nightwatch
Newsletter of the Pomona Valley Amateur Astronomers

Measure what is measurable, and make measurable what is not so. *Galileo Galilei*

Volume 35 Number 10 ***nightwatch*** **October 2015**

President's Message

Lots to report this month. The club tour of the Big Bear Solar Observatory earlier this month was fascinating and a lot of fun – see the report elsewhere in this issue. Those of us who went on the tour had lunch together afterward, and we talked about setting up a tour of the Palomar Observatory for next year. The board is working on that right now, so expect more news on that soon.

The December issue of *Sky & Telescope* magazine will be hitting newsstands any day now. I'm particularly excited about this issue, because it has an article I wrote: "Binocular Holiday", a tour of the winter Milky Way for binoculars and widefield telescopes. Copies can be had at major bookstores or online at http://www.skyandtelescope.com/sky-and-telescope-magazine/.

The club has taken possession of a Meade Starfinder ten-inch, equatorially-mounted Newtonian telescope. We already have a very nice 10" Newt available for members to use (let me or another board member know if you'd ever like to borrow it), and we don't have any more space to store this one, so we'll be selling it. PVAA members will get first crack at it. I don't have pictures or a price yet – it's happening too close to newsletter time – but there will be more info at the meeting, and probably an email to members in the near future. If you're interested, or know someone who might be, please let me know.

After this month, we have one more general meeting, in November, and then the club holiday party. For the past several years we've held the holiday party at Sizzlin' Skillets in Upland, but that restaurant has now closed. Instead we'll hold the party at the IHOP at 80 North Euclid Ave. in Upland, on the east side of the street just north of the train tracks, on the evening of Saturday, December 12.

Our speaker this month is accomplished observer and author Bob Buchheim of the Orange County Astronomers. Bob spoke to us a few years ago about his book, *The Sky Is Your Laboratory*, for amateur astronomers who want to try their hands at small-telescope research. This time he'll tell us about his new book, *Astronomical Discoveries You Can Make*, which is a collection of astronomical projects aimed at high school and college students, and amateur astronomers. The meeting will be at 7:30 this Friday night in Shanahan B460 on the Harvey Mudd campus – I hope to see you there.

Matt Wedel

Club Events Calendar

October 30, 2015, General meeting, Bob Buchheim

Nov. 5-8, 2015, Joint Star Party with RAS, Night Fall at Borrego Springs
November 12, 2015, Board meeting, 6:15
November 20, 2015, General meeting

December 3, 2015, Board meeting, 6:15
December 11, 2015, Holiday Party, Sizzlin' Skillets 7:00pm
No scheduled General meeting.
No scheduled Star Party.

