Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers Apr 2016

Events:

General Meeting : Monday, April 4, 2016 at the Temecula Library, Room B, 30600 Pauba Rd, at 7 pm.

President Mark Baker's comments will by followed by Sharon Flemings and "What's Up". Then we will talk about TVA's new observatory complex. Sam Pitts will present some of the drawings he's done and talk about the possible layouts and structures...Mark Baker will talk on the outbuilding, i.e. office/ classroom and some of the specific applications and equipment we would like to have considered...And Chuck Dyson will bundle up some info on potential funding sources and resources...others might have ideas as well.

For the latest on Star Parties, check the web page.

APOD: 21 Mar 2006 The Coma Cluster of Galaxies, Credit & Copyright: Jim Misti (Misti Mountain Observatory)

WHAT'S INSIDE THIS MONTH:

Send newsletter submissions to Mark DiVecchio <markd@silogic.com> by the 20th of the month for the next month's issue.

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General information:
Subscription to the TVA is included in the annual $25 membership (regular members) donation ($9 student; $35 family).

President: Mark Baker 951-691-0101 <shknbk13@hotmail.com>
Vice President: Chuck Dyson <mrplegia@gmail.com>
Past President: John Garrett <garrjohn@gmail.com>
Treasurer: Curtis Croulet <calypte@verizon.net>
Secretary: Deborah Cheong <geedeb@gmail.com>
Club Librarian: Bob Leffler <bobjleffler@msn.com>
Facebook: Tim Deardorff <tim-deardorff@yahoo.com>
Star Party Coordinator and Outreach: Deborah Cheong <geedeb@gmail.com>

Address renewals or other correspondence to:
Temecula Valley Astronomers
PO Box 1292
Murrieta, CA 92564

Member's Mailing List: tvastronomers@googlegroups.com
Website: http://www.temeculavalleyastronomers.com/

Cosmic Comments – April/2016
by President Mark Baker

There is much ado about the New Frontiers mission to Jupiter that was launched on August 11, 2011. Traveling at over 23K mph, JUNO is due to rendezvous this July 4th and is expected to add a plethora of knowledge about the gas giant, its moons, and the general environment surrounding it. Some of the key elements will include:

- Determine how much water is in Jupiter's atmosphere, which helps determine which planet formation theory is correct (or if new theories are needed)
- Look deep into Jupiter's atmosphere to measure composition, temperature, cloud motions and other properties
- Map Jupiter's magnetic and gravity fields, revealing the planet's deep structure
- Explore and study Jupiter's magnetosphere near the planet's poles, especially the auroras – Jupiter's northern and southern lights – providing new insights about how the planet's enormous magnetic force field affects its atmosphere.

But the basic principle involved has to do with us better understanding the evolution behind the formation of our solar system. You can find more details on this exciting mission at the following links:

https://www.nasa.gov/mission_pages/juno/main/index.html
http://www.jpl.nasa.gov/missions/juno/

I look forward to an added cause for celebration this 4th of July by reuniting King Jupiter with his Queen, Juno, and adding to the coffers of human knowledge!!

Clear, Dark Skies my Friends…

Looking Up – April 2016
by Curtis Croulet

New Moon is April 7 at 4:24 AM PDT; **First Quarter Moon** is April 13 at 11:39 PM PDT; **Full Moon** is April 21 at 10:24 PM PDT; **Last Quarter Moon** is April 29 at 8:29 PM PDT.

Mercury reaches its best evening apparition of 2016 in April. Greatest elongation (angular distance east of the Sun) is on April 18, after which Mercury fades quickly and plunges out of view by April 28. Interestingly, although greatest elongation is April 18, it Mercury is brightest on April 1. The messenger planet's narrowing crescent negates the effects of its reduced distance as it approaches greatest elongation.

Venus is in the morning sky. It becomes unviewable after about the first week of April. Superior conjunction, when it's on the far side of the Sun, is on June 6.

