

# The Objective View

Newsletter of the Northern Colorado Astronomical Society

February 2008

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Cheyenne Astronomical Society Feb 22 7 pm

Cheyenne Botanic Garden

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

Chamberlin Observatory Open House, dusk to 10 pm

Feb 16, Mar 15, Apr 12, May 10, Jun 7, Jul 12, Aug 9, Sep 6

303 871 5172 <http://www.du.edu/~rstencel/Chamberlin/>

Longmont Astronomical Society Feb 22 7 pm

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

**Next Meeting: February 7 7:30 pm**

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

**Club Business at 7:15 pm**

**Discovery Science Center  
703 E Prospect Ave, Fort Collins**

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

## NCAS Programs

Mar 6 New Horizons/Pluto Fran Bagenal

## Discovery Sci Ctr Starwatch, 703 E Prospect, Ft Collins

Feb 20 6:30 pm Total Lunar Eclipse

March 14 7:30 pm

## Dark Sky Observing Opportunities, Roland's Astro Corral

Feb 1-2, 8-9. Check club-news that site is accessible.

## Other Events

Little Thompson Observatory Star Night:

Feb 15 7:30 pm Chandra X-ray Observatory by Dr. Steve

Jordan <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

## January 10 Program

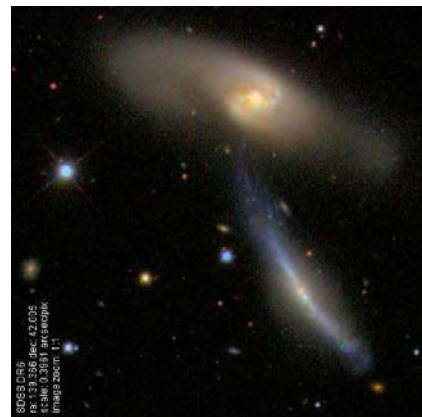
**Cosmic Collisions: Galaxy Mergers and Formations**

**By Tom Fay**

Tom dates his membership in NCAS to the days of meeting in the Teledyne Waterpik building. He has always had an affinity for galaxies. M51 is his favorite. It was the subject of a recent Hubble Heritage release which nicely highlights its H-alpha emission. It is a nearby example of interacting galaxies.

Such collisions are a window on galaxy evolution. Edwin Hubble classified galaxies as elliptical, spiral, or barred spiral.

Irregulars were ignored in his progression. We now recognize that his progression was reversed. Elliptical galaxies are the end of the process. Galaxy evolution hinges on galaxy mergers. Ellipticals have red stars, little gas, no star formation, no coherent rotation. Some have counter-rotating cores and ripples. Spirals have many blue stars, abundant dust and gas, star formation, a mix of old and new stars. They have a disk and rotate. The Galaxy Zoo project has recruited amateurs in a wildly successful project to classify galaxies. In the process, images of complex systems have come to light through the Zoo community. Images are generated in the Sloan Digital Sky Survey. Five filters and a spectrograph are used. Limiting magnitude is 22. Eighty million galaxies are cataloged. A "Best Mergers" list from the site was shown by Tom. Many are not NGC objects. The structures range from barely in contact to distorted beyond recognition as spirals. Arp 120 and 283 have substantial distortion.



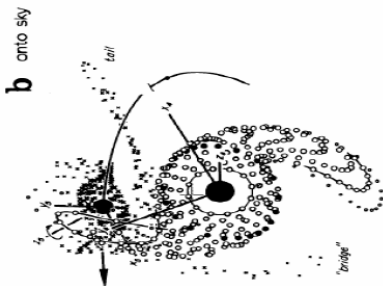
**Arp 283, NGC 2798 and 2799**

NGC 6090 has a long asymmetrical arm. The images are a celestial Rorschach test. The Mice (NGC 4676) and The Antennae are familiar. The multitude of forms has begged for explanation. We see a snapshot of a dynamic encounter. N-body simulations can model the problem and are already enlightening. Movies are available of a Mice-like merger by Joshua Barnes. Galaxy transformations

