

Mount Diablo Astronomical Society

Diablo Moon Watch

March 2014

GENERAL MEETING

Tuesday March 25, 2014

Numerical Simulations of Galaxies

Past, Present, Future

By Dr. Robert Feldmann

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

Numerical simulations have proven to be an essential tool for the study of galaxies.

I will review the early successes and failures of numerical methods and shed light on the inner workings of simulations. I will demonstrate their wide applicability by studying selected scientific problems in the field of galaxy evolution. Finally, I will highlight current challenges faced by the numerical approach and discuss how they may be overcome.

Dr. Robert Feldmann is a post-doctoral researcher at the University of California, Berkeley. He obtained his PhD at the ETH Zurich (Switzerland) in 2009 for studying the evolution of massive galaxies in the early Universe with the help of numerical simulations. From 2009 to 2012 he worked as Research



Associate at the Fermi National Accelerator Laboratory, near Chicago, investigating the interstellar medium in galaxies from a theoretical perspective. Dr Feldmann arrived at UC Berkeley in 2012 and since then has continued his numerical work on the evolution of galaxies.

European Space Agency Selects Planets-Hunting Plato Mission

A space-based observatory to search for planets orbiting alien stars has been selected today as ESA's third medium-class science mission. It is planned for launch by 2024.

The PLATO - Planetary Transits and Oscillations of stars - mission was selected by ESA's Science

Programme Committee for implementation as part of its Cosmic Vision 2015-25 Programme.

The mission will address two key themes of Cosmic Vision: what are the conditions for planet formation and the emergence of life, and how does the Solar System work?

PLATO will monitor relatively nearby stars, searching for tiny, regular dips in brightness as their planets transit in front of them, temporarily blocking out a small fraction of the starlight.

By using 34 separate small telescopes and cameras, PLATO will search for planets around up to a million stars spread over half of the sky.

It will also investigate seismic activity in the

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WHAT'S UP

Recent Solar Eclipses

By Robert Minor

The Solar Eclipse of November 2013 was a "hybrid" eclipse. It started out as an annular eclipse at sunrise and became a short duration total

(Continued on page 11)

PRESIDENT'S CORNER

This month's Club News and Commentary

by Jim Head

New Cosmos Series

Did you hear that a new Cosmos series is set to begin March 9th, with Neil deGrasse Tyson as narrator? Ann Druyan wrote the final drafts for the 13 part series, Tyson's wit is a perfect fit for our times, when Carl Sagan first brought this series to television 34 years ago, it brought much of the public up-to-date with current developments in astronomy, I strongly encourage everyone to get out the word to your friends and teachers to tune in to what should be an entertaining opportunity to learn more about our incredible Universe.

First Human Landing on Mars?

Almost as exciting, we came close to having our first human landing on Mars! Recently at a local elementary school, a student was examining the 3D posters of Mars (courtesy of NASA/JPL), when she got to the image of Victoria Crater, she kept looking closer and closer, then fell into the display, knocking down the easels that held the smaller 3D posters, Touchdown! She was a bit surprised, then embarrassed, but seemed to enjoy the experience!

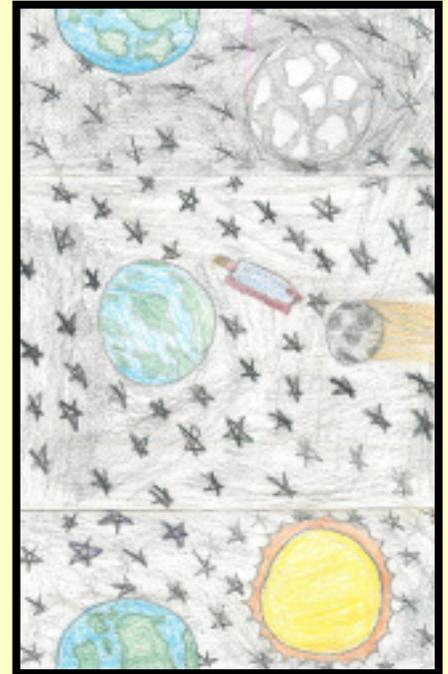
Upcoming Events

There's an exciting season ahead, first, if you're available, come out and help with our pub-

lic stargazing event at Old Ranch Park this Friday, March 7th, last year we had a huge crowd, partly as a result of the Chelyabinsk Meteor burst earlier in the day, along with the close flyby of asteroid 2012 DA., however, our events in San Ramon have always been well-attended so we probably could use extra help. In addition to the telescope setups, we'll need help passing out flyers and answering questions about our club. Stay tuned for other upcoming events in the lowlands, we plan a date in May at the Muir Heritage Land Trust's Fernandez Ranch, and another evening at Larkey Park with participation from the Lindsay Wildlife Museum.

