

PrimeFocus



WHEN:

December 17, 2021
Meeting at 7:30pm
Lecture at 8:00pm

WHERE:

Virtual Meeting using Zoom
See the April 2020 issue of
PrimeFocus for info on
getting connected using
Zoom

TVS QR Code

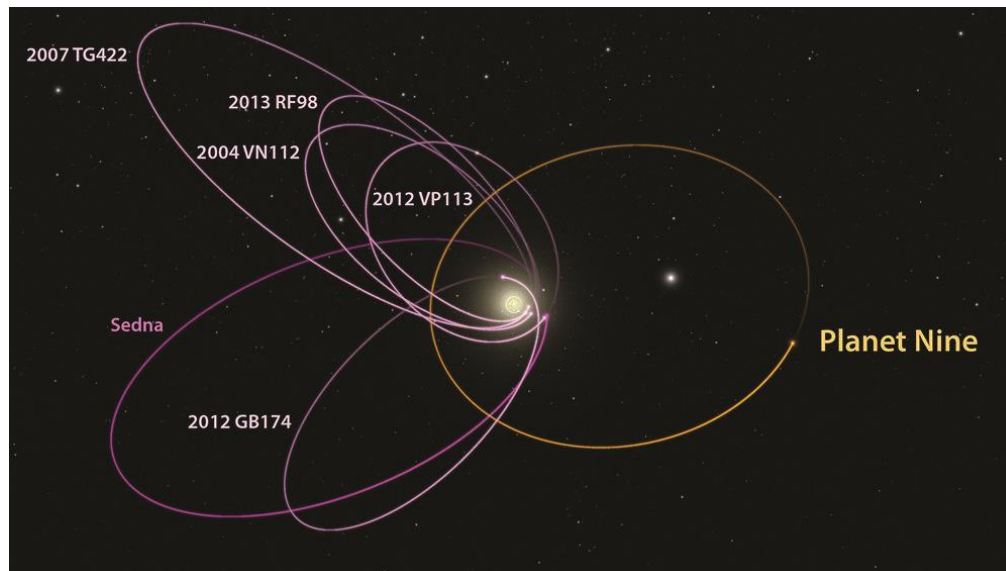


INSIDE THIS ISSUE:

News and Notes	2
Calendar of Events	2
DART Launch	4
What's Up	6
NASA Night Sky Notes	7
Membership/Renewal Application	8

Planet Nine from Outer Space: A Status Update Prof. Konstantin Batygin, Caltech

Over the course of the past two decades, observational surveys have unveiled the intricate orbital structure of the Kuiper Belt, a field of icy bodies orbiting the Sun beyond Neptune. In addition to a host of readily-predictable orbital behavior, the emerging census of trans-Neptunian objects appears to display dynamical phenomena that cannot be explained by interactions with the known eight-planet Solar System alone. Specifically, the observed physical clustering of orbits with semi-major axes in excess of ~ 250 AU, the detachment of perihelia of select Kuiper belt objects from Neptune, as well as the dynamical origin of highly inclined/retrograde long-period orbits remain elusive within the context of the classical view of the Solar System. This newly outlined dynamical architecture of the distant solar system points to the existence of planet with mass $M_9 \sim 5M_{\oplus}$ on a moderately inclined orbit with semi-major axis $a_9 \sim 400\text{--}800$ AU and eccentricity $e_9 \sim 0.4\text{--}0.6$. In this talk, I will review the observational motivation, dynamical constraints, and prospects for detection of this proposed object known as Planet Nine.



Caption: Orbital alignment of Trans-Neptunian objects suggests the presence of Planet Nine. Credit: Caltech/R. Hurt (IPAC) (https://mediaassets.caltech.edu/evidence_of_ninth_planet)

Bio: Konstantin Batygin received his bachelor's degree in Physics from University of California, Santa Cruz in 2008, before pursuing graduate studies at California Institute of Technology. Prior to joining the faculty at Caltech, Batygin was a postdoctoral scholar at Observatoire de la Côte d'Azur in Nice, France, and Harvard University. When not doing science, he moonlights as the singer and guitar player of the rock band The Seventh Season (we are about 4 shows away from becoming the next Metallica — I can feel it! ;-).

