



The universe seems neither benign nor hostile,
merely indifferent.
Carl Sagan

Newsletter of the Pomona Valley Amateur Astronomers

Volume 36 Number 7

nightwatch

July 2016

President's Message

So much good stuff going on right now! NASA's Juno probe arrived at Jupiter on July 4 and started sending back beautiful pictures of the Jovian system almost immediately. Juno will study Jupiter for more than a year before being deliberately crashed into the planet's clouds at the end of its mission, to avoid possible contamination of Jupiter's moons.

This past Sunday night (for us - early Monday morning in Florida), SpaceX launched its latest Dragon capsule to the International Space Station and landed the Falcon 9 first stage back at Cape Canaveral - the fifth successful Falcon 9 landing to date.

This is prime observing time, too. Jupiter, Mars, and Saturn are all past opposition but they're all still spectacular, and the summer Milky Way is already well above the horizon by nightfall. I was just out in Utah last week chasing dinosaurs, and I got spectacular views of the galactic center under very dark skies.

The club's return visit to the Mt Wilson 60-inch telescope on July 6 was a success, with attendees reporting dark skies and decent seeing. Hopefully we can con someone into giving us a full report at the meeting.

Speaking of the meeting, our speaker this month is, er, me! My talk is "Observing the scale of the cosmos", about using binoculars and small telescopes to understand our place in the Milky Way and in the larger universe. The meeting will be this Friday, July 22, at 7:30 PM in Shanahan B460 at Harvey Mudd College. I hope to see you there.

Matt Wedel

Club Events Calendar

July 22, 2016 [General Meeting](#)

July 30, 2016 [Star Party - Grandview](#)

Aug 11, 2016 [Board Meeting](#)

Aug 19, 2016 [General Meeting](#)

Aug 27, 2016 [Star Party – Cow Canyon Saddle, Mt Baldy](#)

Sept 3, 2016 [Star Party– Cow Canyon Saddle, Mt Baldy](#)

Sept 8, 2016 [Board Meeting](#)

Sept 16, 2016 [General Meeting – Dr. Elijah Quentin – Stars Consumed by Black Holes](#)

Oct 1, 2016 [Star Party-- Palomar Campground Palomar 200" Tour](#)

Oct 6, 2016 [Board Meeting](#)

Oct 14, 2016 [General Meeting](#)

Oct 29, 2016 [Star Party](#)

Nov 10, 2016 [Board Meeting](#)

Nov 18, 2016 [General Meeting](#)

Dec 1, 2016 [Board Meeting](#)

Dec 9, 2016 [Xmas Party](#)

PVAA General Meeting 06/24/16

Ron Hoekwater opened the meeting and greeted several first time attendees. Ludd Trozpek gave a presentation on binoculars that can be quite a find if you are patient and know what to look for. He showed several that he owns, and talked about the strengths and weaknesses of each one. One good place to look for reviews and used astro gear is:

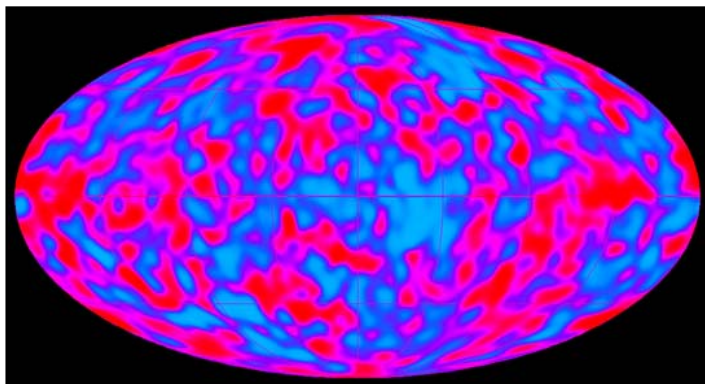
<http://www.cloudynights.com/page/index.html>

Our speaker for the evening was Jason Gallicchio, Assistant Professor at Harvey Mudd College. His topic for the night was his year stay at the South Pole titled: "A Long Winter: Cosmic Microwave Background Polarization with The South Pole Telescope" The South Pole radio telescope is 10 meters, run by the University of Chicago. It is funded by the National Science Foundation.