This Saturday, March 8th, the San Francisco Amateur Astronomers plan a John Dobson Memorial program at Land's End / Pt. Lobos starting at 12 Noon. I plan to setup a Solar Scope along with a few others, everyone is welcome. Complete event information is at <http://www.sfaa-astronomy.org/>

We have a great lineup for our Public Night programs this year. Our first public night of the year is March 22. The park has rearranged the area nearby the restrooms, where our visitors used to park, now, it's a very nice picnic area. There are only a few parking spaces there, many of our visitors will have to park along the bushes at the east side of our telescope setup area. We will need extra help with parking. The following month is the Mt. Diablo



State Park's 100th Birthday party, on April 26th, we plan to setup solar scopes during the day, and follow up with a Public Night that evening. We'll have two society nights in May, a Public night during the 4th of July weekend on July 5th, then two Public nights in August. Next October 23rd we hope to see a partial solar eclipse.

Outreach Awards and Recognition

At our next meeting we'll pass out the NightSky Network award pins, thanks to Marni and all other outreachers for working with NSN props, if you setup a telescope or helped at 5 or more of our events with NSN activities during 2013, you qualify to receive this award. This year there were 27 members in this group, a new record high. Thank you everyone. Also, I'd like to thank the Ruhl family, for making poster stands for

(Continued on page 3)

A collection of news and events *(Continued from the previous page)*

use at our outreach events, Sheri and Jason, along with their son, often helped at our events, we wish them well at their new location in Texas.

Our club purchased a new Public Address system, Mike Lewis was instrumental in helping us choose a suitable setup, with two wireless microphone channels, and many inputs to accept various sources, the sound is clearer, and the entire setup is portable for field work (with adequate power supply). Thanks Mike

The Mt. Diablo astronomical Society was one of the clubs that nominated Richard Ozer for this year's Western Astronomer's Association G. Bruce Blair Award, given to those who made an important contribution to amateur astronomy. Richard has contributed much to the benefit of amateur astronomers over many years and in a wide area, heading up the Telescope Maker's Workshop at Chabot, was instrumental in setting up the library for amateur astronomers, was the



continues to produce the wonderful event each year, helps run the Mt. Diablo Observatory Association's Turn-Key Observatory on Mt. Diablo, is a productive liaison with the Mt. Diablo State Park, provided invaluable business advice and helped run the finances of the Astronomical Association of Northern California, the Eastbay Astronomical Society, the Mt.

Diablo Astronomical Society, and the Mt. Diablo Observatory Association. He's also been involved with judging the telescopes for the RTMC Merit Awards, given out during RTMC at Camp

he has assisted or encouraged thousands of amateur astronomers through the years, it is our belief that this is the least we could do to honor Richard Ozer for his public service. The WAA agreed and awarded the G. Bruce Blair Award to Richard last month.

NightSky Network Resources

It is worth mentioning that results from the Hubble and the Herschel Space Telescopes provide clues that infer Ceres might have as much or more fresh water than what is found here on planet Earth, read more about the water content in our solar system in a feature story at the Night Sky Network, learn how to spot Ceres in a telescope, and imagine what the Dawn mission might find when it visits the watery rock next year. See this and other news stories at