News and Notes

2021-2022 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
Dec. 17	Dec. 20	
Jan.21	Jan. 24	Jan. 7
Feb. 18	Feb. 21	Feb. 4
Mar. 18	Mar. 21	Mar. 4
Apr. 15	Apr. 18	Apr. 1
May 20	May 23	May 6
Jun. 17	Jun. 20	Jun. 3
Jul. 15	Jul. 18	Jul. 1
Aug. 19	Aug. 22	Aug. 5
Sep. 16	Sep.19	Sep. 2
Oct. 21	Oct. 24	Oct. 7
Nov. 18	Nov. 21	Nov. 4
Dec. 16	Dec. 19	Dec. 2

Money Matters

As of the last Treasurer's Report on 11/22/21, our club's account balance is \$65,308.00. This includes \$43,102.14 in the H2O Rebuild fund.

TVS Welcomes New Members

TVS welcomes new members Abigail Gilmore and Percy Mistry. Please say hello and chat with them during our Zoom meetings.

Time to Renew Club Membership for 2022

Now is a great time to become part of TVS. Membership is open to anyone with an interest in astronomy. Amateurs and professionals are equally welcome; skilled amateurs comprise the majority of the membership. You do not have to own a telescope in order to be a member.

Those renewing their club membership are encouraged to do so by using the online application before the end of December. Normally our memberships are only good for the calendar year, but anyone joining after October 1st will be given a membership for the remainder of 2021 and all of 2022.

The regular club membership remains a bargain at \$30. Student membership (full-time High School or College student) is only \$10! To become a key holder to H2O, you must be 18 or older. There is a one-time \$20 Key deposit and a \$10 annual access fee.

You can join TVS or renew your membership online at: <http://www.trivalleystargazers.org/membership.shtml> After filling out the application form you are connected to the PayPal payment form. You do not need to have a PayPal account to pay online, since PayPal will accept credit cards. Everyone is encouraged to use the online application. Alternatively, you can mail in the Membership Application on the last page of this newsletter along with a check to the Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551-2476. Note that TVS will not

share your information with anyone. We only use the e-mail address to notify you when the newsletter becomes available.

All members agree to hold the Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function

H2O and Del Valle Observing Sites Reopened

The Del Valle and Hidden Hill Observatory sites have reopened for observing by those who have paid their 2021 TVS Membership dues and are approved key holders.

As of June 15, California state guidance on COVID-19 indicates that use of masks is not required for **outdoor** activities. However, common sense dictates that club members and guests

- *Do not use either observing site if you are not feeling well or suspect you were recently exposed to the virus

- *You use each observing site at your own risk and agree to hold the club and the landowners free of all liability

- *H2O users should wear a mask while at the landowner's home depositing the daily usage fee

- *H2O keyholders who wish to use the Quick Dome should first contact Ross Gaunt (secretary"at"trivalleystargazers.org) to reserve it for individual use for the day

Ross Gaunt, our club secretary, emailed the updated lock combinations and usage instructions for each site to all H2O key holders and all Del Valle registered users. If you are a H2O key holder or Del Valle registered user and didn't get Ross's email, please let Ron (president"at"trivalleystargazers.org) or Ross know and we'll straighten it out.

Calendar of Events

December 15, 5:00pm

What: Solving Venus' Mysteries, Three Missions At A Time
Who: Dr. Sue Smrekar (JPL) and Dr. Thomas Widemann (Observatoire de Paris)

Sponsor: SETI Institute

Online: REGISTRATION REQUIRED

<https://www.eventbrite.com/e/seti-talks-solving-venus-mysteries-three-missions-at-a-time-tickets-221530683237>

After years of waiting, an armada of spacecraft are headed to Venus. In June, NASA approved not one, but two new missions named VERITAS and DAVINCI to our closest planetary neighbor and ESA quickly followed suit and approved its own mission called EnVision.