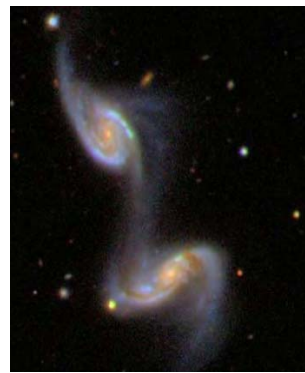
<http://0-www.ifa.hawaii.edu.pugwash.lib.warwick.ac.uk/~barnes/transform.html>

and a high-resolution spiral merger by Volker Springel.  
<http://www.mpa-garching.mpg.de/~volker/>

In 1941 Holmberg modeled an analog simulation with  $N=74$  stars. In 1972, Juri Toomres at the University of Colorado ran an early digital simulation with  $N=120$  stars, mergers of equals, unequals, 3 body simulation. He posited that spirals merge into ellipticals, that mergers are short-term running in about one galaxy revolution. He thought mergers formed tidal tails and bridges. Gas funneled to the core caused star formation. Today  $N > 1,000,000$ . Included are stars, gas, cold-dark matter, the central bulge and black holes. Initial conditions are size, orientation, kind, angle of approach, speed. Toomres model produced an uncanny match to The Mice and M51:

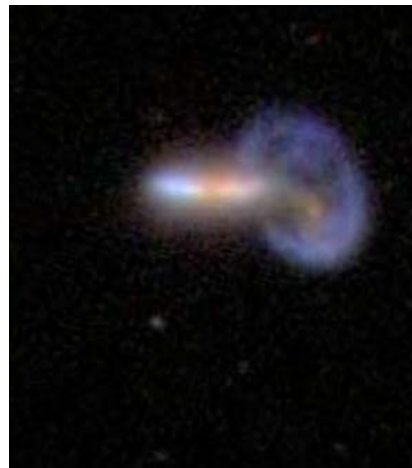


Simulations confirm that the merger time is about 300 million years. Stars, gas and cold dark matter are needed for this speed. In general you only need gravity to account for their behavior. Gravitational interactions cause tidal tails and bridges. Gas does not flow freely through due to magnetic field. Star formation is triggered in tails and the core. Prograde mergers lead to spirals. Retrograde give single tails. Mergers can form bars and rings. Minor mergers are slower and give luminous halos. And spirals can merge to form ellipticals. Many ultraluminous IR galaxies show collisional effects. Ellipticals have shells and some have counter-rotating cores. Quasars are often in merger remnants. Mergers are concentrated in small compact groups, not large clusters. But large ellipticals centered in clusters appear to be merger products. A plot of galaxy color vs magnitude or mass shows a clear linear relationship for red galaxies, becoming more pronounced since  $z = 1$  (Cooper, 2006). The red sequence mass is growing, maybe due to mergers.

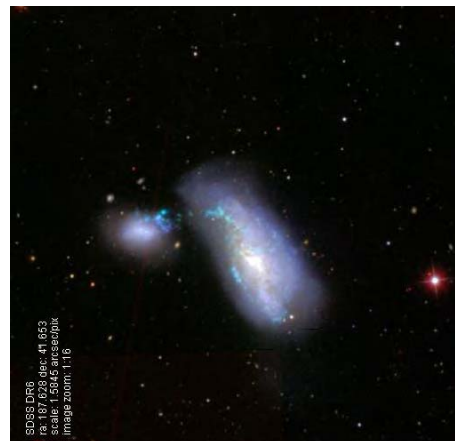


Arp 301

Tom concluded with images of elliptical mergers in a cluster, merging ellipticals, wound-up spirals as NGC 5278-79, ring-forming collisions like Arp 148, the hummingbird form of NGC 4837 and heron of Arp 142. Late stage mergers are NGC 4088 and NGC 3780.



