility of stars and other faint features, but amplifying the light from nearby sources. Thus there may not be a simple linear relationship between scattering, artificial light, and night sky visibility. Urban settings typically have poor outdoor lighting, projecting a tremendous amount of light upwards into the atmosphere. This wasted light is commonly seen on satellite images at night (Fig. 2). However, increase of urban aerosols



Figure 2. A mosaic of night time satellite images reveals the emission of artificial light across the USA. Aerosols and atmospheric gases scatter a portion of this light, which is perceived by observers on the ground as light pollution. This image also provides a perspective on the scope and severity of the light pollution problem and the associated energy inefficiency.

scatters this artificial light downward towards the observer, dramatically brightening the appearance of the urban night sky (Fig 3). This brightening of the sky greatly reduces the contrast between the sky background and starlight, rendering the Milky Way and other faint extended features invisible, and only allowing the light of a few bright stars and planets to be seen through the murk. Most of the sample locations typically have good air quality and conditions optimal for photometric measures. Occasionally in these data sets, variation in absorption can be dramatically seen during episodes of wildfires, dust storms, or hazy conditions which affect light domes from surrounding cities. This provides an opportunity for insight into atmospheric science.





Top. Figure 4a. National Park Service night sky brightness panoramic map in magnitude/arseconds<sup>2</sup> at North Rim, Grand Canyon, Arizona, taken on June 27, 2008. Sky brightness is depicted in false color. The mottled arch in both images is our own galaxy seen edge on – the Milky Way.

Figure 4b. The same location as top image, taken on the next night of June 28, 2008. Note the lack of the Las Vegas light dome at 270°.

Figure 4 shows data taken from the North Rim at the Grand Canyon on the consecutive nights of June 27 and June 28, 2008. In Figure 4a, the light dome of Las Vegas, at 271° azimuth, is clearly seen from over 285 km, despite the recent flaring of a nearby fuels reduction fire burning at 309° azimuth. The smoke from the fire is drifting to the northeast, extinguishing the light dome of Page, Arizona at 34° azimuth, 95 km and Tuba City, Arizona at 95° azimuth, 73 km. The optical depth above the observation point is 0.162, aerosol to Rayleigh scattering ratio is 4.4 and the visual range for this night is 75km. In Figure 4b, the Las Vegas light dome on the next night is greatly reduced from the smoke of the fuels reduction burn, drifting heavily to the southwest, the fire is shown at 309° azimuth and the light dome of Tuba City is barely visible at 95° azimuth. The optical depth is 0.233, aerosol to Rayleigh scattering ratio 9.4 and the visual range is 39 km.

In each NSP dataset, optical depth is calculated by measuring stellar extinction averaged over the entire sky. By using known standard stars and matching them within the data set, the

observed brightness of the standard stars can be individually calibrated against their known brightness. A subset of 300 nonvariant stars picked from the Hubble Guide Star Catalogue is used for this calculation. The extinction coefficient is calculated in magnitude/airmass and then converted to the dimensionless optical depth parameter.

The NSP has begun collecting complimentary data on atmospheric conditions that may help to sort out the causal factors of night sky degradations. This includes nephelometer data captured alongside these images to determine scattering coefficient at ground level. These site specific parameters can be combined with surrounding air quality station data to build a more comprehensive picture of atmospheric scattering. Additionally, the NPS and Air Resource Specialists have begun building a radiation transfer computer model addressing night time conditions and light propagation in the urban environment (with its correspondingly higher in aerosol concentrations). Thus the project's extensive data collected at various sites and under various atmospheric

conditions and depicting light sources at a range of distances provides atmospheric science an opportunity to untangle the relationship between scattering aerosols and night time visibility. The Night Sky Program located at CIRA is looking for assistance and collaborators on this project interested in adding to the body of knowledge on this topic. The Clean Air Act provides protection for visibility, but the interpretation and implementation of this legislation has only addressed daytime visibility. The data and approach outlined here may yield evidence to show that visibility degradation per increment of air pollution is greater at night than in the day. Besides the policy ramifications, a more thorough understanding of the propagation of artificial light will help guide the protection and restoration of natural night skies that piques scientific interest in youth and provides inspirational scenes in parks and backyards alike.

