Stargazing at Home
August 2020

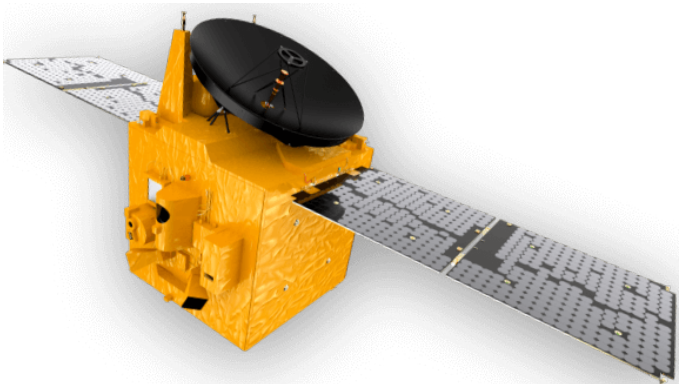
By Aaron Slonecker, Thomas Planetarium Manager and NASA Solar System Ambassador

UP, UP AND AWAY TO MARS

Last month was busy for Mars-bound spacecraft. Not one, not two, but three different spacecrafts launched to the red planet. The United Arab Emirates, China, and the United States all sent spacecraft in July, during the current Mars launch window. For Mars, launch windows are approximately every 26 months and allow for spacecraft to leave Earth, travel in a curved trajectory towards Mars, rendezvous with Mars months later, all while using very little fuel. This Hohmann transfer allows for spacecraft to reach their destination in the most efficient way, allowing engineers and scientists to focus on the equipment and instruments on board, instead of taking up limited space and weight with extra fuel.

HOPE PROBE

The Emirates Mars Mission, launched July 19 by the United Arab Emirates, is the first interplanetary mission of the UAE. The Emirates Mars mission's, Hope Probe, will be observing and analyzing the atmosphere of Mars, attempting to understand climate dynamics and the interactions of hydrogen and oxygen. This spacecraft will be the first weather satellite of Mars, monitoring weather changes across the planet, throughout the day and seasons.



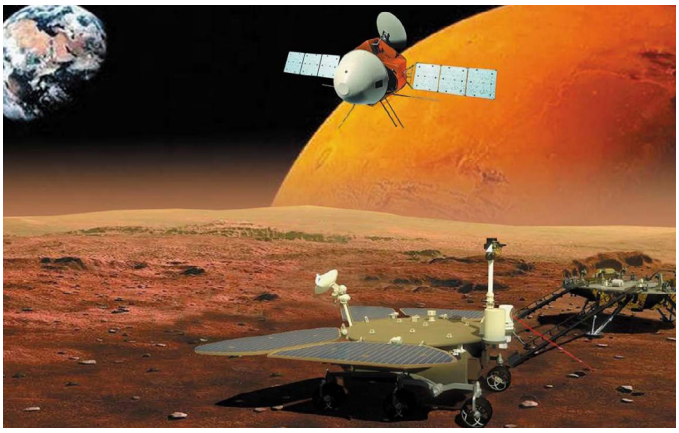
Emirates Mars Mission Hope Probe (UAE Space Agency)

Instruments on board were collaboratively developed with the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado Boulder. The EMIRS, EXI, and EMUS instruments are designed to study different wavelengths of light to help build a profile for atmospheric layers and overall atmospheric structure. For more information on the Hope Probe click here.

Hope Probe Instruments. Emirates Mars Infrared Spectrometer (EMIRS) *left*, Emirates Exploration Imager (EXI) *center*, Emirates Mars Ultraviolet Spectrometer (EMUS) *right*. (UAE Space Agency)

TIANWEN-1

Four days after the United Arab Emirates launched their first ever interplanetary mission, China launched Tianwen-1. This is China's second attempt at sending a spacecraft to Mars, but the first time doing so independently. Back on November 9, 2011 China's Yinghuo-1 orbiter hitched a ride on Russia's Phobos-Grunt mission as it launched from Earth headed to Mars. After entering an orbit around Earth, the spacecraft failed to perform the maneuvers necessary to escape Earth's gravity, and about a month after the launch, the spacecraft - with China's orbiter - came to a fiery end upon reentry into Earth's atmosphere.