PVAA Officers and Board

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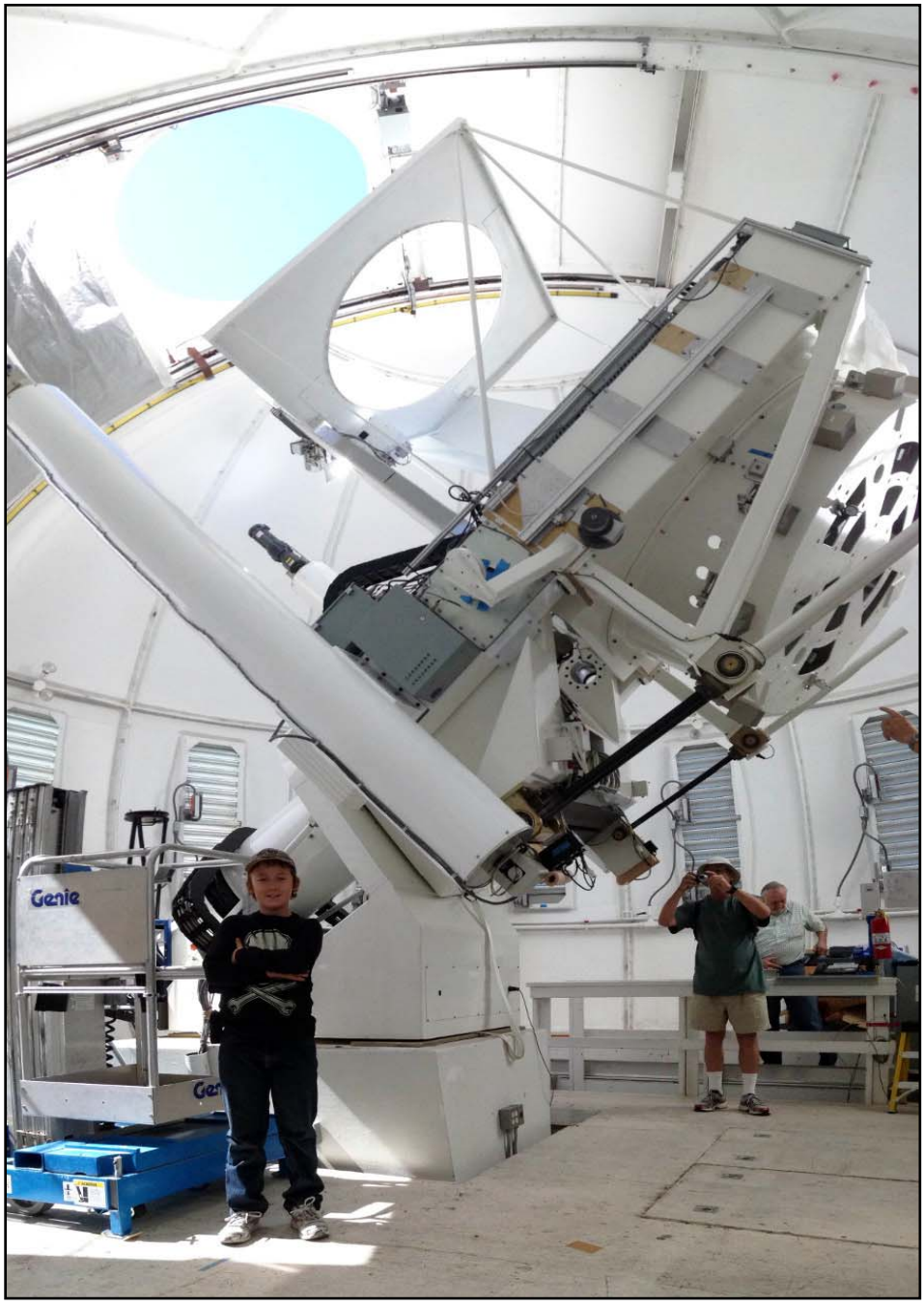
Big Bear Solar Observatory Tour

A group of us from the PVAA got to visit the BBSO on Friday, October 9. We were greeted at the gate by Claude Plymate, Chief Observer and Telescope Engineer at BBSO, and Teresa Bippert-Plymate, who is not only a professional solar astronomer but also the president of the Big Bear Valley Astronomical Society. As pros who are also enthusiastic amateur observers, Claude and Teresa did a great job of pitching the tour with just the right balance of necessary background, technical detail, and the hands-on practicality of managing big scopes and the complicated hardware and software necessary to run them.

The smaller dome just short of the end of the causeway holds two telescopes on a common mount. One is a 10cm full-disc hydrogen-alpha solar telescope, the other is a second smallish refractor for Project Earthshine, which tracks the Earth's albedo by measuring the intensity of the earthshine that falls on the moon's unlit side.

The observatory's 'big gun' is the 1.6-meter New Solar Telescope, an off-axis Gregorian. The NST is currently the largest, best-equipped solar telescope in the history of humankind, and it is producing the sharpest images of the sun ever taken. BBSO joins Mount Wilson and Palomar in continuing the long, proud history of world-class astronomy in southern California.



Our last stop on the tour was the telescope control room, where another professional astronomer was driving the scope and taking data. It was amazing to see live images coming in in real time. I've been fortunate to tour a lot of observatories but never while they were working. Many thanks to Claude and Teresa for being such gracious hosts and letting us see their beautiful machines in action.

Matt Wedel

What's Up? - It Comes From Our Sun

We all feel the life giving heat coming from our Sun. Its impressive size makes up 99.86% of the total mass of our solar system. So what other phenomenon come from our Sun?

