Newsletter of the Pomona Valley Amateur Astronomers

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President's Message

It's another busy month on Earth and in space. If all goes according to schedule, on March 16 SpaceX will launch their latest Dragon capsule to the International Space Station using the Falcon 9 rocket. What's different about this launch is that for the first time ever, they'll try to fly the first stage of the rocket back to Earth for a powered soft landing, so it can be refurbished and used again. If the test is successful, it will pave the way for a new generation of reusable space vehicles. Yes, we've had a reusable space vehicle in the form of the Space Shuttle, but even there we were tossing the external fuel tank, and the booster rockets required significant overhaul after they were fished out of the ocean. The gleam in the eye of Elon Musk, the founder of SpaceX, is a fully reusable system, from first stage to capsule. If it sounds like a pipe dream, check out these videos of the Grasshopper test vehicle, which was simply the first stage of the Falcon 9 optimized for low-altitude maneuvering and soft landing.

Grasshopper 744m flight test:
http://www.youtube.com/watch?v=9ZDkItO-0a4
Grasshopper divert (side-to-side flight):
http://www.youtube.com/watch?v=2t15vP1PyoA

Here on Earth, we have the annual Claremont Library Children's Festival coming up on Saturday, March 29. We've participated in both of the past two years and our table has been a big hit. The folks at the library already have space set aside for us, and they'll have both library telescopes present so people can see them. Last year we had a fantastic turnout of volunteers and I'm hoping for the same this year.

Our speaker this month is Dr. Michael Storrie-Lombardi, who will speak about the search for life in extreme environments, from Antarctica to Mars and beyond. I hope to see you there.

Matt Wedel

PVAA Officers and Board

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PVAA General Meeting 02/14/14

The February General Meeting of the PVAA had some changes. 1st - We moved the date from Friday the 14th, to Friday the 21st. (We didn't want Saint Valentine to be mad with us.) 2nd – We met for the first time in the new Shannah Center Building – room B460 on the Claremont College campus. (Right below the campus cafe) We didn't get the meeting room door unlocked until 7:35pm. It is a smaller version of our usual Beckman Hall meeting room. President Mathew Wedel reminded us of the upcoming elections in May, and every member is encouraged to run for office. Our yearly dues of $30/ person or $40/family are due in May.

There will be a FREE pre-screening of the new COSMOS TV series at the Greek Theatre, Cosmos Pavilion on Tuesday, March 4th. Go to this website: cosmosrsvp.com. You may be charged $15.00 to park your car. Doors open at 4pm, screening at 5pm, live Q&A at 6pm.

Again doing something different for this meeting, we had the guest speaker, Ian Beardsley of the Pine Mountain Observatory run by the Oregon State University, go before the break instead of after. Ian was a data taker at the Observatory. He is also the author of several books: "The Book Of Two", "Europia", and "An Extraterrestrial Analysis ".

His topic was “Polarized Light Studies at Pine Mountain Observatory.” At Pine Mountain they have a 15 inch, a 24 inch and a 32 inch telescope. They were studying the polarization of light, and determining the angle of polarization. A star gives off light in every direction, and its light is unpolarized. If that light reflects off of a planet, then the reflected light is polarized - that is, its light photons bounce off of it in a uniform matter, and isn't scattered in every direction. Since light is both photons and part of the electromagnetic spectrum, light can be polarized by a highly magnetic source. Passing through a gas cloud will partially polarize light. Measuring the polarization of a star's light will give you a very rough estimate of its distance to earth. If you have two stars very close together from earth's perspective, an apparent binary system, but one star is more polarized than the other, then they are not binary stars, but just close in the field of view. This is from the interstellar polarization caused by interstellar gas.

Dr. J.C. Kemp of Oregon State started the work with stellar polarization back in the 1980's. You can see some of his work at these links:

http://www.hindsinstruments.com/wp-content/uploads/Polarized_Light_and_Its_Interaction.pdf

and

http://articles.adsabs.harvard.edu/full/seri/ApJ../0266//L000069.000.html.

Gary Thompson

Club Events Calendar

March 14, General meeting,
Michael Storrie-Lombardi, M.D
"Searching for Life in Extreme Environments"

March 22, Star Party, Cottonwood Springs, Joshua Tree
March 29, Children’s Festival, Claremont Library 1- 4pm

April 3, Board meeting, 6:15
April 11, General meeting
April 26, Star Party, Anza Borrego State Park

May 8, Board meeting, 6:15
May 16, General meeting, Vatche Sahakian
May 22-26, RTMC

June 5, Board meeting, 6:15
June 13, General meeting
June 28, 2014, Star Party, White Mountain, Bishop

July 3, Board meeting, 6:15
July 11, General meeting
July 26, Star Party, Mt Baldy, Cow Canyon Saddle

August 7, Board meeting, 6:15
August 15, General meeting
August 23, Star Party

September 4, Board meeting, 6:15
September 12, General meeting
September 20, Star Party
September 27, Mt Wilson Observing

October 2, Board meeting 6:15
October 10, General meeting
October 25, Star Party

October 30, Board meeting, 6:15
November 7, General meeting
November 22, Star Party

December 4, Board meeting, 6:15
December 5, Christmas Party, Sizzlin’ Skillets 7:00pm
No scheduled Star Party

Old Tool, New Use: GPS and the Terrestrial Reference Frame

Flying over 1300 kilometers above Earth, the Jason 2 satellite knows its distance from the ocean down to a matter of centimeters, allowing for the creation of detailed maps of the ocean's surface. This information is invaluable to oceanographers and climate scientists. By understanding the ocean's complex topography—its barely perceptible hills and troughs—these scientists can monitor the pace of sea level rise, unravel the intricacies of ocean currents, and project the effects of future climate change.