Calendar of Events (con't)

Venus has been a forgotten planet for too long, especially if we compared the number of missions which explored it to the ones which visited Mars.

These missions will not only answer key questions about Venus, but on comparative planetary science, the science of comparing planets and their evolution over time. One of the fundamental questions since we visited Venus in the 1960s is why are Venus and Earth so different. Venus could have been our twin planet but instead it has become a hellish sister with surface temperatures that are hot enough to melt lead.

Venus' atmosphere has traces of water today, but the history of water is unclear. Did Venus have an ocean and if so when was it lost? Is there still water deep in the interior of the planet? Answers to these questions will give us clues on the past habitability of Venus.

For more information, see: <https://www.seti.org/talks>

December 17, 18, January 7, 8, 7:30pm-10:30pm

What: Virtual Telescope Viewing

Who: Chabot Staff

Sponsor: Chabot Space and Science Center

Online: <https://www.youtube.com/c/ChabotSpace>

Join our resident astronomers on Facebook Live and YouTube every Saturday evening live from Chabot's Observation deck!

Each week, our astronomers will guide us through spectacular night sky viewing through Nellie, Chabot's most powerful telescope. Weather permitting, we will be able to view objects live through the telescopes and our astronomers will be

available to answer your most pressing astronomy questions.

Nellie is a 36-inch reflector telescope, housed in a rolling roof observatory that allows access to 180 degrees of sky. This modern, research-quality telescope offers breathtaking views of the cosmos.

For more information, see:

<https://chabotspace.org/events/events-listing/>

December 18, 10:00am-5pm

What: James Webb Telescope Launch Party

Who: Chabot Staff

Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619

Cost: Adults \$24; Youth (2-12), Senior, Student \$19

JWST will unveil invisible mysteries of the universe in infrared radiation from the early universe and the birth of stars to distant other worlds. Join us for an illuminating celebration with special activities, infrared demonstrations and talks about the telescope with our Educators, Galaxy Educators, Volunteers, the Astronomical Society of the Pacific, SETI and the East Bay Astronomical Society.

We ask that all visitors over the age of 2 wear a mask during their visit in all indoor and outdoor spaces, regardless of vaccination status. Additionally, we ask visitors to wash their hands, make space for others when exploring and stay home if sick within 14 days of their visit.

For more information, see:

<https://chabotspace.org/events/events-listing/>

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TVS E-Group

To join the TVS e-group just send an email message to TVS at: info@trivalleystargazers.org asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.

TVS Astrophotos: DART Launch from Vandenberg AFB

The Double Asteroid Redirection Test (DART) Mission launched on November 23 from Vandenberg Air Force Base. The goal of DART is to deliver a kinetic impactor into the 160 meter sized moonlet, named Dimorphos, of the 780 meter Asteroid (65803) Didymos. This mission will test our ability to change the orbit of this binary asteroid as a means of planetary protection from Earth crossing asteroids.

Asteroid (65803) Didymos does not pose a threat to Earth, but is rather an ideal testbed to test this technology. The impactor will crash into Dimorphos at a speed of ~ 6.6 km/s, changing the moonlets orbital period by several minutes relative to its 11.9 hour orbital period. The extent of the change will be dependent on the kinetic energy of the impact, how porous

the moonlet is, and how much material is thrown out by the impact. The change in the orbital period will be measured by observing the light curve of the system, with the change in the angular momentum modifying the orbit of the Asteroid system around the Sun. Thus, the mission will provide firsthand knowledge of our ability to deflect a potentially hazardous asteroid in cases in which we would have decade+ advance notice of a high probability Earth impact.

