

# The Objective View

Newsletter of the Northern Colorado Astronomical Society

April 2007

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Cheyenne Astronomical Society, Cheyenne Botanical Garden

April 20 7 pm Mauna Kea's First Telescope

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

Chamberlin Observatory Open House, dusk to 10 pm

Apr 21, May 26, Jun 23, July 21 303 871 5172

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

Longmont Astronomical Society April 19 6:45 pm

NOAA, Rayleigh at Broadway, Boulder, LAS members only

<http://longmontastro.org/>

## March 1 Program

**Near Earth Asteroids: The Threat of Impact and the Promise of Exploration**

**Dan Durda, Southwest Research Institute**

The asteroids are fossil building blocks left over from the formation of the terrestrial planets. There are many small remnant objects. Comets are mostly beyond the outer planets.

Asteroids form a belt between the orbits of Mars and Jupiter. Eros was visited by the NEAR-Shoemaker spacecraft. It is shaped like a potato and is heavily cratered. Hayabusa visited the asteroid Itokawa last year to attempt a sample return. We have much to learn about potentially hazardous asteroids. In the early 1900s, Comet Halley was tagged as a threat to life. Gene Shoemaker identified the Arizona Meteor Crater as an impact site in the 1960s through recognition of the shock signature in minerals. In the 1980s, Alvarez proposed a link between an asteroid impact at Chicxulub, iridium level at the K-T boundary, and species extinction. In the 1990s, surveys for near-Earth asteroids (Spaceguard) started, and disaster movies dramatized the consequences. Such tiny risk but huge stakes disasters are challenging for citizens and policy makers.

The Earth encounters dust sized meteors every few seconds. Boulder sized hits are weekly. A building-sized object hits once per millennium (Tunguska, 1908). A mountain-sized impact like Comet SL-9 hits every 500,000 years. A strike like the Chicxulub object, 15 km, occurs about every 100 million years. The Spaceguard survey started to ID objects which threaten to collide with Earth. It was recently extended to 140 meter objects by Congress. When a threat is detected, alternatives are evacuation, food stockpiles, or altering the object's path. The B612 project would use an ion thruster with solar power to nudge a test asteroid. Astronauts Ed Lu and Stan Love determined that a spacecraft's own gravity could be used to tow an asteroid without contact, avoiding the risk of fragmentation. To put risk of human mortality in perspective, death from disaster comes from war, 67%; epidemic, 20%; famine, 9%; storm 3%; earthquake 1%; volcano 0.1%. It is the stakes, and our ability to act with existing technology, that makes measuring the threat a major current priority. It is true that space program opportunities and pressure to move beyond low-earth orbit, may well outpace the very low probability we will need to deflect or destroy a threatening asteroid. An NEA could be a scientific bonanza. A survey team in a month could: complete

**Next Meeting: April 5 7:30 PM**

## Choice Images of the Messier Catalog, part II

**Lee Gregory, NCAS**

### Discovery Science Center

**703 E Prospect Ave, Fort Collins**

Club business at 7:15 pm

### Meeting directions:

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. From I-25, take Exit 268, West to Lemay Ave, continue West 1/2 mile, see Discovery Science Center on the left.

### NCAS Programs

May 3

June 7 Dick Dietz Solar Eclipses

### NCAS Public Starwatch

April 20 8:00 pm Discovery Science Center

May 25 8:30 pm Discovery Science Center

### Rocky Mountain National Park Starwatch

Dates for 2007 are June 15 & 22; July 6 & 20; Aug 3 & 17.

Please email objview at ncastro.org if you can volunteer.