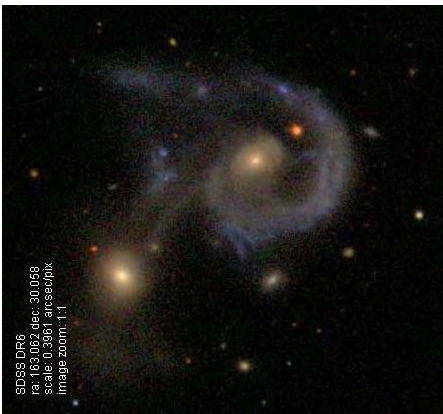
Arp 148 shows ring



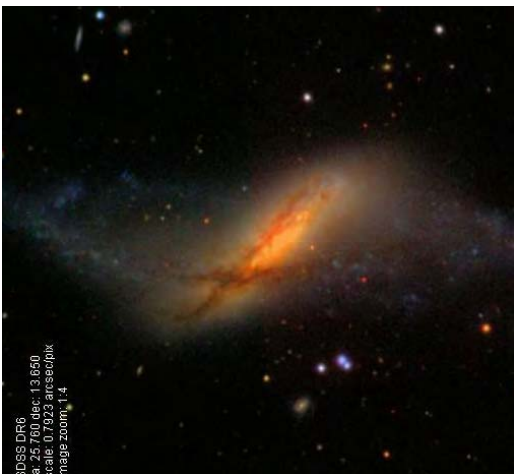
VV126 and NGC 4490 have spectacular blue star formation. Multi-mergers are seen in NGC 6027 (Seyfert's Sextet) and Arp 214. Merger of unequals are seen in Arp 107 and NGC 5996.



**The Penguin, NGC 2942, Arp 142**



**Unequal pair**



**NGC 660**

Tom's opus magnum may be found in PDF form in NCAS Member Creations at:

[http://www.ncastro.org/Contrib/Fay\\_T/2008-01\\_CosmicCollisions.pdf](http://www.ncastro.org/Contrib/Fay_T/2008-01_CosmicCollisions.pdf)

Tom Fay works at Agilent Technologies in Loveland.

Galaxy Zoo

<http://www.galaxyzoo.org/Default.aspx>

GalCrashcollision simulator applet + backgrounder

<http://burro.astr.cwru.edu/JavaLab/GalCrashWeb/>

SDSS galaxy study guide

<http://cas.sdss.org/dr3/en/proj/basic/galaxies/>

Joshua Barnes Simulations

<http://ifa.hawaii.edu/~barnes/transform.html>

Galaxy Formation Group

<http://www.mpa-garching.mpg.de/galform/>

Galaxy Merger article (1999) for laymen

<http://nedwww.ipac.caltech.edu/level5/Struck/frames.html>

Galaxy Collision slide set (with simmovies)

<http://www.etsu.edu/physics/bsmith/collisions/collisions.html>

### December 6 NCAS Business

Vice President Greg Halac 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 \$498.79. Our Winter speakers were announced. Officers elected for 2008 were Nate Perkins, President, Greg Halac, Vice-President, Bob Michael, Treasurer, and Dave Chamness, Secretary. Steve Little notes that the building is nearly done for the Estes Park Observatory at the high school. It has a 40 x 60 foot room and a 28 x 40 foot warm room. Sadly, the telescope piers at Upper Beaver Meadows were removed, due to miscommunication. Piers will be available again, plus at the high school. Greg has updated the club brochure with New Moon dates, planet info, and maps to local observing sites, see:

[http://www.ncastro.org/Contrib/2008\\_Brochure.pdf](http://www.ncastro.org/Contrib/2008_Brochure.pdf)

Max Moe is adding a math major and deciding about a graduate program.

### Total Lunar Eclipse Feb 20

Partial phase begins at 1843 MST. Totality from 2000 to 2052. Partial eclipse ends 2209.