As DART launch day approached, launch-fever gripped many members of TVS. John Barclay observed the launch from within 4 miles of Vandenberg. His friend Bill Preston obtained the beautiful time exposure of the launch, seen below.

continued on p.5



Caption: Bill Preston used a Canon EOS RP, with zoom lens set to 16mm, f/8, and ISO-100 for a 165 second exposure to image the launch of the Double Asteroid Redirection Test from an observing site within about 4 miles of the launch site at Vandenberg Air Force Base.

TVS Astrophotos: DART Launch from Vandenberg AFB (con't)

As the crow flies, Vandenberg Air Force Base is located about 300 miles south of the Bay area, and previous experience indicated that such launches are visible from the Bay area.



Gert Gottschalk imaged the DART launch from his residence in Fremont. For his first image above, he used his Canon DSLR with a zoom lens set to 28mm for 3 x 10 second exposures, capturing the end of the first stage burn.



In Gert's second image above, he captured the 2nd stage burn with the zoom lens set to 135mm. He stated "I was able to follow the flight path until it ended at a nearby roof. The start of the trace is at the left (with the darker red color). I was surprised how red the color of the rocket exhaust was."

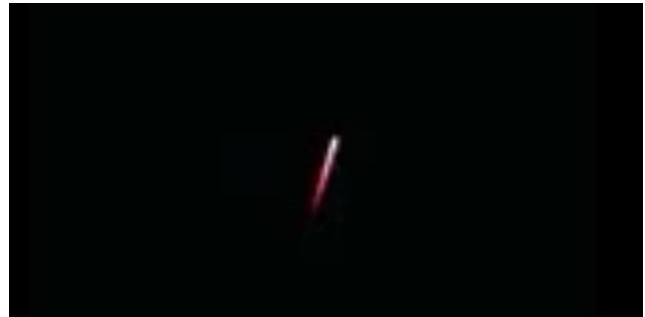


Rich Hayes took numerous images the launch, with his image above capturing the boost back burn. He stated "Great view

from Brentwood! Red plume, saw it past the second stage. Slowly shrank out of sight. Not much color."



Ojas Girish stated "Got to see the launch too. Never saw a rocket launch before, very interesting. I got to take a picture of the 2nd stage burn and saw the gases coming out of it (as seen above)."



Doug Martin made a video of the launch from Sunol using his cell phone held up to the 15mm eyepiece on a 4" refractor (frame grab seen above). He and his wife marveled that the launch was "incredible."

Numerous other club members commented on the launch. Ashish Joshi had an "incredible" view from west Dublin. Also in Dublin, Ken Sperber noted "The plume was deep orange. I saw it disappear and reappear." Bill Fischer viewed the launch through a tree gap, noting "it faded before engine cutoff." Deniz Demirci watched from Livermore, stating "We have watched the red plume for around 20 sec., then it went further south and disappeared." Manny Sawit from Hayward said he "Saw it through second stage, must have been about 5 minutes viewing before it faded out."

You too can enjoy launches, and perhaps join a virtual or in-person launch party. Spaceflight Now (<https://spaceflightnow.com/>) is one of many resources for information on present and future launches, including a frequently updated international launch schedule.

What's Up

By Ken Sperber (adapted from S&T)

All times are Pacific Standard Time

December

- 14 Tue The Geminid Meteor Shower peaks in the early morning hours. The Moon sets at about 3am.
16 Thu The nearly Full Moon is situated between the Pleiades and the Hyades (Evening)
18 Sat Full Moon (8:35pm)
21 Tue The Moon is $\sim 3^\circ$ from Pollux in the west (Dawn)
22 Wed The Moon is $\sim 3^\circ$ from M44, the Beehive Cluster in the west-southwest (Dawn)
26 Sun Last-Quarter Moon (6:24pm)
27 Mon Algol at minimum brightness for 2 hours centered on 10:22pm
28 Tue The Moon is $\sim 4.5^\circ$ from Spica in the south-southeast (Dawn)
29 Wed Mercury and Venus adorn the southwest horizon; binoculars suggested (Dusk)
31 Fri The crescent Moon, Mars, and Antares form an equilateral triangle in the southeast (Dawn)

