

Mount Diablo Astronomical Society

Diablo Moon Watch

August 2014

GENERAL MEETING

Tuesday August 26, 2014

Keck Ten Meter Telescope Primary Mirror

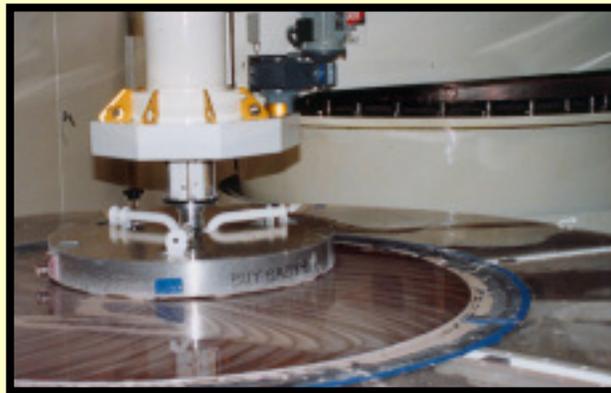
by Jim Morton, Tinsley-Keck SMP Program Manager

Doors open at 6:45 p.m.
Lindsay Wildlife Museum
1931 First Avenue,
Walnut Creek, CA 94597

Please park East of the
museum, follow the
instructions on the last page

W.M. Keck Ten Meter Telescope Primary Mirror Segment Stress Mirror Polishing (SMP); a history of the SMP process as developed in conjunction with Morton Engineering and Tinsley Laboratories, Inc.

In the late 1980's, Tinsley Laboratories Inc. (Tinsley) was contracted by CARA (California Astronomical Research Associates) to become a second supplier of Keck 10 Meter Telescope primary mirror tiles.



The primary mirror segment tiles were to be completed through fully polished and figured round segments. The RMS surface figuring tolerance for front side surface was to be less than

250nm while the segment was completed through a polished roundel. To achieve a relatively rapid schedule for grinding, polishing and figuring for the front side surface of the mirror tiles achieving the 250nm RMS figuring objective, Tinsley was to utilize a newly developed

technique for aspheric surfacing of thin shell optics, branded by CARA as "Stress Mirror Polishing" (SMP).

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WHAT'S UP

Ancient Megalithic Observatories

by Kent Richardson

Everyone has heard of Stonehenge, but ancient megalithic "observatories" abound on all continents except Antarctica. We'll take a look at several and consider what archeologists and explorers have thought about their use by their builders.

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/s² (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,

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PRESIDENT'S CORNER

This Month's Club News and Commentary

by Jim Head

The summer Monsoons are back, nevertheless, we had a good time dodging clouds at the Family Camp Out in Moraga, most everyone had a chance to see Saturn but not much else, the same conditions were reported for our Society Night on Mt. Diablo, those at Lick said it opened up later into the night. It was mostly clear at the start of last

Saturday's public night, then clouds rolled in. It was well attended with many curious folks, many saw the ISS pass close to the Moon.

Upcoming events:

Yosemite Weekend Aug 15-16, Bridalveil Creek Campground just opened after being used as a fire base. Check for alerts and other information on the campground at <http://www.nps.gov/yose/planyourvisit/bvcamp.htm>

Imaging meeting 8/21. The next Society night is August 23rd, then come out and help for Solar Sunday at the Lindsay Wildlife Museum, August 24th from 1:00 p.m. to 4:00 p.m.

Then don't miss the General Meeting at the Lindsay Wildlife Museum Aug, 26th.

Our next Public Night is August 30th, we could use help parking cars at the start. This

might be the last Public Night of this year to have good view of Saturn, by the time of our next Public Night on Sep. 27th Saturn will be very low in the sky soon after sunset.

Hope to see you out there!

Jim



Images from the 2014 Golden State Star Party, taken by Lance Schlichter.

Keck Ten Meter Telescope Primary Mirror *(Continued from page 1)*

The requested timeline for the Tinsley-Keck M1 segment SMP program to design and construct a SMP facility was “as soon as possible” (ASAP). The ASAP timeline was critical in order to bring the delivery of Keck primary segments back on track with the overall telescope construction schedule. The Tinsley team looked to design, fabricate and qualify the SMP facility within 12 months of contract award. With the overall primary mirror segment production schedule driving the ASAP need, a computer controlled “turntable-less” grinding / side polishing machine was developed and qualified for use on the Keck segment blanks.

