THE OBSERVER

The Newsletter of Central Valley Astronomers of Fresno November-December 2019

Hubble Gives a Spooky Halloween Gift in 2019

This eerie looking face-like image was taken by the Hubble Space Telescope on June 19, 1919, and released by NASA and ESA on October 29. It is of AM 2026-424, about 700 million light years from Earth. The image shows two almost identical spiral galaxies in the early process of collision, forming a rare ring galaxy. Astronomers say that in about a billion years, the two will completely merge into an elliptical galaxy.

Image from HST/NASA/ESA; story from Fox News

"Astronomy is an impossible science. It's a wonder we know anything at all..."

-Alan Sandage (1926-2010) Mt. Wilson astronomer, quoted in *Lonely Hearts of the Cosmos*

In this Issue-

Central Valley Astronomers

Web address
www.cvafresno.org

Webmaster-Scott Davis

To all CVA members-

A few days ago, we received an email from president Scott Davis that long time member Dale Lohrman died suddenly on October 25. As well, a while back, I heard that Don Miller, who had also been a long time member some years ago, died earlier this fall. I'm not here to speculate on religion or philosophy, but just to say that both were fascinated with the galaxies, stars, and planets, and worked to share that fascination with other members and the public as well. In this era, when so many are more concerned with the latest gossip and self-interests on social media, they helped to open up the treasures of the skies to all. They will be remembered for their enthusiasm and dedication to amateur astronomy, and will be missed by those of us in the cosmic community.

-The editor

Remember-December 7-
CVA's annual elections for officers and board members
7pm
East Engineering Building
Fresno State

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Number of exoplanets found as October 2019- 4,122

How many more are out there?

Tens of thousands? Hundreds of thousands?

Profiles in Astronomy

Benjamin Baillaud 1848-1934

Baillaud was born in the town of Chalon-sur-Saone in France, and educated at the Sorbonne, the University of Paris. He first worked as an assistant at the Paris Observatory, then became a professor of physics and astronomy at the University of Toulouse. He eventually became the director of the Toulouse Observatory and the dean of the school of sciences at the University. In 1903, while still dean, he arranged for the Toulouse Observatory to take over management of the Pic du Midi in the Pyrennes Mountains. This had been a favorite spot for amateur astronomers; Baillaud arranged for two large telescopes to be built there and made it an annex site for the Toulouse Observatory. In 1907, he went back to Paris to be the director of the Paris Observatory(which is today the oldest operational observatory in the world). He remained as director until his retirement in 1926.

Baillaud specialized in celestial mechanics, particularly plotting the orbits of the moons of Jupiter and Saturn to a high degree of accuracy. He was also deeply involved in the World Timekeeping conference in 1884, which broke the planet up into twenty-four standard time zones and set Greenwich, England as the Prime Meridian(The French, though, protested this, and claimed that Paris should be the Prime Meridian). As a result of this, he became the first president of the International Time Bureau. He was also one of the founders of and the first president of the International Astronomical Union. Among many other honors, he was a recipient of the Bruce Medal of the Astronomical Society of the Pacific. A crater on the Moon and two asteroids are named for him.
Source-Wikipedia

The Ladd Observatory

The Ladd Observatory, on the campus of Brown University in Providence, Rhode Island, was officially established in 1891; it was named after Herbert W. Ladd, a wealthy benefactor of the school. Today, it is managed and operated by the physics department at Brown University, and has been on the National Register of Historic Places since 2000.

The observatory has two telescopes: a 12" refractor, which was built in 1891 and is still used today for both academic research and public viewing, and an 88mm transit telescope, which for many years was used for timekeeping. For almost 80 years, using the transit telescope, the observatory would send out a time signal at noon and 8:30pm every day to local emergency and civil defense organizations and government offices in order to calibrate their timepieces. This was temporarily discontinued during both world wars, and was finally ended altogether in 1973.

An interesting fact about the Ladd Observatory is that the science fiction/fantasy writer H. P. Lovecraft worked and did research at it for several years in the nineteen-teens, and subsequently wrote about it in columns for the Providence newspaper.

Sources-Wkipedia, Ladd Observatory website

Where Does Outer Space Begin?

