Temecula Valley Astronomer

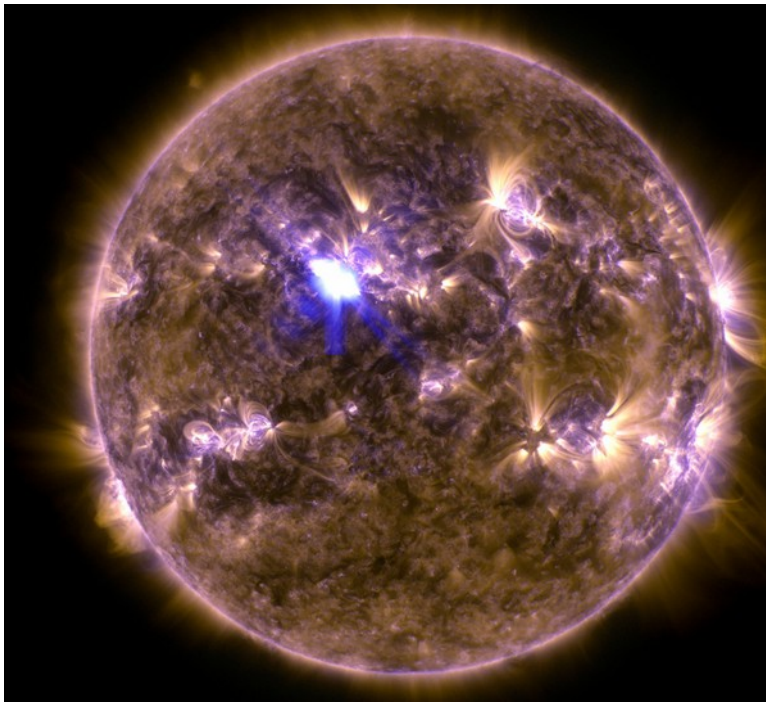
The monthly newsletter of the Temecula Valley Astronomers April 2015

Events:

General Meeting : Monday, April 6, 2015 at the Temecula Library, 30600 Pauba Rd, Rm. B at 7 pm.

We will have our usual What's Up by Tim Deardorff and Bob Fuller will present a talk on Stellar Evolution - about how stars are born, live and die. He also talks about the properties of stars and how astronomers measure these properties. Bob bought his first telescope three years ago.

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



APOD: Sun with Solar Flare - Image Credit: NASA Solar Dynamics 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 & Facebook: Tim Deardorff 951-775-1036 (tim-deardorff@yahoo.com)
Outreach: John Garrett 951-609-3021 (garrjohn@gmail.com)
Treasurer: Curtis Croulet (calypte@verizon.net)
Secretary: Deborah Cheong (geedeb@gmail.com)
Club Librarian: Bob Leffler 951-541-5400 (bobjleffler@msn.com)

Star Party Coordinator: Deborah Cheong (geedeb@gmail.com)

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

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

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Cosmic Comments – April/2015
by President Mark Baker

I was thinking how fortunate we have been to have an **Emma Garrett** participate in our Club. She attends meetings and enthusiastically supports Outreach activities, which is part of the reason why she has received National attention and awards in her tender years. It will be a sad day when she moves on and leaves the Club in her wake…

But just as concerning to me is where the "Next" Emma is going to come from. We had hoped by promoting Astronomy in the community, and especially in the schools, that we would start seeing an influx of the younger generation into the program. We do generate a lot of interest "in the moment", but the flood of youth participants has not materialized…yet!!

Maybe once we establish the observatory complex, and promote the science utilizing current digital and internet technologies, we can reach more students from the primary levels, up through the secondary, and even the local colleges. I just feel that they are really out there, and "if we build it, they will come…!!!"

Here's to keeping the Faith and the TVA mission…

Clear and Dark Skies, my friends…

Looking Up – April 2015
by Curtis Croulet

Full Moon is April 4 at 5:05 am; **Last Quarter Moon** is April 11 at 8:44 pm; **New Moon** is April 18 at 11:57 am; and **First Quarter Moon** is April 25 at 4:55 pm.

