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THE OBSERVER

BATTLE POINT ASTRONOMICAL ASSOCIATION

WWW.BPASTRO.ORG BAINBRIDGE ISLAND, WA

James Webb Space Telescope event at KiDiMu 11/20/21

The James Webb Space Telescope event at the Bainbridge Island Kids Discovery Museum (KiDiMu) was a great success!

Two BPAA members, Natalie Allen and Frank Petrie gave presentations about the Webb, its science objectives, and other space telescopes, which included good Q&A sessions. We also setup 3 different types of telescopes in the upstairs section of the museum where different targets were placed around the walls. This provided the opportunity for kids and their parents to experience controlling and viewing objects with refracting, reflecting and catadioptric telescopes. Thanks to BPAA members Kaitlin Chester, Ally Payne, Natalie Allen, Annika Johnson, Denise Hidano, Ulysses Glanzrock, Peter Moseley, Steve Ruhl, Nels Johansen, Frank Petrie, and Joe Mulligan for their support of this event. Unfortunately, cloudy weather prevented us from doing any solar or planetary observing, but the kids all seemed very excited and engaged about their experiences.

BPAA Annual Meeting: New and Returning Board Members Elected

BPAA members in attendance at the January 12 Annual Meeting elected three new and five continuing members to the Board of Directors. This is especially notable as we now have a full board with no vacancies! Please welcome the 2022 Board:

New officers and directors:
Mario Alejandro Torres, Vice President
Cole Rees, Chief Astronomer
Ulysses Glanzrock, Education Officer

Returning:
Frank Petrie, President
Peter Moseley, Secretary
Frank Schroer, Treasurer
Steve Ruhl, Chief Scientist
Denise Hidano, Facilities Officer

A big Thank You! to outgoing Chief Astronomer Nels Johansen who is retiring from his very long tenure on the Board. To read more about the Annual Meeting, please request a copy of the minutes from Frank Petrie at president@bpastro.org.

John Rudolph Planetarium News

Steve Ruhl, Joe Mulligan, and Frank Petrie recently visited Digitalis Education in Bremerton to see a demonstration of the latest in planetarium projection equipment. We are looking to replace our old, defunct projector that gave up its last photon a few years ago, leaving us without a planetarium capability. Depending on the model we choose, a new projector will cost $20 to $30 thousand dollars. We will also need to look at improving or replacing our projection dome. We will be seeking grant funding and donations to support this acquisition. Stay tuned for more news on this soon.

James Webb Space Telescope Has Unfolded Its Primary Mirror

Folding mirror segments for the James Webb Space Telescope on Earth. *Northrop Grumann*

Just over two weeks into the mission and the origami-like James Webb Space Telescope (JWST) has unfolded just as expected. NASA controllers announced today at 19:17 UT/1:17 p.m. EST that the telescope's final primary mirror segment had locked into place, marking the end of the deployment phase for the space telescope.

JWST launched on an Ariane 5 rocket from the Guiana Space Center on December 25, 2021. The last couple weeks have seen the telescope's separation from the second stage, the unfolding and tensioning of its sunshield, and myriad other steps to full deployment.

The observatory sports a 6.5-meter (21.6-foot) primary mirror and a sunshield the size of a tennis court, all of which had to fold up to fit inside the 4.57 meter-wide Ariane 5 rocket fairing before unfolding in space after launch.

The size also meant that there wasn't a vacuum chamber on Earth large enough to test the telescope in its unfurled configuration; instead, engineers are carefully watching how the telescope reacts to the super-cold, zero-g environment of space as it deploys, and adjusting the deployment phase accordingly.
(Source: skyandtelescope.org)

Celestron CPC Telescope

A few years ago BPAA received a donated 9.25-inch Celestron CPC Schmidt-Cassegrain telescope equipped with a GPS-enabled automated drive system. This scope has beautiful optics but unfortunately the drive system was buggy. Our new VP Mario Alejandro Torres researched and successfully implemented a firmware update which seems to have resolved the issue. Mario reports that the newly functional telescope “works like a charm” and shared this “first light” image as proof.

