Covid-19 Notice

HAS have decided to cancel public HAS events for the time being, beginning with the March 14 public star party at Dillingham. Includes the upcoming in town star parties at Kahala and Geiger, as well as the monthly meeting. These cancellations will continue while we remain on lock down. We don't know yet what will happen with the club star party in April. We will try to update as soon as possible.

On Friday, April 24th, 2020, Hubble Space Telescope (HST) celebrated its 30th birthday. It was launched into space by Space Shuttle Discovery mission STS-31 (https://www.nasa.gov/mission_pages/shuttle/shuttlemissions/archives/sts-31.html) on Thursday, April 24, 1990, 8:33:51 a.m. EDT. HST was deployed from Shuttle Discovery the very next day. HST has provide us with many amazing detail photos that we enjoyed through out the years. I have copied the timeline of HST and put it on page 4 since we have extra space this month. Let’s hope HST provides us more photos until its retirement and be replaced by James Webb Space Telescope.
President’s Message
May 2020

Six months ago, if you had asked an amateur astronomer what “coronavirus” was, they might have guessed that it was the irrational urge to travel halfway around the world to a remote location for a chance at a two-minute view of a total solar eclipse. Now we are all familiar with COVID-19 and what it has done to our lives. HAS, along with so many others, has cancelled all events that bring people physically together until further notice.

Hawaii, along with many other places, has done fairly well in “flattening the curve” to keep the number of infections below the number that our medical system can handle at once. There has already been a small amount of loosening of restrictions, but the process will (and should) progress very slowly. Only a small percentage of the population has been exposed to the disease (as far as we know – testing must be greatly expanded), so it is important to keep employing the techniques that have been working. It is very unlikely that things will go back to normal before a vaccine is available for general use.

Until then, we must forgo the meetings and star parties that make up such a great part of our club’s activities. That doesn’t mean that we have to stop looking at the sky! Those who have suitable conditions at their homes can still take out their telescopes and observe, and anyone can step outside and observe the night sky with their eyes or binoculars.

There will continue to be expected and unexpected events in the sky. Meteor showers and the appearances of planets will continue. Rarer events, such as the passage of asteroid (52768) 1998 OR2, will crop up from time to time. As I write this, the passage is a few hours away. I won’t be able to observe it, but some of you will (did). Please let me know if you observed it, and send pictures if you took any. We can still share our love of the sky, even under these unusual circumstances.
Planets in May

**Mercury**
- Will be visible low in the evening sky the last half of May. It is within 1.0° of Venus on the evening of May 21.

**Venus**
- Shines brightly in the western sky after sunset. It rapidly loses altitude during May.

**Mars**
- Shines brightly (magnitude about +0.2) in the southeast before dawn.

**Jupiter**
- Is in the eastern sky before dawn rising between 2:00 AM and midnight. It is a spectacular view which reached greatest brightness on April 27.

**Saturn**
- Can be viewed near Jupiter in the eastern sky in May. On May 12 it is joined by the moon and Jupiter in a circle of 4.72°.

**Neptune**
- Is still fairly close to the sun in the morning sky.

**3 Juno (Asteroid)**
- Is found in the constellation of Virgo shining at about magnitude +9.8.

**Pluto (Dwarf Planet)**
- Close to Jupiter in the pre-dawn sky.

Other Events of Interest

**Planets Close To the Moon**
- Times are Hawaii Standard Time

- May 12, 01h, Moon 2.24° S of Jupiter (115° from sun in morning sky)
- May 12, 10h, Moon 2.66° SE of Saturn (110° from sun in morning sky)
- May 14, 19h, Moon 8° SE of Mars (83° from sun in morning sky)
- May 6, 09h, Moon 4.1° SE of Neptune (66° from sun in morning sky)
- May 29, 09h, Moon 3.6° SE of Uranus (22° from sun in morning sky)
- May 23, 19h, Moon 3.6° SE of Venus (17° from sun in evening sky)
- May 24, 03h, Moon 2.76° SE of Mercury (21° from sun in evening sky)

**Other Events of Interest**
- Times are Hawaii Standard Time

- May 4, 11h, Mercury at superior cong. with sun (Passes into evening sky)
- May 7, 00:44h, Full Moon
- May 12, 04h, Moon, Jupiter, and Saturn within a Circle of diameter 4.72° (115° from sun in morning sky)
- May 22, 07:39h, New Moon
- May 23, 20h, Moon, Mercury, and Venus within a Circle of diameter 4.44° (21° from sun in evening sky)
Hubble History Timeline

First conceived in the 1940s and initially called the Large Space Telescope, the Hubble Space Telescope took decades of planning and research before it launched on April 24, 1990. Since launch, Hubble has overcome its troubled beginnings to perform innumerable science observations that have revolutionized humanity’s understanding of the universe. From determining the age of the universe to observing dramatic changes on celestial bodies in our own solar system, Hubble has become one of humanity’s greatest scientific instruments.