While processing Keck 1 M1 segments, Tinsley-Keck staff continued to improve details of the SMP process to a point where delivery timelines were able to be

tightly predicted. By the time that processing of Keck II M1 began, delivery of SMP completed Keck segment rounds were scheduled to occur within a few calendar days of the target. Review of the Tinsley Keck Phase 2 production schedule demonstrates a process capable and stable aspheric optical surfacing process. Jim Morton is the managing partner for Morton Engineering, a San Francisco Bay Area manufacturing engineering consulting firm.

Morton Engineering was formed in 1988 as a small manufacturing engineering and process development consultancy firm.

Following the completion of earlier consulting contracts with Tinsley Laboratories, Inc., Morton Engineering was engaged as mechanical design engineer to develop fixtures and the dedicat-

ed grinder / polisher machine needed for production surfacing for the W.M. Keck Telescope primary mirror tile segments. Upon completion of the fixture and polishing machine design, Mr. Morton advanced into the role of SMP operations manager for the Tinsley - Keck Stress Mirror Polishing facility.

Since Tinsley-Keck SMP project, Mr. Morton has consulted on many more mechanical engineering projects in various industries from electro-mechanical materials handling and instrumentation for the natural sciences, marine navigational hardware, control dynamics and instrumentation for automotive motor-sports.

Mr. Morton holds a Bachelors’ of Science degree in Mechanical Engineering from the University of California at Davis.



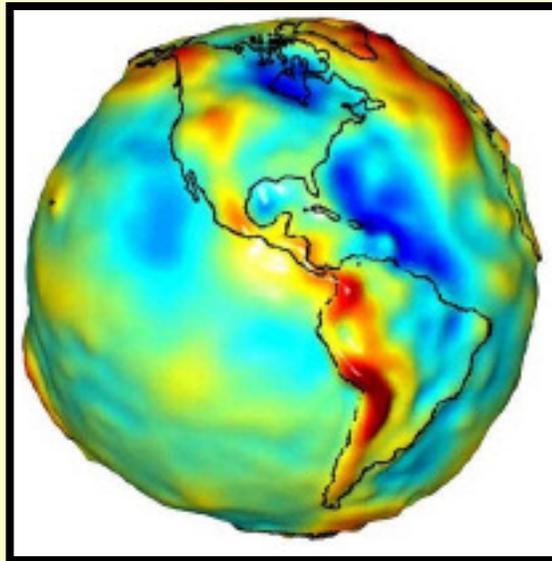
Droughts, Floods and the Earth's Gravity, by the GRACE of NASA (Continued from page 1)

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



GRACE's plot of gravity over the Americas

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!

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

Rosetta Arrives at Comet Destination by European Space Agency

After a decade-long journey chasing its target, ESA's Rosetta has today become the first spacecraft to rendezvous with a comet, opening a new chapter in Solar System exploration.

Comet 67P/Churyumov-Gerasimenko and Rosetta now lie 405 million kilometres from Earth, about half way between the orbits of Jupiter and Mars, rushing towards the inner Solar System at nearly 55 000 kilometres per hour.

The comet is in an elliptical 6.5-year orbit that takes it from beyond Jupiter at its furthest point, to between the orbits of Mars and Earth at its closest to the Sun. Rosetta will accompany it for over a year as they swing around the Sun and back out towards Jupiter again.

Comets are considered to be primitive building blocks of the Solar System and may have helped to 'seed' Earth with water, perhaps even the ingredients for life. But many fundamental questions about these enigmatic objects remain, and through a comprehensive, in situ study of the comet, Rosetta aims to unlock the secrets within.

The journey to the comet was not straightforward, however. Since its launch in 2004, Rosetta had to make three gravity-assist flybys of Earth and one of Mars to help it on course to its rendezvous with the comet. This complex course also allowed Rosetta to pass by asteroids



Comet 67P/Churyumov-Gerasimenko on August 3rd 2014

and Lutetia, obtaining unprecedented views and scientific data on these two objects.

"After ten years, five months and four days travelling towards our destination, looping around the Sun five times and clocking up 6.4 billion kilometres, we are delighted to announce finally 'we are here'," says Jean-Jacques Dordain, ESA's Director General.

"Europe's Rosetta is now the first spacecraft in history to rendezvous with a comet, a major highlight in exploring our origins. Discoveries can start."

Today saw the last of a series of ten rendezvous manoeuvres that began in May to adjust Rosetta's speed and trajectory gradually to match those of the comet. If any of these manoeuvres had failed, the mission would have been lost, and the spacecraft would simply have flown by the comet.

"Today's achievement is a result of a huge international endeavour spanning several decades," says Alvaro Giménez, ESA's Director of Science and

Robotic Exploration.