Artist impression of Tianwen-1 spacecraft (Nature Astronomy)

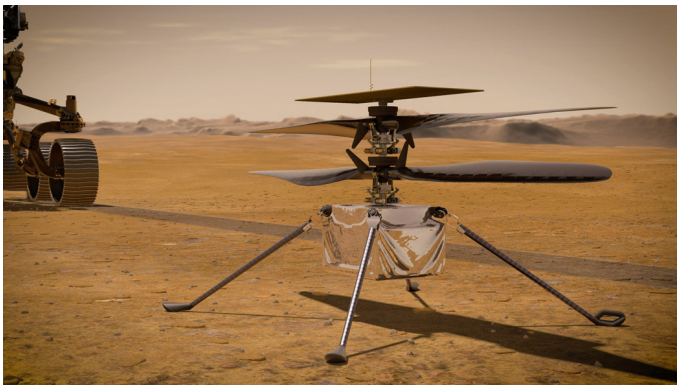
Tiawen-1 is not just China's first spacecraft to Mars, but is also a brand new design and concept for robotic Mars exploration. Tiawen-1 consists of an orbiter and lander-rover. This map of past Mars missions - including both successes and failures - shows just how difficult it has been to land on Mars, and for Tiawen-1 to have both an orbiter and rover as part of a first time mission, is quite ambitious. If successful, however, it could revolutionize how future Mars missions are designed and engineered.

This mission has five main objectives including making a geologic map of Mars, investigating the atmosphere, and understanding the electromagnetic and gravitational fields of the planet. The combination of up-close observation from the rover, plus the 'birds eye' view from the orbiter, should provide a better overall understanding of Mars, further shedding light on our own planet's formation and evolution.

PERSEVERANCE ROVER

The third Mars-bound spacecraft, NASA's Perseverance rover, launched on July 30, 2020. Perseverance is built similarly to the Curiosity rover, which landed on Mars in 2012. Perseverance is about 10 feet long, 9 feet wide and 7 feet tall, or about the size of a small SUV. Equipped with state-of-the-art science instruments, Perseverance seeks to determine if life ever existed on Mars. Earlier rovers, like Spirit and Opportunity, discovered evidence for past liquid water on the surface of Mars. Curiosity rover confirmed that Mars once had the chemistry needed for habitable conditions. Now, Perseverance aims to find biosignatures and signs of life in the geologic record.

Perseverance will also be testing out new technologies for future robotic and human exploration. Attached to the rover is the Ingenuity Mars helicopter, which will demonstrate the capabilities of a drone-like helicopter and its ability to help both robots and humans in the future. NASA will also be testing out five different materials that could be used in future astronaut suits. On-site (Mars) testing of these materials will be crucial in future human exploration to the planet.



Ingenuity Mars Helicopter illustration (NASA/JPL-Caltech)

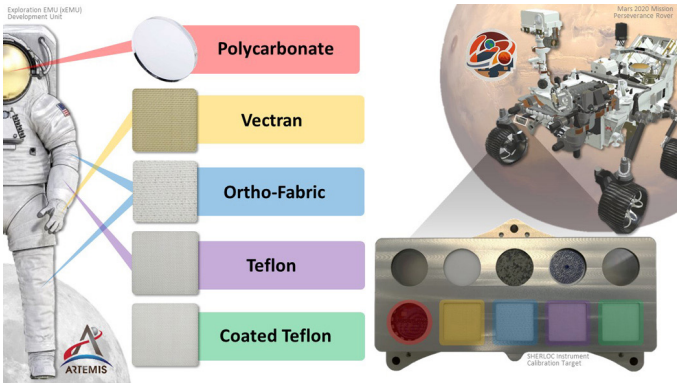


Illustration of astronaut suit prototype material on Perseverance rover. (NASA)