This timeline describes Hubble’s history from the first proposal of a space telescope by Lyman Spitzer in 1946, through the completion of Hubble’s five servicing missions in the 1990s and 2000s, and to many of the significant observations and discoveries Hubble has made during its years in orbit.

Pre-Launch
1946 – First paper about space telescopes published
October 4, 1957 – Sputnik launched
October 1, 1958 – NASA created
1969 – Project gained support
1974 – First working group held
October 1, 1977 – Congress approved funding and project began
December 1978 – Grinding of primary mirror began
1979 – Astronauts began training for servicing missions
1983 – Large space telescope named after Edwin Hubble
January 28, 1986 – Space shuttle Challenger lost

1990
April 24, 1990 – Hubble launched
April 25, 1990 – Hubble deployed
May 20, 1990 – First image taken
June 27, 1990 – Spherical aberration discovered in mirror
August 29, 1990 – Supernova 1987A ring resolved
October 1, 1990 – First Hubble science paper submitted

1991
January 16, 1991 – Accurate distance measured to neighboring galaxy
May 17, 1991 – Hubble’s first images of Jupiter released

1992
January 13, 1992 – Chemistry of early universe probed
November 19, 1992 – Material fueling black hole discovered
June 9, 1993 – Hubble takes major step in determining universe’s age
December 2–13, 1993 – First servicing mission conducted
January 13, 1994 – Spherical aberration fixed
January 14, 1994 – Observations released of massive, unstable star
May 25, 1994 – Existence of supermassive black holes confirmed
July 16–23, 1994 – Comet Shoemaker-Levy 9 struck Jupiter
November 8, 1994 – Surface features of Titan resolved

1995
February 23, 1995 – Oxygen found on Europa
November 2, 1995 – Star birth seen in the Eagle Nebula
January 15, 1996 – Hubble Deep Field image released
January 17, 1996 – Evidence presented of a planet orbiting star Beta Pictoris
March 7, 1996 – Pluto’s surface revealed
July 18, 1996 – Hubble’s 100,000th exposure taken

(Continued on page 6)
Hawaiian Astronomical Society
Event Calendar

May 2020

<<Upcoming Star Parties>>

Public Party Geiger/Kahala May 30—CANCELLED
Public Party Dillingham May 23—CANCELLED
Club Party-Dillingham May 16—CANCELLED

Upcoming School Star Parties
(Continued from page 4) Meeting Minutes

1997  February 11–21, 1997 – Second servicing mission conducted
May 12, 1997 – First images released after Servicing Mission 2
May 12, 1997 – Black hole signature recorded
June 19, 1997 – Plume from Io imaged


1999  January 6, 1999 – Sharpest view of Ring Nebula released
November 13, 1999 – Hubble entered safe mode following gyroscope failures
December 19–27, 1999 – Third servicing mission conducted

2000  May 3, 2000 – Universe’s missing hydrogen found

2001  April 26, 2001 – First direct visual evidence of planet growth released
November 27, 2001 – First exoplanet atmosphere directly detected

2002  March 1–12, 2002 – Fourth servicing mission conducted
April 30, 2002 – Advanced Camera for Surveys first images released
September 19, 2002 – Crab pulsar dynamics observed

2003  February 1, 2003 – Space shuttle Columbia lost during reentry
March 12, 2003 – Evaporating planet discovered
March 26, 2003 – Light echo recorded

2004  January 16, 2004 – Servicing Mission 4 canceled
March 9, 2004 – Hubble Ultra Deep Field released

August 31, 2005 – Hubble began “two-gyro” science operations
October 31, 2005 – Two small moons of Pluto discovered
December 22, 2005 – Moons and rings around Uranus discovered

2006  April 18–20, 2006 – Breakup of comet witnessed
August 21, 2006 – Direct proof of dark matter observed
October 31, 2006 – Servicing Mission 4 reinstated

2007  October 29 – November 4, 2007 - Mystery comet observed
December 11, 2007 – Hazy extrasolar atmosphere discovered

2008  March 19, 2008 – First organic molecule detected on an exoplanet
August 11, 2008 – Hubble completed its 100,000th orbit
September 27, 2008 – Hubble entered safe mode
November 13, 2008 – Visible-light images of an exoplanet released

2009  May 11–24, 2009 – Fifth servicing mission conducted
September 9, 2009 – Post-Servicing Mission 4 observations released