Mercury reaches superior conjunction (i.e., it's on the other side of the Sun) on April 10. It'll be low in the evening sky during the last part of April. Its best evening apparition of 2015 comes around May 7.

Venus is high and bright in the evening sky, shining at magnitude -4.1. As **Venus** brightens, its disk grows from 14 to 18 arc seconds. **Venus** and the Pleiades pass each other April 10th & 11th. Greatest elongation (angular distance east of the Sun) occurs on June 6. March 4 brings an interesting conjunction of **Venus** and **Uranus**. You can get an interesting view of the two planets in the same low-power field on the evening of March 4, but that'll be after their closest approach, which occurs around 10:40 am. Venus should be easy to see in the daylight sky in a scope, although *finding* can be a problem. An accurately calibrated go-to scope makes it easy, however. **Uranus**, which will be about 10,000 times fainter than Venus, will probably be impossible to see in a scope during the closest approach.

Mars is too close to the Sun, and the so-called "red planet" is too small to see any surface detail. But you might have fun viewing it in the evening twilight. Next opposition is May 22, 2016.

Jupiter is high in the east at sunset. Jupiter is now in retrograde motion. It stops and then resumes its normal eastward journey on April 7. Keep in mind that Jupiter was at its largest at opposition on February 6. Although it's more convenient for viewing now, it shrinking in size.

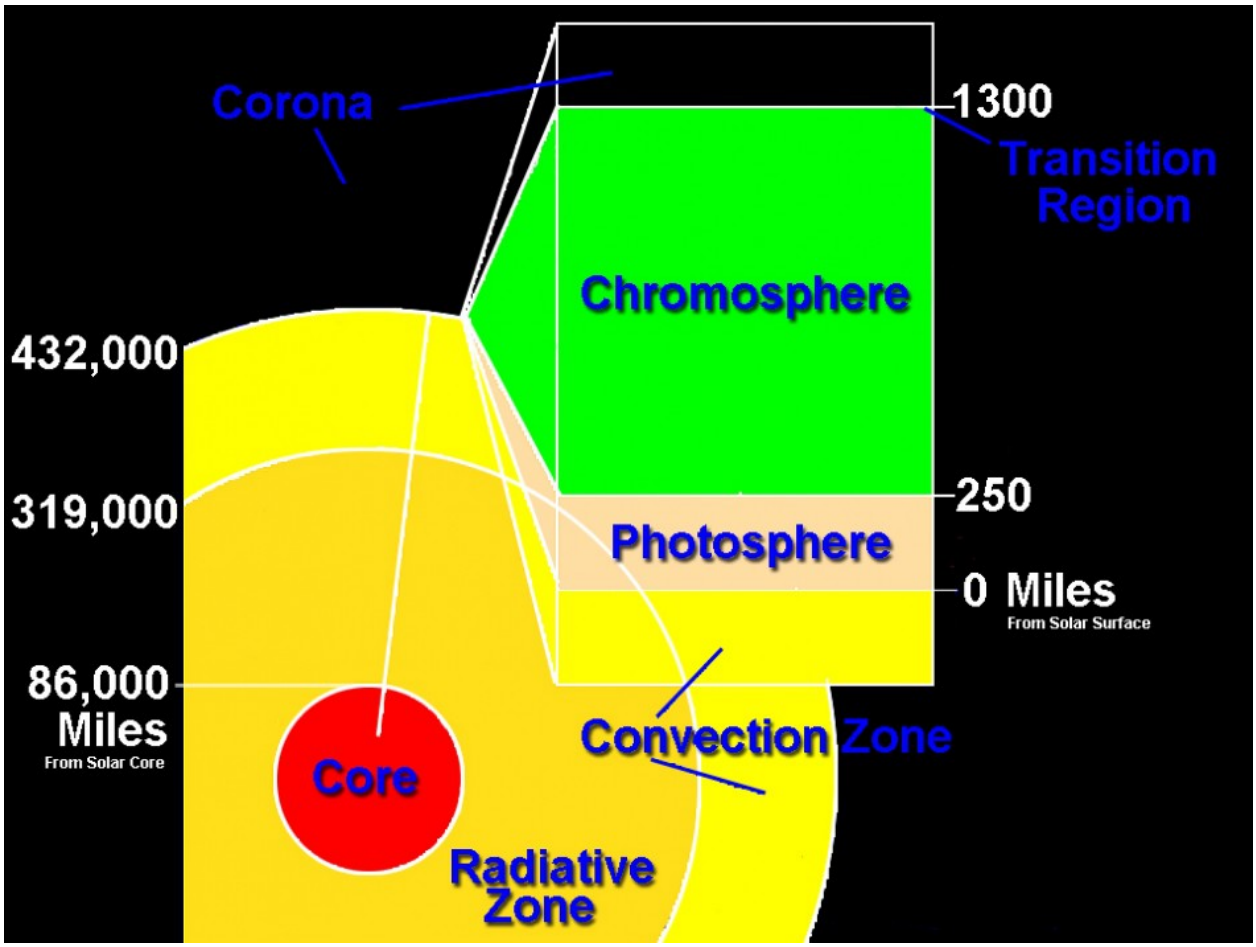
Saturn is in Scorpius. At the beginning of April, Saturn rises shortly after 11 pm. By April 30 it rises two hours earlier, a bit after 9 pm.

