The Objective View

June 2008

Newsletter of the Northern Colorado Astronomical Society

Nate Perkins, President
pres@ 970 207 0863
Greg Halac, Vice President, Web Editor
vp@ 970 223 7210
Dave Chamness, Secretary and AL Correspondent
sec@ 970 482 1794
Robert Michael, Treasurer
treas@ 970 482 3615
Dan Laszlo, Newsletter Editor
objview@ Office 970 498 9226
add ncastro.org to complete email address

Next Meeting: June 5, 7:00 pm

Telescope Help Session and Annual NCAS Potluck Picnic

Discovery Science Center 703 E Prospect Ave, Fort Collins

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

Club Brochure: http://www.ncastro.org/Contrib/2008_Brochure.pdf

NCAS Programs

July 10	Black Holes	David Chamness
August 7	TBA	Roger Appeldorn
Sept 4	Intl Yr of Astronomy	Andrea Schweitzer

Dark Sky Observing Opportunities, Foxpark WY or RAC

June 6 to 8, 27 to 29 Check club-news that site is accessible.

Rocky Mountain National Park Starwatch
Upper Beaver Meadows

June 13, 27; Jul 4,11, 25; August 8, 22

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

Other Events

Little Thompson Observatory Star Night:
June 20 7:30 pm Dr. Suzanne Traub-Metlay
http://www.starkids.org

CSU Madison Macdonald Observatory Public Nights
On East Drive, north of Pitkin Street
Tuesdays after 8:30 pm if clear, when class is in session

Chamberlin Observatory Open House, dusk to 10 pm
Jun 7, Jul 12, Aug 9, Sep 6 303 871 5172
http://www.du.edu/~rstencel/Chamberlin/

Longmont Astronomical Society June 19 7 pm
Dr. Emily Haynes, Phoenix Mars Lander
FRCC, 2121 Miller Rd. See new web page design at:
http://www.longmontastro.org/

Cheyenne Astronomical Society June 20 9 pm
Cheyenne Botanic Garden
http://home.bresnan.net/~curranm/

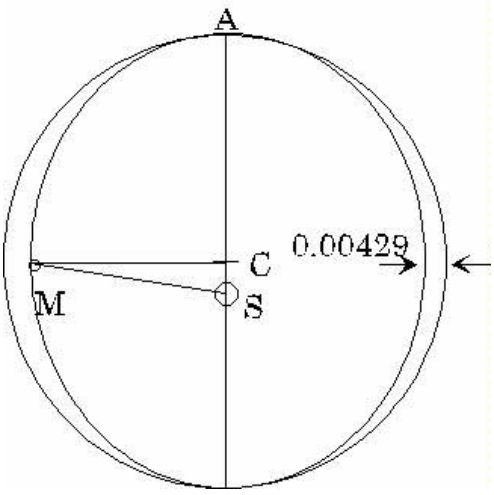
May 1 Program

Johannes Kepler, His Life and Discoveries

by Nate Perkins, Ph.D., Avago Technologies

Johannes Kepler wrestled tradition and personal tragedies to find truth by the scientific method. His lifetime from 1571 to 1630 was a period for recognition of the power of observation. He was the first to publish natural laws in the scientific sense. His laws of planetary motion are universal, verifiable, and precise. He proposed tides are caused by the Moon, and that the Sun rotates. He coined the term “satellite.” He made several novel contributions to optics. He used a pinhole camera to produce images, explained refraction and parallax in human eyes, developed eyeglass design, and recognized real, virtual and inverted images. He described the principles of telescope optics. He made calculations which are part of the basis for integral calculus. He developed a system for logarithms prior to Napier’s 1614 tables. He was a contemporary of Galileo and Shakespeare, experienced a great comet as a child, and was at the mercy of the Thirty Years War which started in 1618. Religion dominated politics and science. Catholic states were challenged by Lutherans and Calvinists. The Copernican system was promoted versus the traditional Ptolemaic system. Astronomy and astrology were largely indistinguishable. The Scientific Method was in its infancy. New science depended on a fragile system of political patronage. War made life a struggle for all. Kepler is recalled as egotistical, stubborn and blunt. He had patience to invest years toward a single goal. He was also pragmatic and flexible enough to learn and adapt. He could recognize his errors. His birthplace in 1571 in Weil der Stadt, Wurttemburg, in the Holy Roman Empire placed him in peril. The Peace of Augsburg halted war over the Reformation (1517), but religious tolerance was at the whim of the local ruler, and there were over 200 German princes. Spain, France, Denmark, and Sweden each wanted a piece of the German states. His grandfathers had served as mayors and were respected, but the families were in decline. Kepler described his father was an “immoral, rough, and quarrelsome soldier.” His mother was “a small, thin, and quarrelsome busybody who was generally unpleasant.” Three of their six children died in