### Other Events

Little Thompson Observatory Star Night

April 20 7:30 pm

<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

detailed seismic, radar and gravity surveys, develop a timescale for space weathering, collect undisturbed material by core sampling, and practice resource extraction and utilization. The scale and data return of in situ human investigations dwarf the capabilities of any robotic probe or series of probes, illustrated with a movie of rock sampling by the Sojourner rover, vs John Young and Charlie Duke collecting a lunar rock in their Apollo 16 flight. John S Lewis has promoted mining the sky. They are a source of Ni-Fe alloys, platinum, palladium, chromium, gold, sulfur. Carbonaceous NEAs contain water and organic compounds for life support fluids and rocket propellants. Cost is prohibitive if mining for use on Earth is contemplated, but the NEA would be a source of materials which would not need to be launched out of the Earth's gravity well. The Constellation hardware developed for the Moon has the capability to reach several NEAs. Durda showed a sample mission to the NEA 2000 SG344. The trip would take 3 months and need less rocket fuel than a trip to the Moon's surface. The mission duration is well within our ISS experience, and would stay within a few lunar distances from Earth. There are challenges to meet: work in microgravity, a dusty surface, rapid day-night cycles, harsh lighting, complex orbital and surface navigation requirements. An improved astronaut maneuvering unit is needed. Dan is a cave diver, and find the similarities are striking but manageable. Prior to launching a visit to an NEA, we should complete the Spaceguard survey. Ground-based and robotic surveys should characterize the physical properties of a large sample of NEAs. A target can be chosen when we know which have manageable rotation and are solid, vs rubble piles. The electrostatic properties of dusty soil in micro-g conditions need to be characterized. Grappling and tethering procedures are needed. New propulsion and power generation technologies such as VASIMR or Project Prometheus may be incorporated. A human mission to NEAs offers a scientific bonanza, plus hardware directly applicable to lunar and Mars exploration. Development of credible deflection or destruction technologies would benefit. Durda sees the NEAs as a low-energy opportunity for our next great leap. Recommended website:

<http://neo.jpl.nasa.gov>

Daniel D. Durda is a Principal Scientist in the Department of Space Studies of the Southwest Research Institute's Boulder Co office. He has more than a dozen years' experience researching the collisional and dynamical evolution of main-belt and near-Earth asteroids, Vulcanoids, KBOs, and interplanetary dust. He is an active pilot, cave diver, and artist. He has co-authored a book and dozens of articles popularizing planetary science and human exploration of space.

### **NCAS Business, March 1 2006**

President Nate Perkins called the meeting to order. The meeting schedule and observing nights were announced.

Treasurer Bob Michael encouraged members to keep their \$15 annual dues current, January of each year. His address is: 1212 Raintree Dr, A5; Fort Collins CO 80526. Phone is 970 482 3615. A yearly contribution to the IDSA was approved. Nate has completed a 16 inch ultralight Newtonian.

### **Messier Marathon Reports**

From Mike Prochoda, Estes Park.

Overall, Dan Laszlo, Shawn Curry, Mike Fitzgerald, Bill Travis and I had an AWESOME night at Cactus Flats North. Wind was never an issue and the night was incredible! I'm sure those of you at Crow Valley had the same amazing night. In a nutshell, I was able to observe 109 out of 110 Messier objects using both my 80 mm doublet refractor and my TEC 140 mm APO triplet refractor, and I observed 105 out of 110 Messier objects using 16 x 60 Pentax binoculars mounted on an observing chair. NGC 5866 in Draco was used as a stand-in for M102 which is a duplicate observation of M101 in Messier's catalog. I tried star-hopping to all objects, but had to rely on my Sky Commander for the last two objects, as they were almost lost in the glare of coming dawn (M73 and M2).

#### **OBSERVING EQUIPMENT AND SITE:**

DATE: Saturday PM 3/17/07 to Sunday AM 3/18/07

SITE: Cactus Flats North (Latitude: 40 deg., 39', 46" N., Longitude: 104 deg., 26', 54" W.). Excellent horizons in all directions with a small rise (< 5 degrees) to the West, East, and South.

TRANSPARENCY: 9/10 with no clouds throughout the night. There was a small amount of horizon haze in all directions with visible light domes to 30 degrees high in the Southwest and West (Greeley/Denver/Ft. Collins) and a smaller light dome to about 10 degrees high to the North and Northeast (Cheyenne, WY). Naked-eye limiting mag between 6.0 - 6.5.

SEEING: Pickering 6 (1-10 scale) early in the evening which improved to about Pickering 8 between midnight to 1 AM. I could see the "E" and "F" stars in the Trapezium (M42) at 122x in my 140 mm APO refractor early in the evening. Seeing deteriorated markedly within 30 minutes of morning twilight.

OBSERVING CONDITIONS: Early light breeze after sunset, which became calm for most of the rest of the night.

