Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers July 2016

Events:

General Meeting : No general meeting this month. Join us for our annual Anza Star-B-Q. Watch your email for details.

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

Juno spacecraft and its science instruments. Image credit: NASA/JPL

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).

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Cosmic Comments – July/2016
by President Mark Baker

As some of you may notice, I will often despair at the *current* state of the US Space program, to the point of disparagement. That doesn't mean I am thrilled with the current missions, or even the planned missions. But keep in mind, many were conceived of, and been in the works for, at least a decade or more. The JUNO mission is just such an event. When it arrives in orbit around Jupiter on this 4th of July, it will be a major milestone in the enhancement of understanding the formation and evolution of our Solar System. And this is because Jupiter is the only planet in our system that hasn't changed much, if at all, since its formation. It holds all the keys to what was going on so many billion years ago in our little piece of the galaxy. I am excited by the following scientific packages it will employ to expand our horizons:

- Gravity Science
- Magnetometer (MAG)
- Microwave Radiometer (MWR)
- Jupiter Energetic Particle Detector Instrument (JEDI)
- Jovian Auroral Distributions Experiment (JADE)
- Waves
- Ultraviolet Imaging Spectrograph (UVS)
- Jovian Infrared Auroral Mapper (JIRAM)
- JunoCam

For more information, you can go to the JUNO related website:

http://www.jpl.nasa.gov/missions/juno/

I hope you will take the opportunity to look into this program and see how exactly the human race will benefit from this endeavor…

That being said, this decade has yet to provide one single program of note. The last time the US was so dried up was in the 80's, when this country did, well, pretty much nothing…!!! But we can always hope…

Just in case?? I admonish interested younglings to take up Mandarin, or Hindi, or Japanese even. They appear to be the leading space science entities taking control in the 2020's and on…the US will probably be renting space from one of them, or a corporation maybe!!!

Clear, Dark Skies my Friends…

Looking Up – July 2016
by Curtis Croulet

New Moon is July 4 at 4:01 AM PDT; **First Quarter Moon** is July 11 at 5:52 PM PDT; **Full Moon** is July 19 at 3:56 PM PDT; **Last Quarter Moon** is July 26 at 4:00 PM PDT.

Venus reappears in the evening sky. But it'll be low. From mid-July and on into August, **Mercury** will join Venus in the dusk sky. On July 30 **Mercury** and the 1st magnitude star Regulus will be only ½ degree apart. You'll probably need binoculars to separate them.

Mars reached opposition on May 22, 2016. **Mars** is still good for viewing – larger and brighter than it has been in years – but it's now shrinking rapidly as the Earth and **Mars** draw apart.

Jupiter is past its prime, being well past the meridian at sunset. The giant planet sets before 10 PM by month's end.

Saturn is well placed for evening viewing. The ringed planet retrogrades westward (goes backward), approaching **Mars**.

Neptune, which is in Aquarius, rises at 11:17 PM at the beginning of July and at 9:17 PM at the end of July. Meanwhile, **Uranus**, which is in Pisces, rises well after midnight at the beginning and a bit after 11 PM at the end of July. Unfortunately, we'll have to wait until S&T's September issue for good finder charts, but you should be able to find it with one of the planetarium programs for your computer or cell phone.

Pluto is in eastern Sagittarius. It's up most of the night. Expect to use a big telescope and spend some time hunting to identify it. The July issues of both *Astronomy* and *Sky & Telescope* have finder charts for **Pluto**.

We have three minor meteor showers: **Pisces Austrinids**, peaking on July 28; **Delta Aquarids** and **Alpha Capricornids**, both peaking on July 30. The Moon will not be a friend to any of these.

Let's look up.

This is Milky Way time. When we see the Milky Way – the luminous band of distant stars and nebulae that stretches across the summer sky -- we're looking into the plane of the Milky Way Galaxy. The great dark patches, most notably that huge "Great Rift" that divides the Milky Way through Cygnus, Aquila, and Scutum, are equivalent to the dust clouds we see when we view edge-on galaxies such as NGC 4565 and NGC 891. Those dust clouds are composed of all of the tiny bits of matter that supply the material for the eventual formation of stars.

In the area of Sagittarius and Scorpius, the Milky Way broadens, and the black dust clouds become more complex. The center of our galaxy is in the direction of Sagittarius and Scorpius, but we can't see the center itself. However, it has been studied in infrared and radio radiation, which penetrates the dust and star clouds. Almost all of the visible stars, star clouds, and nebulae are relatively close to us. There is much more to our galaxy that we can't see.