### **Notes on the Oct 2 NCAS Talk by Chad Moore**

Hi Dan, I started the talk by asking everyone to stand up and count down through the Bortle Classes. When I reached Bortle Class I, only one person was standing. This shows just how rare pristine skies are. I showed maps from Cinzano et al to demonstrate the rapid onslaught of light pollution. Then I talked about my own journey on this project, what we have observed, the surprising extent of light pollution from major cities, and the role national parks play (both good and bad). I briefly went over visual estimates of sky quality (Bortle Scale, Limiting Magnitude), briefly discussed the Sky Quality Meter, then introduced our system. I had a camera on display and demonstrating the automated data collection routine. I showed data from about a dozen parks. I then layed out an overall strategy for dark sky protection (slide #49), stressed the importance of identifying a "battleground" to protect, and laid out possible roles for amateur astronomers. I concluded with all that the night sky provides, reminding astronomers to think beyond their hobby and what the night sky might mean to others, and finished with some pretty pictures and some hopeful comments.

### **November 1 Observing at Crow Valley Campground From Gary Garzone**

Several dark sky marines showed up, Veteran astronomers, Vern ,Stan, Carol and myself. Well skies sure looked bad when we got there ,clouds were still building. We set up and took a break in motor home, got back out around 8 PM or so and skies had opened up completely. I viewed till 4 am, some clouds finally started to build up along front range cities , but still cloudless for entire night of viewing, Seeing got real good about 2 am to 4 am, incredible views of Orion nebula. We did stephan's quintet, NGC 7331 and Stan showed me NGC 7332 galaxy with a real nice second edge on galaxy I never seen before, always learning. I will take a picture of this week if possible.

Vern , Stan and I checked out future possible sites for astronomy park at Crow Valley. We plan to make a better place than RAC for viewing. Skies are about same darkness wise maybe even a tad darker at Crow valley campground which is a few miles further from front range city lights than RAC site. And down lower so maybe less winds at times?? Few pictures of possible newer site, just east of farm museum area, field to east of museum, with bluffs that blocks house and road lights, still within view of campground but few hundred yards away if you go to eastern side of field maybe far enough to get away from camp fires and camper lights. We will be using place mostly in winter months, summer we go to Fox park , too hot in summer on high plains usually. So maybe continue to use parking lot and campground off season then use field to east when campers are around.

### **October 28 Fireball**

At 7:29 PM, helping a stranded family member while standing about 50 feet east of Wadsworth Blvd. on 26th Avenue in Wheat Ridge (a suburb of Denver), I saw a bright fireball (about the magnitude of a full moon) about 20 degrees above the southern horizon traveling on a path roughly 90 degrees long from southeast to southwest before exploding without sound. It appeared to have sparks falling from it as it went by; which had I heard a sound might have distinguished it as someone's errant fireworks rocket.

> Brad Jarvis

Very impressive from Crow Valley, too. Jeff Blume and I were out observing tonight (nobody else in the campground) and watched it travel across the sky. Looked to me like it shed quite a bit of material when ~20deg W of due south, before appearing to disintegrate at ~15deg above the horizon and thought it moved relatively slowly ... probably about 4-5 sec in duration. I did not note the time, but I'm sure this was the same object.

Greg Halac, NCAS

It was seen by hundreds, and was caught by several cameras. I've got images and videos posted at <http://www.cloudbait.com/science/fireball20081028.html>

Chris L Peterson  
Cloudbait Observatory  
<http://www.cloudbait.com>

### **2008 Orionids**

The weather and the Moon could have been better, but my allsky camera managed to record 107 meteors last night, and 228 over the last four nights. I've posted a composite image and a couple of fireball videos at <http://www.cloudbait.com/science/orionid2008.html>

Chris

## NASA 50Y Celebration at Lincoln Center Nov 9

The NASA Celebration will be held at the Lincoln Center in Fort Collins (417 West Magnolia Street).