Temperature in the 40s for most of the night.

EQUIPMENT: 1) Telescope Engineering Company 140 mm F/7 APO ED Triplet Refractor mounted on a DiscMounts DM-6 Alt-Az mount and ATS pier with Sky Commander digital setting circles (DSCs not used except as below). TEC eyepiece turret with TeleVue Panoptic and Radian eyepieces. 2) A. Jaegers 80 mm F/6.2 (500 mm FL) doublet refractor piggybacked on the 140 mm APO Refractor. 3) Pentax 16 x 60 mm binoculars mounted on an observing chair. (Binochair)

#### **PROLOGUE:**

A successful Messier marathon (seeing all 110 objects) requires the sun to be positioned in an area of sky devoid of Messier objects. This occurs around the Spring equinox in mid-to-late March or early April. The new moon weekend in 2007 happened to be somewhat early in March making observing the morning objects particularly difficult from our latitude. One or two weeks

later would have made the morning objects (M72, M73, M2, and M30) easier to observe, and the difficult evening objects (M74, M77, M33, and M110) tougher to observe. From the beginning I thought that the chances of observing M30 (bright globular in Capricornus) this early in the season were almost nil.

Let me start by stating that I have observed most of these objects on multiple occasions over the past 25 years or so. I have re-observed most of them over the past 2 years with my new TEC 140 APO refractor. However, I have never attempted a Messier marathon in the past, mostly because I prefer to observe when the object of interest is optimally placed in the sky, and at my own leisure. I have become a convert to goto mounts and have become somewhat lazy over the past few years using my Sky Commander DSCs and Celestron CGE goto mount. The Messier marathon was a challenge, and probably a little bit of an attempt to "regain my youth" so-to-speak, to see if I still had it in me to star-hop across the evening sky, unassisted by a computer.

#### OBSERVING REPORT:

From the outset, I had planned on observing all of the Messier objects using both my chair-mounted binoculars and my piggybacked refractors. As dusk gave way to late evening twilight, I tried for M74 in Pisces (low-surface-brightness face-on spiral galaxy) without success, despite being in the correct area as I have the star field memorized for this tough object. M74 was buried in bright zodiacal light and late twilight. The other tough evening Messier objects were easily found and confirmed by myself and several others at my site in the following order: M77 (first object at 8:20 PM MDT), M33, and then M31/M32/M110. As I continued along the Messier marathon list, I intermittently swung back several times to try again for M74 as it was rapidly setting lower in the West (still buried in bright zodiacal light, but with no significant remaining evening twilight). I finally managed to observe this object successfully in both refractors at 8:40 PM MDT. It was seen with averted vision in the 80 mm refractor at 21x and with direct vision in the TEC 140 APO at 70x (confirmed by others). Despite several valiant attempts using averted vision, M74 eluded me in the 16 x 60 binoculars prior to setting in the West.

Next, I spent a pleasant evening sequentially observing the Messier objects on the marathon list, many NGC objects, and Saturn until after midnight, finally stopping at globular cluster M5 in Serpens prior to an early morning nap. The evening observing conditions were excellent with the following memorable observations. I could spot the lenticular galaxy NGC 3384 in Leo next to M105 with the binoculars. NGC 3628 next to M65 and M66 (Leo triple) was seen in the binoculars and showed its dust lane with averted vision in the 140 refractor at 122x. Galaxies NGC 4435 and 4438, "The Eyes" in Markarian's Chain (near M84 and M86) were seen with averted vision in the binoculars. All of the faint NGC galaxies in Markarian's chain were identified (some with averted vision) in the TEC 140 refractor. M97, the Owl Nebula in Ursa Major, showed its dark "eyes" with averted vision, and the nearby galaxy M108 showed significant mottling (both at 163x) in the 140 refractor. A faint galaxy, 12.5 magnitude NGC 4290 was spied just West of M40 (double star Winnecke 4 in Ursa Major) in the 140 refractor.

Galaxies M33, M51, M101, M99, M100, M61, and M83 all showed spiral structure to some degree in the 140 refractor. The dust lanes in M64 (black-eye galaxy), M104 (Sombrero galaxy) and NGC 4565 (edge-on galaxy in Coma) were all apparent with averted vision (direct vision for M104) in the 140 refractor. Most of the Messier globulars showed some to significant resolution in the TEC 140 refractor. Especially notable were globulars M53, M3, M5, M13, M92, M10, M12, and M22.