NIGHT SKY OBSERVATIONS AND THE THOMAS PLANETARIUM SKY PATROL

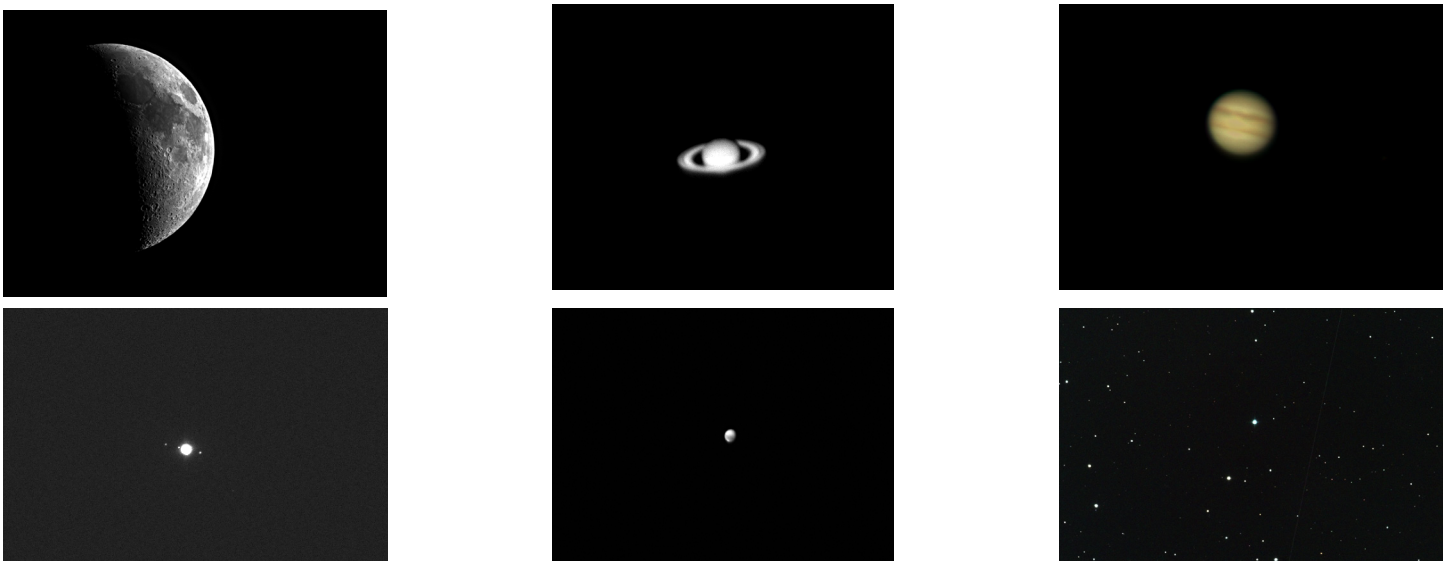
The fall welcomes back darker skies and hopefully some great future night sky viewing. During this time of anxiety and socially-distanced interactions, getting outside and in nature is a wonderful way to relax and reflect through viewing the skies above.

To join the Thomas Planetarium Sky Patrol click here

The Anchorage Museum seeks to collaborate with the community through a new platform. Slooh allows members to control telescopes around the world and capture images of celestial objects, learn about astronomy in interactive ways by completing quests, and share observations and images with a community of like-minded astronomy enthusiasts. Together with Slooh, the Anchorage Museum has created the Thomas Planetarium Sky Patrol, a digital astronomy club where members can share images, engage in discussions about astronomy topics and share other fun online astronomy resources. Memberships to the club range in price from Student level ($50/year) to Apprentice level ($100/year) to Astronomer level ($300/year). To join the Thomas Planetarium Sky Patrol click here, and make sure to use Club Code 17DC9-CBC10. With generous support from the Pacific Planetarium Association, we are pleased to be able to offer 10 scholarships for student level memberships to the club. If you have any questions please email aslonecker@anchoragemuseum.org. The highlights visible in our August night sky, along with images of those objects taken using the Slooh platform are below.