<https://nightsky.jpl.nasa.gov/news-archive.cfm>

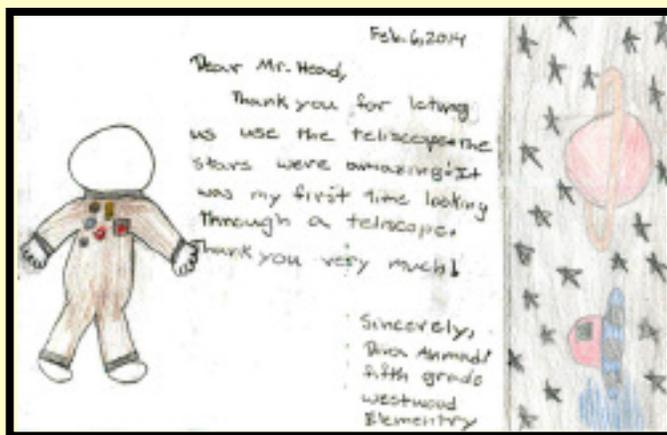
Have you seen the new Discovery Guides on the Night Sky Network? There's a guide for each month of the year that serves as a great introduction to the night sky.

http://nightsky.jpl.nasa.gov/news-display.cfm?News_ID=611

Here's a handy page for planning a night's observation, <https://nightsky.jpl.nasa.gov/planner.cfm>

Thanks for reading this month's Moonwatch, we hope you enjoy our member's contributions.

Jim Head



key player in starting up the annual Golden State Starparty and con-

Oak's YMCA Camp outside of Big Bear Lake, California. Altogether

Free and cheap astrophotography software

By Stuart Forman

The astrophotography community is pretty small and vendors are all vying for your money.

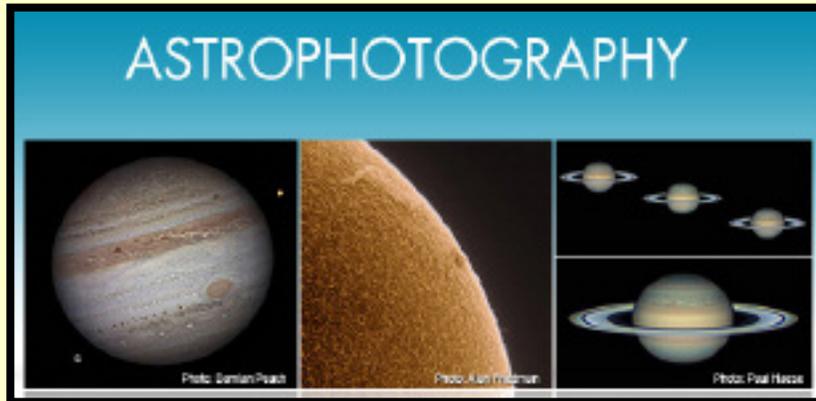
If you open up any astronomy magazine you'll see bright glossy photos of very cool new equipment that YOU want to buy. Software manufacturers are no different. Astrophotography requires software, and software costs money. It's really easy to hit that Paypal link and buy a new piece of software, but there are very inexpensive and sometimes free good alternatives and that's what I would like to discuss this month. My goal is to give you an idea of what software is available for less than \$100. Unfortunately, this article is only for Windows users; I don't own a Mac and I don't know the software.

There are actually many astronomy software programs that are available for free, especially for planetary work that you can hook up to a webcam. These are all free programs:

Registax is free image processing software that works particularly well with .avi files that are downloaded from webcams. It's not an easy program to learn but with the updated version 6 it's relatively plug and play. You take your webcam video of a solar system object, reject the bad frames, and align and stack the good ones. Then you can apply wavelet processing, color balancing, and then export to another program. Often, though, the results are fine right out of Registax. <http://www.astronomie.be/registax/>

AVI stacker is a similar program like Registax, but my friends who do planetary like it much better because it can handle multiple files. Damien Peach uses AVI stacker. <http://www.avistack.de/>

And while we're on the subject of planetary capture, my planetary and solar friends highly recommend Firecapture. They tell me it's easy to set up and use. <http://firecapture.wonderplanets.de/>



Do you want to get more out of Jupiter than just a few moments because of planetary rotation? WinJupos is an outstanding tool (also used by Peach) to derotate the planet. If you're interested in more information on this, my friend Mike

Phillips has some tutorials on his youtube page. Just contact me and I can point you to them. <http://jupos.org/gh/download.htm>

But what about imaging the deep sky? The program that pretty much every astrophotographer cuts their teeth on is the utterly outstanding Deep Sky Stacker. DSS is an incredibly powerful program and has a lot going on "under the hood" but on the surface, it's pretty much plug and play. You load up your calibration and light frames, push a button, and off you go. It doesn't do any post-processing though, so you will need another program to play with it later. I



Free and cheap astrophotography software *(Continued from the previous page)*

can't recommend this program more highly. And did I mention it's free?