Sunspot blotches were first studied by telescope in 1610 by Galileo. This allowed him to note that the Sun rotated about once a month. It has a differential rotation, its equator spinning much faster than its poles. Gas giant planets do this too. Its sunspots are temporary dark splotches that are really brighter than a full moon but appear relatively dark on the Sun's blinding surface. They also seem small but are all bigger than our Earth. George Ellery Hale of Mt. Wilson fame was the first to link the spots to magnetic fields in 1908. Sunspots are the visible surface storm appearance of flow disturbances in the Sun's magnetic flux tubes. Like all storms these eruptions of inhibited convection have a limited period of surface puncture ranging from days to weeks. They also have a 11 year cycle corresponding to a solar maximum and minimum. They tend to form in groups and migrate slowly from higher to lower latitudes. Their involvement with complex changes in the polarity of the solar magnetic field is still being studied.

Sunspots appear during an intense magnetic activity that also produces eruptive coronal loops know as prominences. Sunspots are also associated with bursting solar flares and coronal mass ejections that come from our Sun. Sun spots are also seen on other stars where they're called star spots.

The prominences are huge flaming gaseous extensions from the Sun's surface. They typically form and exhaust their enormous loops in one day. They're made of a hot electrically charged hydrogen and helium plasma. Sometimes the loops break apart and extend into coronal mass ejections. The longest ejection on record extended half a solar diameter (500,000 mi).

Solar flares are sudden explosive flashes that rise the temperature of the Sun's corona by millions of degrees in a few minutes. Radio telescopes reveal that solar flares also radiate low-frequency radio waves, X rays, ultra-violet, and gamma rays. If all this is extensive enough to reach Earth it can disrupt long-range radio communication, radar, computers and other electronic devices. In 1991 the Japanese launched a satellite, called Yohkoh (sunbeam) that studies solar radiation and flares. This is good, because in July, 2012 a potentially destructive solar super mass ejection barely missed Earth. Next time?

These solar flares and coronal mass ejections greatly enlarge the normal streaming of plasma from our Sun. This invisible flow of charged atomic particles is known as the solar wind.

The spookiest phenomenon caused by solar wind radiation are the aurora. Particles are drawn by Earth's magnetic field to form rings around both our polar regions. They're known as the aurora borealis (or northern lights) in the north and the aurora australis (southern lights) in the less inhabited south. Aurora is the Roman goddess of dawn and Boreas a god of the north wind. Galileo invented the name in an attempt to understand their hypnotic glow.

The ring of magnetospheric plasma around the poles forms the auroral oval. The luminous forms (best seen at night of course) take on the several colors and shapes. Most common are quiet folded "curtains" or bow like "arcs" but sometimes it all changes slowly in a hypnotic light show. In keeping with their name they often take on long wind blown forms that disappear over the horizon. Sometimes they take on the forms of haunting figures which encouraged tribal peoples to see them as spirits of the dead building camp fires in the sky (pictured). They can be bright enough to read a newspaper or diffuse and ghostly. The most common color is green which is caused by a charged particle excitation of the many atoms of oxygen in our atmosphere. A blue color is produced by nitrogen atoms. Blue green mixtures are very common. They're often topped off by red in the upper atmosphere. Yellow and pink can be produced by a mixture of red, blue, and green. Ultraviolet and infrared can also be seen with the requisite equipment.

Many radio telescopes around the world are used gather constant observations of our Sun. Some of the oldest optical solar telescopes (from 1904) are on Mt. Wilson. Today the major optical solar observatories are the Swedish Solar telescope on the Spanish island of La Palma, the very large McMath Solar Telescope on Kitt Peak in Arizona, and the local Big Bear Solar Observatory recently visited by PVAA members..