You can find more details at:

<http://secure.fcgov.com/lctix/ap-show.php?id=374>

since there doesn't seem to be much on the [www.BeetStreet.org](http://www.BeetStreet.org) website (even though the original email said to look there for info).

Beet Street Presents:

A Celebration of NASA's 50 Years of Innovation & Discovery

Sun, Nov 9th: 3:00pm

Sun, Nov 9th: 7:00pm

Prices:

\$15 - adult 3pm

\$10 - student/senior 3pm

\$5 - all ages 7pm

3:00 PM: Spend an Afternoon in Space

Join the Youth Orchestra of the Rockies and former NASA astronauts and scientists for a spectacular journey in Space. View many of the 50,000 images from space and space missions of the past 50 years, accompanied by the epic music of Beethoven and Star Wars.

Special narrators and guests include:

Bob Phillips, Space Station Chief Scientist

Joe Tanner, four-time Space Shuttle Astronaut

Nick Schneider, Chief Investigator for part of the 2014 Mars MAVEN project

Following this unique interactive performance, our guests will discuss the legacy of NASA and some of the upcoming missions. Questions prepared by students from area schools as well as from the audience will be welcomed. Come early to enjoy space exhibits in the lobby!

7:00 PM: In the Shadow of the Moon

Enjoy a big-screen showing of the 2007 Ron Howard film, *In the Shadow of the Moon*, documenting NASA's Apollo Moon missions with special rarely-seen footage from the Moon, and interviews with Apollo astronauts. The film won the 2007 Sundance Film Festival's World Cinema Audience Award.

"An out-of-this-world cinematic experience! Spectacular! A must-see! One of the year's very best movies!" --Access Hollywood

Space Shuttle Astronaut Ron Sega and Space Station Chief Scientist Bob Phillips will introduce the film and talk about NASA's plans to return to the Moon.

For information visit <http://www.beetstreet.org> and <http://secure.fcgov.com/lctix/ap-show.php?id=374>

## Okie Tex Star Party Oct 2008 Observing Report

I attended the entire week-long Okie-Tex 2008 Star Party at Camp Billy Joe near Kenton, Oklahoma last week (9/27/08 to 10/5/08). It was definitely the best star party I have ever attended for two reasons. First, we had beautifully dark, clear skies with great seeing for the entire week except for some occasional patchy clouds on Friday 10/3/08, and only a single night of overcast skies on the final night (Saturday 10/4/08). Most nights you only needed a thin jacket for most of the night - it was in the 50s and 60s most of the time, and wind was not a problem. Sleep deprivation was the norm for the week. Second, I got an opportunity to mingle with several very experienced observers, to reconnect with some old friends, as well as make many new ones. I spent one night observing with Barbara Wilson and her 20" dob (she is an observing contributor to the Arp Peculiar Galaxies Observing Guide, and to Stephen James O'Meara's observing books). She is a delightful person, amazing observer, and a real storehouse of astronomical knowledge. I spent another entire night observing with both Glen Sanner and George (Bob) Kepple (authors of the Night Sky Observer's Guide volumes). These gentlemen were a delight to get to know, and the friendliest and most helpful observers that I have ever met. It was an honor to spend a night under the stars with these experienced amateurs, observing with Bob Kepple's 16" homemade dob, and Glen Sanner's 12.5" Astrosystems travel dob. We observed a huge range of objects and spent a lot of time observing with Bob's scope using a borrowed 8 mm Ethos eyepiece. Views were amazing! On my own, I observed and logged over 100 of the Herschel 400 objects (I'm working on the AL H400 award) using my 5.5" APO refractor. I was able to observe the Horsehead nebula, California nebula, as well as several other "faint fuzzies" I have never seen before using this little refractor. Overall it was a star party I will never forget and I will definitely be back for future Okie-Tex star parties!