Uranus and **Neptune** are *hors de combat* for now.

Pluto is in the predawn sky in Sagittarius.

Let's look up.

Look at a diagram of the Sun. Here are the Sun's layers:



The Sun's layers. The rectangular part of the diagram illustrates the layers above those shown on the circular part of the diagram. But the photosphere and chromosphere are just as round as the interior layers. In contrast, the corona's shape is much more irregular, and it continuously varies. Diagram courtesy NASA.

From inside out, here are the Sun's temperatures:

Core: 15,000,000 C (27,000,000 F)
Radiation Zone: 7,000,000 C (12,600,000 F) to 2,000,000 C (3,600,000 F)
Convective Zone: 2,000,000 C (3,600,000 F)
Photosphere (the layer we see): 5,500 C (10,000 F)
Chromosphere: 4,320 C (7,800 F)
Corona: 2,000,000 C (3,500,000 F)

Thus, the coolest layer of the Sun is the chromosphere, which is about 7,800 deg F, and the hottest layer is the core, about 27 million deg F. The core is where the thermonuclear reactions occur that release the Sun's energy. Photons are being released in the Sun's core. Is the Sun's interior "dark?" No! There are a lot of photons there, the same photons we eventually see. The photons require millions of years to escape to the photosphere and thence into space. Now, it's certainly true that sunspots are cooler and darker than the photosphere, the visible surface of the Sun. The temperature of a sunspot is 4,300 C (7,800 F), compared to 5,500 C (10,000 F) for the photosphere. They are dark in visual contrast to the surrounding photosphere, but if you could see one in isolation in the night sky, it would be brighter than the full Moon (source: http://image.gsfc.nasa.gov/poetry/workbook/sunspot.html). According to the Stefan-Boltzman Law, the increase of radiation of a black body varies with the increase of its temperature to the fourth power. The Sun isn't a black body, of course, but it responds to the same law. Just a little bit of temperature rise (or drop) has a huge effect on brightness. Furthermore, sunspots aren't windows into the interior of the Sun. They are the visible counterparts of magnetic flux tubes in the Sun's convection zone (the layer below the photosphere). But the Sun is bright below the surface where sunspots appear.

