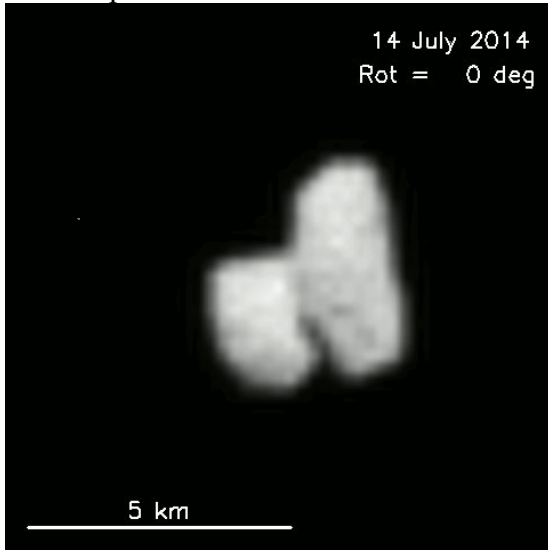


Comet Rubber Ducky

By Bob Moler

I had prepared a presentation for our July meeting on the two comets that will be in the news this summer and fall. However it was preempted. Several weeks of study and preparation shot to hell. However I was able to use an abbreviated version on the first comet with some additional graphics for the summer reading group at the Kalkaska County Library.

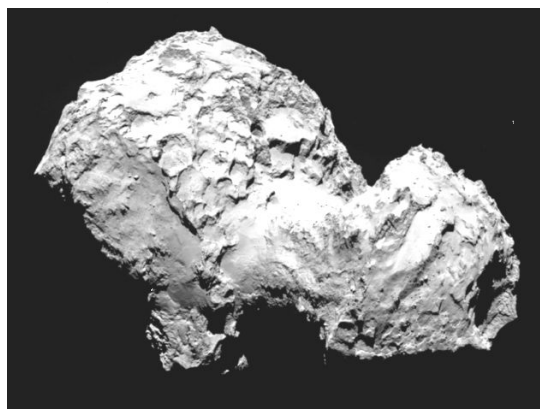
The first part of the talk was to be about the European Space Agency's (ESA) Rosetta mission to the Comet 67P/Churyumov-Gerasimenko or Comet C-G for short. I'll cover the second comet C/2013 A1 Siding Spring just before it side swipes Mars next month.



The "Rubber Ducky". Credit: European Space Agency

We were getting our first detailed look at the comet in early July. And lo and behold, it looked like a rubber ducky as reported by the "Bad Astronomer" Phil Plait and others. As Rosetta got closer surface detail began to appear. I concluded that the Rubber Ducky was really an "Ugly Duckling". The image above shows the comet's nucleus as 30 pixels wide,

and the image was smoothed. For smoothed, read blurred.

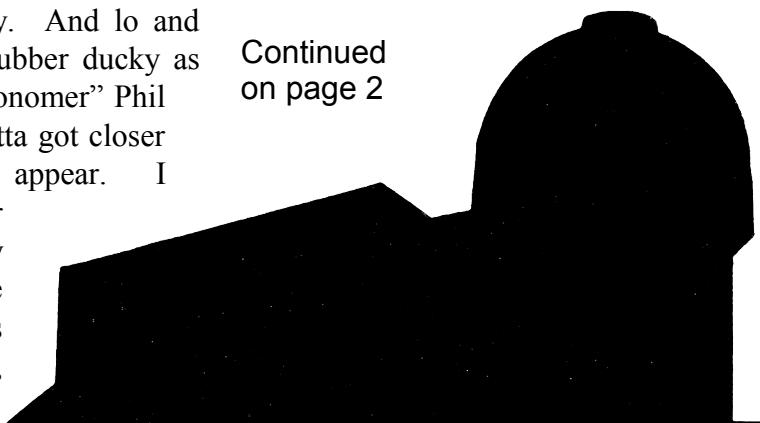


The comet 3 days before reaching it. It kinda looks like an ugly duckling in this image. Credit ESA.