However, we can see a hint of what lies beyond. Littered about the sky are approximately 150 globular clusters, concentrated balls of mostly reddish, mostly very old stars. Globular clusters are not randomly distributed. The majority of them are in the area of Sagittarius and Scorpius.

In 1911 George Ellery Hale, director of the recently-established Mt. Wilson Observatory, hired a brilliant young astronomy student from Princeton University, Harlow Shapley. Shapley went to work to determine the size of the Milky Way Galaxy. Cornelius Kapteyn had previously estimated the galaxy to be about 15,000 parsecs in diameter, or roughly 50,000 light years, by counting stars. Many astronomers thought Kapteyn's Milky Way Galaxy was too small.

Shapley took a different approach. He intuitively understood that globular clusters were unevenly distributed in the sky because most of them surrounded the center of the galaxy, which must therefore be in the direction of Sagittarius and Scorpius. Using the new 60-inch reflector at Mt. Wilson, largest in the world and one of the first modern telescopes specifically designed for photography and spectroscopy, Shapley began studying variable stars in the globular clusters. He studied RR Lyrae variables. The prototype of this class of variable is in the constellation Lyra, but most RR Lyrae variables are in globular clusters.

RR Lyrae stars are often called "cluster variables." RR Lyrae variables were seen as similar to but significantly dimmer than Cepheid variables, whose period-luminosity relation had been recently discovered by Henrietta Leavitt. Brighter Cepheids have longer periods of variation. Once the scale was calibrated, the brightness of any given Cepheid could be calculated from its period of variation. From its brightness, its distance could be calculated. A similar approach could be applied to the RR Lyrae stars.

Using those RR Lyrae variables that could be resolved in presumably closer globular clusters, Shapley announced in 1919 that the Milky Way Galaxy was about 100,000 parsecs in diameter, or nearly seven times larger than Kapteyn's estimate. He also said the Sun was 15,000 parsecs away from the galaxy's center. Shapley's Milky Way Galaxy was so large that Shapley thought it constituted the entire universe. Further, he said the mysterious spiral nebulae must be relatively small structures within our galaxy. It later turned out that Shapley had insufficiently accounted for intervening dust, which made the globulars appear more distant than they actually were. His estimate for the size of our galaxy was three times too large. A few years later, Edwin Hubble proved that the spiral nebulae were actually other galaxies, far beyond the limits of our own. "Island universes" was a popular term at the time. That's another story for another column.

But those globular clusters that so delight us can be appreciated for their role in the discovery of the dimensions of the Milky Way Galaxy and of our position in it.

Clear skies.

Random Thoughts
by Chuck Dyson

1917 was a very bad year if you were in Germany as most of the lads were off fighting the French and Italians and no one was at home to harvest the grapes. 1917 was a very bad year for France as most of the lads were off fighting the Germans and worse yet some of the fighting was in the vineyards of Champaign and not only were the grapes not being harvested but in addition the grapes and vineyards were being blown-up. The Italians well I am sure get the drift of how things were going.

So, was anyone having a good year in 1917? Well if you take the train out of Paris and a ship from Le Havre to New York, try not to get torpedoed on the way please, and then another train from New York to Pasadena California you will have arrived in Americas finest orange groves, new winter playground for the rich, home of a parade where the floats are all decked out in flowers, and ground zero for an architectural revolution spear headed by the Greene brothers.

For Pasadena, 1917 was a good year, but if you decided and were determined you could take a strenuous and dangerous trip up to the top of Mt. Wilson and the astronomers up there were having a great year because in November of that year, after being more than a decade in production, the 100in Hooker telescope saw first light and to the surprise of at least half of the people there it worked; however, the work horse of the observatory, the 60 in reflector, was having a very good year too as it was collecting the spectra of white dwarfs and other stars that were used by Henry Norris Russel to build and fill out the H-R diagram. In 1917, the observatory director Walter Adams made photographic plate spectra of van Maanen's star which is a relatively regular white dwarf.