<http://deepskystacker.free.fr/english/index.html>

And for guiding, PHD (for "Push Here Dummy") has been updated and open sourced. PHD 2, as it's now called, can be found at <http://openphdguiding.org/> If you've been using PHD 1, its time to switch. It's way better.

For post processing you're going to run into more of an issue finding free programs here, although I do know some people who are

EOS. It will control your camera and perform image acquisition. There are two versions at \$35 and \$50. Poke around the website to see what is right for you.

<http://www.backyardeos.com/>

For monochrome CCD and DSLR image capture, my current favorite program is Sequence Generator Pro. It does everything you would want in image acquisition including total camera and telescope control. And it comes

in just under my \$100 limit at \$99.

http://www.mainsequencesoftware.com/Products/S_GPro

For image processing, Michael Lewis told me about a program called Star Tools, that appears to be an all you need post-processing software solution. The developer is obviously trying to go for the market of people who aren't willing to spend hundreds of dollars on software, as he only \$60.

<http://startools.org/drupal/>

Nebulosity is popular among some although I'm not a fan. Nevertheless, it's inexpensive, it will control your camera, it will stack images and perform some post processing, which is a deal for \$80.

<http://www.stark-labs.com/nebulosity.html>

My last recommendation for this article is my favorite ipad app, Sky Safari, which is actually coming DOWN in price (I paid \$60, it's now \$40 for the full version). My favorite part of this app, is that you can program in your field of view and it will show you exactly what you'll see in your CCD chip.

<http://www.southernstars.com/products/skysafari/>

There are a lot of other programs that are out there, but this is a list of some of my favorite cheap ones. As always, you're welcome to email me with questions or join our imaging group.

S24man@gmail.com

IMAGING MEETING
 Every Third Thursday of every month.
 Walnut Acres Elementary School, room B7



using GIMP. It's recently been upgraded for 16 bit processing. I've never used it, but I'm told that it's akin to Photoshop. <http://www.gimp.org/>

Lastly, for general, "what's in the night sky" type questions, Stellarium is excellent. We use it all the time for demos at our Virtual Star Parties. However, as you will see below, there are some better atlas for image planning if you're willing to pay a little bit. <http://www.stellarium.org/>

What do you get if you're willing to pay a little money?

My favorite low price point program for image acquisition if you have a Canon DSLR, is Backyard

European Space Agency Selects Planets-Hunting Plato Mission *(Continued from page 1)*

stars, enabling a precise characterisation of the host sun of each planet discovered, including its mass, radius and age.

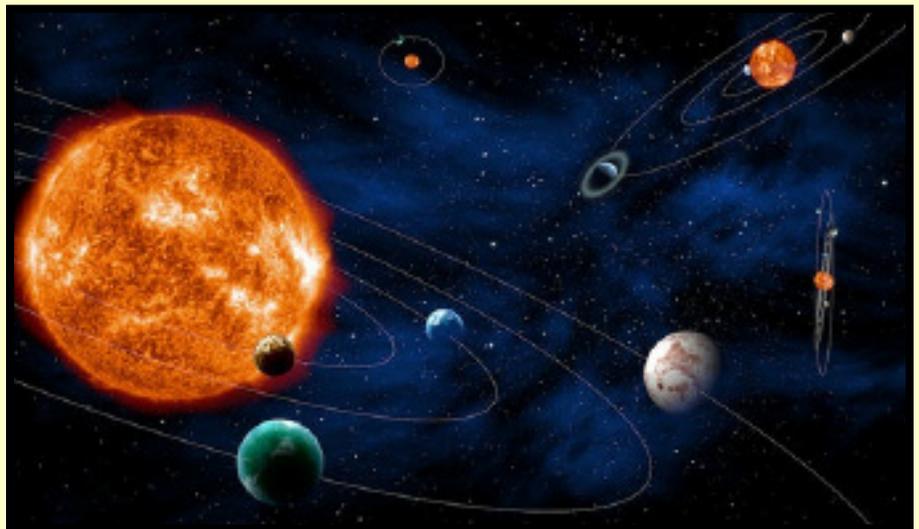
When coupled with ground-based radial velocity observations, PLATO's measurements will allow a planet's mass and radius to be calculated, and therefore its density, providing an indication of its composition.