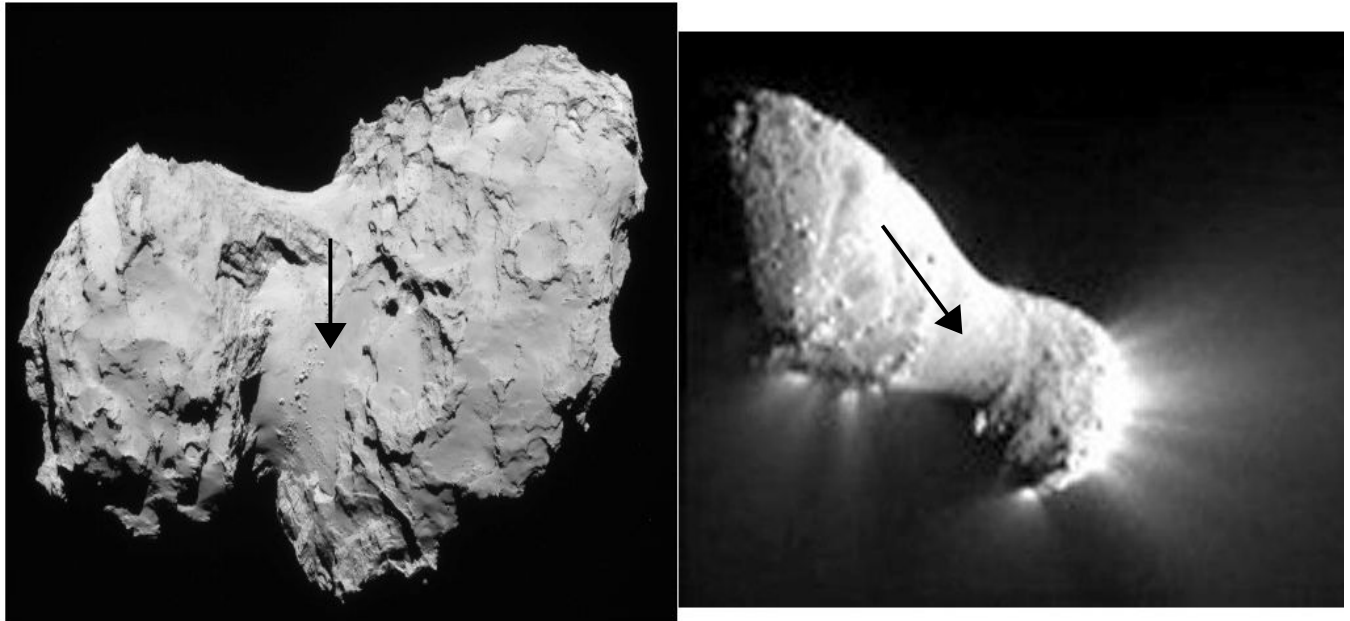
The big surprise when the shape of the comet was revealed was that that it looks like two nuclei stuck together. However looking back at the few comet nuclei that have been visited, a large percentage of them seem to be compound objects. Comet Hartley 2 looks like a dog bone with a relatively thin waist between the two lobes. Comet Borrelly's nucleus looks like a bowling pin. The Soviet image of Halley's nucleus back in 1986 suggests a somewhat narrow waist between two lobes.

A look at the region of Comet C-G where the two lobes appear joined seem to have fine material deposited much like on Comet Hartley 2. Like Hartley 2 The neck of the ducky is a gravitational low area where loose stuff seems to settle.

Continued on page 2



Comet Rubber Ducky (From page 1)



Comparing Comet C-G on the left and Comet Hartley 2. Notice how parts of the neck of the ducky is smooth, like the narrow part of Hartley. Credits: ESA and NASA.

The Rosetta folks are scanning the surface, looking for a landing spot for the Philae lander. Despite the roughness of the terrain, quite a few potential landing sites have been found. As of August 25th, ESA announced that the search was down to five landing sites.

Rosetta, as of August 6th, has entered a kind of an orbit around the comet's nucleus. It is not a sustainable orbit, but one that is triangular. The comet's gravitational pull is almost non-existent. As it is the spacecraft's velocity with respect to the comet is best be described as a walk. It's still too fast not to fly off. As the spacecraft makes it's 120 degree tweaks, three times an orbit, it is slowly moving closer to the nucleus.

The official ESA Rosetta website is not always the most helpful. Most scientific results will not be released less than a year from the observations.

Even NASA has a similar policy. I find that Emily Lakdawalla blogging for the Planetary Society usually has the best unofficial analysis of the images. She is a planetary geologist and an excellent communicator. Here's a link to her tour of the comet's nucleus: <http://www.planetary.org/blogs/emily-lakdawalla/2014/08150814-finding-my-way-around-cg.html>.

If you receive the Stellar Sentinel via email you will receive an Adobe Acrobat (PDF) copy of the newsletter. It can be printed, or viewed on the computer screen. Hyperlinks like the one above can be clicked on to directly link to the page. If you email your email address to info@gtaastro you will receive the pdf copy of this issue to start you off plus be enrolled to receive better quality issues with even more content that can be squeezed into 8 pages.

