Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers Jan 2016

Events:

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

Paul Kreitz will speak on "The History of Mars Exploration", covering the period from Schiaparelli's "discovery" of canals on Mars in 1871 to the present rovers exploring Martian geology and looking into the future planned manned missions in the 2030s.

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

Quadrantid Meteors and Aurora from the Air Credit: Jeremie Vaubaillon et al., Caltech, NASA. NASA APOD 7 Jan 2008

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 – January/2016
by President Mark Baker

2016 is upon us… I so look forward to wondering, learning, sharing, and enjoying more of the Cosmos this year. And it's especially gratifying because I get to do it with you, the TVA members and associates. There are a lot of questions and possibilities before us… do we finally get an observatory complex built, a place to call our own?? Will we be able to support the growth in Outreach, especially in the school Clubs?? Will Betelgeuse finally blow?? What new wonders will be revealed and will we step up and support programs where we can through observing, recording, data analysis, etc.??

This could be an awesome year for science in our communities and I have a good feeling about TVA's part in it all…in fact, I feel we are in a position to take the lead in several areas if we are of a mind to. I know it takes commitment to do so… to even put common good above our personal wants and needs in some cases. It all intrigues me and I hope to look back on this year with a smile on my face and say "You did good, TVA… you did real good!!" Thanks for all you do…

Clear, Dark Skies my Friends…

TVA Apparel
by Mark Baker

We reached our ordering goal and the order was placed.

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Looking Up – January 2016
by Curtis Croulet

Last Quarter Moon is January 1 at 9:30 PM; **First Quarter Moon** is January 16 at 3:26 PM;

Full Moon is January 23 at 5:46 PM; and the second **Last Quarter Moon** is January 31 at 7:28 PM.

Mercury will be in the evening sky during the first week of January. The best view will be New Year's Day, right after sunset. **Mercury** reaches inferior conjunction (between the Earth and the Sun) on January 8, then it creeps into the pre-dawn sky at the end of the month. The best evening apparition of Mercury in 2016 will be in April.

Venus is already well past greatest western elongation as 2016 begins. It is diving toward the Sun, rising 3 hours before sunrise on January 1, but only 2 hours before sunrise on January 31. **Venus** and **Saturn** are only ½ degree apart on the morning of January 9.

Mars rises as early as 1:30 AM on January 1. It brightens and grows slightly during the month. Opposition for **Mars** is May 22, 2016.

Jupiter is nudging back into civilized viewing hours. It rises a bit before 10:30 PM on New Year's Day and a bit before 9:30 PM on January 31. Opposition is March 8, 2016.

Saturn is a pre-dawn object during January.

If **Uranus** and **Neptune** are on your observing agenda, it's time to get busy. They are in Pisces and Aquarius, respectively. **Neptune** sets a bit after 9 PM on New Year's Day and a bit after 7 PM on January 31. **Uranus** sets about 3 hours later at both ends of the month.

Pluto reaches conjunction with the Sun on January 6, and it's unavailable for viewing all month.

January's best meteor shower is the **Quadrantids**, which peak (for us) around midnight on the morning of January 4. The radiant is at the northern end of Boötes ("boh-oh-teez," not "boots"). The Quadrantids are named for an obsolete constellation, Quadrans Muralis, the "wall quadrant." A quadrant was an instrument used before the invention of the telescope to measure the positions of stars. Quadrants were often mounted on walls, presumably to provide stability for accurate measurements.

We also have a comet: C/2013 US10 (Catalina), more easily known as **Comet Catalina**. We've already seen a couple of excellent photos of the comet by TVA members. I finally got up to view it on the morning of December 19, viewing between 3:30 AM and 4:00 AM. The comet was easy to see in 8.5x42 binoculars. The December 2015 issue of *Sky & Telescope*,

p.45, has an excellent finder chart. You might also check www.skyandtelescope.com. On January 1 the comet will be very close to Arcturus.

Let's look up.

Probably the most beloved of the winter constellations is Orion. Its numerous bright stars and prominent three-star "belt" make it instantly recognizable. Orion's star pattern is widely recognized in many cultures as representing a human figure, usually a god, hunter, or hero. In classical mythology, Orion invites comparison with Hercules, who was a similar "hero" type. Robert Burnham Jr., in his classic *Burnham's Celestial Handbook*, refers to Orion as a "vague and shadowy figure," in contrast to Hercules, to whom many exploits were attributed. Even the name "Orion" has a variety of possible origins.