Mars rises around midnight at the beginning of April and around 10 PM at the end of the month. The "red" planet grows and brightens rapidly as it heads toward opposition on May 22, 2016. By the end of April, **Mars** will be larger than and as bright as it was at its last opposition in 2014. As with most good oppositions, Mars will be in the southern sky, in Scorpius.

Jupiter reached opposition on March 8. It's at its biggest and brightest right now. And it's high in the evening sky in eastern Leo. What are you waiting for?

Saturn is slowly creeping into civilized hours. It rises at 11 PM (PDT now) on April 1 and as early as 9 PM on April 30. Opposition is the night of June 2-3.

Uranus and **Neptune** have been put to bed for awhile. **Pluto** rises shortly after midnight at the end of April. **Pluto** is in Sagittarius.

The **Lyrid Meteors** peak on April 22. The radiant is overhead by 4 AM. It's not usually a spectacular shower, but there have been rare outbursts.

Let's look up.

A story about the close approach of a comet has been making the rounds lately. Comet C/2016 BA14 (PanSTARRS) will pass the Earth as close as 2,199,933 miles on March 23 (perhaps before you read this). This is the closest approach of any comet in the past 246 years and the third closest approach ever recorded. That's the good news. The bad news is that it'll still be 12th magnitude.

I hope you've enjoyed your view of Crux, the Southern Cross, around 2:30 AM as I write this in mid-March.

What? You haven't seen it? Oh, I forgot – it's 2016 CE now. If you had been around 1,000 years ago, the entire Southern Cross asterism would have just barely cleared our southern horizon. Atmospheric refraction might have pushed it a bit higher, making it a bit easier to see.

2,000 years ago, the Southern Cross would have been another 4-1/2 degrees above our horizon, rendering it distinctly and obviously visible, sort of like we now see Canopus on a good winter night.

These effects are caused by precession, the wobble of the Earth's axis. Because of the wobble, Polaris won't always be the "North Star." Around 2500 BC (4500 years ago) Thuban (Alpha Draconis) was the "North Star." The Big Dipper was much closer to the pole than it is now. Going 4500 years in the future, Alfirk (in Cepheus) and Iota Cephei will have approximately equal claim to being the "North Star." Iota Cephei will be about 5 degrees from the pole (the "pointers" in the Big Dipper are about 5 degrees apart). In about 10,000 years, Deneb, in Cygnus, will be the "North Star." In about 13,000 years from now, Vega will be the "North Star." And the cycle will continue, ignoring (for now) the changes in star positions due to proper motion – the angular motion of the stars on the celestial sphere.

I'll wrap up these musings on the implications of precession by pointing out that Achernar, ninth brightest star in the night sky, should just barely clear the horizon at the latitude of San Diego in the current era. Viewing it from the city would be impossible (I tried once), but it always seemed to me that it might be visible from the San Diego Astronomy Association's observing site at Tierra del Sol, on the international border. Atmospheric refraction should help to lift it a bit. The one time I tried to see it, I failed. Maybe this coming October would be a good time to try again.

Turning our attention to April's evening sky, it's time to try your observing skills on the Coma-Virgo Cluster of galaxies, often called simply the Virgo Cluster. Many years ago, before I bothered to learn the individual galaxies, I was often content to simply point my telescope (an 8-inch Newtonian reflector) in the border area of northern Virgo and Coma Berenices and sweep around. I tried to collect the maximum number of galaxies on one low-power field of view. The area of M84 and M86 has the greatest concentration of bright galaxies. You can also see many of them in ordinary birding binoculars. Telescope or binoculars, you'll need a dark sky. These galaxies will be invisible from the suburbs. Coma-Virgo Cluster averages about 54 million light years away. As with most galaxy clusters, the center is anchored by an extremely massive elliptical galaxy, M87 in this case. Have fun.

Clear skies.

Random Thoughts
by Chuck Dyson

This article will be the last time that I talk about the January 2016 issue of Sky and Telescope, I promise. But having written about Tony Flanders article I thought that I must continue and comment on the article by Al Paslow (page 68) concerning the discovery of a time capsule at the Brashear factory, who was John Brashear and why was this capsule so important?