Grand Traverse Astronomical Society - Est. June 1982 – 32 years of service

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Editor	Bob Moler			Nancy Hammond
				Charles Bell

Society Events

Check <http://www.gtaastro.org> for late breaking events.

September

- 5 Friday **Board of Directors** – 7 p.m. - NMC Rogers Observatory
General Meeting – 8 p.m. - NMC Rogers Observatory.
Star Party: 9 p.m. - 11 p.m. - NMC Rogers Observatory.
- 6 Saturday **International Observe the Moon Night** 200 block of Front St near Orvis Streamside
- 13 Saturday **Star Party** – 9-11 p.m. - Sleeping Bear Dunes, Dune Climb Parking Lot
- 20 Saturday **Leland Heritage Celebration** – River St. Leland – 9 a.m. - 5 p.m.
Star Party – 9 p.m. - 11 p.m. - NMC Rogers Observatory.
- 27 Saturday **Acme Fall Festival** - Flint Fields Horse Park on Bates Rd. N of M72 - 10 a.m. - 5 p.m.

October

- 4 Saturday! **Board of Directors** – 7 p.m. - NMC Rogers Observatory
General Meeting – 8 p.m. - NMC Rogers Observatory.
Star Party – 9 p.m. - 11 p.m. - NMC Rogers Observatory. Fall Astronomy Day.
- 8 Wednesday **Total Lunar Eclipse** – 5 - 8 a.m. Rogers Observatory & Sleeping Bear Dunes – Platte River Point
- 18 Saturday **Star Party** – 9 p.m. - 11 p.m. - NMC Rogers Observatory.
- 21 Tuesday **44th Anniversary Star Party at Sleeping Bear Dunes National Lakeshore** – 8 p.m. - 10 p.m.
- 23 Thursday **Solar Eclipse at sunset** – 5 p.m. - 6:45 p.m. Rogers Observatory & Sleeping Bear Dunes – Platte River Point

----- Star Parties -----

Rogers Observatory star parties for the rest of 2014: 9/5, 9/20, 10/4, 10/18, 11/7, 11/15, 12/5. Eclipses: 10/8 lunar a.m., 10/23 solar p.m.

Sleeping Bear Dunes star parties for the rest of 2014: 9/13, 10/21. Eclipses: 10/8 lunar a.m., 10/23 solar p.m.

----- Some of the best objects for public viewing in September -----

Planetary Object(s): Mars, Saturn

Deep Sky Object, description, constellation, distance	Rt. Asc.	Declin.
	hr. min.	° ' "
M 13: Great Hercules globular cluster, Her, 25k l.y.	16 41.7	+36 28
M 57: Ring Nebula (planetary), Lyr, 1500 l.y.	18 53.6	+33 02
Alberio (β Cygni): Gold and blue double star, Cyg, 160 l.y., actual separation = 400b miles	19 30.3	+27 43
M 11: A great open (galactic) star cluster, Sct, 5.5k l.y.	18 50.0	-06 16
M 27: Dumbbell nebula (planetary), Vul, 900 l.y.	19 58.8	+22 43
M 8: Lagoon Nebula (Emission Nebula) with cluster NGC 6530, Sgr, about 5K l.y.	18 03.8	-24 23
M 16: Cluster and Eagle Nebula, Ser, 8k l.y.	18 18.8	-13 47
M 17: Swan Nebula (a.k.a. Horseshoe and Omega), Sgr, 5.7k l.y.	18 20.8	-16 11
M 22: Bright, large globular cluster, Sgr, 10.6k l.y.	18 36.4	-23 54