Let's focus for a moment on Orion's reddish 1st magnitude star Betelgeuse, Alpha Orionis. The name is a corruption of the Arabic *yad al-jauza*, which translates to the "hand of *al-jauza*." "*Al-jauza*" has been translated as "the giant" or "the middle one." The name didn't originally mean the "armpit of the giant," as is so frequently claimed. I'm relying on Fred Schaaf's *The Brightest Stars* for this information.

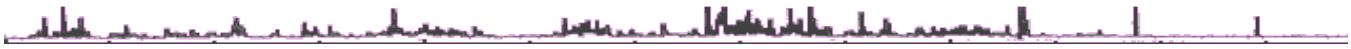
Betelgeuse is a red giant star, spectral class M. It's very large, and it irregularly varies in magnitude. It has been as bright as mag -0.1 and as faint as +1.1. Average is about mag +0.45. Betelgeuse was the first star ever to have its physical diameter directly measured. This was accomplished in 1920 by Albert Michelson, using a beam interferometer mounted on the 100-inch Hooker Telescope at Mt. Wilson Observatory. The angular diameter of Betelgeuse was measured at 0.044 arc seconds. Betelgeuse is estimated to be about 430 light years from Earth. Because its outer layers are so tenuous – thinner than the best laboratory vacuum – deciding the true "surface" of Betelgeuse is difficult. However, we do know that it is at least as large as the orbit of Mars.

Since we know that Betelgeuse is near the end of its life, and it's massive enough to collapse into a supernova, the question frequently discussed astronomy enthusiasts is, when will Betelgeuse blow? The only estimate astrophysicists offer is, "Sometime in the next several million years." Perhaps it has already blown, but we haven't seen it yet. When it finally pops, it'll be at least as bright as the full Moon, which is mag -12.6.

Before I close, I want to say good-bye to an astronomical friend. For many years the annual *Astronomical Calendar*, by Guy Ottewell, has been an indispensable reference for details about planetary positions, periodic comets, meteor showers, and much else. You could learn a lot about astronomy from this one publication. The *Astronomical Calendar* has been prominently spread out next to me while preparing these articles, going back to the first essays in 1996. The latest 2016 issue of *Astronomical Calendar* will be the last. This isn't the first time Guy announced he was retiring the *Astronomical Calendar*. Several years ago he proclaimed its demise, but then he had a change of heart and resumed publication the following year. I think Guy means it this time. Some of the *Astronomical Calendar*'s data are available elsewhere, but, for example, Ottewell's annual has very detailed descriptions of even

the most minor meteor showers and periodic comets. I know of no other readily-available, printed source for this information. It's the end of an era.

Clear skies.



How will we finally image the event horizon of a black hole? by Ethan Siegel

One hundred years ago, Albert Einstein first put forth his theory of General Relativity, which laid out the relationship between spacetime and the matter and energy present within it. While it successfully recovered Newtonian gravity and predicted the additional precession of Mercury's orbit, the only exact solution that Einstein himself discovered was the trivial one: that for completely empty space. Less than two months after releasing his theory, however, the German scientist Karl Schwarzschild provided a true exact solution, that of a massive, infinitely dense object, *a black hole*.

One of the curious things that popped out of Schwarzschild's solution was the existence of an event horizon, or a region of space that was so severely curved that nothing, not even light, could escape from it. The size of this event horizon would be directly proportional to the mass of the black hole. A black hole the mass of Earth would have an event horizon less than a centimeter in radius; a black hole the mass of the sun would have an event horizon just a few kilometers in radius; and a supermassive black hole would have an event horizon the size of a planetary orbit.

Our galaxy has since been discovered to house a black hole about four million solar masses in size, with an event horizon about 23.6 million kilometers across, or about 40 percent the size of Mercury's orbit around the sun. At a distance of 26,000 light years, it's the largest event horizon in angular size visible from Earth, but at just 19 micro-arc-seconds, it would take a telescope the size of Earth to resolve it – a practical impossibility.

But all hope isn't lost! If instead of a single telescope, we built an *array* of telescopes located all over Earth, we could simultaneously image the galactic center, and use the technique of VLBI (very long-baseline interferometry) to resolve the black hole's event horizon. The array would only have the light-gathering power of the individual telescopes, meaning the black hole (in the radio) will appear very faint, but they can obtain the resolution of a telescope that's the distance between the farthest telescopes in the array! The planned Event Horizon Telescope, spanning four different continents (including Antarctica), should be able to resolve under 10 micro-arc-seconds, imaging a black hole directly for the first time and answering the question of whether or not they truly contain an event horizon. What began as a mere mathematical solution is now just a few years away from being observed and known for certain!