### Best Looks

Moon By Antares 2/1 by Jupiter and Venus 2/3  
by Mars 2/15,16 by Saturn 2/20-21

Mercury low in ESE at dawn last 2 weeks of month  
By Venus 2/25 to 3/2

Venus by Jupiter first week of month, dawn

Mars high overhead in evening

Jupiter Next to Venus start of month at dawn

Saturn Highest at midnight. Opposition 2/23-24

Uranus in SW at dusk early in month

**From Andrea Schweitzer**

If you have time, please check out the astronomy podcast:  
<http://universe.nasa.gov/blueshift>  
A colleague of mine produces them, and would appreciate your feedback (more info below)! Andrea

----- Forwarded message -----  
Date: Tue, 15 Jan 2008 18:41:22 -0800 (PST)  
Subject: seeking feedback on podcast

Hi everyone,

... I have been involved in producing podcasts as part of my job and we really need some feedback to learn if what we are doing is any good! (We can't conduct surveys being part of the govt. and we have no money to hire a market researcher!) The podcast is called "Blueshift" (Bringing the Universe closer to you - blueshift as opposed to redshift? Geeky, I know! :)

It can be accessed through iTunes or our website at <http://universe.nasa.gov/blueshift>. There is a "Rate this episode" poll for each release on the webpage for each episode. I am particularly looking to get ratings and feedback on our latest episode (Episode 6, currently highlighted on the homepage).

The rating is completely blind, we only see aggregate scores. If you submit any feedback through the website, it also comes in as anonymous feedback. So please be as honest as you wish - we need to know if we should keep doing this or call it quits! You are welcome to listen to any/all of the episodes and rate them/send feedback if you like what you hear or have suggestions for us. If you have friends and colleagues who may be interested, please pass the link along to them as well! Again, it is <http://universe.nasa.gov/blueshift>

Thanks!  
Anita

**Mars Society 2008**

The annual Mars Society conference will be held August 14-17, 2008 in Boulder. If you are interested in attending, their website is:  
<http://www.marsociety.org/>  
and the conference information is at:  
<http://www.marsociety.org/portal/c/Conventions/2008/convention-2008-event>

**From Max Moe  
Front Range Seeing at Sommers-Bausch Observatory**

Hi all,

Attached is the seeing plot in Boulder (which should be fairly representative of the entire CO Front Range) that Steve

mentioned. The data comes from 88 nights of imaging at the Sommers-Bausch Observatory. I also copied below the caption from my thesis which I defend in April.

Note that visually at the eyepiece you can cut the image seeing by about a factor of two since seeing conditions average out over a few seconds but your eye operates at about 10 Hertz, e.g. if you take an image longer than 3 seconds (as I always did for the data below) and the Full Width Half Max (FWHM) was 2.0", then visually at the eyepiece you could probably separate a 1.0" double star if you wait for that tenth of a second the seeing is better than the average seeing of 2.0".

Cheers, Max

The average FWHM seeing and 1 sigma spread are shown for each month. The number of observations per month are also indicated. The average seeing of all 88 nights was 2.6 +/-0.6 arcsec, where the error is the standard deviation, {\it not} the standard deviation of the mean. The seeing averaged less than 2.3 arcsec from late-March through early-October when the jet stream remained north of the observatory.

**Latest elements for USA 193**

Tony Beresford, David Brierley and Russell Eberst have reported new observations. The object was more than half a minute early relative my three day old elements, due to an increase in geomagnetic activity during Feb 1 to 3, which sometimes reached storm level:

<http://www.swpc.noaa.gov/ftpdir/indices/DGD.txt>

This is reflected in the updated elements by a 50 percent increase in rate of decay:

USA 193      5.0 2.5 0.0 4.3 v                      264 X 273 km  
1 29651U 06057A 08035.26297568 .00167697 00000-0  
28374-3 0 08  
2 29651 58.4890 101.9619 0006774 80.4195 279.7669  
16.02067677 05  
Arc 2008 Jan 31.29 - Feb 04.28, WRMS residuals = 0.029 deg

Definition of 2-line elements format:

[http://spaceflight.nasa.gov/realdata/sightings/SSApplications/Pst/JavaSSOP/SSOP\\_Help/tle\\_def.html](http://spaceflight.nasa.gov/realdata/sightings/SSApplications/Pst/JavaSSOP/SSOP_Help/tle_def.html)

Geomagnetic activity has since subsided; therefore, the above rate of decay probably is overstated for prediction purposes, which will result in the object running late. Using the above elements, but with a guessed lower rate of decay going forward (ndot/2 = 0.0012), and a 10.7 cm solar flux of 71, Satevo v0.51 estimates decay from orbit on 2008 March 26, in line with earlier estimates. The uncertainty is at least one week.