"We have come an extraordinarily long way since the mission concept was first discussed in the late 1970s and approved in 1993, and now we are ready to open a treasure chest of scientific discovery that is destined to rewrite the textbooks on comets for even more decades to come."

Comet activity on 2 August 2014

The comet began to reveal its personality while Rosetta was on its approach. Images taken by the OSIRIS camera between late April and early June showed that its activity was variable. The comet's 'coma' - an extended envelope of gas and dust - became rapidly brighter and then died down again over the course of those six weeks. In the same period, first measurements from the Microwave Instrument for the Rosetta Orbiter, MIRO, suggested that the comet was emitting water vapour into space at about 300 millilitres per second.

Meanwhile, the Visible and Infrared Thermal Imaging Spectrometer, VIRTIS, measured the comet's average temperature to be about -70°C, indicating that the surface is predominantly dark and dusty rather than clean and icy.

Then, stunning images taken from a distance of about 12 000 km began to reveal that the nucleus comprises two distinct segments joined by a 'neck', giving it a duck-like appearance. Subsequent images showed more

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Rosetta Arrives at Comet Destination *Continued from page 5.*

and more detail – the most recent, highest-resolution image was downloaded from the spacecraft earlier today and will be available this afternoon.

“Our first clear views of the comet have given us plenty to think about,” says Matt Taylor, ESA’s Rosetta project scientist.

“Is this double-lobed structure built from two separate comets that came together in the Solar System’s history, or is it one comet that has eroded dramatically and asymmetrically over time? Rosetta, by design, is in the best place to study one of these unique objects.”

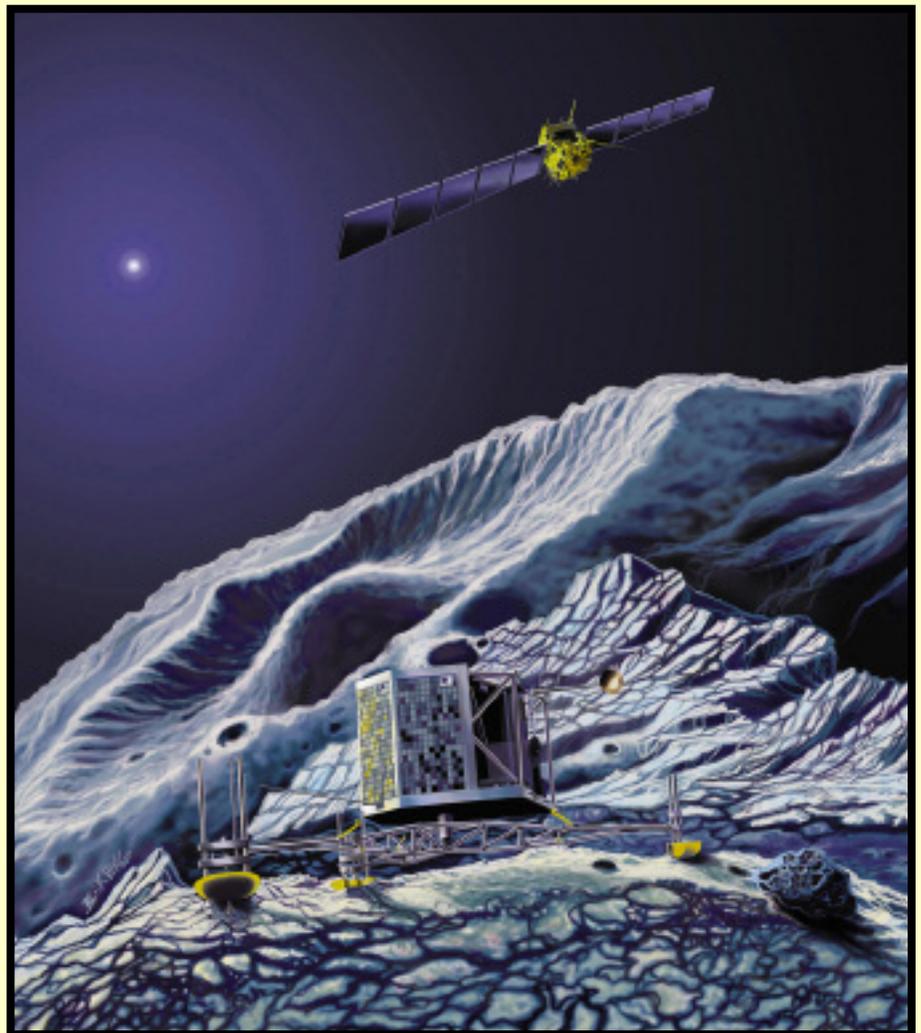
Arriving at a comet

Today, Rosetta is just 100 km from the comet’s surface, but it will edge closer still. Over the next six weeks, it will describe two triangular-shaped trajectories in front of the comet, first at a distance of 100 km and then at 50 km.