Why was there such a hub bub over a time capsule by a gentleman who as far as I knew built quality but modest telescopes? The answer arrived, in part, in the March Sky and Telescope magazine on page 34 in an article about the refurbishing of the Lowell refractor. The article mentions that much science was done using the refractor by Vesto Slipher including measuring the velocities of spiral nebula (the name for galaxies before Hubble) with his modified Brashear spectrograph. This Mr. Brashear seems to have been more than a telescope maker and I must know more; hence, I don my electronic SCUBA gear and dive into the internet.

John Brashear was born in 1840 to a family of very modest means; however, at age nine John's grandfather (I am already starting to bond with John) took him to see a telescope as scopes were very much a novelty at that time and to pay the five cents for John to look through it. Throughout his life John mentioned over and over that the views of the Moon and Saturn were the defining moments in his life. As there were no commercial telescopes and he had not the monies to commission a scope, John did not get to look through a scope that he owned until after he finished school (10th grade), finished a machinist apprenticeship (5 years), became a journeyman machinist and then a millwright and even then all he and his wife could afford was a five inch piece of optical glass and books on math and optical theory. After three years of study, grinding, and consultation with the astronomers at the Allegheny Observatory, John finally had a finished objective lens for his telescope but when checking it one more time for blemishes he dropped it and it broke. Disaster; however, because John had worked with the astronomers at Allegheny Observatory and they had been impressed with his work they purchased a new piece of glass for John out of the observatory budget. The second lens was finished in shorter time than the first and was a success. Now, even though the Brashears had an optical tube, they had no mount for the new telescope (I do not recommend that you do what they did next). They then determined which wall of their house had the best view of the night sky and sawed a hole in the wall and used the wall as their mount. One of the first things that the Brashears did with the new telescope was to have the children of the neighborhood come into the house and look through the scope. Public outreach was always a constant part of the Brashears life and yes he would have been a great member of the TVA.

It appears that in the 1870's there was a serious lack of optical craftsmen and thus the Brashears were soon making lenses for professional and amateur astronomers and by the 1880's, with money from a venture capitalist, they were working full time in their own small factory. At about this time the French had developed a method of silvering the back of glass to produce a superior mirror for my ladies boudoir. The mirrored telescopes of this time had mirrors of metal and when the metal oxidized the entire mirror had to be reconfigured to produce a new surface that was not oxidized and this happened every one to two years, not fun and very expensive. The behind the glass silvering technique was modified to become a cumbersome but effective in front of the glass silvering technique; the new mirrors were much more reflective than the metal ones and much easier to re-coat with new silver. What John Brashear now did was to refine, simplify, and improve on the silvering process and the Brashear process became the standard technique for all glass mirrors until 1934 when silver was replaced by the aluminum vapor process that we use today.

With the increase in business from the telescope mirrors as well as refractor lenses, the factory, with another infusion of cash from the venture capitalists of the day, was expanded to its final size and it was during this expansion that the time capsule was placed in one of the pillars. Also at this time John Brashear, who had been servicing spectrographs from the observatories on the East coast (you can only imagine what it was like in the 1880's to get your spectrograph shipped to Europe for servicing), started designing and building his own spectrographs and these became the preferred instrument by astronomers all over the world and thus its presence at Lowell's Mars Hill Observatory as Mr. Lowell was one who had to have the very best.

Although John Brashear had only a tenth grade education, he taught himself math to the point where he was teaching university level astronomy and became the director of the Allegheny Observatory. In following years, he became the acting chancellor of University Of Pittsburgh and a member of the Board of Directors of Carnegie-Mellon University.