Ted Molczan

International Space Station Passes for Loveland – Fort Collins February 2008

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

Confirm passes after STS launch Feb 7. Boost is due on Feb 15.

Date	Mag	Starts			Max. altitude			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
<a href="#">6 Feb</a>	0.3	17:50:06	10	NW	17:51:26	13	NNW	17:52:45	10	NNE
<a href="#">9 Feb</a>	0.3	18:53:54	10	N	18:54:33	11	N	18:54:33	11	N
<a href="#">10 Feb</a>	0.3	19:13:56	10	NNW	19:14:31	13	NNW	19:14:31	13	NNW
<a href="#">11 Feb</a>	0.1	18:00:16	10	N	18:01:15	11	NNE	18:02:14	10	NNE
<a href="#">11 Feb</a>	0.7	19:34:06	10	NW	19:34:30	13	NW	19:34:30	13	NW
<a href="#">12 Feb</a>	-0.5	18:20:07	10	NNW	18:22:08	17	NNE	18:23:16	14	NE
<a href="#">12 Feb</a>	1.3	19:54:31	10	WNW	19:54:31	10	WNW	19:54:31	10	WNW
<a href="#">13 Feb</a>	-1.6	18:40:11	10	NW	18:42:49	35	NNE	18:43:21	31	ENE
<a href="#">14 Feb</a>	-2.4	19:00:26	10	NW	19:03:13	77	SW	19:03:32	66	SSE
<a href="#">15 Feb</a>	-1.4	17:46:02	10	NW	17:48:36	31	NNE	17:51:11	10	E
<a href="#">15 Feb</a>	-0.1	19:21:09	10	W	19:23:27	22	SW	19:23:52	21	SSW
<a href="#">16 Feb</a>	-2.4	18:06:08	10	NW	18:08:58	90	SSE	18:11:47	10	SE
<a href="#">17 Feb</a>	-0.2	18:26:39	10	WNW	18:29:05	26	SW	18:31:30	10	SSE
<a href="#">20 Feb</a>	1.7	17:54:08	10	SW	17:54:17	10	SW	17:54:26	10	SW

USA 193 Passes for Fort Collins (Click on the date to get a star chart and other pass details.)