In March and April of this year, I taught a class on the History of Human Spaceflight for the OLLI program at Fresno State. One of the topics I brought up was at what point in the atmosphere does one become an astronaut? Exactly where the outer space line begins has been a source of controversy for a number of years, and I ended up doing a good deal of research on it. This is what I learned, and passed on to the class.-the editor

The search for the definition of outer space begins in the 1940s with Theodore von Karman(right), the Hungarian-born physicist who taught at Caltech for many years. He was one of the first, in fact probably the first, to use rockets to gather data on the upper atmosphere. He and students would fire rockets high into the atmosphere from an arroyo only a couple of miles from the Caltech campus; that arroyo is where NASA's Jet Propulsion Laboratory now stands. von Karman learned over the years that the atmosphere gets thinner and thinner the higher it goes above the Earth's surface(I pointed out to the class that the Earth's atmosphere doesn't simply vanish above a certain point; as it goes higher, it just gets thinner. Even at the altitude of the International Space Station, about 300 miles above the Earth's surface, for instance, there's still some atmosphere. It's thin, though, maybe a thousandth that of sea level. But it also has enough resistance to slow down orbiting objects like ISS, which has small thrusters to boost its orbit every now and then). Anyway, after of years of gathering data and analyzing it, von Karman concluded around 1950 that outer space begins at the point where the atmosphere is so thin that it can no longer provide lift for an aeronautical craft; it has to have its own internal propulsion system to stay aloft. He calculated this dividing line in the sky to be 83 kilometers(about 51 miles) above the Earth's surface at sea level. The demarcation line between the atmosphere and outer space became known as, and still is, the Karman Line.

In 1961, at the advent of the Space Age, NASA and the Air Force decreed that, using von Karman's research and calculations, anyone who flew 50 miles or higher above the Earth would be given astronaut wings and status. Thus, starting with the first Mercury flight in 1961, and going through Gemini, the X-15, the Apollo, and the space shuttle, all pilots and passengers who crossed the Karman line or when higher were considered astronauts. In 2002, the Federal Aviation Administration(FAA), looking forward to the time when commercial space flight would be achieved, announced that any civilian who flew above 50 miles would be given astronaut status as well(and this went into affect when Applied Composites' SpaceShipOne won the X-Prize in 2004; two of its pilots were named astronauts for flying 50 miles or higher. More recently, Virgin Galactic's VSS Unity pilots and passengers have also been given astronaut status for their flights.

There is a glitch, though. In 1967, the International Aeronautical Federation(FAI) which is based in Paris, decreed that the outer space boundary begins, not at 50 miles, but at 100 kilometers(about 62 miles) above the Earth. Since then, it has refused to accept any flight which does not reach that altitude, or give astronaut status to any person who flies below it. As a result, some of the X-15 flights, as well as Virgin Galactic's VSS Unity flights earlier this year, have not been recognized by the FAI. However, over the years, a number of scientific institutes and organizations have protested the FAI's decision, and more recent scientific research shows that von Karman was probably right. in his assigning outer space to 50+ miles. The FAI announced in 2017 that an international conference will be held in 2019 to review the evidence for the Karman Line. In the announcement, it did hint that it may have to modify its definition of outer space.

This argument of the boundary of outer space is not just about who is an astronaut or not. It has political and legal ramifications as well. Von Karman theorized, and international legal scholars and many countries have agreed, and this has been written into some international agreements and treaties, that all air space over a country up to the outer space line is sovereign territory; that is, it belongs to that country. But once a craft crosses and flies above the outer space line; i.e., the Karman line, then it is in *terra nullis*, free space, like Antarctica, and anyone can use it without penalty or (hopefully) conflict. So, where the Karman Line is placed is extremely important, not just for those wishing to fly in space, but also for individual countries who want to protect their own airspace, and fly over other countries as well.

Star Stories

Bernard's Star(Gliese 699)

Bernard's Star is well known in scientific circles for two distinct reasons. One-it is the closest star to our own after the three stars that make up the Alpha Centauri system; and two-it has the highest proper motion of any star yet known. As such, it has been intensely studied for many years.

Bernard's Star was noted on star charts as early as 1888, but is named after the American astronomer Edward Bernard, who first studied it in 1916, and discovered its high proper motion. It is a red dwarf star in the constellation Ophiuchus, class M4, with an apparent magnitude of 9.5 and an absolute magnitude of 13.2. It is 5.9 light years from our sun, and is the closest star to our own in the northern celestial hemisphere. Bernard's Star is now estimated to be between seven and twelve billion years old, much older than our sun, and possibly one of the oldest stars in the Milky Way. Despite its age, the star produced a major solar flare in 1998, surprising scientists, who thought that it was long beyond that stage. It is now considered a flare star, and is also catalogued as the variable star V2500 Ophiuchi. It has been measured as being just under twice the the size of Jupiter, with a mass of .14 that of our Sun. It rotates on its axis once every 130 days.