SOLAR SYSTEM NEIGHBORS

We start with a parade of planets visible after midnight. By 1am these objects make a nice line stretching from south (Jupiter and Saturn) to east (Mars). These planets are only between five and fifteen degrees above the horizon. Almost straight between due south and due east (as of August 13), lies the planet Neptune, one of two planets in our solar system not visible with the naked eye. Neptune is an ice giant, larger than terrestrial planets like the Earth and Mars, but smaller than Jupiter and Saturn, and a lot farther from the sun. Its distinctive bluish hue comes from methane ice crystals suspended in the atmosphere reflecting blue wavelength colored light. Below are images captured using the Slooh telescopes. These pictures are unique and special because I was able to take them myself without owning any specialized observing equipment.



Waxing crescent Moon (top left), Saturn (top center), Jupiter (top right), Jupiter and moons (bottom left), Mars (bottom center), Neptune (bottom right). (Images by Aaron Slonecker with Slooh)

DEEP SKY OBJECTS

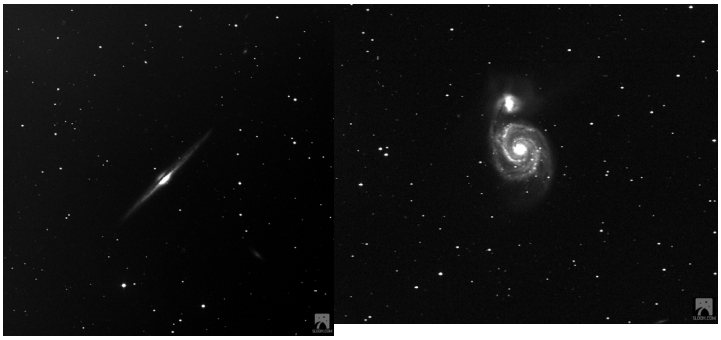
A number of deep sky objects including nebulae and galaxies surround us at night. Often they are not visible without the help of binoculars or telescopes. Nebulae are clouds of gas and dust that often represent both the birth places and deathly remains of a star. The Helix Nebula is a good example of a planetary nebula, and can be found low on the horizon between Saturn and Mars in the constellation Aquarius. When a medium size star, like our sun, runs out of fuel for nuclear fusion in its core, the star gently blows off its atmosphere, cools and transitions into a white dwarf. These 'stellar embers' live out the remainder of their lives in a slow cool down, becoming fainter and fainter. The shell of gases produced from this process glows and reflects different colors and wavelengths of light.

Helix Nebula (Image by Aaron Slonecker with Slooh)

Galaxies are another type of fascinating deep sky object. Containing between 200-400 billion stars, galaxies are gigantic stellar cities. The Andromeda Galaxy is the only object outside of our own Milky Way galaxy visible in the northern hemisphere, with the naked eye. A clear night and little to no light pollution reveals it as a faint grey smudge. The Andromeda Galaxy is about 220,000 light years across. Imagine standing at one end of the galaxy with a flashlight while your friend stands at the other end. If you turned on your flashlight and pointed it at your friend, they would not see the light from your flashlight for 220,000 years! It took that long for the light to reach the other side of this galaxy.