Between midnight and 1:00 AM the seeing become outstanding and we got some excellent views of Saturn along with 5 of its moons in Dan Laszlo's TMB 175mm F/8 triplet APO refractor with a 5 mm Super Monocentric eyepiece (280x). The Cassini division could be seen all the way around the rings, the Crepe ring was obvious, several dusky bands were seen on the globe, and the South polar hood was obvious. One of my best views of Saturn ever! The steady seeing also made observation of many of the Winter Milky Way Messier open clusters particularly memorable in Dan's TMB 175 mm APO and in my TEC 140 mm APO refractor (pinpoint stars, many being quite colorful).

At 1:00 AM MDT I decided to take a nap for a couple of hours in the car, and awoke at 3:00 AM MDT to continue the Messier marathon. At this early hour I was able to see Omega Centauri (noted at first by Shawn Curry) skimming about 1 degree above the Southern horizon in both refractors and with my binoculars. Though mostly a fuzzy blob, a handful of bloated stars could just be resolved in the outer halo with the TEC 140 refractor. I continued the Messier marathon successfully until about 5:05 AM MDT when I got stuck trying to find M55 (large diffuse globular in Sagittarius). After almost 15' of checking and rechecking my star charts, I finally was able to pick this object out of the "muck" only a couple of degrees above the Southeastern horizon - first with the binoculars, and then with the two refractors. It's low surface brightness and low altitude made M55 a real "toughie" for me. Globulars M75 and M15 proved easy and quick, both being quite condensed and bright. These were followed by M72 at about 5:35 AM MDT (globular in Aquarius) which definitely took some time and effort as it is faint, was quite low in the Southeastern sky, and the Eastern sky was rapidly brightening with the coming dawn. I then tried for M73 (asterism in Aquarius) which although very close to M72, eluded me for several precious minutes initially. I then realized that I had skipped M2 (bright globular in Aquarius) by wasting time searching for M72 and M73, and the brightening dawn made finding the field stars for this globular impossible.

I therefore "threw in the proverbial towel", initialized my Sky Commander digital setting circles, and "bagged" M2 while I could still see it at about 5:55 AM MDT. I then swung back again to the field stars of M72 (the globular itself had become lost in morning twilight), and tried to star hop again to the field of M73 without success due to the bright dawn sky. I therefore used the Sky Commander once again to finally make out 3 of the 4 stars that form this asterism at 122x in bright twilight with the 140 APO refractor. I think that my earlier failure on M73 was due in part to not using high enough power to see this asterism easily, as I was able to confirm with the Sky Commander that I had been in the correct star field previously. I then set my Sky Commander to M30 and pointed it toward this globular. It was

still fully 5 degrees below my local Southeastern horizon! I tore down my binocular chair and some of my equipment, chatted some with the others at the site, and by 6:20 AM MDT I could no longer see Mars in Capricornus in the bright dawn sky. The Sky Commander still showed M30 as being almost a degree below the local horizon! M30 was not going to be a possibility during this particular Messier marathon. We all packed-up our equipment and drove through the gate at Cactus Flats as the sun was just rising.

#### POSTSCRIPT:

My final Messier Marathon tally:

Total Messier objects observed with both refractors: 109 of 110 (M30 was not observed)

Total Messier objects observed by star hopping with both refractors: 107 of 110 (M2 and M73 required use of the Sky Commander DSCs in the bright dawn sky)

Total Messier objects observed by star-hopping with 16 x 60 mm binoculars: 105 of 110 (M74 was not seen, and M2, M72, M73, and M30 were not even attempted as I was too busy trying to find these objects in the brightening dawn sky using my refractors).