January

- 1 Sat Jupiter, Saturn, Mercury, and Venus form a line above the southwestern horizon (Dusk)
2 Sun New Moon (10:33am)
3 Mon The 1.5 day old Moon hangs 4° below Mercury in the southwest (Dusk, see January S&T, p.46)
3-4 Mon The Quadrantid peaks at 12:40pm (Visible all night)
4 Tue The crescent Moon hangs 5° below Saturn (Dusk)
5 Wed The Moon is 5° from Jupiter (Dusk)
9 Sun First-Quarter Moon (10:11am)
12 Wed Mercury and Saturn, separated by 3° , hang above the southwestern horizon (Dusk)
12 Wed The Moon and the Pleiades, M45, are separated by 4° (Evening)
13 Thu The Moon and Aldebaran are separated by 6° (Evening)
17 Mon The Moon is 4° from Pollux in the west (Morning)
17 Mon Full Moon (3:48pm)
19 Wed Algol at minimum brightness for 2 hours centered on 8:56pm
20 Thu The Moon is 4° from Regulus in the west (Dawn)
24 Mon The Moon is 5° to the upper right of Spica (Dawn)
25 Tue Last-Quarter Moon (5:41am)
29 Sat The crescent Moon, Mars, and Venus rise in the south-southeast (Dawn)

NASA Night Sky Notes

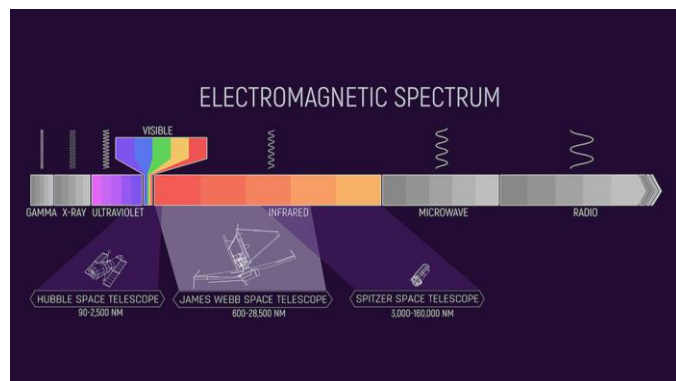


The James Webb Space Telescope: Ready for Launch!

By David Prosper

NASA's James Webb Space Telescope is ready for lift-off! As of the publication of this newsletter, the much-anticipated next-generation space telescope is being carefully prepared for launch on December 22, 2021, and will begin its mission to investigate some of the deepest mysteries of our universe.

The development of the Webb began earlier than you might expect – the concept that would develop into Webb was proposed even before the launch of the Hubble in the late 1980s! Since then, its design underwent many refinements, and the telescope experienced a series of delays during construction and testing. While frustrating, the team needs to ensure that this extremely complex and advanced scientific instrument is successfully launched and deployed. The Webb team can't take any chances; unlike the Hubble, orbiting at an astronaut-serviceable 340 miles (347 km) above Earth, the Webb will orbit about one million miles away (or 1.6 million km), at Lagrange Point 2. Lagrange Points are special positions where the gravitational influence between two different bodies, like the Sun and Earth, "balance out," allowing objects like space telescopes to be placed into stable long-term orbits, requiring only minor adjustments - saving Webb a good deal of fuel.