The James Webb Space Telescope Will Map the Atmosphere of Exoplanets

Exoplanets, planets that orbit stars other than the sun, are found at distances very far from Earth. For example, the closest exoplanet to us, Proxima Centauri b, is 4.2 light years away, or 265,000 times the distance between the Earth and the sun.

Some exoplanets have strong spatial variation in their atmospheres. Hot Jupiters, similar in size to Jupiter, orbit very close to their host star and can thus reach temperatures of several thousand degrees Celsius.

Although it is impossible to observe the surface of an exoplanet directly, it is possible to measure the spatial variation of the atmosphere using two methods: phase curve analysis and secondary eclipse mapping.

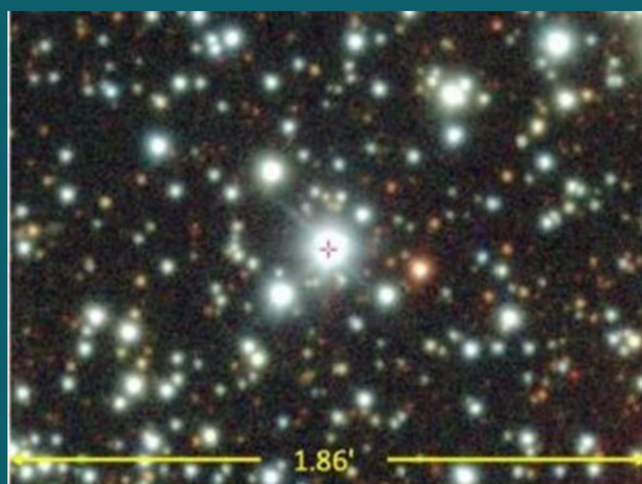
The phase curve is the variation of light from the star-planet system during a period of revolution. Since the planet rotates on itself during its orbit, different sections of its atmosphere are successively visible to us. From this signal, it is possible to map the intensity of the light emitted by the planet in longitude. In the case of hot Jupiters, whose day side is generally hotter, the maximum of light from the planet is near the secondary eclipse. Similarly, the minimum of the curve is near the transit, since it is then the night side that is observed.

In secondary eclipse mapping, the day side of the exoplanet is resolved. As the planet moves in and out from behind its star from our point of view, sections of it are hidden, allowing us to isolate the light emitted by a given section of its atmosphere. By measuring the amount of light emitted by each individual section, it is then possible to map the day side of the atmosphere against longitude and latitude.

With the Webb telescope, it will be possible to apply the mapping methods available to us to measure the three-dimensional variation of exoplanet atmospheres. These measurements will allow us to deepen our knowledge of atmospheric processes.

(Source: phys.org)

NASA's TESS Exoplanet Mission Reveals Mystery of Strange Signals From Dusty Object



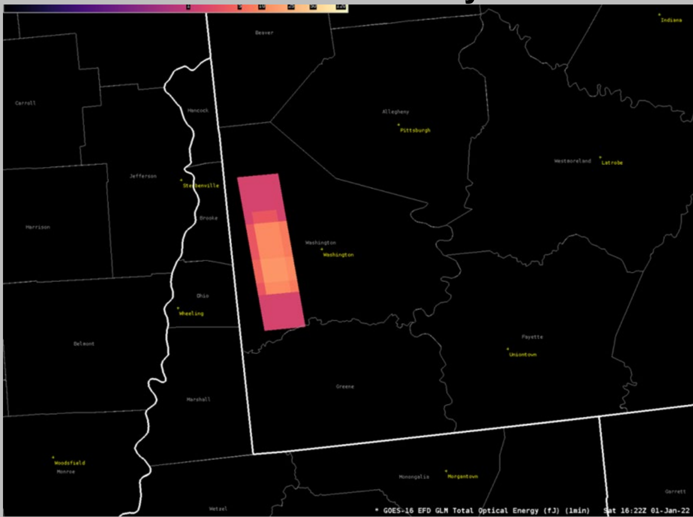
An image taken by the Dark Energy Camera in Chile shows TIC 400799224. (Image credit: Powell et al., 2021)