The star's high proper motion is what has interested scientists for many years. Measurements have shown that it is moving towards our solar system at 10.3" of arc every year, about 90 kilometer per second. This, combined with its blueshifted radial velocity of 110 kilometers per second means that, if it continues on its present course, it will come to within 3.75 light years of our Sun in 9,000 years from now(however, Proxima Centauri, currently the closest star to our own, is also blueshifted and will come even closer to our solar system at about the same time).

In 2018, a group of astronomers from Spain announced that they had discovered a "super planet" orbiting Bernard's Star. This object, known as Bernard's Star b, is about .4 astronomical units from the star, and orbits it every 288 days. It is believed to covered with ice and is considered to be not habitable.

What's New in Space

Another 1960s Space Pioneer Passes from the Scene

Alexi Leonov 1934-2019

Alexi Leonov, the first person to walk in space, and the most celebrated of the early cosmonauts after Yuri Gagarin, died on October 12 at the age of 85. The cause of death was not given, but RKA, the Russian Space Agency, which first announced his death, said that he had been ill for some time.

Leonov was born in 1934, and entered the Soviet Air Force at age 22 as a pilot. He was chosen in the first group of cosmonauts, all air force pilots, in 1960. He was training for a future Soyuz mission in late 1964, when the Soviet political leadership demanded a "first," a spacewalker. Leonov was chosen along with commander Pavel Baleyev. They went through hurried training, and were launched in Voskhod 2, actually a modified Vostok capsule with an inflatable air lock, on March 5, 1965. On the second orbit, Leonov made a ten minute spacewalk with an oxygen bottle strapped to his leg. When he went to reenter the air lock, however, his space suit had inflated to the point where he could not fit inside it. He had to lower the suit pressure to a dangerously low level, and was finally able to enter. That was not the end of the flight's problems, though. When the Voskhod reentered the atmosphere the next day, it overshot the landing zone by almost 500 miles and landed in a densely wooded area in Siberia. When the two cosmonauts tried to leave the capsule, they were harassed by a pack of wolves and had to spend the night in the capsule with temperatures at zero and the wolves howling all around them. The recovery crew rescued them the next morning.

Leonov never talked about it, but he was heavily involved in the Soviet lunar landing program. It is now known that he was assigned to the first Moon landing mission and would have been the first Russian on the Moon. After the U.S. got to the Moon first, Leonov transferred to the space station program. He was scheduled to be the commander of Soyuz 11, but an erroneous medical diagnosis involving his crewmate Valeri Kubasov caused his crew to be replaced by the backup crew of Georgi Dobrovolski, Vladislav Volkov, and Vitkor Patsayev. The Soyuz 11 crewmembers all died when an air release valve opened during reentry and emptied the air in the crew capsule. Leonov and Kubasov were then assigned to the Apollo Soyuz Test Program, the first joint space mission between the U.S. and the Soviet Union. While training for this flight, he struck up associations with many of the American astronauts, especially Tom Stafford, the Apollo commander. Leonov and Stafford would end up being lifelong friends.

After the ASTP mission in 1975, Leonov moved into administration, overseeing cosmonaut training and directing manned spaceflight activities. He would be in this role until his retirement from the space program in 1992. At the same time, he rose to a major general in the Russian Air Force. In the years following his retirement, he became a successful businessman and also an international ambassador for space exploration, traveling throughout the world promoting space travel. A fluent English speaker, he visited the U.S. on many occasions, calling for greater cooperation between the space powers and the need for international unity in space activities.

Leonov was the last of the Voskhod cosmonauts, and his death leaves only a few of the 1960s cosmonauts and astronauts, all of whom are now in their 80s and 90s, still alive. He was a pioneer in the first great era of space flight, and will be remembered for many years to come.