At the same time, more of the suite of instruments will provide a detailed scientific study of the comet, scrutinising the surface for a target site for the Philae lander.

Eventually, Rosetta will attempt a close, near-circular orbit at 30 km and, depending on the activity of the comet, perhaps come even closer.

“Arriving at the comet is really only just the beginning of an even bigger adventure, with greater challenges still to come as we learn how to operate in this



Artist rendition of probe resting Comet 67P/Churyumov –Gerasimenko

unchartered environment, start to orbit and, eventually, land,” says Sylvain Lodiot, ESA’s Rosetta spacecraft operations manager.

As many as five possible landing sites will be identified by late August, before the primary site is identified in mid-September. The final timeline for the sequence of events for deploying Philae – currently expected for 11 November – will be confirmed by the middle of October.

“Over the next few months, in

addition to characterising the comet nucleus and setting the bar for the rest of the mission, we will begin final preparations for another space history first: landing on a comet,” says Matt.

“After landing, Rosetta will continue to accompany the comet until its closest approach to the Sun in August 2015 and beyond, watching its behaviour from close quarters to give us a unique insight and realtime experience of how a comet works as it hurtles around the Sun.”

Mount Diablo Astronomical Society Event Calendar–August 2014

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2 7:30 PM Public Astronomy Rocks
3 sunset: 18:54	4	5	6	7	8	9
10 sunset: 18:45	11 7:30 PM Board Meeting (Private)	12	13	14	15 7:00 PM Yosemite Astronomy	16 7:00 PM Yosemite Astronomy 7:00 PM Observatory
17 sunset: 18:36	18	19	20	21 7:00 PM MDAS Imaging Meeting (Private)	22	23 7:30 PM Society Observing (Private)
24 1:00 PM Solar at the LWM sunset: 18:26	25	26 7:15 PM GenMtg: The Keck telescope	27	28	29	30 7:00 PM Public Astronomy: MilkyV
31 sunset: 18:15						

Mount Diablo Astronomical Society Event Calendar—September 2014

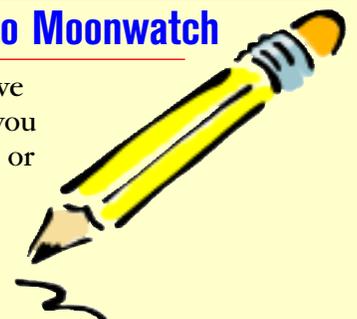
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
7 sunset 18:04	8 7:30 PM Board Meeting (Private)	9	10	11	12	13 7:00 PM Observatory Maintenance (Private)
14 sunset 17:53	15	16	17	18 7:00 PM MDAS Imaging Meeting (Private)	19	20 7:00 PM Society Observing (Private)
21 sunset 17:41	22	23 7:15 PM GenMtg: Lord Rosse	24	25	26	27 6:30 PM Public Astronomy: Super
28 sunset 17:29	29	30				

Share your news with other members through the Diablo Moonwatch

We are always looking for new articles, images or photos and content. If you have astronomical perspectives or experiences to share with your fellow members that you would us to consider, please feel free to contact me Jim (jamesnhead@comcast.net) or our newsletter editor Vianney. (veloroute@hotmail.com)

Clear skies!

Jim and Vianney



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MDAS

P.O. Box 4889

Walnut Creek, CA 94596-3754

General Meetings:

Fourth Tuesday every month,
except on the third Tuesday in
November and December.

Refreshments and conversations at 6:45 pm;

Meeting begins at 7:15

Where:

Lindsay Wildlife Museum

1931 1st Avenue

Walnut Creek, CA 94597

(925) 935-1978

wildlife-museum.org.

Directions to facility:

From the North: Take 680 South to Treat Blvd.
exit. Turn left at light onto North Main St. Turn
right on Geary Road. Turn left on Buena Vista.

Turn right on First Avenue. The museum is
halfway up the block on the left.

From the South: Take 680 North. Take the Treat
Blvd./Geary Road exit and turn left over free-
way. Go three more lights and turn left on
Buena Vista. Turn right on First Avenue. The
museum is halfway up the block on the left.

Parking:

The museum is located in a residential area.
There are no parking fees nor meters. Please
park only in the museum parking lots on the
east side of the museum, the Friends Church lot
across the street (except Sunday mornings) or
on Buena Vista Avenue. Please do not park on
First Avenue in front of our neighbors' homes
— you will get a parking ticket.