I was also quite surprised to find that I can (probably) observe all of the Messier objects with chair-mounted 16 x 60 mm binoculars under good observing conditions. I was able to find all of the Messier objects that I attempted (with the exception of M74 - galaxy in Pisces - which has low surface brightness and was very low in the Western dusk) in the binoculars. Particularly tough binocular objects included: M74 (as noted above), M76 - Planetary nebula in Perseus (small and relatively faint), M109 - Galaxy in Ursa Major (faint), M98 - Galaxy in Coma (faint and only seen with averted vision), M89 - Galaxy in Virgo (small and relatively faint), M57 - Ring nebula in Lyra (bright but tiny), and M70 - globular in Sagittarius (small and faint while low in the sky). I will attempt to observe the 5 Messier objects that I "missed" under better observing conditions during the coming few months to verify their visibility in 16 x 60 mm binoculars. Here's hoping for better skies than we've had all winter!  
- Mike Prochoda (Estes Park)

#### From Vern Raben

I got back from Crow Valley a little over an hour ago after a long night checking off Messier objects. I ended up with 109 of the 110 -- yes I cheated and used Goto for most of them. M74 and M55 were the toughest ones for me. The scope performed flawlessly, and nailed most objects within middle 1/3 of 30 arc min field. Only 3 or 4 were off a half a field.

Clear sky all night, turbulence around 6/10, no wind, excellent transparency, and other campers weren't an issue. We didn't even have to put on much winter gear till after midnight or so. We couldn't ask for better conditions. A great group of club members from LAS, BASS, and NCAS were there. Needless to say, a good time was had by all. We used Gary's notebook and webcam and did manage to get a few Saturn images.

#### From Gary G:

The extremely lucky bunch of about 10 astronomers from LAS and NCAS clubs who made the Saturday night Messier Marathon viewing at the Pawnee grasslands. Mike Hotka called me and said nobody was at Crow Valley so we all headed there instead of Cactus flats North, for fear of high winds which never did materialize. What a night we had, with no wind, total clear skies all night long. Some good seeing periods, so we cranked up the powers on Saturn. Vern Raben even did web camera shots of Saturn. Vern also did NGC galaxies and some comet hunting in his spare time from hunting down 109 Messier objects. Ha! like we had any spare time, still managed to do so much more.

I must say that was one of our best extreme astronomy nights in a long time. Vern, Cheyenne and myself made it till after 6 am, did not get M30, last object, too low and daylight was breaking. First two objects of the night were M77 and M74, both 10.5 mag galaxies were very difficult, not quite dark and going down on western horizon. Few others were difficult too. M6 and M7 were low in skies to the south, M54 and M55, also low were hard to do. Most of the rest we have all done lots of times.

I got 109 Messiers, plus favorites like NGC 4565 edge on Galaxy, Blue Snowball, Blinking planetary nebula, Veil nebula, Saturn, Jupiter, and at least another dozen objects. I did use my digital setting circles to max out the night. It was more the endurance test on how long you can stay awake. Just how often do you get total clear skies all night to do all the objects?? Wow!! So many photons sucked up last night, my dark sky viewing spirit was recharged to full. Pictures to follow later, need a nap soon for sure. later, Gary



Nate Perkins 16" Ultralight

### Best Looks

Moon By Antares + Jupiter 4/7, 4/8. By Mars 4/13, 4/14  
by Venus 4/19, 4/20; by Saturn 4/24  
By Regulus 4/26, occultation starts at Moonset 0330