The mission will identify and study thousands of exoplanetary systems, with an emphasis on discovering and characterising Earth-sized planets and super-Earths in the habitable zone of their parent star – the distance from the star where liquid surface water could exist.

“PLATO, with its unique ability to hunt for Sun-Earth analogue systems, will build on the expertise accumulated with a number of European missions, including CoRot and Cheops,” says Alvaro Giménez, ESA's Director of Science and Robotic Exploration.

Its discoveries will help to place our own Solar System's architecture in the context of other planetary systems.

All M3 mission candidates presented excellent opportunities for answering the major scientific questions that define our Cosmic Vision programme.



The four other mission concepts competing for the M3 launch opportunity were: EChO (the Exoplanet CHAracterisation Observatory), LOFT (the Large Observatory For x-ray Timing), MarcoPolo-R (to collect and return a sample from a near-Earth asteroid) and STE-Quest (Space-Time Explorer and Quantum Equivalence principle Space Test).

PLATO joins Solar Orbiter and Euclid, which were chosen in 2011 as ESA's first M-class missions. Solar Orbiter will be launched in 2017 to study the Sun and solar wind from a distance of less than 50 million km, while Euclid, to be launched in 2020, will focus on dark energy, dark matter and the structure of the Universe.

PLATO will be launched on a Soyuz rocket from Europe's

Spaceport in Kourou by 2024 for an initial six-year mission. It will operate from L2, a virtual point in space 1.5 million km beyond Earth as seen from the Sun.

Data from ESA's recently launched Gaia mission will help PLATO to provide precise characteristics of thousands of exoplanet systems. These systems will provide natural targets for detailed follow-up observations by future large ground- and space-based observatories.

Designing A Zero Expansion Astrograph

By Chris Ford

This is one of a series of periodic articles on the techniques and challenges of astrophotography (aka "imaging") with the goal of sharing individual experiences that describe some of the basic techniques and processes in an easy to understand format. This month we will look at some of the unique challenges of building a specialized imaging telescope or astrograph.

One of the challenges of very long exposure deep sky imaging overnight in California, especially at summer star parties, is dealing with the extensive temperature gradients that can see day-time temperatures of 90 degrees drop to 30 degrees at night. For dedicated imaging astrograph's, even the slightest contraction of the telescope structure can cause a focus shift over multiple exposures resulting in increasingly bloated stars. Certainly regular refocusing, either manually or automatically under software control is an option. The price though is more complexity in the imaging process, and computer assisted

methods are less adaptable to imaging with DSLR's if you do not want to bring a computer into the field.

As one who personally likes to point a telescope at an object, turn on guiding, hit the start button to begin imaging, then go off and do some visual observing for hours without having to even worry about whether or not everything is still in focus, I have undertaken a lot of research into the thermal properties of telescope structures, and whether one can define a specification for a focus-free astrograph.

Many telescopes capable of long exposure astrophotography are constructed of aluminum that



tends to contract notably during significant temperature changes. In general, refractors tend to be more forgiving than cassegrains which are especially prone to temperature induced focus shift and their mirrors can take a lot of time to reach ambient temperature and the right level of correc-

tion. Of course low expansion carbon fibre telescopes are commercially available, but that does not deliver any major benefits if the mirror substrate does not cool at the same rate or there are aluminum components in the chain such as the backplate or even simple fastenings, that contract and expand differentially. Everything is in the fine details and interplay of how all these elements work together as part of a considered overall imaging system and there are surprisingly few if any telescopes available on market that provide a fully satisfactory solution to an all-night zero refocus requirement.

To meet this objective and after considerable deliberation I recently decided to commission a semi-custom astrograph constructed to an extremely high degree of thermal stability, that in principle should never need refocusing throughout a California night. As portability is also a requirement that caps out an instrument in the 14.5" aperture and 50 to 70 pound weight range.