In the beginning, America sent its students to Europe for the best education and American scientists went to Europe for state-of-the-art instruments. Starting in the late 1800's to the early 1900's, a group of American renaissance men in science/education and in industry changed that metric with students and researchers started coming to America for education and state-of-the-art equipment. John Brashear & Co was a big part of that change and a snapshot of the man, the factory, and people is what was in that time capsule; however, the city of Pittsburgh only wanted the old factory gone as cheaply as possible until the contents and their significance was brought to the attention of the news by Mr. Paslow and then the story changed and the city threatened litigation, withheld payment to the salvage company and did what city officials do when threatened with embarrassment. Fortunately for all a local museum with a collection of artifacts from the Brashear factory came forward with an offer and purchased the time capsule so as to add its contents to the exhibit on the Brashear story.

So the city was able to save face, our understanding of the history and contributions of the Brashear factory and family was enhanced, and hopefully the exhibit at the Sen. John Heinz History Center will inspire us to go out and carpe diem (seize the day).

Oh, yes, the cities big interest in the time capsule; in the background of the photo of the Brashear factory is the only known image of Pittsburgh's first stadium Recreation Park, the birthplace of professional football and the site of Pittsburgh's first baseball victory in the National League. Well, all I can say is that the city has its priorities and I have mine and they ain't the same, at all.

The ashes of John Brashear and his wife are in a vault in the basement of their beloved Allegheny Observatory and their epitaph is from one of the favorite poems.

"I have loved the stars too fondly
To be fearful of the night."

I would also like to thank the editors of Sky and Telescope magazine for printing the articles that led me through a most interesting historical journey.

Cheers All
Chuck

Gravitational Wave Astronomy Will Be The Next Great Scientific Frontier

by Ethan Siegel

Imagine a world very different from our own: permanently shrouded in clouds, where the sky was never seen. Never had anyone see the Sun, the Moon, the stars or planets, until one night, a single bright object shone through. Imagine that you saw not only a bright point of light against a dark backdrop of sky, but that you could see a banded structure, a ringed system around it and perhaps even a bright satellite: a moon. That's the magnitude of what LIGO (the Laser Interferometer Gravitational-wave Observatory) saw, when it directly detected gravitational waves for the first time.

An unavoidable prediction of Einstein's General Relativity, gravitational waves emerge whenever a mass gets accelerated. For most systems -- like Earth orbiting the Sun -- the waves are so weak that it would take many times the age of the Universe to notice. But when very massive objects orbit at very short distances, the orbits decay noticeably and rapidly, producing potentially observable gravitational waves. Systems such as the binary pulsar PSR B1913+16 [the subtlety here is that binary pulsars may contain a single neutron star, so it's best to be specific], where two neutron stars orbit one another at very short distances, had previously shown this phenomenon of orbital decay, but gravitational waves had never been directly detected until now.

When a gravitational wave passes through an objects, it simultaneously stretches and compresses space along mutually perpendicular directions: first horizontally, then vertically, in an oscillating fashion. The LIGO detectors work by splitting a laser beam into perpendicular "arms," letting the beams reflect back and forth in each arm hundreds of times (for an effective path lengths of hundreds of km), and then recombining them at a photodetector. The interference pattern seen there will shift, predictably, if gravitational waves pass through and change the effective path lengths of the arms. Over a span of 20 milliseconds on September 14, 2015, both LIGO detectors (in Louisiana and Washington) saw identical stretching-and-compressing patterns. From that tiny amount of data, scientists were able to conclude that two black holes, of 36 and 29 solar masses apiece, merged together, emitting 5% of their total mass into gravitational wave energy, via Einstein's $E = mc^2$.

During that event, more energy was emitted in gravitational waves than by all the stars in the observable Universe combined. The entire Earth was compressed by less than the width of a proton during this event, yet thanks to LIGO's incredible precision, we were able to detect it. At least a handful of these events are expected every year. In the future, different observatories, such as NANOGrav (which uses radiotelescopes to the delay caused by gravitational waves on pulsar radiation) and the space mission LISA will detect gravitational waves from supermassive black holes and many other sources. We've just seen our first event using a new type of astronomy, and can now test black holes and gravity like never before.