During my research for this essay, I encountered a website with an alternate explanation for the nature of the Sun. It was something about everything in the universe being "electric." The conventional explanation of the Sun's interior as a site of thermonuclear fusion was dismissed as "far-fetched" and a mere "theory." In everyday conversation, the term "theory" is often applied to flat-out guesses. But scientific theories are not guesses. A scientific theory is a well-tested explanation of a group of related phenomena, supported by strong evidence. The true test of the validity of a theory is its capacity to make testable predictions of phenomena that we should observe if the theory is true. A famous example relevant to astronomy is the prediction of Einstein's general theory of relativity that very strong gravitational sources can bend the path of passing photons. The bending of light from distant stars passing near the limb of the Sun was observed during the total solar eclipse of 1919, confirming a prediction of Einstein's theory. It is possible for even good theories to eventually fail. Newton's theory of gravity prevailed for over two centuries before it was superseded by Einstein's. But, as the late geologist Stephen Jay Gould once put it, apples did not suspend in mid-air while they awaited Einstein. They fell to the ground as predicted by Newton's theory. Newton's theory was good enough until astronomy was able to describe a universe immensely larger than Newton could have imagined. Einstein or Darwin may eventually suffer a fate similar to Newton. But, for now, they provide a predictive and explanatory framework that serves science well, and the validity of their theories – explanations, not guesses – are almost universally accepted.

Clear skies.

Art's Night Out
Article 158 April 2015

I'd like to start us out observing in and near the Constellation Ursa Major. The common visual "asterism" in this constellation is the "Big Dipper". An "asterism" is a group of stars forming the shape of a familiar object. The "Big Dipper" is in our N/E sky up about 30 degrees extending to about 50 degrees. The "Big Dipper" gets its name obviously from the appearance of what looks like a 'big dipper'. As you look into our eastern sky, you'll notice four stars forming what looks a fairly large rectangle. Extending downward from the bottom left-side star of the rectangle are three stars forming an arc. These stars form the "handle" of the 'dipper' or rectangle. The 'dipper' or 'cup' part of the 'Big Dipper' is sitting on top of the 'handle' of the 'dipper' this month. The open part of the 'cup' is facing to the left.

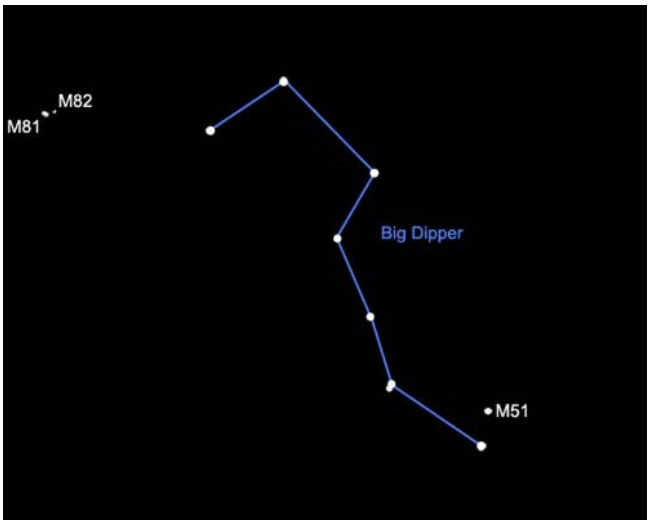
Before I get into the naming of the stars, look at the middle star of the 'handle'. Start with a pair of binoculars (if you have them handy) and observe this star. You'll quickly see that this star is actually more than one star. It appears to be two stars. This would be known as a "binary" or "double" star. If you are in dark skies and have a fairly large aperture telescope (8" or larger), you can see more than two stars. This is in reality a quadruple star. This star is identified as "Mizor/Alcor" or more formally as "Zeta".

Let me identify the remaining stars of our "Big Dipper". The tip handle star is Alkaid or "Eta". The 'handle' star closest to the "pot" is Alioth or "Epsilon". The bottom-left star of the 'pot' is Megrez or "Delta". The bottom-right star is Phad or "Gamma". The upper-right star is Merak or "Beta". And the upper-left star is Dubhe or "Alpha". Okay, we now have the shape of the "Big Dipper" identified in stars.