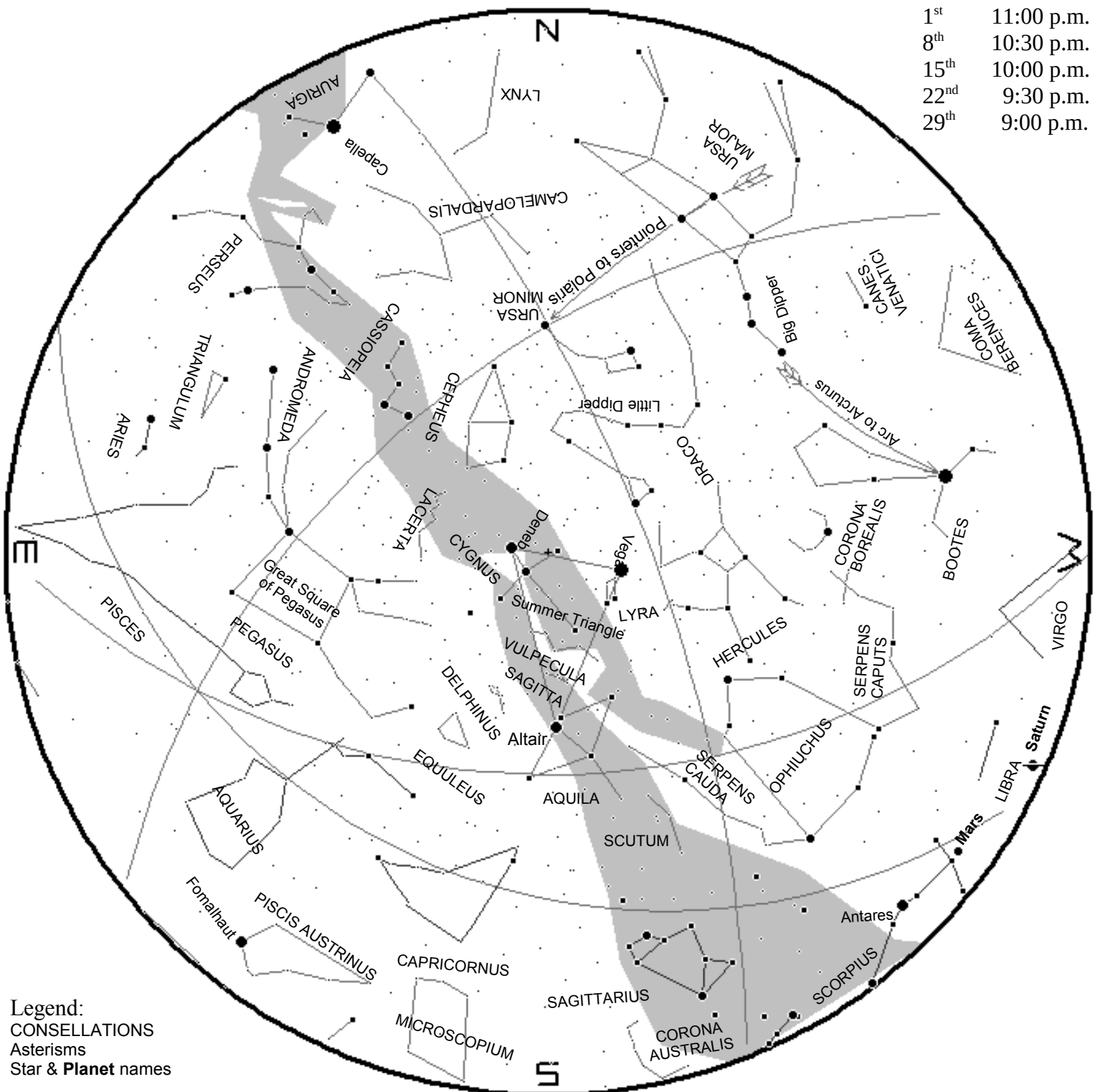
Note: The rest of the objects for viewing are located in the emailed edition of the Stellar Sentinel.

The Stars and Planets for September 2014

By Bob Moler

Planets are plotted for mid month. The star positions are correct for:

1 st	11:00 p.m.
8 th	10:30 p.m.
15 th	10:00 p.m.
22 nd	9:30 p.m.
29 th	9:00 p.m.