<https://physics.hmc.edu/colloquium/566/>
<https://pole.uchicago.edu/>

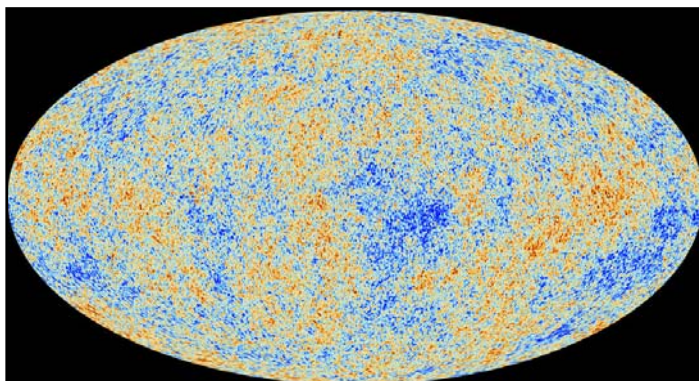
The Cosmic Background Radiation came from the "Big Bang" that started our universe. - At least that is the current prevailing theory. Back in 1920 there was the "Great Debate" on April 26th between Harlow Shapley and Heber Curtis at the Smithsonian Museum of Natural History. Shapley argued that spiral nebula were within our galaxy, and that our galaxy was the entire universe. He also argued that our sun was not at the center of our galaxy. Curtis argued that our sun was in the center of our galaxy, but the spiral nebula were not in our galaxy, but were far away, being their own "island" universe. Edwin Hubble in 1922 determined the distances of the spiral nebulae by using Cepheid Variables. The spiral structures were actually galaxies in their own right, and most were moving away from our galaxy. This greatly increased the size of our universe, and it was expanding.

Then in 1965 Bell Labs in New Jersey discovered the Cosmic Microwave Background. (CWB) To better measure CWB the COBE satellite was launched in 1989. COBE stands for Cosmic Background Explorer. It found that the temperature of the universe was 2.7255 Kelvin +/- .0006K. COBE had a Far Infrared Absolute Spectrophotometer (FIRAS) aboard, along with



John Mather, at Goddard, and George Smoot, at the University of California, Berkeley, shared the 2006 Nobel Prize in physics using the data they received from the COBE satellite. NASA's WMAP (Wilkinson Microwave Anisotropy Probe) and ESA's Planck spacecraft refined the data with increasing precision.

Image by Plank:



He also talked about the conditions of living at the South Pole. They live on top of a continent of ice. They cannot even bring in soil to grow plants by international treaty not to contaminate the continent. While they do have a greenhouse to grow food, most is flown in at great cost. Flights to and from the South Pole are scheduled only during the pole's "summer", and only in emergencies will a non-scheduled flight occur during winter months. Even then it will take weeks to set up. They are



more 'stranded' than the astronauts are, as they would be back safe in a few hours, if not minutes. During the summer the South Pole Station has about 200 people, and only 44 during the winter. While he was there they had an electrician that caused problems, and the company that hired him to work there had to pay about a million dollars to have a special flight to get him out. Only special planes can fly in that extreme cold.

Gary Thompson

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What's Up? - Living On Mars?

Mars has been so close lately that people have asked me, when will we live on Mars? As a kid I read novels about colonies on Mars. Ray Bradbury's *Martian Chronicles* had farmers growing crops with water from the canals. The canals were originally imagined by astronomer Percival Lowell. Every time his father asked him to leave his observatory and return to run the family textile mills he saw more Martians transporting water from the poles to irrigate a dry planet. No other astronomers visualized free flowing water on Mars. But it inspired H.G. Wells *War Of The Worlds* where Martians invade Earth in search of more water. These early science fiction writers created a belief in Mars as a habitable planet.