- Mike Prochoda (Estes Park)

### Best Looks

Moon By Venus 11/1 dusk; by Jupiter 11/3 dusk

By Saturn 11/21 dawn

Mercury Very low in SE first week

Venus Low in SW at dusk; by Jupiter 11/30

Jupiter Low in SW at dusk

Saturn In E predawn

Uranus In Aquarius eves

Neptune In Capricornus eves

International Space Station passes for Loveland – Fort Collins

November 2008

Date	Mag	Starts			Max. <u>altitude</u>			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
<a href="#">5 Nov</a>	-0.5	05:52:12	10	NNW	05:54:42	25	NNE	05:57:13	10	E
<a href="#">6 Nov</a>	0.3	04:45:32	15	NNE	04:45:32	15	NNE	04:47:08	10	NE
<a href="#">7 Nov</a>	-0.6	05:10:58	22	N	05:11:59	27	NNE	05:14:33	10	E
<a href="#">8 Nov</a>	-2.3	05:36:26	20	NW	05:38:21	78	NE	05:41:16	10	ESE
<a href="#">9 Nov</a>	0.3	04:30:22	21	ENE	04:30:22	21	ENE	04:31:48	10	E
<a href="#">9 Nov</a>	-1.0	06:01:58	11	WNW	06:04:26	27	SW	06:07:00	10	SSE
<a href="#">10 Nov</a>	-1.3	04:55:58	57	SE	04:56:14	45	SE	04:58:23	10	SE
<a href="#">11 Nov</a>	-0.9	05:21:38	24	SW	05:21:38	24	SW	05:23:56	10	SSE
<a href="#">18 Nov</a>	-0.3	18:27:29	10	SSW	18:28:48	21	S	18:28:48	21	S
<a href="#">19 Nov</a>	0.1	17:20:08	10	SSE	17:21:09	11	SE	17:22:11	10	ESE
<a href="#">19 Nov</a>	0.5	18:53:12	10	WSW	18:54:12	19	WSW	18:54:12	19	WSW
<a href="#">20 Nov</a>	-1.6	17:44:06	10	SSW	17:46:50	39	SE	17:47:56	26	E
<a href="#">21 Nov</a>	-1.9	18:09:52	10	WSW	18:12:43	55	NW	18:13:07	49	N
<a href="#">22 Nov</a>	-1.7	17:00:37	10	SSW	17:03:25	44	SE	17:06:13	10	ENE
<a href="#">22 Nov</a>	0.0	18:36:28	10	WNW	18:38:13	20	NW	18:38:13	20	NW
<a href="#">23 Nov</a>	-1.7	17:26:27	10	WSW	17:29:17	49	NNW	17:31:40	14	NE
<a href="#">24 Nov</a>	-0.3	17:53:05	10	WNW	17:55:23	20	NNW	17:56:36	16	N
<a href="#">25 Nov</a>	-1.5	16:42:57	10	WSW	16:45:46	44	NNW	16:48:35	10	NE
<a href="#">25 Nov</a>	0.4	18:20:17	10	NW	18:21:28	12	NNW	18:21:28	12	NNW
<a href="#">26 Nov</a>	-0.2	17:09:37	10	WNW	17:11:50	19	NNW	17:14:03	10	NNE
<a href="#">27 Nov</a>	0.3	17:36:50	10	NW	17:38:05	12	NNW	17:39:19	10	NNE
<a href="#">29 Nov</a>	0.3	16:53:16	10	NW	16:54:25	12	NNW	16:55:35	10	NNE

To check passes:

<http://www.heavens-above.com/main.asp?Loc=Fort+Collins&Lat=40.585&Lng=-105.084&Alt=1525&TZ=MST>