In observations gathered by NASA's Transiting Exoplanet Survey Satellite (TESS), astronomers stumbled on yet another mystery. In new research, a team of scientists examines potential causes of strange signals emitted by an object dubbed TIC 400799224.

Based on what astronomers have seen so far, the researchers suggest that this object might be a binary star, or double star system, in which one of the stars is surrounded by a massive cloud of dust, the rubble of perhaps a large asteroid, according to a statement from the Harvard-Smithsonian Center for Astrophysics, home to one of the researchers on the team.

The scientists suggest that the most likely case is that collisions between miniature planet-like objects like asteroids are creating the dust. Still, it's a tricky case to explain because the amount of dust hanging around seems to have remained pretty steady throughout the six years that the scientists can find existing observations of TIC 400799224. The researchers hope to continue observing the object to better understand its strange patterns.
(Source: space.com)

Exploding meteor 'booms' over Pennsylvania on New Year's Day



Observations from GOES-16 shows a flash that was later determined came from an exploding meteor on Jan. 1, 2022. (Image credit: Twitter/NWSPittsburgh)

A meteor hurtling through Earth's atmosphere exploded over Pittsburgh, Pennsylvania on New Year's Day (Jan. 1).

Just before 11:30 a.m. EST (1630 GMT) on Jan. 1, people in Pittsburgh heard what sounded like a loud "boom" outside. Reports described windows rattling and objects shaking in their homes, according to CBS Pittsburgh. The sudden blast surprised those living in the Pittsburgh area as the meteor broke up in the cloudy morning sky.

The loud bang was actually a bolide, a term for a large meteor that explodes in our atmosphere, burst apart with the energy of 30 tons of TNT detonating, according to NASA's Meteor Watch.

The doomed meteor, which was estimated to measure about 3 feet (0.9 meters) across with a mass close to 1,000 pounds (453 kilograms), was likely traveling around 45,000 mph (72,420 kph) as it broke apart in Earth's atmosphere, the NASA social media site said.

NASA's Meteor Watch added that if it were not cloudy when the meteor burned up in our atmosphere, the event would have been about 100 times as bright as the full moon and visible in the daylight.

(Source: space.com)

Eccentric Exoplanet Discovered

Led by the University of Bern, an international research team has discovered a sub-Neptune exoplanet orbiting a red dwarf star. The discovery was also made thanks to observations performed by the SAINT-EX observatory in Mexico.

"Red dwarfs" are small stars and thus much cooler than our Sun. Around stars like these, liquid water is possible on planets much closer to the star than in our solar system. The distance between an exoplanet and its star is a crucial factor in its detection: the closer a planet is to its host star, the higher the probability that it can be detected.

In a study recently published in the journal Astronomy & Astrophysics, researchers led by Dr. Nicole Schanche of the Center for Space and Habitability CSH of the University of Bern report the discovery of the exoplanet TOI-2257 b orbiting a nearby red dwarf.

Planet TOI-2257 b was initially identified by data from NASA's Transiting Exoplanet Survey Satellite TESS space telescope. The Mexico-based SAINT-EX telescope, purpose-built to study red dwarfs and their planets in more detail, was able to confirm the exoplanet's exact orbital period around its star, 35 days.

"We found that TOI-2257 b does not have a circular, concentric orbit," explains Dr. Schanche. In fact, it is the most eccentric planet orbiting a cool star ever discovered. A possible explanation for this surprising orbit is that further out in the system a giant planet is lurking and disturbing the orbit of TOI 2257 b. Further observations measuring the radial velocity of the star will help confirm the eccentricity and search for possible additional planets that could not be observed in transit.