In 2004 it was recognized that some white dwarf stars had heavy elements in their spectra and these elements should not be there, just like the Earth when it was molten and the bulk of its heavy elements sank to the core of the planet, the heavy elements in a white dwarf should sink and all be in its core. Now the only way for a white dwarf to have its surface polluted with heavy elements, and, by-the-by, these white dwarfs have been named "polluted white dwarfs", is for a planet either whole or broken up to rain down of the surface of the white dwarf. In 2015 a researcher from University College London who was studying "polluted white dwarfs" contacted the Carnegie Observatory and wanted to examine the 1917 plate from Mt. Wilson and when he did examine the plate there was the unmistakable spectral signature of heavy elements. 1917 was a very good year for the Mt. Wilson Observatory because they had discovered the very first evidence of extrasolar planets using the little 60 in telescope that could and a photographic plate technique that would preserve the information on that plate completely for 98 years.

Also late in March, the Harvard Observatories archive vaults of photographic plates from 1885 to 1992 were flooded and the information on them is considered valuable enough for the 16,000 plates to be frozen to prevent molding and then individually thawed and cleaned, cataloged, and re-archived.

Now the reason I have brought up the subject of archival data is because in the May 12th Naval History Blog, there is an article on storing digital images and the degradation that they can undergo in just 20 years. This has caused me wonder as we now store virtually all of our astronomy data in digital format, what will these digital archives look like in a hundred years and how useful will they be to my great, great grandchildren when they do a data search of the archives?

Last thoughts. Now I don’t know about you all, but as for me there are nights when I want to observe but I do not even want to drag out my grab-and-go telescope and AZ mount; so, these are the nights that I just take a pair of binoculars out to my back yard and look up. Now I actually have two binocular books, one by Gary Seronik and one by Patrick Moore, but really one can never have too many books especially if you can get them for free. The busy lads in the Indiana Astronomical Society have made available, as a PDF, the Irish Federation of Astronomical Societies Binocular Challenge Handbook. This book contains 110 objects with hand drawn location charts for each object, just click here and presto it’s yours and *please* ignore the little copyright symbol just like the lads in Indiana did. Of note also is that the Indiana lads have also created PDF files for IFAS Messier Observers Challenge and IFAS Novice Handbook and yes, I do believe that the Indiana Astronomical Society is the only society that operates from inside prison walls. Like all the observing books that I have come to rely on, my three binocular books could use better star charts; so, for my star charts I go to the free Mag-7 Star Atlas and download (legally) the charts that I am interested in, of note, though, is that, except for Messier objects, all objects in this atlas are identified by their NGC number only; no Mell, no Trumpler and no Struve numbers please.

Cheers All
Chuck

Hubble's bubble lights up the interstellar rubble
by Ethan Siegel

When isolated stars like our Sun reach the end of their lives, they're expected to blow off their outer layers in a roughly spherical configuration: a planetary nebula. But the most spectacular bubbles don't come from gas-and-plasma getting expelled into otherwise empty space, but from young, hot stars whose radiation pushes against the gaseous nebulae in which they were born. While most of our Sun's energy is found in the visible part of the spectrum, more massive stars burn at hotter temperatures, producing more ionizing, ultraviolet light, and also at higher luminosities. A star some 40-45 times the mass of the Sun, for example, might emits energy at a rate hundreds of thousands of times as great as our own star.

The Bubble Nebula, discovered in 1787 by William Herschel, is perhaps the classic example of this phenomenon. At a distance of 7,100 light years away in the constellation of Cassiopeia, a molecular gas cloud is actively forming stars, including the massive O-class star BD+60 2522, which itself is a magnitude +8.7 star despite its great distance and its presence in a dusty region of space. Shining with a temperature of 37,500 K and a luminosity nearly 400,000 times that of our Sun, it ionizes and evaporates off all the molecular material within a sphere 7 light years in diameter. The bubble structure itself, when viewed from a dark sky location, can be seen through an amateur telescope with an aperture as small as 8" (20 cm).

As viewed by Hubble, the thickness of the bubble wall is both apparent and spectacular. A star as massive as the one creating this bubble emits stellar winds at approximately 1700 km/s, or 0.6% the speed of light. As those winds slam into the material in the interstellar medium, they push it outwards. The bubble itself appears off-center from the star due to the asymmetry of the surrounding interstellar medium with a greater density of cold gas on the "short" side than on the longer one. The blue color is due to the emission from partially ionized oxygen atoms, while the cooler yellow color highlights the dual presence of hydrogen (red) and nitrogen (green).

The star itself at the core of the nebula is currently fusing helium at its center. It is expected to live only another 10 million years or so before dying in a spectacular Type II supernova explosion.

Image credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA), of the Bubble Nebula as imaged 229 years after its discovery by William Herschel.

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