This brings us to the more hostile aspects of Mars. The surface temperature ranges from 23 degrees F to a low of -125 F. These are the temperatures of Antarctica. Mars only holds a thin 95% carbon dioxide atmosphere. This means Mars has no Earth-like magnetic field to keep hostile solar radiation from reaching the surface. The danger of cancers developing over time is very high. Consequently humans can't exist on the surface without lunar-like pressure suits with radiation shielding. Colonists would have to live underground.

They could exist in cave-like lava tubes. Some have already been discovered by Mars orbiters near several of the large volcanoes. Nevertheless all of this would require an expensive



In Kim Stanley Robinson's *Red Mars*, *Green Mars*, *Blue Mars* novels the red planet is changed into an Earth-like planet by the means of terraforming. That's an incredibly complex process. In fact the enormous expense of an up-front investment is the major problem of going to live on Mars, let alone terraforming it. Any long term economic benefits of living on Mars seem to be outweighed by the immense expense of going there.

Yet the argument exists that humans need to establish a colony on another world in case this one is destroyed by war, natural disasters, etc. Mars is a planet that has some compelling similarities to Earth, at least compared to our closest planet Venus with its scorching surface temperature.

Mars is agreeable by comparison. The 24 hour Martian day is about the same length as Earth's day. Mars has an Earth-like axial tilt which gives it seasons, although its year is twice as long. The land area of Mars is about the same as that of Earth (minus the oceans). There is a lot of water on Mars, frozen at the poles and underground. The Phoenix Lander reached out to touch polar water ice. An attractive carbon dioxide (dry ice) snow falls. But liquid water doesn't exist on the surface because of cold, low gravity and low air pressure. Mars is smaller than Earth so there can't be any flowing Martian canals.

life-support technology to produce a working artificial environment. Colonists would have to be capable of producing their own food and water. Breathable oxygen could be obtained from frozen subsurface water supplies. So crops could be grown underground. Solar energy panels could provide an endless supply of cheap electricity. Although they would have to be cleaned of Martian dust from time to time.

Planet wide red dust storms are known to occur on Mars. With no rainwater or organic matter to produce a solid soil there's a red

calcium powder dust everywhere. Winds have been known to entirely shroud Mars from Earthly view. One imagines it getting into everything.

A long term settlement would have to be large enough to avoid inbred genetic weaknesses. Any mining of valuable minerals that could make a Martian colony economically self-supporting is another unstudied problem.

The primary problem is reaching the red planet in the first place. A journey by today's chemical spacecraft would take 7-9 months at least. Would humans experience the mental disturbances of "cabin fever" over those many months? Complex technology necessary to support them upon landing could be sent first, along with robots to set it up.

But prolonged existence in low gravity is another difficulty that would exist in the spacecraft and when reaching Mars. The effects of less gravity could cause health problems like muscle loss and bone demineralization.

Nevertheless, human missions to Mars are currently planned by the private Space X company as well as NASA and ESA. Going to Mars is a perilous journey. Living there is even more dangerous. Maybe they can take Ray Bradbury's *Martian Chronicles* along to read. .

Lee Collins

Venus and Jupiter prepare for their close-up this August

As Earth speeds along in its annual journey around the Sun, it consistently overtakes the slower-orbiting outer planets, while the inner worlds catch up to and pass Earth periodically. Sometime after an outer world—particularly a slow-moving gas giant—gets passed by Earth, it appears to migrate closer and closer to the Sun, eventually appearing to slip behind it from our perspective. If you've been watching Jupiter this year, it's been doing exactly that, moving consistently from east to west and closer to the Sun ever since May 9th.

