AOH OBSERVER
Summer 2018

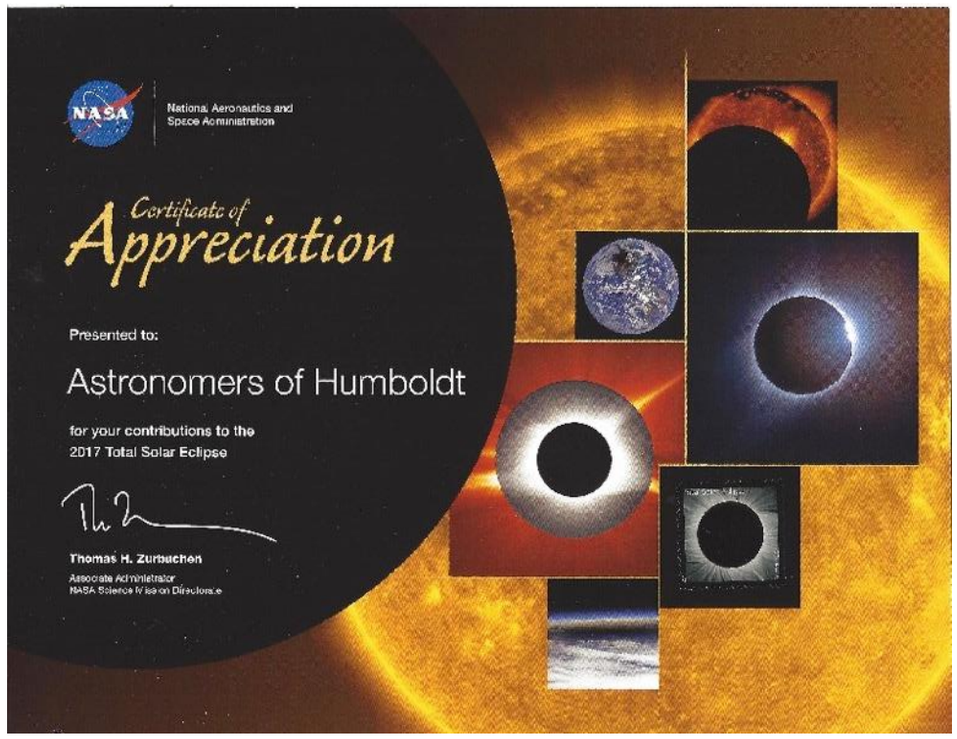
The Newsletter of the Astronomers of Humboldt

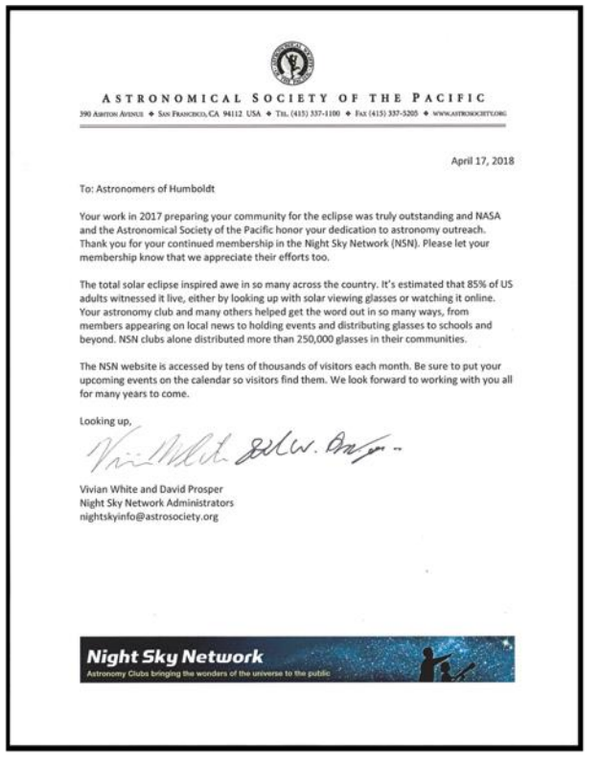
A Look Back at the Great American Solar Eclipse

Just a year ago many of us in the AOH were preparing for our trek to view the August 21 "Eclipse across America." During the late spring and summer, the AOH held several outreach events to educate the public on the science of solar eclipses, how to safely view the solar eclipse, and where to view the solar eclipse in our area. In all, the AOH distributed about 500 eclipse shades to schools, youth groups, and the general public. We also provided HSU and Humboldt Redwoods State Park with educational materials for their eclipse viewing parties.