infancy. At age three, Kepler lived with Mother and her parents at their inn for a year. She then went to join her husband for a year, while Kepler was chronically ill and nearly died of smallpox. When he was 5 y/o, he moved with his parents to Leonsberg and his father soon abandoned them. Kepler completed the Latin school in Wurttemburg between 5 to 12 years of age. He then entered the convent-school at Adelberg. He told others that he had been created by God to ponder the difficult things that others would turn away from. He was eccentric, outspoken, adventurous. He credited his parents with his early interest in the sky. He saw the Great Comet of 1577, and the lunar eclipse of 1580. He received a scholarship for University of Tubingen in 1589, passed his master's examination with high marks, and received another scholarship. His mathematics professor Michael Mastlin introduced him to the Copernican system. He became a fervent believer, defended it in a public debate. This disqualified Kepler from a faculty position at Tubingen because Luther had disavowed the Copernican system. He adhered to the Augsburg Confession, but refused to sign the Formula of Concord. This placed him in jeopardy due to political unrest and the Thirty Years War. Expecting to become a priest, he was disappointed when his superiors recommended him for a position teaching astronomy at the university in Graz. He wrote: "a mind accustomed to mathematical deduction, when confronted with the faulty foundations (of astrology) resists a long, long time like an obstinate mule, until compelled by beating and curses to put its foot into a dirty puddle." Since his astrological predictions came true, he was rewarded with respect and a salary raise. He poured effort into a geometrical framework for the Copernican solar system. First with a system of nested circles and polygons, then spheres in polyhedra, he proposed the model in his 1597 book *Mysterium Cosmographicum*. When the model did not fit, he blamed measurement error. Though the book required disbelief in his data, his work was praised. He received attention from potential patrons. Tycho Brahe was the wealthy son of a noble Danish family. He was able to purchase the revisions of Ptolemy's Almagest, best data of the day. He constructed very large instruments for the most accurate position measurements. He hired dozens of assistants. Kepler wrote to his mentor Mastlin, "he is superlatively rich, but he knows not how to make properuse of it, as is the case with most rich people. Therefore, one must try to wrest his riches from him." The riches are the data Tycho had accumulated. Tycho's publication of his methods and measurements of the Supernova of 1570 made him famous throughout Europe. King Frederick II of Denmark awarded Tycho the island of Hveen, and construction of his observatory, Uraniborg. The observatory was full of gadgets, distinguished guests were constantly present. Tycho entertained with raucous parties including a drunken elk and a dwarf Tycho believed had second sight. Tycho's patron died in 1588, Christian IV was not enamoured of Tycho, and he left with his instruments for Prague, Bohemia. By 1600, the Counter-Reformation had reached Graz, and Archbishop Ferdinand ordered all citizens to be questioned on their faith. Kepler refused to renounce Lutheranism, and was dismissed from his university post. He went to seek employment with Tycho in Prague. Tycho only lived to 1601, his death at least in part due to mercury poisoning. Tycho made a deathbed plea to Kepler to develop the Tychonic model, in which the planets orbit the Sun, but the Sun and Moon orbit the Earth. This was the religiously acceptable alternative since the Earth remained stationary. Kepler instead modified Copernicus model with elliptical orbits. He replaced Tycho as Imperial Mathemetician, appointed by Rudolph II. His major work in 1604 was on the "Optical Part of Astronomy." He described atmospheric refraction applied to eclipses, the reflection of light in flat and curved mirrors, and the inverse-square law for light intensity. Using Tycho's precise observations, Kepler discovered the elliptical orbit of Mars. In 1609 he published *Astronomia Nova*, and his first two planetary laws: 1. The orbit of a planet about the Sun is an ellipse with the Sun's center of mass at one focus. 2. A line joining a planet and the Sun sweeps out equal areas in equal intervals. The book is generally considered to be Kepler's most important contribution to astronomy. It is one of the first works to deal with imperfect data to produce a precise and testable theory. Tycho's data showed that Mars' orbit was not quite circular, and that it moved faster when nearest the Sun. Kepler knew how to determine position by triangulation. He needed two known points. The Sun would suffice for one. The stars were too distant to help. Kepler's stroke of genius was to use Mars as the triangulation point to find the Earth's orbit. Taking one Mars year as 687.1 days, he found the location of Mars from Earth at this interval. He then defined Earth's orbit precisely, and then derived Mars orbit precisely from that.