Note: This month's article describes a project that is not related to NASA and does not suggest any relationship or endorsement. Its coverage is for general interest and educational purposes.

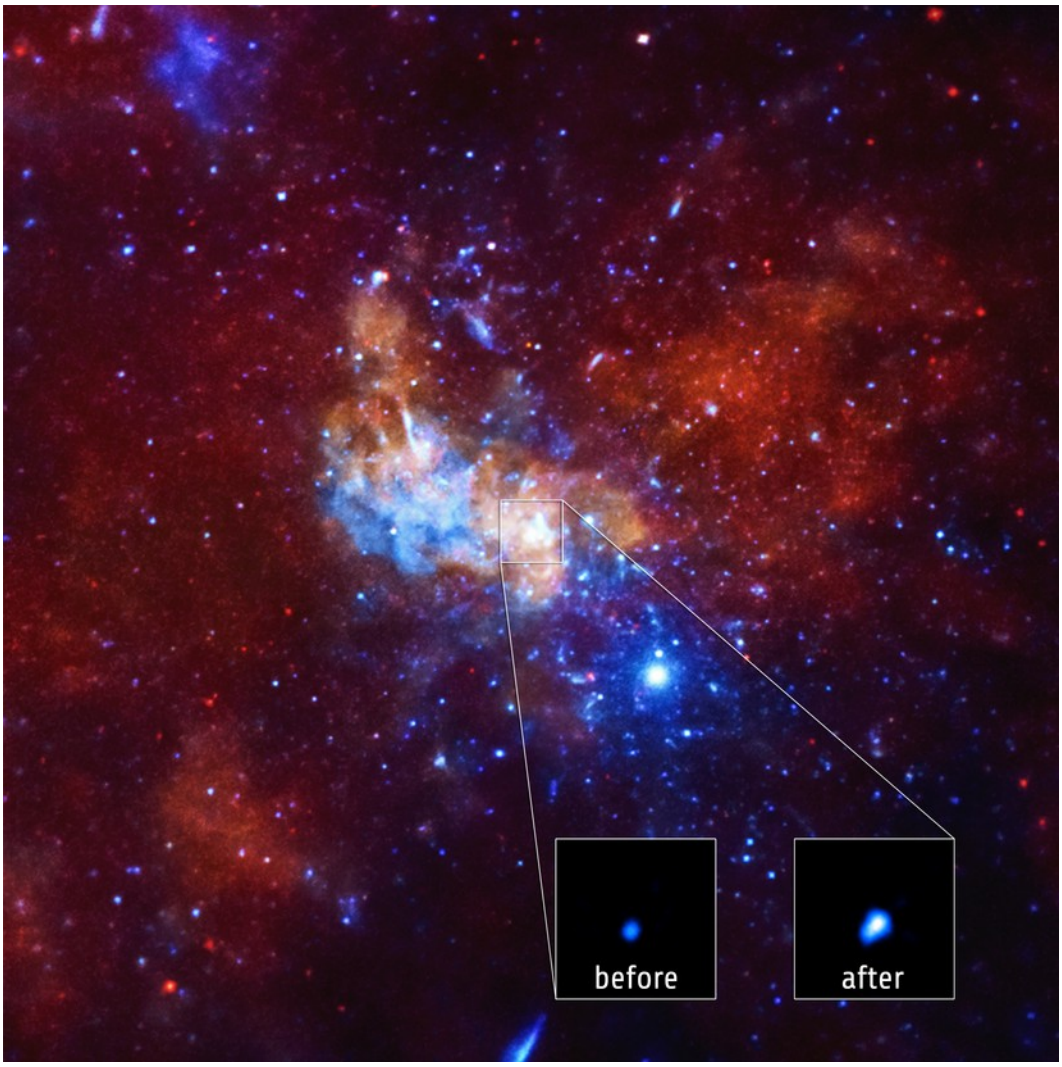


Image credit: NASA/CXC/Amherst College/D.Haggard et al., of the galactic center in X-rays. Sagittarius A is the supermassive black hole at our Milky Way's center, which normally emits X-ray light of a particular brightness. However, 2013 saw a flare increase its luminosity by a factor of many hundreds, as the black hole devoured matter. The event horizon has yet to be revealed.*

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The TVA is a member club of The Astronomical League.