On the other hand, the inner worlds pass by Earth. They speed away from us, then slip behind the Sun from west to east, re-emerging in Earth's evening skies to the east of the Sun. Of all the planets visible from Earth, the two brightest are Venus and Jupiter, which experience a conjunction from our perspective only about once per year. Normally, Venus and Jupiter will appear separated by approximately 0.5° to 3° at closest approach. This is due to the fact that the Solar System's planets don't all orbit in the same perfect, two-dimensional plane.

But this summer, as Venus emerges from behind the Sun and begins catching up to Earth, Jupiter falls back toward the Sun, from Earth's perspective, at the same time. On August 27th, all three planets—Earth, Venus and Jupiter—will make nearly a perfectly straight line.

As a result, Venus and Jupiter, at 9:48 PM Universal time, will appear separated by only 4 arc-minutes, the closest conjunction of naked eye planets since the Venus/Saturn conjunction in 2006. Seen right next to one another, it's startling how much brighter Venus appears than Jupiter; at magnitude -3.80, Venus appears some eight times brighter than Jupiter, which is at magnitude -1.53.

Look to the western skies immediately after sunset on August 27th, and the two brightest planets of all—brighter than all the stars—will make a dazzling duo in the twilight sky. As soon as the sun is below the horizon, the pair will be about two fists (at arm's length) to the left of the sun's disappearance and about one fist above a flat horizon. You may need binoculars to find them initially and to separate them. Through a telescope, a large, gibbous Venus will appear no more distant from Jupiter than Callisto, its farthest Galilean satellite.

As a bonus, Mercury is nearby as well. At just 5° below and left of the Venus/Jupiter pair, Mercury achieved a distant conjunction with Venus less than 24 hours prior. In 2065, Venus will actually occult Jupiter, passing in front of the planet's disk. Until then, the only comparably close conjunctions between these two worlds occur in 2039 and 2056, meaning this one is worth some special effort—including traveling to get clear skies and a good horizon—to see!

Ethan Siegel



This article is provided by NASA Space Place.

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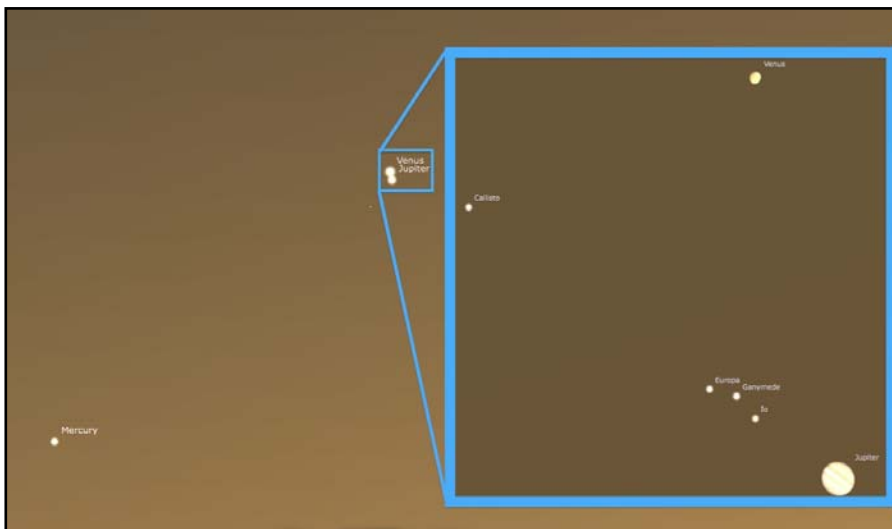


Image credit: E. Siegel, created with Stellarium, of a small section of the western skies as they will appear this August 27th just after sunset from the United States, with Venus and Jupiter separated by less than 6 arc-minutes as shown. Inset shows Venus and Jupiter as they'll appear through a very good amateur telescope, in the same field of view.

To teach kids more about Venus and Jupiter, visit the NASA Space Place webpages titled "All About Venus" <http://spaceplace.nasa.gov/all-about-venus/en/> and "All About Jupiter" <http://spaceplace.nasa.gov/all-about-jupiter/en/>.