In 1610 Kepler heard of Galileo's discoveries and quickly composed 2 supporting documents, "Conversation with the Sidereal Messenger" and Narration about Four Satellites of Jupiter observed." Kepler then provided the beginning of the theory of the telescope in his Dioptrice, 1611. It had the theory of convex and concave lenses, real and virtual images, magnification, and the Keplerian telescope which had a convex lens for eyepiece (Galileo used a concave lens.) From 1611-12, Kepler lost a child to smallpox, and his wife died of complications of Hungarian fever. Rudolph II's successor, Matthias, forced the Lutherans out of Prague. Denied positions in Rome and Tubingen, he went to Linz as

Provincial Mathemetician. In 1613 he married Susanna Reuttinger. They had seven children and three died in infancy. Kepler's mother was charged with witchcraft in 1615 and with the aid of friends in Tubingen her defense was successful. In 1619 he published "Harmonice Mundi." He addressed regular polygons, congruence of figures, the origin of harmonic proportions in music, and on harmonic configurations in astrology. The fifth was on the harmony of the motions of the planets. Kepler's Third Law states: the squares of the periods of the planets are proportional to the cubes of their semi-major axes. The escalation of the Counter Reformation brought pressure on Kepler in Linz. In 1618 the Thirty Years War began. It was to bring the loss of 1/3 of the German population, half of the males. Swedish armies alone destroyed 2000 castles, 18000 villages, and 1500 (one-half) of the towns. In 1625 he published the Rudolphine Tables. They are derived from the observations of Tycho and Kepler and calculated from Kepler's elliptical models. Some calculations used logarithms, preceding John Napier. Included were perpetual tables for calculating planet positions for any past/future date. His family moved from Linz to Ulm in 1626. He was hired in 1628 at the Duchy of Sagan as court mathematician but suffered chronic problems getting paid. Desperate for funds by 1630, he left for Regensburg to collect an old debt. He died in transit at age 59. Conquering armies desecrated his grave 2 years later. Kepler's Laws were not immediately accepted. His work has stood the test of time and formed the foundation for later scientists. In the words of Carl Sagan, he was the first astrophysicist and the last scientific astrologer. He is memorialized by a lunar crater and the Kepler Space Observatory, the first NASA mission capable of finding Earth-size and smaller planets. For further study:

http://en.wikipedia.org/wiki/Johannes_Kepler

http://kepler.nasa.gov/johannes/

http://galileo.rice.edu/sci/kepler.html

http://galileoandeinstein.physics.virginia.edu/1995/lectures/kepler.html

http://courses.science.fau.edu/~rjordan/bios/Kepler/Kepler_bio.htm

http://mit.fnal.gov/~paus/phys/johannes-kepler.html

Dr. Nate Perkins is an award-winning telescope builder and rarely misses a chance to volunteer for outreach events.

May 1 NCAS Business

President Nate Perkins called the meeting to order. The calendar of observing events was announced. Our Spring speakers were announced. The Western Nebraska Star Party is May 29 to June 1. The Nebraska Star Party is Jul 27 to August 1. The Astronomical League convention for 2008 is in Des Moines IA this summer. Treasurer Bob Michael reported the club account at $1078.79. Members were polled about projects they would like to support. Ideas include a solar telescope, a beginner's telescope to be awarded as a prize, or a loaner scope intended for a school or educator.

Summer Dark Sky Sites

On Jun 10, 2008, at 7:52 AM, John Warren wrote:

As many of you know this is the first time around the yearly cycle of observing for my son,Jamie (my 10 yr old astronomer) and I. We are having a great time with this wonderful new hobby and wanted to share this information with our astro - friends.