But these measurements would be useless if there were not some frame of reference to put them in context. A terrestrial reference frame, ratified by an international group of scientists, serves that purpose. "It's a lot like air," says JPL scientist Jan Weiss. "It's all around us and is vitally important, but people don't really think about it." Creating such a frame of reference is more of a challenge than you might think, though. No point on the surface of Earth is truly fixed.

To create a terrestrial reference frame, you need to know the distance between as many points as possible. Two methods help achieve that goal. Very-long baseline interferometry uses multiple radio antennas to monitor the signal from something very far away in space, like a quasar. The distance between the antennas can be calculated based on tiny changes in the time it takes the signal to reach them. Satellite laser ranging, the second method, bounces lasers off of satellites and measures the two-way travel time to calculate distance between ground stations.

Weiss and his colleagues would like to add a third method into the mix—GPS. At the moment, GPS measurements are used only to tie together the points created by very long baseline interferometry and satellite laser ranging together, not to directly calculate a terrestrial reference frame.

"There hasn't been a whole lot of serious effort to include GPS directly," says Weiss. His goal is to show that GPS can be used to create a terrestrial reference frame on its own. "The thing about GPS that's different from very-long baseline interferometry and satellite laser ranging is that you don't need complex and expensive infrastructure and can deploy many stations all around the world."

Feeding GPS data directly into the calculation of a terrestrial reference frame could lead to an even more accurate and cost effective way to reference points geospatially. This could be good news for missions like Jason 2. Slight errors in the terrestrial reference frame can create significant errors where precise measurements are required. GPS stations could prove to be a vital and untapped resource in the quest to create the most accurate terrestrial reference frame possible. "The thing about GPS," says Weiss, "is that you are just so data rich when compared to these other techniques."

Alex H. Kasprak

You can learn more about NASA's efforts to create an accurate terrestrial reference frame here: http://space-geodesy.nasa.gov/.

Kids can learn all about GPS by visiting http://spaceplace.nasa.gov/gps and watching a fun animation about finding pizza here: http://spaceplace.nasa.gov/gps-pizza.

Artist's interpretation of the Jason 2 satellite. To do its job properly, satellites like Jason 2 require as accurate a terrestrial reference frame as possible. Image courtesy: NASA/JPL-Caltech.

Searching for Life in Extreme Environments: The Mojave, Antarctica, Mars, and Beyond

On January 17th, 1996, at the annual meeting of the American Astronomical Society in San Antonio, Texas, NASA Administrator Dan Goldin asked three questions that have intrigued humankind throughout recorded history. “First, where did galaxies, stars, and planets come from, and how did they evolve? Second, are there worlds like Earth around nearby stars, and if so, are they potentially habitable or can we detect any signs of life there? Third, what is the origin and the fate of the universe?”

The presentation, which became known as "the Origins Speech", sparked considerable public interest and marked the appearance of Astrobiology as a discipline and a central focus for NASA's exploration of Earth and space. Now, almost two decades later, efforts in Astrobiology encompass the search for life in extreme environments here on Earth, the development of instrumentation to search for life on other worlds, the discovery of neighboring planetary system, and a new appreciation for how rapidly the building blocks of life appeared in the Universe.

In 1999, Dr. Storrie-Lombardi served as the faculty liaison between the original Astrobiology group at Jet Propulsion Laboratory, and a Harvey Mudd College Engineering Clinic team developing astrobiology instrumentation. Since that time, he has explored extreme environments in Australia, Russian Antarctica, and the Mojave Desert. Dr. Storrie-Lombardi is Director of the Kinohi Institute and is an Associate Clinical Professor in the Physics Department at Harvey Mudd College. Along with colleagues Ann Esin and Greg Lyzenga he teaches an introductory course in Astrobiology at the college. His particular interest is the development of non-contact, non-destructive instrumentation for detecting life living in the rocks and ice of Earth and other terrestrial planets.

During the evening presentation Dr. Storrie-Lombardi will review the history of Astrobiology, provide a tour of several extreme environments on Earth that may be analogs for habitable sites on Mars, describe current exoplanet characterization efforts, and present data acquired by the Spitzer Space telescope tracing the origin and evolution of organic material in both our own Milky Way galaxy, and also in neighboring and distant (ancient) galaxies. Finally, he will present a brief review of student research efforts at Harvey Mudd as they develop the laser and autonomous robotic systems needed to explore lava tubes in the Mojave. The systems are being built to test strategies for the non-destructive exploration of lava tubes on the Moon and Mars prior to human colonization.

Ron Hoekwater

2014 RTMC Astronomy Expo

The 46th annual RTMC Astronomy Expo will take place from Thursday, May 22 through Monday, May 26, 2014. It will be held at YMCA Camp Oakes, five miles southeast of Big Bear City, California on State Route 38 at Lake Williams Road between mileposts 44 and 45. This location is about 50 miles northeast of Riverside in the San Bernardino Mountains. For more information about the RTMC Astronomy Expo see http://rtmcastronomyexpo.org/general.html