To get to this decision point, I needed to research and evaluate currently available alternatives. Though there are occasional RCOS telescopes on Astromart possessed of a high level of thermal stability and relevant size, as they are now out of business I was highly wary of following this path as there is no future support for the slowly obsolescing electronic and software components. Also Ritchey Chretien astro-

Designing A Zero Expansion Astrograph *(Continued from the previous page)*

graph's are more fiddly to collimate than Corrected Dall Kirkham (CDK) designs in the field. I also looked at the Starizona Hyperion Harmer-Wynne design with its 70mm non-vignetted field and the new 14" Planewave, but I had concerns over some significant structural details after inspecting both designs, especially the differential expansion of mounting plate and main structure which can slightly distort the telescopes optical configuration over long exposures, even under the minute variations induced by a temperature change.

My research eventually led me to start talking to a new company called AG Optical, as I became interested in their very "RCOS like" (and photographically fast) F/6.7 CDK's at the 2400+ mm focal length that I am looking for. In talking to the owner, it quickly became apparent that their expertise and engineering background is particularly in carbon fibre construction, and we started talking about how to make the best possible thermally stable astrograph. Their Facebook page has interesting insight into the fine attention to structural detail: <https://www.facebook.com/AgOpticalSystems>

AG Optical are still fairly new so choosing them to build a custom astrograph contains some risk that has not yet been fully quantified as I have not yet received my astrograph, but I have received excellent reports about the quality of their instruments from other early adopters.

Their optics are also sourced from Ostahowski who has a good reputation, so after a three way-conversation I decided to define a telescope using Ultra Low Expansion (ULE) Zerodur as the primary/secondary substrate rather than quartz for the highest levels of cooling and low expansion properties. (About 1/6th that of quartz and 1/30th that of supremax or pyrex.)

A key design decision was whether to go for a truss or solid tube configuration.

A aluminum truss structure potentially contracts more than a carbon-fiber tube because of the higher CFE (Coefficient of Expansion) of the aluminum components. I suspect that truss structures tend to be more aesthetically attractive to the amateur market as they resemble large observatory instruments and "look" the part. Of course large observatory instruments are built as trusses for proper engineering reasons and because ULE tubes are infeasible at those sizes, but I was not convinced that current commercial truss designs scale down most efficiently to the 14.5" aperture range, where it remains possible to build larger

ultra-low expansion light-weight carbon-fiber tubes and mount them so that there is almost zero differential thermal expansion. It is notable that some other astrographs in the 12" to 14" range are supplied as tubes, but over that size trusses become more attractive as larger carbon-fiber tubes are harder to make. This is where AGO's prior expertise in carbon-fiber sandwich construction really came into play in my decision process as they have their own custom carbon-fiber manufacturing and baking facilities that can create larger instruments, rather than ordering standard tubes from a third party. The result is that an



custom all carbon-fiber tubed 14.5" CDK astrograph is currently being constructed to my specification with the following characteristics:

- 14.5" F/6.7 Corrected Dall Kirkham-

Designing A Zero Expansion Astrograph *(Continued from the previous page)*

- Zerodur primary and secondary mirrors
- Carbon fiber (Nomex sandwich) tube (Almost 1/2" thick!)
- Carbon fibre tube backplate mounted sliding in support ring for zero differential thermal flexure.
- 4 fans spaced around mirror perimeter to draw air out for measurable local seeing improvements
- Standard cooling fans at the rear wired internally to heater/focus controller.
- New general thermal controller allowing autonomous usage in the field without laptop.

This astrograph is not any different in principle to the tubes that have been built for professional optical applications such as air-force tracking telescopes. The structural design at around 66 pounds weight will ideally deliver a zero expansion astrograph requiring little refocusing throughout the night if any. The tube will be about 1/2" thick and so stiff that you should be able to actually sit on it, and yet it will be extremely lightweight. Internally, it will be a composite construction of a Nomex interior sandwiched between inner and outer carbon fibre layers. A closed tube is also easier to keep dust out of than an integrated truss, and if it were to ever expand or contract in some extreme temperature gradient, it would slide unidirectionally parallel to the optical axis within its retaining rings, eliminat-

ing any differential flexure caused by the mounting plate expanding against the carbon fibre structure.