2010  February 25–28, 2010 – Large asteroid Vesta observed
August 19, 2010 – Cosmic lens used for the first time to probe dark energy

2011  May 11–24, 2011 – One millionth science observation made
July 4, 2011 – Nobel Prize awarded for discovery of accelerating universe
December 6, 2011 – 10,000th Hubble science paper published

2012  May 31, 2012 – Milky Way–Andromeda collision determined to be head-on
July 11, 2012 - Fifth Pluto moon discovered
September 25, 2012 – Hubble eXtreme Deep Field released

2013  April 19, 2013 – Horsehead Nebula infrared image released
November 7, 2013 – Asteroid found to have comet-like tails
December 12, 2013 – Water vapor plumes observed on Europa

2014  March 7, 2014 – First Frontier Field image released
March 6, 2014 – Disintegrating asteroid imaged
May 15, 2014 – Great Red Spot found to be shrinking
June 3, 2014 – Hubble Ultra Deep Field updated
October 15, 2014 – Potential targets identified for New Horizons

2015  January 5, 2015 – Hubble revisited iconic “Pillars of Creation”
January 5, 2015 – Panoramic view of Andromeda galaxy released
December 16, 2015 – First-ever predicted supernova captured

2016  March 3, 2016 – Cosmic distance record broken
April 26, 2016 – Hubble discovered moon of dwarf planet Makemake

2017  February 22, 2017 – Hubble studied atmospheres of Earth-sized exoplanets
October 16, 2017 – Hubble observed source of gravitational waves

2018  April 2, 2018 – Hubble revealed farthest star ever seen
June 27, 2018 – First known interstellar object studied
October 3, 2018 – Possible exomoon found

2019  September 13, 2019 – Water vapor detected on habitable-zone exoplanet
Ever want to mix in some science with your stargazing, but not sure where to start? NASA hosts a galaxy of citizen science programs that you can join! You’ll find programs perfect for dedicated astronomers and novices alike, from reporting aurora, creating amazing images from real NASA data, searching for asteroids, and scouring data from NASA missions from the comfort of your home. If you can’t get to your favorite stargazing spot, then NASA’s suite of citizen science programs may be just the thing for you.

Jupiter shines brightly in the morning sky this spring. If you’d rather catch up on sleep, or if your local weather isn’t cooperating, all you need is a space telescope - preferably one in orbit around Jupiter! Download raw images straight from the Juno mission, and even process and submit your favorites, on the JunoCam website! You may have seen some incredible images from Juno in the news, but did you know that these images were created by enthusiasts like yourself? Go to their website and download some sample images to start your image processing journey. Who knows where it will take you? Get started at bit.ly/nasajunocam

Interested in hunting for asteroids? Want to collaborate with a team to find them?? The International Astronomical Search Collaboration program matches potential asteroid hunters together into teams throughout the year to help each other dig into astronomical data in order to spot dim objects moving in between photos. If your team discovers a potential asteroid that is later confirmed, you may even get a chance to name it! Join or build a team and search for asteroids at iasc.cosmosearch.org

Want to help discover planets around other star systems? NASA’s TESS mission is orbiting the Earth right now and scanning the sky for planets around other stars. It’s accumulating a giant horde of data, and NASA scientists need your help to sift through it all to find other worlds! You can join Planet Hunters TESS at: planethunters.org

Intrigued by these opportunities? These are just a few of the many ways to participate in NASA citizen science, including observing your local environment with the GLOBE program, reporting aurora with Aurorasaurus, measuring snowpack levels, training software for Mars missions – even

GREAT SOUTHERN JUPITER: Incredible image of Jupiter, submitted to the JunoCam site by Kevin M. Gill. Full Credits: NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill

(Continued on page 10)
Meteor Log—May 2020  
by Tom Giguere

This month’s meteor shower information is sourced to the International Meteor Organization (IMO), edited by Jurgen Rendtel. The eta Aauriids (ETA) meteor stream is associated with Comet 1P/Halley, like the Orionids of October. This year the shower is best observed in the pre-dawn hours due to the 98% illuminated gibbous Moon. The Moon sets at 4:50am on morning of the maximum, so I would recommend observing from 3 or 3:30am until morning twilight. The shower has not been heavily observed and would benefit from increased observer activity. The fast and often bright meteors make the wait for radiant-rise worthwhile, and many meteors leave persistent trains. A relatively broad maximum, sometimes with a variable number of submaxima, occurs around May 5/6. IMO analyses of visual data collected since 1984 have shown that ZHRs are generally above 30 in the period May 3–10. The peak rates appear to be variable on a roughly 12-year timescale. Assuming this Jupiter-influenced cycle is real, the next high level returns may occur in the years 2020–2022. The following table shows recent peak ZHRs.