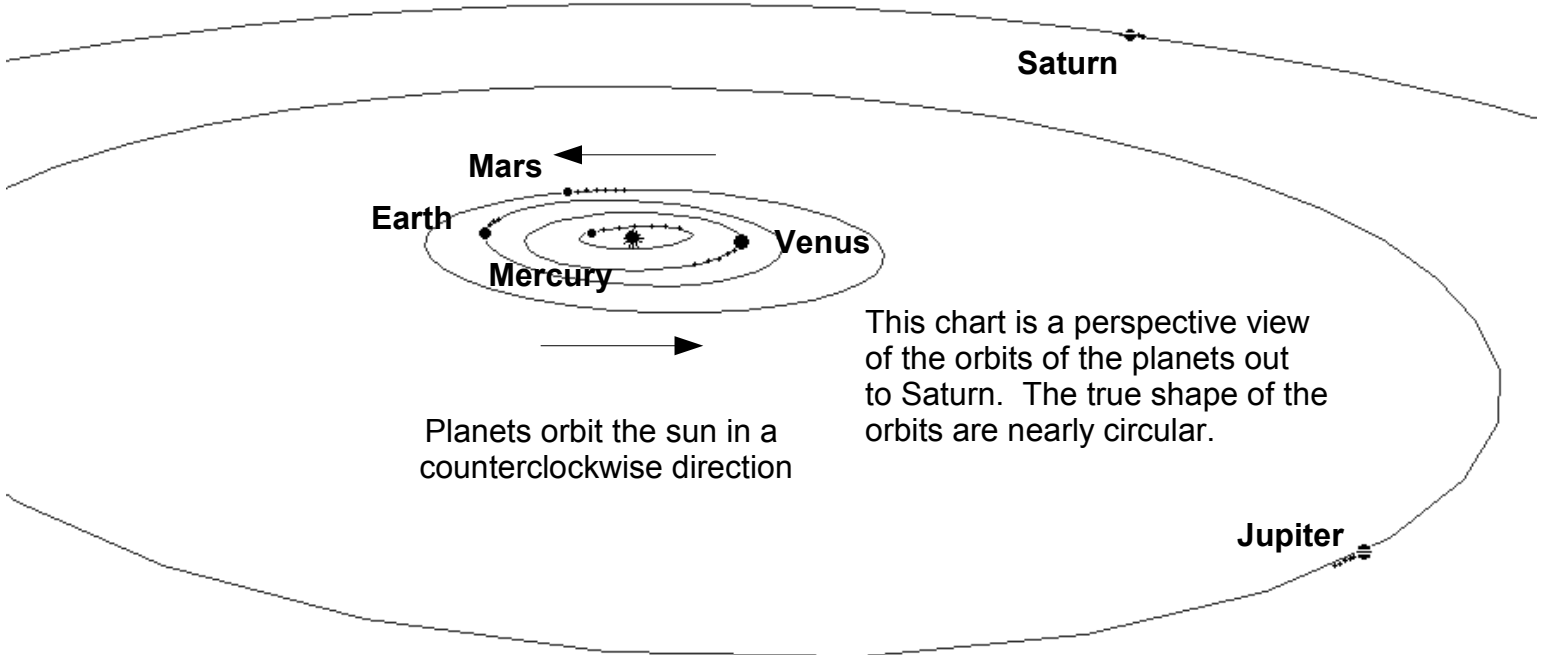


Legend:
 CONSELLATIONS
 Asterisms
 Star & Planet names

September is second only to August as the greatest month to view the stars, in my humble opinion. That's because summer Milky Way extends to the south southwestern horizon showing us still the great star fields in Sagittarius and Scutum. A pair of binoculars are all that is necessary to scan the milky band for deep sky wonders such as star clusters and nebulae, both bright and dark. Chart time at mid month is 10 p.m. in tune with the sunset and twilight end times which are decreasing. This will soon give us colder weather, but for now it gives us darker skies at a reasonable hour. At chart time Saturn and Mars will be very low in the southwest. On the 27th Mars will be directly north of Antares, the "Rival of Mars".

The Naked Eye Planets

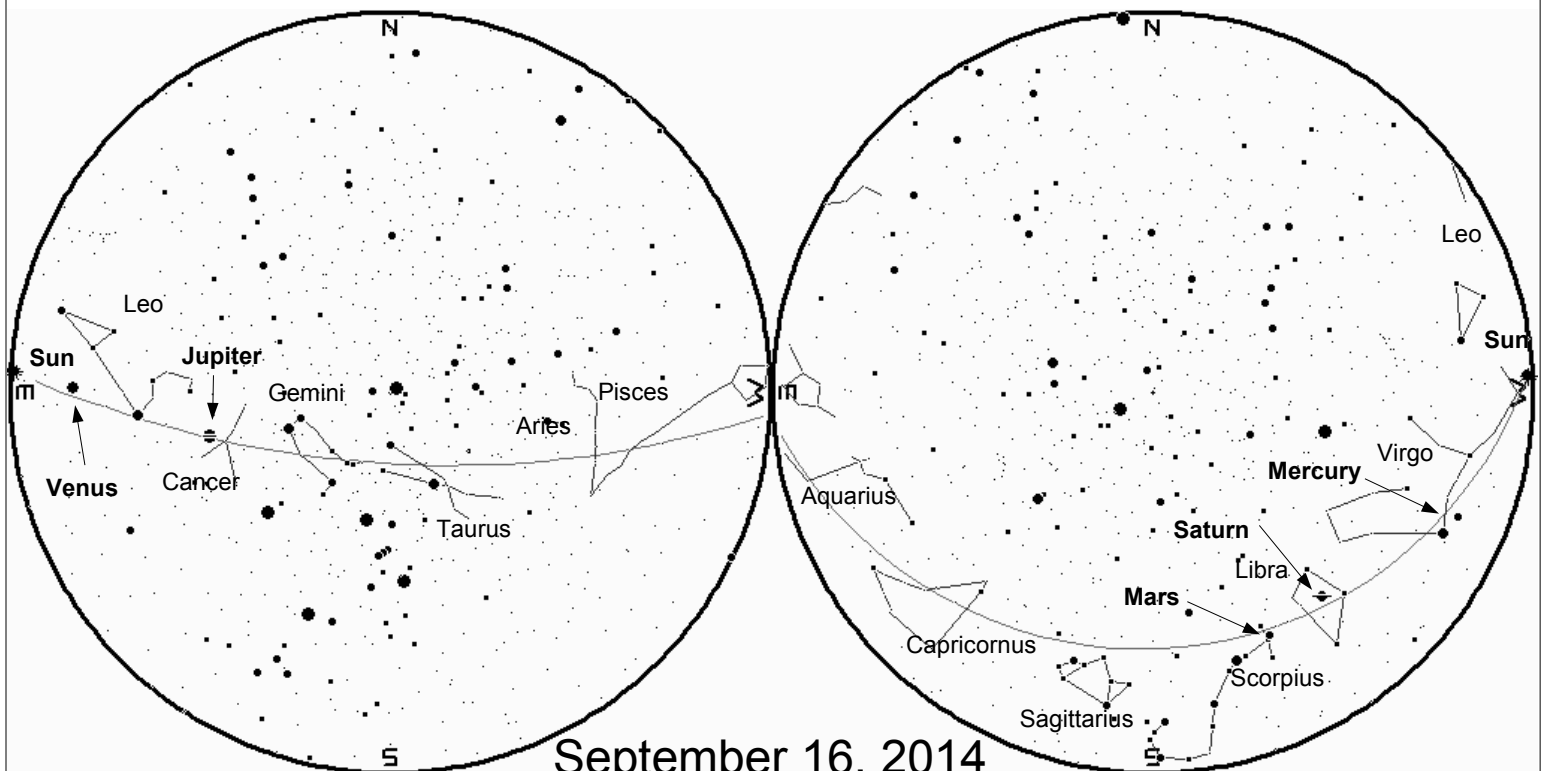
September 1st, 6th, 11th, 16th, 21st, 26th, & October 1st