Additional constructional aspects include fans not only behind the mirror, but an additional four fans mounted at 90 degrees around the side of the tube at the plane of the mirror surface. These will potentially improve internal tube seeing by the order of 0.5 arc secs/pixel according to tests by AG Optics. Another is an easier to use 2 point secondary adjustment for faster collimation. One final design decision was whether to go for a carbon fibre mirror support and flotation system as well. This would eliminate aluminum completely from the image train. However it appears according to AG Optical that an Optec thermally compensating focuser on the backplate with a conventional aluminum flotation system, actually cancels each other out under usual thermal gradients, so for the moment I have decided to evaluate that configuration.

I do not have any pictures yet as the telescope has not yet been delivered, but I will post a first light report on Moonwatch soon after the telescope arrives hopefully around April or May. However, it will look like something containing elements of the telescopes in the pictures below, but with 4 dovetail bars connecting the backplate to a support ring and perimeter mirror fans. What this description I hope conveys is that one always has to consider a telescope designed to work at exacting tolerances as

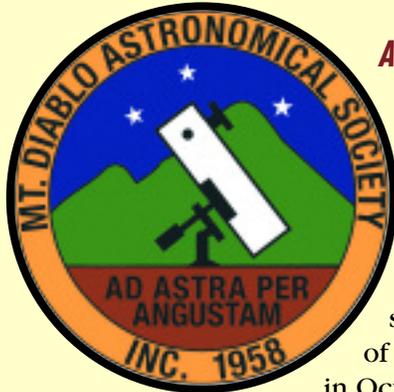
part of an overall system in which all parts work with each other. Advertising a telescope as carbon fibre does not necessarily make it a low expansion solution if other elements in the design are not constructed with the same goals.

Clear skies!

Chris Ford

It's Membership Renewal Time for April members!

Renew your MDAS membership and your magazines online!



ANNUAL MEMBERSHIP DUES OF \$25 ARE DUE MARCH 31, 2014.

For members on the April membership cycle only. Some of our members renew in October, but they will be notified separately.

You should have already received an email if your membership needs renewing. To renew your club membership, you may either:

- Renew online using Paypal or your credit card at http://mdas.net/mdas_store.html , select Membership Renewal. On the same web page, please consider making an additional MDAS Donation or MDOA Donation (for our Observatory on Mount Diablo)
- Or if you do not have internet access or prefer not to make online payments, you may mail a check for \$25 (or more!) made payable the M.D.A.S. to this address:

Mount Diablo Astronomical Society
P.O. Box 4889
Walnut Creek, CA 94596

MAGAZINE SUBSCRIPTION RENEWALS

All Sky & Telescope and Astronomy magazine subscriptions renewals are handled online, at the club discount rate.

The Astronomical Society of the Pacific has made arrangements with these magazines to allow members of the NASA Night Sky Network to renew at the club discount rate. All you need is a login for the Night Sky Network (NSN) through our club.

You can log into Night Sky Network and go to the Magazine Subscriptions and Links page to find the "New and Renewal Subscriptions" link. Here's the direct link: <http://www.astrosociety.org/magazine/>

If you don't have access to a computer, please renew by mail directly with the magazine using your renewal notification.

Any questions?

Please email memberinfo@mdas.net or call Marni Berendsen at 925-930-7431.



Mount Diablo Astronomical Society Event Calendar—March 2014

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
23	24	25	26	27	28	Society Observing 1 (Private) 9:00 AM District Science Fair Sunset: 6:04 PM 
2	3	Cambridge Astronomy Night (Private) 4	Ron Nunn Astronomy (Private) 5	Lafayette Elementary Astr (Private) 6	7:00 PM San Ramon Astronomy 7	6:00 PM ISAN 12:00 PM J Dobson Memorial Solar Sunset: 6:10 PM 
9	Board Meeting (Private) 10	11	12	13	Oak Grove Middle school (Private) 14	15 Sunset: 7:17 PM
16	17	18	19	March Equinox: MDAS Imaging Meeting (Private) 20	Globe at Night: March 21	Globe at Night: March 22 7:00 PM Public Astronomy: Stars Sunset: 7:24 PM
Globe at Night: March 23	Globe at Night: March 24	Globe at Night: March 7:15 PM GenMtg-Galactic Evolution 25	Globe at Night: March 26	Globe at Night: March Burton Valley Astronomy (Private) 27	Globe at Night: March 28	Globe at Night: March Observatory Maintenance (Private) 29 Sunset: 7:31 PM

What's Up *Continued from page 1*

eclipse as the moon's shadow traveled from west to east first over the Atlantic Ocean and then over Africa. This gave a unique opportunity to witness the transition between annular and total.