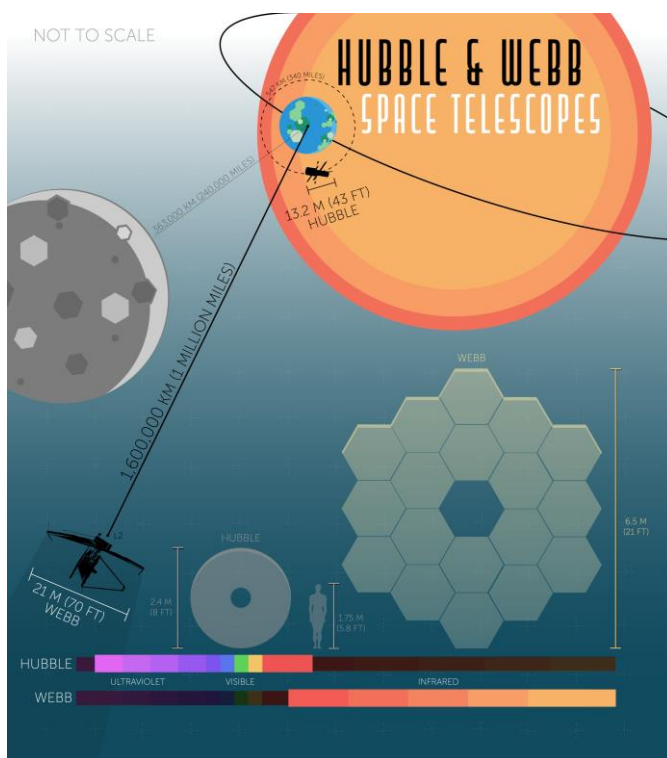


Caption: Webb will observe a wide band of the infrared spectrum, including parts observed by the Hubble - which also observes in a bit of ultraviolet light as well as visible - and the recently retired Spitzer Space Telescope. Webb will even observe parts of the infrared spectrum not seen by either of these missions! Credits: NASA and J. Olmstead (STScI)

Since this position is also several times further than the Moon, Webb's sunshield will safely cover the Moon, Earth, and Sun and block any potential interference from their own infrared radiation. Even the seemingly small amount of heat from the surfaces of the Earth and Moon would interfere with Webb's extraordinarily sensitive infrared observations of our universe if left unblocked. More detailed information about Webb's orbit can be found at bit.ly/webborbitinfo, and a video

showing its movement at bit.ly/webborbitvideo.

Once in its final position, its sunshield and mirror fully deployed and instruments checked out, Webb will begin observing! Webb's 21-foot segmented mirror will be trained on targets as fine and varied as planets, moons, and distant objects in our outer Solar System, active centers of galaxies, and some of the most distant stars and galaxies in our universe: objects that may be some of the first luminous objects formed after the Big Bang! Webb will join with other observatories to study black holes - including the one lurking in the center of our galaxy, and will study solar systems around other stars, including planetary atmospheres, to investigate their potential for hosting life.



Caption: Webb will follow up on many of Hubble's observations and continue its mission to study the most distant galaxies and stars it can - and as you can see in this comparison, its mirror and orbit are both huge in comparison, in order to continue these studies in an even deeper fashion! Credits: NASA, J. Olmsted (STScI)

Wondering how Webb's infrared observations can reveal what visible light cannot? The "Universe in a Different Light" Night Sky Network activity can help - find it at bit.ly/different-light-nsn. Find the latest news from NASA and Webb team as it begins its mission by following #UnfoldTheUniverse on social media, and on the web at nasa.gov/webb

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.



Tri-Valley Stargazers
P.O. Box 2476
Livermore, CA 94551
www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

Contact information:

Name: _____ Phone: _____

Street Address: _____

City, State, Zip: _____

Email Address: _____

Status (select one): _____ New member _____ Renewing or returning member

Membership category (select one): Membership term is for one calendar year, January through December.

_____ Student member (\$10). Must be a full-time high-school or college student.

_____ Regular member (\$30).

Hidden Hill Observatory Access (optional): Must be 18 or older.

_____ One-time key deposit (\$20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

_____ Annual access fee (\$10). You must also be a key holder to access the site.

Donation (optional):

_____ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: \$ _____

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function. TVS will not share information with anyone except as detailed in our Privacy Policy (<http://www.trivalleystargazers.org/privacy.shtml>).

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.