Wow talk about an awesome night sky..... maybe as good as Hawaii ?? Friday night (6-6) on the way to the Sand Dunes Nat'l Park this my family hit a great car camping spot near Villa Grove in the beautiful San Luis Valley at the foot of the Sangre de Cristo Mountains. I brought only bino's due to minivan size and sand anticipation.
I would say the Milkyway was blindingly bright. I could not believe the amazing size and contrast of it - all the way across the sky from below Sagittarius thought Cassiopeia. Many DSO's were naked eye visible. I got the feeling I was looking out through our galaxies dust lane. The North American Nebulae was a great 10x50 binocular view. It sure gave me a feeling for what the best of dark skies can be like. If you can make it to a spot like this with your gear you'll be blown away by the quality of the night sky! It is well worth the effort. I wonder how Fox Park will compare to this as I have yet to observe from there? Cheers and Clear Dark Skies to All !!
John and Jamie

Sounds cool. You've found one of the the really great observing spots in the state. I used to live in Salida, and the area just north of Villa Grove was one of my favorite "really dark sites" (as opposed to our normal dark site, which was darker than Rolland's :)). Because of the clear southern horizon, I got my first view of Omega Centauri from near there. WOW! One way I'm sure Hawaii has the north end of the San Louis Valley beat is in seeing. It usually stinks in Villa Grove, although I had one spectacular night there. A thin layer of stratus nixed all the DSOs, but Saturn and Jupiter were very steady. Villa Grove does have light domes on the horizon from Salida and Cañon City. The really, Really dark site I found in that area is about 20 miles west, along the Marshall Pass road near Sargents (38°22'20.41"N 106°22'12.36"W). More complicated to get to, and the surrounding mountains limit views near the horizon, but worth the drive. The road is passable for a lot of the winter, just make sure you stay on the packed snow part. If you don't, floor mats work good at getting the car unstuck. Either site is about 3.5 hours from my home in Louisville. Salida has plenty of decent motels and B&Bs, plus lots of family activities while you sleep off your dark sky bender. :) That area gets a lot of Monsoon moisture in late July and August with afternoon t-storms, but nights are usually clear. Lots of camping in the area including a couple Forest Service grounds on Monarch Pass, but check, some

have been closed in the area due to "budget re-prioritizations"
Cheers, Shawn

Gunnison Valley Observatory

To: Astronomy Lovers! Date: May 26, 2008

Gunnison is a little closer to the stars! The long-anticipated Gunnison Valley Observatory telescope has arrived and is operational. The distinctive dome-topped, publically-owned observatory, located at the base of "W" Mountain at 2805 County Road 38 (south on Gold Basin Road), houses a telescope with a 30-inch mirror to view the moon, planets, stars and other astronomical wonders under Gunnison's clear, stable skies.

Everyone is invited to a free grand opening celebration starting at sunset, approximately 8:30 p.m., on Saturday, June 28th. Public viewing through the new telescope and a variety of "support" telescopes will be available that evening. An astronomy education program will also be offered that evening. For those who can't make it to the festivities on Saturday, public viewing through the main telescope will be available on Sunday evening, June 29th as well.

Following the grand opening weekend, the observatory will be open to the public, at sunset, every Friday night during the months of July through September, for open telescope viewing for a nominal fee. In addition, the Gunnison Valley Observatory will be offering a unique astronomy Lecture Series Program on select Saturdays throughout the summer and early fall. The Observatory, including the classroom and telescope, will soon be available by reservation for private educational sessions, research programs and star parties. For more information and directions to the Gunnison Valley Observatory, visit www.coloradoskies.org. Carpe Noctem – Seize the Night!

Contact: Mike Brooks; 641-6181; mbrooks@western.edu

Sky This Week Video by Vern Raben

The weekly "Sky this Week" video for Jun 1 to 7 is available at the Longmont website http://www.longmontastro.org , at the Astroleague website http://www.astroleague.org and at the YouTube website http://www.youtube.com/SkyThisWeek

If you have a high speed internet connection and somewhat fast machine you may also download the video in high definition HD 720P windows media format from the astroleague website. There is a link under the Youtube video on the main page which points to this url, http://www.astroleague.org/files/video/SkyThisWeek-2008-06-07HD.wmv (104 megabytes).

Vern

June 1 Rolland's Astro Corral Report from Gary Garzone

Friday night was cloud out till 3 am, not a good night for viewing . We just had a few sucker holes before I shut down scope , then of course it cleared but was late already , 3 am,so I went to bed and missed out on only about hour of views anyway..

Saturday night we had clearing around 12:30 am when skies opened up. Dave Dunn showed up for some observing too. He left early around 11 PM because of too many clouds, so we thanked him and sure enough, hour later we were in full swing observing again, skies had cleared up nicely. Good Transparency , poor seeing mostly, but very clear Milky Way and dust bands easily seen..