(Source: phys.org)

Our galaxy's most recent major collision

One of the characteristic features of modern cosmology is its description of how galaxies evolve: via a hierarchical process of colliding and merging with other systems. Nowhere in the universe do we have a clearer view of this buildup than in our own Milky Way.

The Gaia spacecraft was launched in 2013 with the goal of making a precise three-dimensional map of the Milky Way by surveying 1% of its approximately 100 billion stars. Harvard Center for Astrophysics astronomers used Gaia results combined with a new survey of the outer reaches of our Galaxy with the 6.5m MMT telescope in AZ (the "H3 Survey") to piece together the history of the Milky Way's stars in unprecedented detail in order to determine the nature of the Galaxy's last merger. The evidence was already convincing that a single dwarf galaxy merged with the Milky Way about 8-10 billion years ago. Known as Gaia-Sausage-Enceladus (GSE), what is left of the object today is inferred from the stars in the inner halo by their stellar motions and compositions. Still uncertain, however, was whether GSE collided with our galaxy head-on, or if instead it orbited the galaxy before gradually merging, and if so, what that orbit looked like.

The astronomers addressed these questions by modeling Gaia's measured halo stars with a set of numerical simulations coupled with a comparison to the stellar ages and compositions. They show that GSE contained about half a billion stars, and did not orbit the Milky Way but approached it moving in a retrograde direction (that is, opposite to the Galaxy's rotational motion).

With the completion of this study, however, almost the entire growth of the Milky Way over the past ten billion years can be accounted for.

(Source: phys.org)

Astronomers witness a dying star reach its explosive end

An artist's impression of a red supergiant star in the final year of its life emitting a tumultuous cloud of gas. This suggests at least some of these stars undergo significant internal changes before going supernova. Credit: W. M. Keck Observatory/Adam Makarenko

For the very first time, astronomers have imaged in real time the dramatic end to a red supergiant's life, watching the massive star's rapid self-destruction and final death throes before it collapsed into a Type II supernova.

Using two Hawaiʻi telescopes—the University of Hawaiʻi Institute for Astronomy Pan-STARRS on Haleakalā, Maui and W. M. Keck Observatory on Maunakea, Hawaiʻi Island—a team of researchers conducting the Young Supernova Experiment (YSE) transient survey observed the red supergiant during its last 130 days leading up to its deadly detonation.

"This is a breakthrough in our understanding of what massive stars do moments before they die," says Wynn Jacobson-Galán, an NSF Graduate Research Fellow at UC Berkeley and lead author of the study. "Direct detection of pre-supernova activity in a red supergiant star has never been observed before in an ordinary Type II supernova. For the first time, we watched a red supergiant star explode!"

Pan-STARRS first detected the doomed massive star in Summer of 2020 via the huge amount of light radiating from the red supergiant. A few months later, in Fall of 2020, a supernova lit the sky.

The team quickly captured the powerful flash and obtained the very first spectrum of the energetic explosion, named supernova 2020tlf, or SN 2020tlf, using Keck Observatory's Low Resolution Imaging Spectrometer (LRIS). The data showed direct evidence of dense circumstellar material surrounding the star at the time of explosion, likely the same exact gas that Pan-STARRS had imaged the red supergiant star violently ejecting earlier in the summer.

(Source: phys.org)

Largest collection of free-floating planets found in the Milky Way

An artist's impression of a free-floating planet.. Credit: NOIRLab/NSF/AURA/J. da Silva

Using observations and archival data from several of NSF's NOIRLab's observatories, together with observations from telescopes around the world and in orbit, astronomers have discovered at least 70 new free-floating planets—planets that wander through space without a parent star—in a nearby region of the Milky Way. This is the largest sample of such planets found in a single group and it nearly doubles the number known over the entire sky.