Left-Leonov and Stafford in 2017

What's New in Space, con't

Boeing to Launch Starliner in December-Maybe

In October, Boeing announced that the first, uncrewed, flight of its Starliner spacecraft will be launched on December 17. This mission, which will last a week, is contingent on the Starliner passing a critical abort test in November. If not, the launch will be delayed to early 2020. The Starliner has been dogged by repeated delays; it was begun in 2011, and was originally scheduled to be launched in 2017, then 2018, and finally late 2019-maybe. As a result of all the delays, Boeing is now under heavy criticism. Currently, Boeing will use the Atlas 5 to launch Starliner, but will eventually switch to the newly developed Vulcan rocket around 2022.

In the meantime, Boeing is also under fire for numerous delays with the Space Lunch System(SLS). The giant heavy lift rocket was supposed to be ready for its first flight in 2017. NASA wanted the SLS to be operational for the first Artemis mission in August 2020, but has been told that it will not be ready until at least 2021. At the same time, Congressional committees are investigating the SLS program, some viewing it as more of a semi-permanent public jobs project, rather than a technological necessity. There has been talk of cancelling the SLS program altogether, but the states involved are fighting it every inch of the way. Many now feel that the next generation of private commercial heavy lift rockets, such as the Falcon Heavy, New Glenn, and the Vulcan Heavy may work much better and be cheaper for America's long-range space goals.

The Astronomer-Jock(No, it's Not an Oxymoron)

Jonathan Taylor is a twenty year old junior at the University of Wisconsin who is also on the football team. That's not different from thousands of other players on college teams throughout the nation. But how many of them have risen to the very top of the college ranks while playing? Not many. How many are also pursuing majors in both physics and astronomy? Almost none. But Taylor is. He has had an interest in astronomy since childhood, whizzed through the International Baccalaureate program at his high school in New Jersey, and was offered a scholarship to Harvard to study astrophysics as well as play football. He decided to turn it down and go to the University of Wisconsin instead. Then he found out that Wisconsin doesn't have an astrophysics program, but instead separate majors in physics and astronomy. So, he's majoring in both while playing football for the Badgers. In the meantime, he's set several NCAA records and has been in the top six for the Heisman Trophy. This isn't your average college athlete.

Taylor got his inspiration from his hero, Neal deGrasse Tyson, the well-known astrophysicist; he said that at an early age, deGrasse Tyson inspired him to look up at the nighttime sky and wonder what was up there. At the same time, he was doing better and better on the field, and a number of schools were looking at him, and eventually offering him scholarships to play football. He ended up choosing Wisconsin over Harvard because, he said, Wisconsin just felt like a better fit. His teammates, classmates, and friends take his academic interests in stride, and completely support him. Many say that, on weekend nights, sometimes after a game when most athletes are at parties, he takes a small telescope, finds a dark area near campus, and starwatches. He would eventually like to go on to a career in the NFL, but also wants to go to graduate school-at Harvard. Somehow, one gets the idea that he'll achieve both.

Source and image-bleacherreport. com

A Look(if that's possible) at Dark Matter

Dark Matter has come back into vogue lately as a topic of serious study in the astrophysics world. Even though it makes up an estimated 80% of the mass of the universe, scientists are still not sure of exactly what it is.

Dark Matter was first hypothesized by Lord Kelvin in 1884, when he noted that galaxies seemed to have insufficient stars and other material to account for their mass. He believed that the majority of mass in them was due to "dark bodies." Henri Ponicare, the French scientist, also speculated in 1906 that galaxies have far more mass than their luminous matter implies. Jan Oort, the Dutch astronomer, concluded in 1932 that galaxies, in order to say together, needed far more mass than could be observed by optical telescopes. The next year, Fritz Zwicky of Cal Tech, was also studying galaxies, and calculated that many of them would fly apart but for some unseen mass in them. He called it the "missing mass." He also tried to get other scientists interested in studying it, but had little support. He wrote a few papers on his ideas, then went on to other projects. Dark matter, aka Missing Mass, languished for over thirty years.

In the mid-1970s, Vera Rubin, at the Carnegie Institute in Washington, D,C., and her colleague Kent Ford, were studying rotation curves of galaxies, when they noticed the same thing that Zwicky had: the galaxies were moving too fast to stay together; by all logical means, they should have been flying apart. Rubin and Ford calculated that over 90% of their mass could not be detected. Some unknown mass was keeping them together. Rubin's paper, published in 1978, called it Dark Matter. This time, astrophysics was ready to take it seriously, and Rubin became one of the best known scientists in the world as a result.