The Planets as Seen From Northern Michigan

Sunrise

Sunset

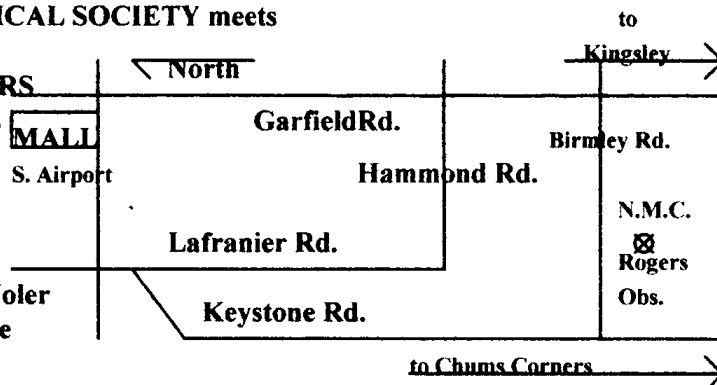


CELESTIAL CALENDAR

Sep 02	7:11 a.m.	FIRST QUARTER MOON
05	4 p.m.	Venus at Perihelion
05	7 p.m.	GTAS Board Meeting
05	8 p.m.	GTAS Monthly Meeting
05	9 p.m.	Star Party at NMC Observatory
06	9 p.m.	International Observe the Moon Night @ Front St, T.C.
07	11:29 p.m.	Moon at Perigee: 358388 km
08	9:38 p.m.	FULL MOON Harvest Moon
11	3:32 a.m.	Moon at Descending Node
11	6 p.m.	Mercury at Aphelion
13	9 p.m.	Star Party @ Sleeping Bear Dunes Dune Climb
14	9:01 p.m.	Aldebaran 1.4°S of Moon
15	10:05 p.m.	LAST QUARTER MOON
20	6:39 a.m.	Jupiter 5.4°N of Moon
20	9:56 a.m.	Mercury 0.5°S of Spica
20	10 a.m.	Leland Heritage Celebration @ Leland
20	10:22 a.m.	Moon at Apogee: 405846 km
20	9 p.m.	Star Party at NMC Observatory
21	2:52 p.m.	Regulus 4.7°N of Moon
21	6 p.m.	Mercury at Greatest Elongation: 26.4°E
22	10:30 p.m.	Autumnal Equinox
24	2:14 a.m.	NEW MOON
25	1:41 p.m.	Moon at Ascending Node
25	8:48 p.m.	Spica 2.6°S of Moon
26	5:32 a.m.	Mercury 4.2°S of Moon
27	10 a.m.	Acme Fall Festival, Acme
28	12:46 a.m.	Saturn 0.8°S of Moon: Occn.
28	2:26 a.m.	Mars 3.0°N of Antares
29	1:01 p.m.	Mars 5.6°S of Moon

