Temecula Valley Astronomer

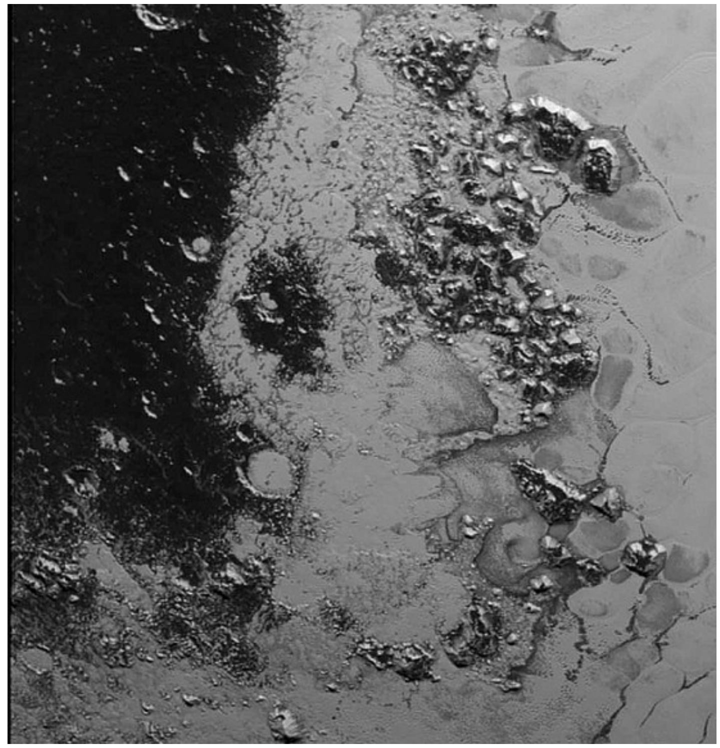
The monthly newsletter of the Temecula Valley Astronomers Oct 2015

Events:

General Meeting : Monday, Oct 5, 2015 at the Temecula Library, 30600 Pauba Rd, Rm. B at 7 pm.

Following Mark Baker's comments, Tim Deardorff will present "What's Up". Then we will hear from Sam Pitts who will speak on "Building an Observatory in Central Oregon". Sam will share with us his experiences and how it turned out. All are welcome....

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



A newly discovered mountain range lies near the southwestern margin of Pluto's Tombaugh Region (NASA/JHUAPL/SWRI)

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 – October/2015
by President Mark Baker

I wish I could convey how gratifying it is to participate in the plethora of Star Parties, Star-B-Q’s, meetings, and related events with my TVA teammates. And it’s not that so many of you do it, as much as you keep doing it – over, and over, and over…!!!

I personally appreciate the dedication and sacrifices so many of you make just to maybe touch the spirit of even one individual and get them to look up and wonder…although I know we inspire dozens at most events. And it’s often adults that are the most awestruck after seeing a planet, or cluster, or fuzzy and are the most expressive. Still, that aside, the only reward I find necessary is the simple statement by a child, such as “Wow” or “Cool”, when seeing a celestial object for the first time and instantly expanding their horizon. I can almost hear the wheels turning…

So even though I am at a loss for words, please accept my humble thank you for all you do… we know not what seeds we plant!!

Clear, Dark Skies my Friends…

Looking Up – October 2015
by Curtis Croulet

Last Quarter Moon is October 4 at 2:06 PM; **New Moon** is October 12 at 5:06 PM; **First Quarter Moon** is October 20 at 1:31 PM; and **Full Moon** is October 27 at 5:05 PM.

Mercury will have a nice morning apparition during most of October. Greatest western elongation (angular distance westward from the Sun) will be October 16.

From high to low in October's morning sky, we have **Venus**, **Mars** and **Jupiter**.

Venus is a brilliant crescent at the beginning of October, shrinking to a "half-Moon" appearance by the end of the month. It dims slightly from magnitude -4.7 to -4.5.

Mars is tiny, too small to show detail in amateur telescopes. Next opposition is May 22, 2016.

Jupiter is only about 2/3 as big as it'll be at next opposition (March 8, 2016).

Saturn is in easternmost Libra as October begins. It creeps back into Scorpius mid-month. It sets about 1-1/2 hours after the Sun by the end of October, and it'll never be very high.

Uranus is in Pisces. It reaches opposition during the evening of October 11. **Neptune** is further west, in Aquarius. This is a good time of year to look at both of them. Uranus is visible in ordinary birding binoculars. Neptune will require a telescope or really big binoculars. *Sky & Telescope*'s September 2015 issue has good finder charts on p.49.