In April, the AOH, along with hundreds of other community astronomy clubs, received a certificate of appreciation from NASA for our educational activities in the run-up to the solar eclipse. We also received a letter from the Astronomical Society of the Pacific/Night Sky Network thanking us for our participation in the Great American Solar Eclipse. I have posted here the certificate, letter, and a photo montage of last year's solar eclipse/astronomy outreach events. Articles about these events are in the 2017 Summer and Fall editions of the AOH Observer. We might be a small club, but we do make a big difference in our community.

Thank you to our outreach volunteers who worked tirelessly throughout the spring and summer of 2017 on these outreach events: Ken Yanosko, Mark Mueller, Mark Wilson, Brent Howatt, Dan Eaton, Greg Deja, Bob Zigler, and Russ Owsley.





ASTRONOMICAL SOCIETY OF THE PACIFIC
390 Ashton Avenue ◆ San Francisco, CA 94112 USA ◆ Tel (415) 337-1100 ◆ Fax (415) 337-5205 ◆ www.astrosociety.org

April 17, 2018

To: Astronomers of Humboldt

Your work in 2017 preparing your community for the eclipse was truly outstanding and NASA and the Astronomical Society of the Pacific honor your dedication to astronomy outreach. Thank you for your continued membership in the Night Sky Network (NSN). Please let your membership know that we appreciate their efforts too.

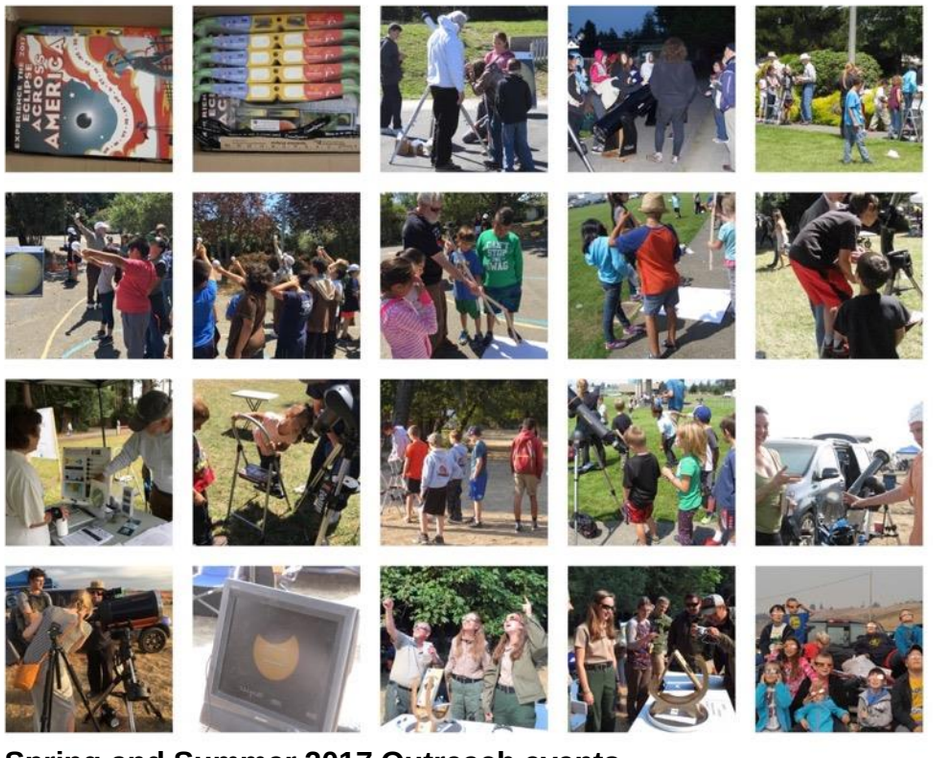
The total solar eclipse inspired awe in so many across the country. It's estimated that 85% of US adults witnessed it live, either by looking up with solar viewing glasses or watching it online. Your astronomy club and many others helped get the word out in so many ways, from members appearing on local news to holding events and distributing glasses to schools and beyond. NSN clubs alone distributed more than 250,000 glasses in their communities.