On the morning of the eclipse, I joined 9 other passengers from the US, Canada and Europe, the flight crew, and a film crew from German TV for a flight over the Atlantic to intercept the umbra.

My goal for the flight was to see a complete chromospheric ring and to photograph it in such a way as to show that we were in fact inside the umbra. I chose a "flash spectrum" to capture the eclipse through the window of the moving plane.

I will also give a brief description of the upcoming 2017 total eclipse which will be visible across the USA including Oregon and Idaho.

Mount Diablo Astronomical Society Event Calendar—April 2014

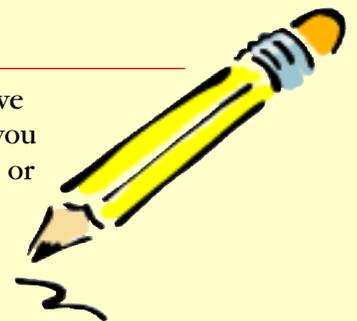
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	31	1	2	Timber Point Stargazing (Private) 3	4	Society Observing (Private) 5 Sunset: 7:37 PM
6	Board Meeting (Private) 7 	Greenbrook Stargazing (Private) 8 6:00 PM Mars at Opposition	6:00 PM Mars at Opposition 9 Riverview Solar Observing (Private)	10	11	12 Sunset: 7:43 PM
13	Total Lunar Eclipse 14	Total Lunar Eclipse 15 Astronomy Night (Private) 	16	MDAS Imaging Meeting (Private) 17 Northgate HS Astronomy Ni (Private)	18	Observatory Maintenance (Private) 19 Sunset: 7:49 PM
Globe at Night: April 20	Globe at Night: April 21	3 events: Click here to view 22 	Globe at Night: April 23	Globe at Night: April 24	Globe at Night: April 25	Globe at Night: April 26 7:30 PM Public Astronomy: Galaxies Sunset: 7:57 PM
Globe at Night: April 27	Globe at Night: April 28	Globe at Night: April 29 	30	1	2	3

Always in Need of Articles

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!

Chris and Vianney



Board Members & Address

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Newsletter Editor, Board Member

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Webmaster

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Secretary

Moon - Moonglow6@hotmail.com

New Member Steward

Nick Tsakoyias - claytonjandl@aol.com

Mailing address:

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

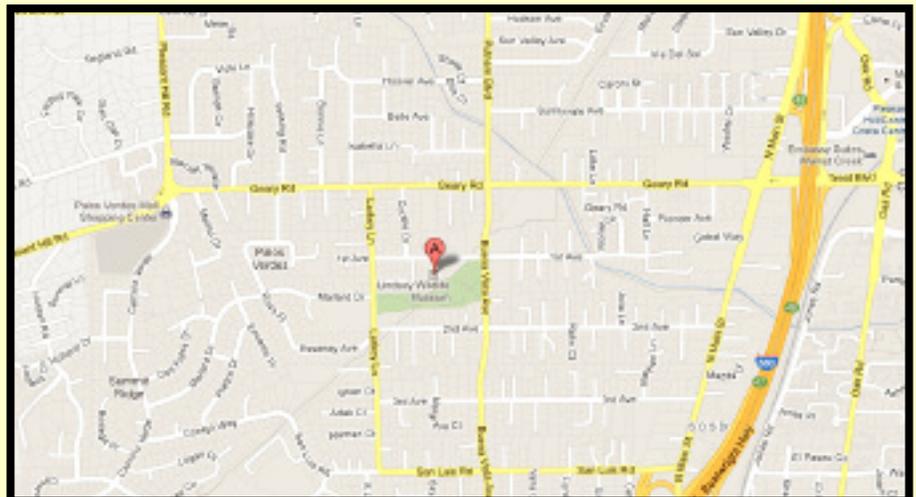
right on Geary Road. Turn left on Buena Vista.

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.



Outreach Program at Hidden Valley Elementary School Science Fair, Martinez, CA

Photos by Mike Harms