Free-floating planets have mostly been discovered via microlensing surveys, in which astronomers watch for a brief chance alignment between an exoplanet and a background star. However, microlensing events only happen once, meaning follow-up observations are impossible.

These new planets were discovered using a different method. These planets, lurking far away from any star illuminating them, would normally be impossible to image. However, researchers took advantage of the fact that, in the few million years after their formation, these planets are still hot enough to glow, making them directly detectable by sensitive cameras on large telescopes.

The discovery also sheds light on the origin of free-floating planets. Some scientists believe these planets can form from the collapse of a gas cloud that is too small to lead to the formation of a star, or that they could have been kicked out from their parent system. But which is the actual mechanism remains unknown.

The ejection model suggests that there could be even greater numbers of free-floating planets that are Earth-sized. "The free-floating Jupiter-mass planets are the most difficult to eject, meaning that there might even be more free-floating Earth-mass planets wandering the galaxy," says the study's first author, Núria Miret-Roig of the Laboratoire d'Astrophysique de Bordeaux.

It is expected that Vera C. Rubin Observatory could find many more free-floating planets when it begins scientific operations this decade.

(Source: phys.org)

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When will the sun die?

One of the first images taken by the ESA/NASA Solar Orbiter during its first close pass at the sun in 2020. (Image credit: Solar Orbiter/EUI Team/ ESA & NASA; CSL, IAS, MPS, PMOD/WRC, ROB, UCL/MSSL)

If you worry about when the sun will die, never fear: that moment is billions of years away.

The sun gives energy to life on Earth, and without this star, we wouldn't be here. But even stars have limited lifetimes, and someday our sun will die.

Stars like our sun form when a huge cloud of gas (mostly hydrogen and helium) grows so large that it collapses under its own weight. The pressure is so high in the center of that collapsing mass of gas that the heat reaches unimaginable levels, with temperatures so hot that hydrogen atoms lose their electrons. Those naked hydrogen atoms then fuse together into helium atoms, and that reaction releases enough energy to counter the intense pressure of gravity collapsing the cloud of gas. The battle between gravity and the energy from fusion reactions fuels our sun and billions of other stars in our galaxy and beyond.

But in about 5 billion years, the sun will run out of hydrogen. Our star is currently in the most stable phase of its life cycle and has been since the formation of our solar system, about 4.5 billion years ago. Once all the hydrogen gets used up, the sun will grow out of this stable phase. Astronomers estimate that the sun has about 7 billion to 8 billion years left before it sputters out and dies.

Our sun isn't massive enough to trigger a stellar explosion, called a supernova, when it dies, and it will never become a black hole either. In order to create a supernova, a star needs about 10 times the mass of our sun. An object of that size would form a dense stellar corpse called a neutron star after the explosion. To leave behind a black hole, a supernova must occur in a star with about 20 times the mass of the sun.

(Source: space.com)

WHAT'S UP(COMING)!

Jan 2 – New Moon
C/2021 A1 (Leonard) at perihelion
Jan 3 – Quadrantid meteor shower peak
Jan 10 – C/2019 L3 (ATLAS) at perihelion
Jan 12 – Mercury at highest altitude in evening sky
104P/Kowal at perihelion
Jan 17 – Full Moon
Jan 19 – γ-Ursae Minorid meteor shower peak
104P/Kowal reaches its brightest
Jan 20 – 19P/Borrelly reaches its brightest
Jan 31 – New Moon
Feb 2 – 19P/Borrelly at perihelion
Feb 6 – Mercury at highest altitude in morning sky
Feb 8 – α-Centaurid meteor shower 2022
Feb 9 – Venus at greatest brightness
Feb 13 – Venus at highest altitude in morning sky
Feb 16 – Full Moon
Mar 2 – New Moon
Mar 14 – γ-Normid meteor shower 2022
Mar 18 – Full Moon
Mar 20 – March equinox
Mar 31 – New Moon