The NSN website is accessed by tens of thousands of visitors each month. Be sure to put your upcoming events on the calendar so visitors find them. We look forward to working with you all for many years to come.

Looking up,

Vivian White and David Prosper
Night Sky Network Administrators
nightskyinfo@astrosociety.org

Night Sky Network
Astronomy Clubs bringing the wonders of the universe to the public



Spring and Summer 2017 Outreach events

Acknowledgements:

Thank you to Ken Yanosko and Don Wheeler for their suggestions and proofreading of the Newsletter. The contributions of Mark Wilson and Susie Christian to the 2018 Summer Issue are greatly appreciated.

Grace Wheeler
Editor & Staff Writer

A Beautiful Sight: A Visit to the VLA

By Mark Wilson

In mid-May on a vacation tour of New Mexico, USA, I took the opportunity to visit the site of the Very Large Array (VLA) radio telescope. The VLA is located 50 miles west of Socorro which in turn is about 50 miles south of the booming burg of Albuquerque. The site is located in a very large basin of grassland surrounded by forested mountains.

The radio antenna on the walking tour, foreground, and an arm of the array with additional similar antennae in the background. Each radio antenna has a dish diameter of 25 m (82 ft) and weighs 209 metric tons. (Wikipedia VLA).
Photo credit: Mark Wilson

There is a small visitor center which is open daily. At the center, there is a very good orientation video narrated by film star Jodie Foster of "Contact" fame. The main attraction at the visitor center is an outside walking tour with interpretation panels along the way. Visitors can walk right up to one of the antennae. The antenna dishes have a diameter of two school buses. As I got up to the dish, it began to move! I suspect the operators in the building behind me thought I was a worthy target for investigation. The system consists of 27 dishes which move about on double parallel railroad tracks laid out in a Y pattern. There is a specially designed locomotive, red in the photo, that transports the antennae to various locations on the Y.

Antennae next to the Antennae Assembly building. The red locomotive transports the antennae to various locations on the Y. Photo credit: Mark Wilson

The VLA was designed and built during the 1970s and became operational in 1980. Over the decades, electronics and sensors advanced geometrically. In the early part of the 21st century, the facility went through a mega retooling. One of the upgrades was the computing systems which resulted in one of the world's largest and fastest computers. This baby can do 16 quadrillion calculations a second!

Above is one arm of the array. Arrays are expansive series of telescopes that work together as one telescope. The VLA has the same resolving power of a telescope that is 22 miles (36 kilometers) in diameter, and has been used to study radio galaxies, quasars, pulsars, gamma-ray bursts, the sun and planets, and black holes. (Wikipedia VLA). Photo Credit: Mark Wilson

Double tracks and mountains on the east side of the basin. Photo credit: Mark Wilson

The VLA is definitely worth a visit. You can spend two to three hours. Did I mention there is also a nice gift shop? New Mexico USA (that's what it says on the vehicle license plates) has several exciting astronomy and space tourist places to visit. Check the state's web page for a list of sites you can visit.