Vern R., Tom T., Chris N., Glenn F., and my wife Carol and myself had a real good night of viewing . Vern once again bagged a faint comet on laptop, I tried to find with 30 scope but no luck. I was in right area, had Ra and DEC numbers and was checking out location in telrad, no luck ,too small and faint I guess?

We did all the favorites, Veil and some planetary nebula, globulars, edge on galaxies, tea pot nebula wonders , wow!, summer is here.

Photos of Horned toad, sunset, bye, Gary

From Tom Teters: Microsoft's WorldWide Telescope

I was just show this link a minute ago here at work and it looks VERY interesting.

http://news.bbc.co.uk/2/hi/technology/7397811.stm

http://www.worldwidetelescope.org/experienceIt/ExperienceIt.aspx?exp=true

Why Finding ET Would Be Bad, from Brad Jarvis

Here's an interesting article discussing the existential consequences of finding extraterrestrial life: http://www.nickbostrom.com/extraterrestrial.pdf.

See also the Future of Humanity Institute Web site: http://www.fhi.ox.ac.uk/.

From Ray Warren: X-Rays Announce Supernova

http://www.sciam.com/article.cfm?id=astronomers-witness-supernovas-first-moments

May 21, 2008

Astronomers have observed for the first time the thunderclap of x-rays that announces a star has exploded into a supernova. Researchers monitoring spiral galaxy NGC 2770, approximately 88 million light-years away, observed a brief but intense flash of x-rays in early January, followed by a prolonged afterglow of visible and ultraviolet light—the hallmark of a supernova.

Although the x-ray outburst lasted only seven minutes, it flashed 100 billion times brighter than the sun in that time. Based on that brightness and the duration of the flash, researchers conclude that the star (SN 2008D) was approximately 20 times the size of the sun and was blown apart by a shock wave expanding outward at 70 percent the speed of light.

Astronomer Alicia Soderberg, a postdoctoral fellow at Princeton University and the first author of the report, was using the Burst Alert Telescope, an instrument on NASA's orbiting Swift observatory, on January 9 to study a supernova in NGC 2770 that was then two weeks in progress (but still 88 million years old, given the transit time of light). In a stroke of luck, the same galaxy suddenly flared with x-rays. "The probability of that happening is about one in 10,000," she says. "It was really exciting. We caught the whole thing on tape, basically."

New Book on the Moonwatch Program, from Ted Molczan

I have just read the new book, Keep Watching the Skies!, historian W. PatrickMcCray's richly detailed story of Operation Moonwatch. I thoroughly enjoyed reading it, and recommend it to anyone interested in the early history of the space age. It is of special interest to the SeeSat-L community, since Moonwatch was the birth of our hobby.

Moonwatch was the Smithsonian Astrophysical Observatory's program through which thousands of volunteer amateur observers around the world participated in tracking the first artificial satellites launched by the U.S.A. and the U.S.S.R., as part of the International Geophysical Year. Patrick McCray's thorough research, based on archival materials and interviews with numerous surviving participants, brings to life the nearly two decade story of Moonwatch.

The book begins by exploring the social and political conditions in post-WWII America that attracted large numbers of people from all walks of life to amateur science, which made Moonwatch possible. As the story unfolds, a large and diverse cast of characters is introduced, including the professionals who developed and operated Moonwatch, and many of the citizen-scientists who funded, organized, trained and participated in local Moonwatch teams. The following are but a few examples.

The late Fred L. Whipple is best known for proposing his "dirty snowball" concept of the composition of comets, but he was also an early and successful practitioner of big science - research done on a large scale, often with government funding. The book traces Whipple's life and career, showing how he came to propose and win support for his program to visually track the world's first satellites, using separate networks of professionally staffed cameras and teams of amateur observers.

Prominent among the citizen-scientists, was the late Richard Emmons (fondly remembered by many on SeeSat-L), who formed the Moonwatch team of North Canton, Ohio, which he trained in the small planetarium that he built inside his garage. The book tells the story of his life-long devotion to amateur science, his contribution to public education about astronomy, his long and productive participation in Moonwatch, and his research based upon satellite observations.

Teacher Vioalle Clark Heffernan organized Albuquerque High School's long-running Moonwatch team, which was in the top-tier of performers, rated "Prime A" by the SAO. Anyone who has been inspired by the special efforts of a good teacher will appreciate the story of Ms. Heffernan and her students.