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2017</th>
<th>2018</th>
<th>2019 (prelim)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZHR</td>
<td>~80</td>
<td>~70</td>
<td>75</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

Justin Ng of Singapore captured this view of a bright Eta Aquarid meteor hurtling across the night sky over Mount Bromo, on the Indonesian island of Java. (Image credit: © Justin Ng)

(Continued on page 11)

**Phases of the Moon** (courtesy timeanddate.com)

<table>
<thead>
<tr>
<th>First Quarter</th>
<th>Full Moon</th>
<th>Last Quarter</th>
<th>New Moon</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 29</td>
<td>May 07</td>
<td>May 14</td>
<td>May 22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shower</th>
<th>Activity</th>
<th>Maximum</th>
<th>Radiant</th>
<th>( V_\infty )</th>
<th>( r )</th>
<th>ZHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \eta )-Aquariids (ETA), 031 ETA</td>
<td>Apr 19–May 28</td>
<td>May 05</td>
<td>45.5°</td>
<td>338°</td>
<td>-01°</td>
<td>66</td>
</tr>
<tr>
<td>( \eta )-Lyrids (ELY), 145 ELY</td>
<td>May 03–May 14</td>
<td>May 08</td>
<td>48.0°</td>
<td>287°</td>
<td>+44°</td>
<td>43</td>
</tr>
</tbody>
</table>

Stuck inside?? It’s a great time to find that dark corner in the yard and observe a meteor shower! Tom Giguere, 808-782-1408, Thomas.giguere@yahoo.com; Mike Morrow, PO Box 6692, Ocean View, HI 96737.
Here are the financials up through April 9.

Thanks for those who sent in their memberships, and who paid up their calendars.

In short, not much action on the financial front. Not much going on with club observing events, as the April club star party was canceled. Hang in there folks. Covid-19 numbers are way down in Hawaii, and May might offer a bit of loosening of restrictions.
counting penguins! Discover more opportunities at science.nasa.gov/citizenscience and join the NASA citizen science Facebook group at facebook.com/groups/Sciencing/ And of course, visit nasa.gov to find the latest discoveries from all the research teams at NASA!

(Continued from page 7) NASA’s Night Sky Notes

Light curve of a binary star system containing a pulsating (variable) star, as spotted on Planet Hunters TESS by user mhuten and featured by project scientist Nora Eisner as a “Light Curve of the Week.” Credit: Planet Hunters TESS/NASA/mhuten/Nora Eisner

Hubble Captures a Cannibal Galaxy
This remarkable spiral galaxy, known as NGC 4651, may look serene and peaceful as it swirls in the vast, silent emptiness of space, but don’t be fooled — it keeps a violent secret. It is believed that this galaxy consumed another smaller galaxy to become the large and beautiful spiral that we observe today.
Text credit: ESA (European Space Agency)  Image credit: ESA/Hubble & NASA, D. Leonard
(Continued from page 8) Meteor Log by Tom Giguere

The April Lyrids were not affected by the Moon last month. Ort Vanaprucks observed the shower with his two daughters from his backyard (it’s hard to get out these days). As a group they saw 6 Lyrids and 2 sporadics in 30 minutes (4:25-4:55am local time). Two of the meteors were fairly bright at magnitude -3 (1 Lyr, 1 SPO). Their observing session was cut short by a pesky lawn sprinkler that came on; that was not the type of shower they were looking for! I observed for a short time at my abode as twilight was breaking (4:50-5:10am). I saw no meteors! However, I witnessed the ISS pass withing 1/3 degree from Saturn, and saw 4 other satellites. Ort’s clan observed the ISS pass too.

Hubble Hooks a One-Arm Galaxy
NGC 4618 was discovered on April 9, 1787, by the German-British astronomer William Herschel, who also discovered Uranus in 1781. Only a year before discovering NGC 4618, Herschel theorized that the “foggy” objects astronomers were seeing in the night sky were likely to be large star clusters located much farther away than the individual stars he could easily discern.

Text credit: ESA (European Space Agency)  Image credit: ESA/Hubble & NASA, I. Karachentsev

Eagle Nebula’s Pillars of Creation in Infrared
In this Hubble Space Telescope image, researchers revisited one of Hubble's most iconic and popular images: the Eagle Nebula’s Pillars of Creation.

Image Credit: NASA, ESA/Hubble and the Hubble Heritage Team
This image shows sample site Nightingale Crater, OSIRIS-REx’s primary sample collection site on asteroid Bennu. The image is overlaid with a graphic of the OSIRIS-REx spacecraft to illustrate the scale of the site.

Image Credit: NASA/Goddard/University of Arizona