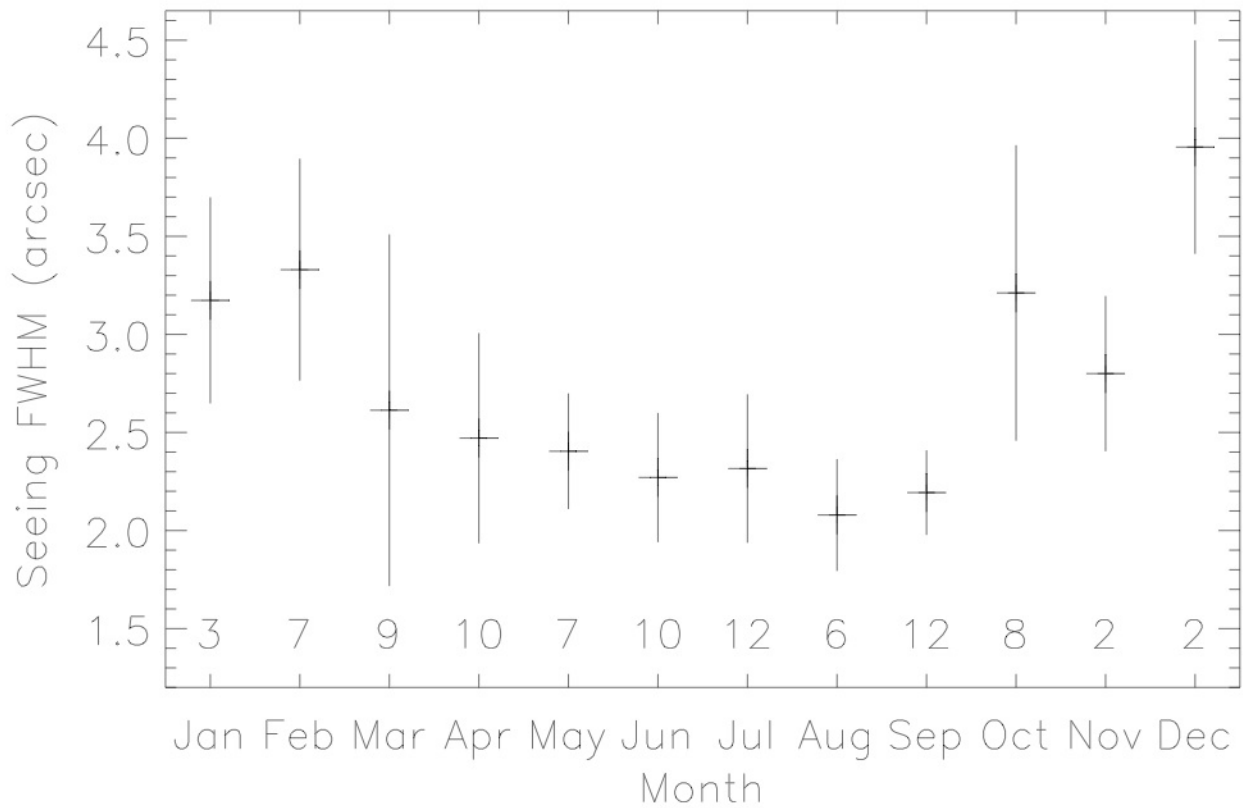
From: <http://www.heavens-above.com/PassSummary.aspx?satid=29651&lat=40.4997&lng=-105.05736&loc=Fort+Collins+CO+USA&alt=0&tz=MST>

USA 193 morning passes for Ft C – Loveland

Date	Mag	Starts			Max. altitude			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
<a href="#">7 Feb</a>	4.3	05:39:26	12	N	05:40:30	15	NE	05:42:02	10	E
<a href="#">8 Feb</a>	3.5	05:37:11	21	NNE	05:37:54	25	NE	05:39:54	10	ESE
<a href="#">9 Feb</a>	2.3	05:34:45	44	NNE	05:34:56	46	NE	05:37:12	10	ESE
<a href="#">10 Feb</a>	2.1	05:32:09	49	SSE	05:32:09	49	SSE	05:33:58	10	SE
<a href="#">11 Feb</a>	3.7	05:29:25	18	S	05:29:25	18	S	05:30:13	10	SSE

USA 193 evening passes for Ft C – Loveland

Date	Mag	Starts			Max. altitude			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
<a href="#">16 Feb</a>	5.1	19:37:01	10	WSW	19:37:04	10	WSW	19:37:04	10	WSW
<a href="#">17 Feb</a>	3.7	18:00:14	10	SSE	18:01:11	12	ESE	18:02:08	10	E
<a href="#">17 Feb</a>	4.7	19:31:48	10	W	19:32:34	16	W	19:32:34	16	W
<a href="#">18 Feb</a>	3.0	17:53:31	10	S	17:55:16	20	SE	17:57:02	10	ENE
<a href="#">18 Feb</a>	4.5	19:26:31	10	WNW	19:27:38	14	NW	19:27:38	14	NW
<a href="#">19 Feb</a>	2.2	17:46:59	10	SSW	17:49:04	34	SE	17:51:12	10	ENE



The average FWHM seeing and 1 sigma spread are shown for each month. The number of observations per month are also indicated. The average seeing of all 88 nights was  $2.6 \pm 0.6$  arcsec, where the error is the standard deviation,  $\{\text{it not}\}$  the standard deviation of the mean. The seeing averaged less than 2.3 arcsec from late-March through early-October when the jet stream remained north of the observatory. Courtesy Max Moe.