Keep Watching the Skies! covers in depth, Moonwatch's achievements, its operational challenges, and its controversies. The biggest controversy: whether amateurs could be relied upon to produce observations of sufficient accuracy to guide the professionally run Baker-Nunn cameras, was settled soon after the launch of Sputnik 1 - they could and they did. Before long, Moonwatchers were asked to improve their precision, so that their data could be used directly for scientific research, and many successfully met this new challenge. Several former Moonwatchers continue to observe, including Russell Eberst, who began observing in late 1958, and is quoted in the book.

http://press.princeton.edu/titles/8645.html

http://www.amazon.com/Keep-Watching-Skies-Operation-Moonwatch/dp/0691128545

Roland Christen: How Professional Opticians Spin Polish and Figure Mirrors Without Grief, from SAA:

The whole idea of polishing from the ground state is to eliminate the pits. So, it is not necessary to worry much about the figure, whether or not it stays spherical or becomes a paraboloid during this initial stage of polishing. Most professional opticians will simply do whatever is necessary to get the grey out fast, the faster the better. In that regard, we don't even use pitch for this because it takes way too long and nobody will pay you for wasted effort. In any case, if you do use pitch for polishing and want to rough polish in the most efficient way, then simply hang the mirror off to one side, about 1/3 of the way off the tool and spin away. The mirror will gradually deepen this way - basically the center still gets more polish than the edge, but it will polish out the grey quite quickly versus the old push-pull method. If you don't want the mirror to get too deep beyond your desired focal length, then either start with a shallower curve, or make the pitch tool 10% larger. This will keep the focal length pretty much constant. It is a good idea to vary the mirror's overhang during this spin-polish cycle. If you make it variable by moving the pivot point regularly from zero to about 1/3 overhang, the resultant curve will be a very smooth and accurate sphere. If you keep it at 1/3 overhang, the resultant curve will be very zony, but this is not a problem at all. It takes only a few minutes of variable motion of the pivot point to bring the surface to a smooth sphere. Do not worry about getting the pivot point exactly in the center of the mirror. No astigmatism will result from having it non-centered. Make a plastic disc with a hole partially drilled thru the disc, and pitch this to the back of the mirror. Then use a pin on a long arm to position this onto the tool. Move the arm back and forth to vary the position of the mirror on the tool to get a smooth sphere. Finally, you can make a very accurate parabola with the spin method AFTER you have fully polished out all the pits. When you are ready to parbolize, place the mirror back onto the tool, but now hang it off almost 1/2 way and vary this position from 1/2 to 1/4 overhang (again with a tool that is 10% larger). Spin SLOWLY and spend more time at the 1/4 position than at the 1/2 position! The mirror will quickly parabolize without turned edge. If you overshoot and begin getting a hyperbola, no problem. Simply reduce the overhang back to about 1/3 or 1/4 and vary from that to zero. If you get zones, then blend them in by hand by using very short strokes I can fully polish out an 8" mirror on pitch this way in about 2 hours, and parabolize it in about 5 minutes to 1/8 wave P-V without turned edge (it takes some practice). Good luck (you might find this method so easy that you will volunteer to make other people's mirrors for them).
Roland Christen

Best Looks

Moon By Mars 6/7 by Saturn & Regulus 6/8
By Jupiter 6/19,20
Mercury In E at dawn last week of month
Venus Hidden by Sun
Mars In W early evening. By Regulus 6/30
Jupiter In S middle of night
Saturn SW in Leo evenings
Uranus In SE predawn
Neptune In SE predawn

International Space Station Passes for Loveland – Fort Collins June 2008

ISS is to receive a boost on June 12 so later passes should be confirmed!

Date	Mag	Starts			Max. altitude			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
9 Jun	-0.2	21:23:05	10	W	21:25:14	19	SW	21:27:21	10	S
29 Jun	0.4	04:52:40	10	SSE	04:53:55	12	SE	04:55:10	10	ESE
30 Jun	-1.4	05:12:37	10	SSW	05:15:16	38	SE	05:17:56	10	ENE
1 Jul	0.4	04:01:14	10	SSE	04:02:09	11	SE	04:03:04	10	ESE
2 Jul	-1.3	04:21:48	18	SSW	04:23:27	35	SE	04:26:04	10	ENE
3 Jul	-2.2	04:42:29	13	WSW	04:44:56	65	NW	04:47:45	10	NE
4 Jul	-1.2	03:31:47	31	SE	03:31:47	31	SE	03:34:08	10	ENE
4 Jul	-0.6	05:04:11	10	W	05:06:36	25	NNW	05:09:01	10	NNE

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