The Andromeda and the Milky Way galaxies are barred spiral galaxies. Spiral galaxies have distinct features and structure including a disk shape and usually two spiral arms. Most star formation takes place within these arms, causing them to appear brighter and full of gas and dust. Spiral galaxies may appear very different depending on the angle at which they are seen. Looking at a spiral galaxy edge on allows us to observe the flat disk shape and central bulge. An example of this can be found with the Needle Galaxy, located 30-50 light years away in the constellation Coma Berenices. The Whirlpool galaxy, located just below the tail of Ursa Major (Big Bear), offers a view from a different angle - the top, and reveals more detail in the spiral arms. This galaxy also offers us a great example of a galaxy merger. Galaxies are outside our own, so when astronomers say galaxies are found in a certain constellation, they mean that while galaxies appear close to, and among, the stars of a constellation, galaxies are actually much farther away and behind all of those stars.

Andromeda Galaxy (Image by Aaron Slonecker with Slooh)



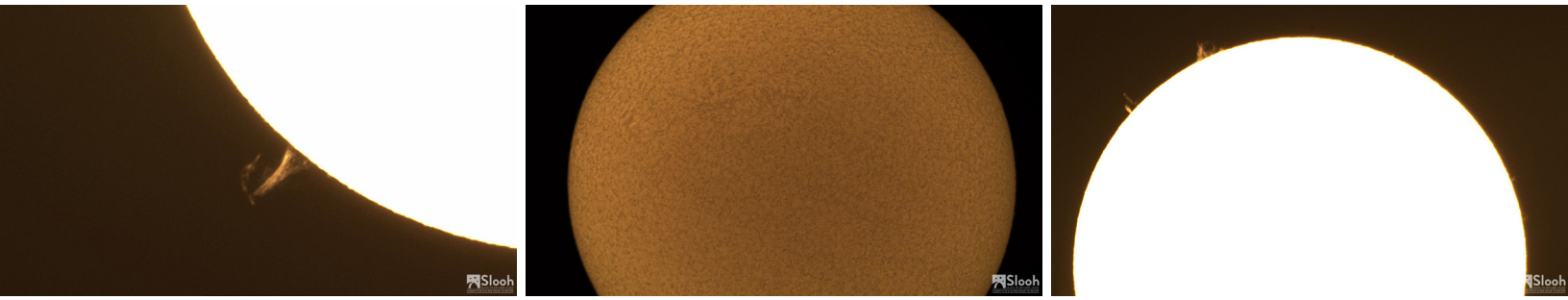
Needle Galaxy (left) and Whirlpool Galaxy (right) (Images by Aaron Slonecker with Slooh)

TELESCOPE SURPRISES

Throughout the month of July, Comet NEOWISE graced the early morning and evening skies around the world. Beautiful pictures flooded the internet and social media. NEOWISE was discovered in March of this year and became the brightest comet in the northern hemisphere since Comet Hale-Bopp in 1997. Unfortunately, in Alaska this happened during the summer when it is too bright to see such an event. Luckily, these types of ephemeral events can be captured elsewhere. Below are three images I took of the comet towards the end of July, using Slooh telescopes located in the Atlantic Ocean on the Canary Islands.

Comet NEOWISE taken with three different telescopes (Images by Aaron Slonecker using Slooh)

The sun dictates what and when we observe in the sky. The sun makes up about 99.8 percent of all the mass in our solar system. Like other stars seen at night, the sun emits energy and light by undergoing nuclear fusion deep in its core. The sun consists of hot gas and plasma, and has an atmosphere that stretches millions of miles into space. The photosphere is the visible surface of the sun - the layer observable using special solar eclipse glasses and solarscopes. This surface appears granulated as hot material rises from deeper inside the sun to the surface, then cools and sinks back down. Similar to a pot of boiling water, convection helps to transfer heat from inside the sun outward. Once material reaches the photosphere, interactions with magnetic field lines form structures like solar flares and prominences. These structures change and evolve over time, helping to showcase the sun as an active and seemingly living entity. This view feels appropriate for an object that is in total control of all the moving pieces of our solar system.



Solar images showing different surface features including solar prominences (left and right) and granulation (middle) (Images by Aaron Slonecker using Slooh)