Calendar of Astronomical Events Courtesy of Fred Espenak, www.AstroPixels.com

The GRAND TRAVERSE ASTRONOMICAL SOCIETY meets on the first Friday of each month at the NORTHWESTERN MICHIGAN ROGERS OBSERVATORY at 8 p.m. The public is invited to attend all Society functions as our guests. We are a non-profit group dedicated to the study of astronomy and the sky above us. If you would like more information on GTAS, please call Bob Moler at 946-8649, or write to the address on the last page of this publication.



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The Stellar Sentinel

Bob Moler, Editor

6003 Secor Rd.

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This Month's Space Place Article



Droughts, Floods and the Earth's Gravity, by the GRACE of NASA

By Dr. Ethan Siegel

When you think about gravitation here on Earth, you very likely think about how constant it is, at 9.8 m/s^2 (32 ft/s²). Only, that's not quite right. Depending on how thick the Earth's crust is, whether you're slightly closer to or farther from the Earth's center, or what the density of the material beneath you is, you'll experience slight variations in Earth's gravity as large as 0.2%, something you'd need to account for if you were a pendulum-clock-maker.

But surprisingly, the amount of *water content* stored on land in the Earth actually changes the gravity field of where you are by a significant, measurable amount. Over land, water is stored in lakes, rivers, aquifers, soil moisture, snow and glaciers. Even a change of just a few centimeters in the water table of an area can be clearly discerned by our best space-borne mission: NASA's twin Gravity Recovery and Climate Experiment (GRACE) satellites.

Since its 2002 launch, GRACE has seen the water-table-equivalent of the United States (and the rest of the world) change significantly over that time. Groundwater supplies are vital for agriculture and provide half of the world's drinking water. Yet GRACE has seen California's central valley and the southern high plains rapidly deplete their groundwater reserves, endangering a significant portion of the nation's food supply. Meanwhile, the upper Missouri River Basin—recently home to severe flooding—continues to see its water table rise.

NASA's GRACE satellites are the only pieces of equipment currently capable of making these global, precision measurements, providing our best knowledge for mitigating these terrestrial changes. Thanks to GRACE, we've been able to quantify the water loss of the Colorado River Basin (65 cubic kilometers), add months to the lead-time water managers have for flood prediction, and better predict the impacts of droughts worldwide. As NASA scientist Matthew Rodell says, "[W]ithout GRACE we would have no routine, global measurements of changes in groundwater availability. Other satellites can't do it, and ground-based monitoring is inadequate." Even though the GRACE satellites are nearing the end of their lives, the GRACE Follow-On satellites will be launched in 2017, providing us with this valuable data far into the future. Although the climate is surely changing, it's water availability, *not* sea level rise, that's the largest near-term danger, and the most important aspect we can work to understand!

Stellar Sentinel Extras for September 2014

Learn more about NASA's GRACE mission here: http://www.nasa.gov/mission_pages/Grace/

Kids can learn all about launching objects into Earth's orbit by shooting a (digital) cannonball on NASA's Space Place website. Check it out at: <http://spaceplace.nasa.gov/how-orbits-work/>