Now that it had been officially found, the question was, What Was It? During the 1980s and 1990s, all kinds of theories were proposed. One was that it was made up of small dim stars; these led to a class of stars known as Brown Dwarfs, and also very dim Red Dwarfs. Other scientists came up with exotic hypothetical particles, first called MACHOs, for Massive Compact Halo Objects; then there were WIMPS, for Weakly Interacting Massive Particles. Both of these are still under consideration, but no real evidence has appeared to show that they even exist.

Then came neutrinos. Neutrinos, which were first hypothesized in the 1930s, and experimentally discovered in the 1950s, are extremely elusive. Billions rain down on the Earth every second; they seemingly effortlessly go through anything, even lead. Over the years, attempts have been made to discover if they even have mass. Some experiments say yes, while others say no. For a time during the 1980s and 1990s, neutrinos were thought to be the source of Dark Matter. The jury is still out on them.

The discovery of Dark Energy in the late 1990s added to the mystery of Dark Matter. Between the two, they make up almost 95% of the entire universe. In 2018, a new theory put out by astrophysicist James Farnes at Oxford University suggested that both Dark Matter and Dark Energy are two examples of the same thing, what is called "dark fluid," which has negative mass, an idea first proposed by Einstein in 1918. Another theory published in August 2019 by a team at Johns Hopkins University suggests that Dark Matter is tied to inflation and may have been formed from exotic particles just before the "Big Bang" that created the universe.

In 2022, the Euclid satellite will be launched specifically to study the nature and distribution of Dark Matter. While it may answer some of the questions surrounding the Dark Matter debate, it will probably raise new ones as well. So, the arguments go on, another mystery in the maddeningly wonderful universe that we live in.

Sources: Wikipedia ; Science Daily, August 16, 2019 ; Vice, December 6, 2018 ; CNET, June 11, 2019

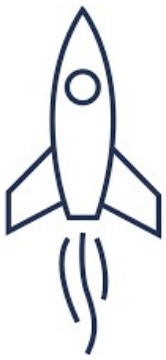
From the Observer Archives

"There is a growing concern in the United States about the decline of engineering skills and students. A few years ago there was an overabundance of engineers for the various fields that were extant at the time so students dropped engineering courses in favor of studies that would give them a better chance of landing a job, and rightfully so. Unfortunately, too many dropped out and now even the "old jobs" are going begging, but the many new ones that have come into existence since then are frightfully short of qualified personnel. Electronics and plastics as well as energy physics and new technology, such as good old fashioned methods of production and mobility problems are almost grinding to a stand-still in a good many phases. We have lots of outlets for electronic "goodies," but where are the QUALIFIED maintainers and scholars? We will not be able to solve energy and production problems with all of these cute little computer games, Oh sure, they are lots of fun and some are educational and improve your reflexes, etc.; I am not knocking that, but will it put food on your table next year or the year after? Think about it. A great demand will soon be , for our nation, for technical supergiants. Maybe you could be one of them!"

From the February 2, 1981 *Observer*

A comment by the editor-

This commentary was written almost forty years ago. Viewed at from today, 2019, it can cut both ways. In 1981, the high tech revolution was just starting. In the years since then, literally millions of jobs in various fields of engineering have been established by Apple, Google, Microsoft, and many other companies. As a result, again, many young people have majored in areas like computer and electrical engineering to fill those jobs. As well, environmental engineering, a field that did not exist forty years ago, is now very popular, with its emphasis on climate change and environmental sustainability. However, many other engineering jobs today are going begging because overall not enough young people want to major in engineering(or in the "hard" sciences like physics and chemistry). College administrators and counselors have noticed a disquieting trend over the last ten-fifteen years: many students enter college with an intended major of engineering or science, but then switch to the social sciences or humanities after a semester or a year. When asked why, their reply is almost all the same, to the tune of: "I didn't come to college in order to work hard." They end up majoring in fields like psychology or social work or communications, programs that they feel are much easier to pass. These are important areas, certainly; but now there's a glut of graduates with those majors who can't find jobs. Studies show that many of the engineering and sciences programs are being filled by immigrant and foreign students, who apparently aren't afraid of hard work. According to the law of supply and demand, though, things will probably eventually even out.



Astronomy (bad) Joke

Werner Heisenburg was out for a drive when he got stopped by a policeman. The officer asked, " Did you know how fast you were going?" And Heisenberg replied,"No, but I know where I am."

From the AstroBob website