Mercury Very low in ESE first week

Venus In W at dusk

Mars Low in SE at sunrise

Jupiter Low in S at sunrise

Saturn High in S in evening

Uranus Low in ESE predawn late in month

Neptune Low in SE predawn

From: Daniel Laszlo  
S Shields St Building H  
Fort Collins CO 80526

**TO:**

| Date                   | Mag  | ISS Starts |     |     | Max. Altitude |     |     | ISS Ends |      |     |
|------------------------|------|------------|-----|-----|---------------|-----|-----|----------|------|-----|
|                        |      | Time       | Alt | Az. | Time          | Alt | Az. | Time     | Alt. | Az. |
| <a href="#">04 Apr</a> | 2.4  | 04:13:46   | 14  | NE  | 04:13:46      | 14  | NE  | 04:14:43 | 10   | ENE |
| <a href="#">04 Apr</a> | -1.0 | 05:45:10   | 10  | WNW | 05:48:00      | 73  | SW  | 05:50:49 | 10   | SE  |
| <a href="#">05 Apr</a> | 1.2  | 04:34:05   | 28  | ENE | 04:34:05      | 28  | ENE | 04:36:01 | 10   | E   |
| <a href="#">05 Apr</a> | 0.5  | 06:05:59   | 10  | W   | 06:08:15      | 21  | SW  | 06:10:31 | 10   | S   |
| <a href="#">06 Apr</a> | 0.0  | 04:54:41   | 41  | SE  | 04:54:41      | 41  | SE  | 04:56:40 | 10   | SE  |
| <a href="#">07 Apr</a> | 1.3  | 05:15:38   | 15  | S   | 05:15:38      | 15  | S   | 05:16:25 | 10   | SSE |
| <a href="#">08 Apr</a> | 0.8  | 20:21:00   | 10  | S   | 20:22:50      | 16  | SE  | 20:23:09 | 16   | SE  |
| <a href="#">09 Apr</a> | -0.9 | 20:40:09   | 10  | SW  | 20:42:51      | 53  | SE  | 20:44:06 | 26   | ENE |
| <a href="#">10 Apr</a> | 0.1  | 21:00:19   | 10  | WSW | 21:02:58      | 44  | NNW | 21:04:37 | 19   | NNE |
| <a href="#">11 Apr</a> | 1.7  | 21:21:06   | 10  | WNW | 21:23:15      | 20  | NNW | 21:24:44 | 14   | NNE |
| <a href="#">12 Apr</a> | -0.1 | 20:05:30   | 10  | WSW | 20:08:09      | 52  | NW  | 20:10:55 | 10   | NE  |
| <a href="#">13 Apr</a> | 1.5  | 20:26:06   | 10  | W   | 20:28:21      | 22  | NNW | 20:30:36 | 10   | NNE |
| <a href="#">14 Apr</a> | 2.2  | 20:47:12   | 10  | NW  | 20:48:36      | 13  | NNW | 20:50:00 | 10   | NNE |
| <a href="#">18 Apr</a> | 2.3  | 22:07:48   | 10  | NNW | 22:08:27      | 13  | N   | 22:08:27 | 13   | N   |
| <a href="#">19 Apr</a> | 2.7  | 22:27:05   | 10  | NW  | 22:27:19      | 12  | NW  | 22:27:19 | 12   | NW  |
| <a href="#">20 Apr</a> | 1.6  | 21:12:23   | 10  | NNW | 21:14:06      | 15  | NNE | 21:14:58 | 14   | NE  |
| <a href="#">21 Apr</a> | 0.7  | 21:31:32   | 10  | NW  | 21:33:47      | 27  | NNE | 21:33:47 | 27   | NNE |
| <a href="#">22 Apr</a> | 1.6  | 20:16:47   | 10  | NNW | 20:18:21      | 14  | NNE | 20:19:56 | 10   | NE  |
| <a href="#">22 Apr</a> | 0.8  | 21:50:52   | 10  | NW  | 21:52:34      | 33  | NW  | 21:52:34 | 33   | NW  |
| <a href="#">23 Apr</a> | 0.7  | 20:35:48   | 10  | NNW | 20:38:10      | 24  | NNE | 20:40:11 | 12   | E   |
| <a href="#">23 Apr</a> | 2.0  | 22:10:34   | 10  | WNW | 22:11:21      | 16  | W   | 22:11:21 | 16   | W   |
| <a href="#">24 Apr</a> | -0.9 | 20:55:00   | 10  | NW  | 20:57:50      | 62  | NE  | 20:58:58 | 28   | ESE |
| <a href="#">25 Apr</a> | 0.1  | 21:14:31   | 10  | WNW | 21:17:07      | 37  | SW  | 21:17:45 | 31   | S   |
| <a href="#">26 Apr</a> | 1.8  | 21:34:59   | 10  | WSW | 21:36:14      | 12  | SW  | 21:36:35 | 12   | SW  |
| <a href="#">27 Apr</a> | -0.2 | 20:18:18   | 10  | WNW | 20:21:03      | 46  | SW  | 20:23:38 | 10   | SE  |
| <a href="#">28 Apr</a> | 1.7  | 20:38:21   | 10  | W   | 20:40:02      | 15  | SW  | 20:41:44 | 10   | S   |

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