The "Big Dipper" is often used to help us visually identify "degrees" of distance in the sky. Using your hand and fingers, distances between the "Big Dipper's" stars can aid you in various degrees for the purpose of plotting celestial objects. For example: The distance between the "tip" star of the "handle" and the upper-left star of the "pot" is approximately 25 degrees. If you extend out your hand and spread your thumb and pinky finger out, the distance between your thumb and pinky is about 25 degrees. Adjust your two fingers to fit the between the two stars and you'll have what is 25 degrees in the sky. The distance between the upper-left star and the bottom-left star is 10 degrees. An extended closed fist measures about 10 degrees from side to side. The distance from the upper-left star and the upper-right star of the 'pot' measures 5 degrees. Your first three fingers held together measures about 5 degrees. The distance of the thickness of your pinky is about one degree.

I would like to help you find a couple of galaxies near the "Big Dipper" that are fairly visible in our light polluted skies of Temecula. You'll want to try and find these on a moonless, clear night with little to no wind. Form a line from the bottom-right star of the 'pot' through the upper-left star of the 'pot', extending upwards towards the north area of the sky. If you look out about the same distance as between the two stars of the 'pot' you just looked at, and to the left a little, you should be able to see two galaxies. One is shaped like a cigar and the other is a small oval. Both of these galaxies I have seen from my backyard using binoculars. As you

look through telescopes at these, they become more visible and will move out of the field of view of any given eyepiece. These are best seen in darker skies, but still a nice find in our area. These are known as M-81 and M-82; a couple of Messier's objects. Be patient as you look for these two small objects. Galaxies sometimes takes averted vision to see them. That means you need to look away from the center point of an object with your eye. As you look to one side or another, the object will be seen in more detail. I have had to move my scope around a little in where I thought these two galaxies were. In so doing, I have been able to spot them.



Most of the objects you can see in and around the "Big Dipper" are visible in darker sky areas. The next few objects I'll describe I have seen up in the Santa Rosa Plateau on a moonless, clear night. Anza in the same conditions would be excellent.

Look at the upper-right star of the 'pot', Beta. Now, look down about 1 degree towards the bottom-right star Phad. You should be able to see a small hazy oval. This is the galaxy M-108. This has a fairly low surface brightness and looks a lot like M-82, the cigar shaped galaxy. If you look about ½ degree down and to the right of M-108, you'll see a very small hazy circle. This is a "planetary" nebula known as M-97. Planetary nebulae are remnants of exploded stars.

If you form a line from the upper-left star Alpha through the lower-right star Phad and out about 8 degrees, you should find another nice galaxy called M-106. This is a nice oval shaped galaxy with a fairly bright core. This galaxy is actually part of the "Canes Venatici" constellation which lies just S/E of the 'handle stars' of the Big Dipper.

Look back at the two outer stars of the 'handle' of the Big Dipper. These are stars "Eta" the tip of the handle and "Zeta" the middle star(s). If you look to the left of the center between these two stars and out about 4 degrees, you should see another galaxy called M-101. This is also called "The Pinwheel" galaxy. This has fairly low surface brightness, but is fairly large and can

be a good challenge on a dark, clear night. This one usually takes my averted vision to pick up.

We have been looking at several Messier objects found near the constellation Ursa Major. This reminds me of the challenging “Messier Marathon” that is usually performed on the “New Moon” weekend in April. Messier listed 109 objects back in the 1700’s which have been since refined to specific listings of galaxies, nebulae, open clusters and globular clusters. These are listed in a catalogue called the Messier Catalogue and have numerical listings preceded with a capital “W”. The challenge is to visually observe and identify all of the 109 objects in one night, starting at dusk and ending at dawn. Completing this challenge would qualify you to receive a Messier Marathon award from the Astronomical League. Actually, you can qualify for this award by observing and identifying these objects at any time. I was able to accomplish this task over the period of one year, using a 3.5” refractor and an 8” Schmidt-Cassegrain telescope. Try your observing skills and do the Messier challenge.

Until next time, Art

The TVA is a member club of The Astronomical League.

Editor's note: Along with this reminder of our membership in the AL, you might also have noticed that our recently revived logo has made its appearance on a few “T” shirts, in this newsletter and on the web page.