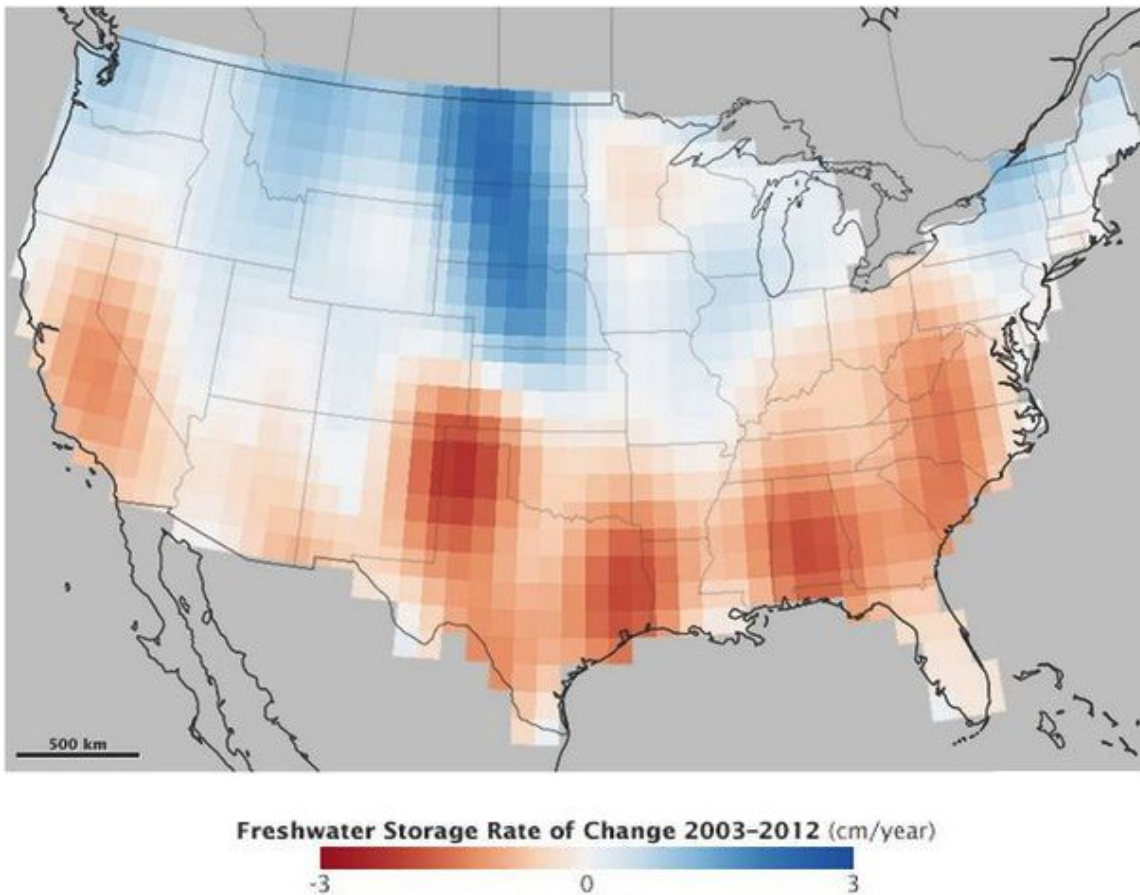


Image credit: NASA Earth Observatory image by Jesse Allen, using GRACE data provide courtesy of Jay Famigleitti, University of California Irvine and Matthew Rodell, NASA Goddard Space Flight Center. Caption by Holli Riebeek.

Stellar Sentinel Extras for September 2014

Some of the best objects for public viewing in September

Planetary Object(s): Mars, Saturn (very early)

Deep Sky Object, description, constellation, distance	Rt. Asc.	Declin.
	hr. min.	° ' "
M 13: Great Hercules globular cluster, Her, 25k l.y.	16 41.7	+36 28
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Alberio (β Cygni): Gold and blue double star, Cyg, 160 l.y., actual separation = 400b miles	19 30.3	+27 43
M 11: A great open (galactic) star cluster, Sct, 5.5k l.y.	18 50.0	-06 16
M 27: Dumbbell nebula (planetary), Vul, 900 l.y.	19 58.8	+22 43
M 8: Lagoon Nebula (Emission Nebula) with cluster NGC 6530, Sgr, about 5K l.y.	18 03.8	-24 23
M 16: Cluster and Eagle Nebula, Ser, 8k l.y.	18 18.8	-13 47
M 17: Swan Nebula (a.k.a. Horseshoe and Omega), Sgr, 5.7k l.y.	18 20.8	-16 11
M 22: Bright, large globular cluster, Sgr, 10.6k l.y.	18 36.4	-23 54
M 31: Great Andromeda Galaxy, And, 2.3m l.y.	00 42.7	+41 16
M52: Rich open cluster, Cas, 5.5k l.y.	23 24.2	+61 35
Almach (γ Andromedae): Yellow and greenish-blue double star, And, 260 l.y.	02 03.2	+42 17
γ & δ Persei: Double Cluster, Per, 7k l.y.; γ Per, 8.1k l.y.	02 20.0	+57 08
M 2: Globular cluster, Aqr, 50k l.y.	21 33.5	-00 49
M 15: Compact globular cluster, Peg, 34-39k l.y.	21 30.0	+12 10

Mars and its rival get together on the 27th

The planet Mars will officially be in conjunction with the star Antares, “The Rival of Mars” in color on September 28th, early in the morning, which makes the evening of the 27th the best time to see them at their closest. Mars will be a bit more than 3 degrees above and right of Antares. Both are nearly the same magnitude, but Antares will appear a bit dimmer because it's lower in the sky. At 8:30 p.m. Antares will be about 10 degrees altitude in the west southwest. The moon will be a thin crescent.



Mars and Antares at 8:30 p.m. September 27 from the Grand Traverse area. Created using Stellarium.