Pluto is in Sagittarius. The July 2015 issue of *Sky & Telescope* has a good finder chart on pp.52-53. These charts are also available on the *S&T* website. Time is drawing short, however, for viewing Pluto. You'll want to start as soon as the sky is completely dark. You'll need a big telescope.

Interesting conjunctions and alignments: **Mars** and **Jupite**r will be less than ½ degree apart on the morning of October 17.

Let's look up.

We have some news from Palomar Observatory, from the 200-inch Hale Telescope.

The Hale Telescope uses a variety of instruments (nobody "looks through" the telescope). The instruments are swapped in and out of the telescope, in accordance with particular astronomers' research programs.

By far the most commonly used instruments are spectrographs, which analyze stars and galaxies by splitting up their light. These spectrographs are used at the telescope's

Cassegrain focus (the “bottom” of the telescope. In the old days, astronomers actually saw tiny spectra (little “rainbows”) on their pictures, which were shot on photographic glass plates. These days the astronomers see graphs on computer screens. While less interesting to the average astronomy enthusiast than plain old pictures, such spectra can tell us what a star or galaxy is made of, how far away it is, what direction it’s moving, how fast it’s moving, and if it consists of more than one object. But the Hale Telescope also uses instruments that are capable of taking pictures. There’s a CCD camera called the Large-format Camera (“LFC”), which is used at prime focus (the “top” of the telescope). The LFC is capable of shooting good, old-fashioned, visible light pictures of galaxies and nebulae, just as Milton Humason shot in the 1950s.

However, one of the most interesting instruments used at prime focus is called the Cosmic Web Imager. When the CWI is deployed, it is mounted at the Hale Telescope’s Cassegrain focus. Quoting from the description provided by its builder and user, Caltech’s Christopher Martin, the CWI is “designed to detect faint emission from extended regions, especially the Intergalactic and Circumgalactic Media with redshifts $1.5<z<4$.” In plain English, the CWI is intended to take images of the stuff between galaxies. The galaxies are far, far away.

The CWI was recently employed to make a significant astronomical discovery. The following information is drawn from a recent Caltech press release.

“A team of astronomers…has discovered a giant swirling disk of gas 10 billion light years away – a galaxy-in-the-making that is actively being fed cool primordial gas tracing back to the Big Bang.” The press release continues, “…the researchers were able to image the protogalaxy and found that it is connected to a filament of the intergalactic medium, the cosmic web made of diffuse gas that crisscrosses between galaxies and extends throughout the universe.” “’This is the first smoking-gun evidence for how galaxies form,’ says Christopher Martin, professor of physics at Caltech.” The protogalaxy’s disk is 400,000 light years across, about four times bigger than the Milky Way. “It is situated in a system dominated by two quasars, the closest of which, UM287, is positioned so that the emission is beamed like a flashlight, helping to illuminate the cosmic web filament feeding gas into the spiraling protogalaxy.”

There are two important take-aways here for astronomy enthusiasts. One take-away is that we have taken a significant step in learning how galaxies formed in the early universe. The other take-away is that the Hale Telescope, which went into service almost 66 years ago, is still performing cutting-edge science.

Clear skies.

How Large *Can a* Star Be?

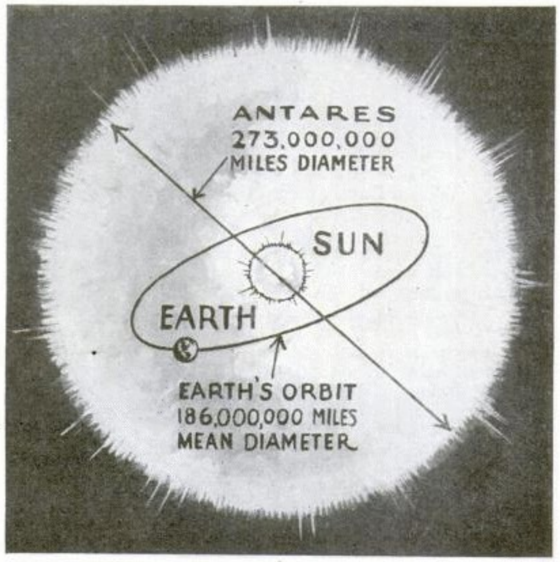
New Discoveries Show That a Sun More Than Fifty Times the Mass of Ours Would Burst into Fragments

By Newton Burke

TO MOST of us, the Sun, which for millions of years has been lighting and warming the Earth day after day, seems quite the greatest and most important body in the universe. Yet actually our Sun is a relatively unimportant little pinhead of fire compared with some of the vast flaming stars swinging through space so far distant from us that they can scarcely be detected with the powerful instruments of astronomy.