Lee Collins

How we know Mars has liquid water on its surface

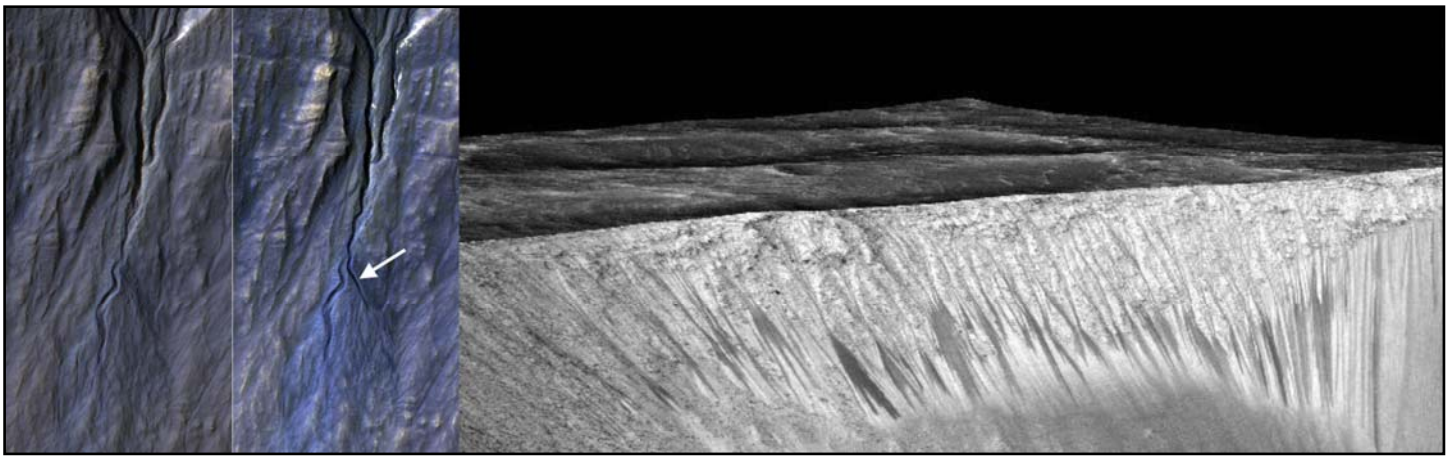
Of all the planets in the solar system other than our own, Mars is the one place with the most Earth-like past. Geological features on the surface such as dried up riverbeds, sedimentary patterns, mineral spherules nicknamed "blueberries," and evidence of liquid-based erosion all tell the same story: that of a wet, watery past. But although we've found plenty of evidence for molecular water on Mars in the solid (ice) and gaseous (vapor) states, including in icecaps, clouds and subsurface ices exposed (and sublimated) by digging, that in no way meant there'd be water in its liquid phase today.

Sure, water flowed on the surface of Mars during the first billion years of the solar system, perhaps producing an ocean a mile deep, though the ocean presence is still much debated. Given that life on Earth took hold well within that time, it's conceivable that Mars was once a rich, living planet as well. But unlike Earth, Mars is small: small enough that its interior cooled and lost its protective magnetic field, enabling the sun's solar wind to strip its atmosphere away. Without a significant atmosphere, the liquid phase of water became a virtual impossibility, and Mars became the arid world we know it to be today.

But certain ions—potassium, calcium, sodium, magnesium, chloride and fluoride, among others—get left behind when the liquid water disappears, leaving a "salt" residue of mineral salts (that may include table salt, sodium chloride) on the surface. While pure liquid water may not persist at standard Martian pressures and temperatures, extremely salty, briny water can indeed stay in a liquid state for extended periods under the conditions on the Red Planet. It's more of a "sandy crust" like you'd experience on the shore when the tide goes out than the flowing waters we're used to in rivers on Earth, but it means that under the right temperature conditions, liquid water does exist on Mars today, at least in small amounts.

The measured presence and concentration of these salts, found in the dark streaks that come and go on steep crater walls, combined with our knowledge of how water behaves under certain physical and chemical conditions and the observations of changing features on the Martian surface supports the idea that this is the action of liquid water. Short of taking a sample and analyzing it in situ on Mars, this is the best current evidence we have for liquid water on our red neighbor. Next up? Finding out if there are any single-celled organisms hardy enough to survive and thrive under those conditions, possibly even native to Mars itself

Ethan Siegel



Images credit: NASA/JPL-Caltech/Univ. of Arizona, of a newly-formed gully on the Martian surface (L) and of the series of gullies where the salt deposits were found (R).