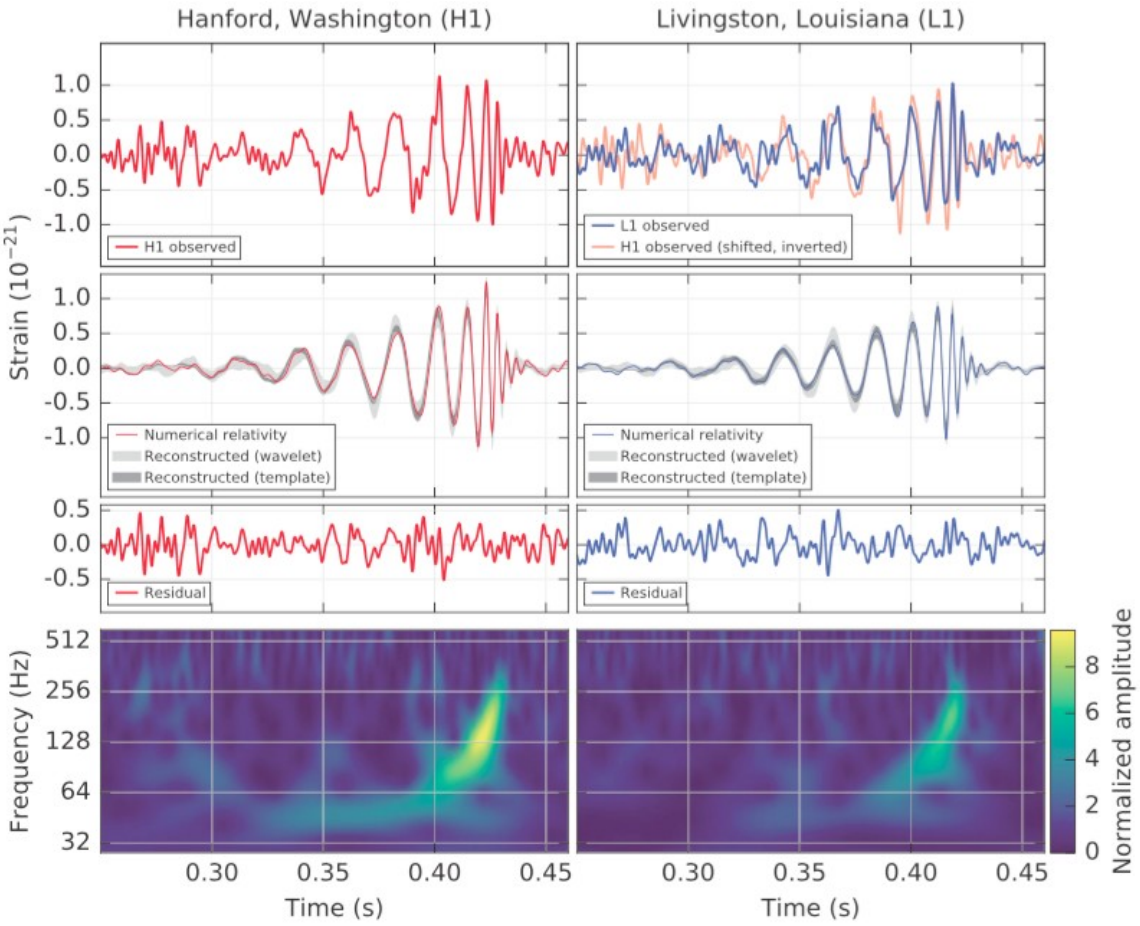

Image credit: Observation of Gravitational Waves from a Binary Black Hole Merger B. P. Abbott et al., (LIGO Scientific Collaboration and Virgo Collaboration), Physical Review Letters 116, 061102 (2016). This figure shows the data (top panels) at the Washington and Louisiana LIGO stations, the predicted signal from Einstein's theory (middle panels), and the inferred signals (bottom panels). The signals matched perfectly in both detectors.

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