Just by way of comparison, imagine that you could hop into your car some day and travel without stop indefinitely. At a continuous speed of sixty miles an hour, you could complete a trip around the Earth's equator in about seventeen days and eight hours. In a little less than five years, you could cover the distance at the same speed around the Sun. But to circle Antares, the largest star we know of, in your fastest motor car, you would take approximately 1,370 years!

The diameter of Antares is estimated at more than 273,000,000 miles, or more than 300 times that of the Sun. And Antares is only one of a number of giant suns. Betelgeuse and *alpha* Hercules are almost as large. They are so huge that not one of them could find room in the vast circle described by the Earth in its path around the Sun.



Greater Than Earth's Whole Path around the Sun

Antares, the largest known star, is just one of a number of giant suns, none of which could find room in the vast circle described by our Earth in its path around the Sun. To motor around it would take 1,370 years

BALLS of fire so enormous as these stagger human imagination. Quite naturally, they lead us to ask whether there is any limit to the size of a star; and, if so, how large it is possible for a star to be.

Answers to these questions recently have been given through remarkable measurements by A. S. Eddington, noted British scientist.

A star whose mass is fifty times that of our Sun, this astronomer found, has reached its limit in greatness. Stars of greater mass than this cannot exist; they would burst of their very enormity. Their own pressure from within, combined with the centrifugal force of rotation, would overbalance the force of gravitation holding them together, and they would fly apart in billions of fragments!

In these calculations it must be remembered, of course, that the mass of a star depends on the weight of materials composing it, and is quite a different thing from volume. Thus, while the great star Antares is hundreds of times larger in dimensions than the Sun, its mass is within the outside limit of fifty times the mass of the Sun.

Eddington's startling conclusions were reached through a study of the light radiation of stars and its causes, by means of ingenious modern instruments of measurement, such as Michelson's interferometer, the spectroscope, and improved photographic apparatus. He learned that in the center of a star whose mass is one and one half that of our Sun, the heat reaches the tremendous temperature of 8,550,000° F. Even a spot halfway between the center and the surface reaches 2,395,000°. The pressure at the center is 21,000,000 atmospheres, or more than 300,000,000 pounds to the square inch—at least 10,000 times as great as the breech pressure of Uncle Sam's largest coast defense gun.

Equal to 6,000 Big Guns

The terrific pressure at the center of the Sun has been estimated at about 180,000,000 pounds to the square inch—6,000 times the breech pressure developed in firing our largest coast defense gun. A star more than fifty times the total mass of our Sun would burst

EDDINGTON learned, too, that just as there is a limit to the greatness of stars so also there is a limit to their smallness. A star less than one seventh the mass of our Sun, he discovered, would cease to shine. For the temperature at its surface could not reach 5400° F.—the lowest temperature at which a star can remain visible by light radiation.

Of dwarf stars, there are undoubtedly far more than we know of, but most of them are invisible to us even through the most powerful telescopes. The smallest observed and studied, a distant companion to *alpha* Centauri, is probably close to the limit of visibility and gives only $\frac{1}{600,000}$th part of the light of the Sun. These dwarfs have diameters between 155,000 and 580,000 miles in length, hence are much smaller than the Sun, which has a diameter of 865,350 miles.

THESE new measurements, incidentally, led to interesting conclusions about our Sun. For instance, his calculations indicate that the highest surface temperature the Sun ever reached was about 16,200° F., while its present surface temperature is not more than 10,800°—thus supporting the theory that our Sun is a "dying star."

That such may be the case, however, need cause us no alarm, scientists tell us; for even if the Sun's energy should continue to decrease at a regular rate, it would take millions of years before it would cool off enough to injure life on Earth. In fact, astronomers say the Sun does not get its heat by burning up as we burn coal. Instead, much of its heat seems to be developed by explosions or changes in atoms of matter composing it.

Thus, so far as we are concerned, its store of energy is inexhaustible. The Sun has been supplying warmth to its family of planets for probably millions of years and, to the best of our knowledge, will continue to do so for many centuries to come.

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Eddington was right up to a point. His limit of 50x the mass of the Sun only took one of the important factors into account. Today, we believe that the limit is about 150x the mass of the Sun.

You can read more at https://en.wikipedia.org/wiki/Eddington_luminosity .

Don't confuse mass with size. There are many stars that are thousands of times the size of the Sun, they just aren't very dense.

In the next to the last paragraph, you can see that even in 1926, scientists weren't sure what caused stars to shine. Understanding of nuclear reactions was still 10-15 years away.

Popular Science Monthly on Google Books, May 1926.

The TVA is a member club of The Astronomical League.