Spring 2018 Outreach Events

by Grace Wheeler

Yuri's Night on the Arcata Plaza, April 13, 2018

The Astronomers of Humboldt first ever Yuri's Night was held during the larger Arts! Arcata event on April 13th. Yuri's Night is an annual global event named for Yuri Gagarin, and it celebrates human spaceflight and space exploration. The AOH took over the southeast corner of the Arcata Plaza and set up an astronomy display that included posters on human spaceflight and space exploration, a scale model of the solar system, and telescope viewing. We were fortunate that the clouds parted just enough for us to view a couple of sizable solar prominences on the margin of the sun (using a hydrogen-alpha solar telescope). Visitors were also able to observe Venus in the daytime through a 6 inch SCT. We had about 75 astronomy enthusiasts, including many kids, who came by our tent to find out about space exploration and astronomy. Visitors to our tent received moon maps, a brochure on celestial objects, NASA Space Place stickers, and tattoos. Everyone enjoyed the fun-sized Milky Way bars and Starbursts. Thank you to Becky Chambers who organized Yuri's Night and the volunteers: Bea Asmundardottir, Brent Howatt, Catrina Howatt, Mark Wilson, Sharon Seagraves, Ken Yanosko, and Grace Wheeler.

Becky's space exploration posters were featured at our AOH tent (photo: G. W.)

Ken and Becky in front of the AOH display. (photo: G.W.)

Becky answering Mark W.'s questions. (photo: G.W.)

A sizable crowd at our AOH display. (photo:K.Yanosko)

Brent showing solar prominences to one of our young visitors. (photo: G.W.)

Starry Night Program at Redwood National and State Parks, April 29, 2018

In spite of the Starry Night Program at the RNSP (April 29) being more cloudy night, we still had a sizable crowd of park visitors who turned up for an evening of stargazing. Brent Howatt, Catrina Howatt, and I (G.Wheeler) set up displays and telescopes near the entrance of the Elk Creek Campground. We hoped to catch the moon rising over the eastern ridge...and it would have worked out beautifully except for the clouds. During a brief clearing, we managed to get a GoTo telescope aligned and pointed at Mizar in the handle of the Big Dipper. While we waited for conditions to improve, visitors got a short talk about the moon and the four planets that are currently visible in our night sky (Venus, Jupiter, Mars, and Saturn). The clouds never dissipated so the moon and the constellations were off the agenda for the night. However, the attendees did get a lesson in the light gathering power of telescopes. While the stars overhead were at best barely visible, the one telescope pointed at Mizar had the double star Mizar and Alcor in the field of view. Overall, the Starry Night Program gave the attendees a lot to think about, and hopefully a greater appreciation of the night sky. Thank you to RSNP ranger David Yake for the invitation, and to Brent and Catrina for their help in pulling this one off. (*Note: A version of this was previously posted on the AOH Facebook Page).*

Posters and handouts were set up at the kiosk. (photo: C. Howatt)

Brent and Grace with their telescope setups. (photo: C. Howatt)

Star field for the telescopes. (photo: C. Howatt)

Playdough moonscape showing how shadows help show the depth of craters.

AOH Public Observing/Regular Monthly Meeting May 12, 2018

We met at Kneeland School under a beautiful clear sky. Although we had invited the School to join us, it turned out to be mostly a members-only event. We spent the evening doing a “show-and-tell” as we visited different telescopes. We observed Venus and Jupiter with its four Galilean moons, and a large number of deep sky objects, including M3 (globular cluster in CVn), M51 (Whirlpool Galaxy), M64 (Black Eye Galaxy), M65-66 (two of the Leo Triplet Galaxies), M81 (Bode's Galaxy), M82 (Cigar Galaxy), M84-86 (galaxies in Virgo), M95-96 (galaxies in Leo), M104 (Sombrero Galaxy), M105 (galaxy in Leo near M95-96), M106 (galaxy in CVn), M109 (galaxy in UMa), NGC 3628 ("Hamburger Galaxy" and third Leo Triplet), NGC 4435-4438 (Eyes Galaxies in the Markarian Chain), NGC 4567-4568 (Butterfly Galaxies), NGC 4656 (Hockey Stick Galaxy in CVn), and La Superba (the carbon star in CVn). And we saw a strange Iridium flare--it looked like Iridium 37 is tumbling, since we got 3 or 4 smallish flashes instead of the single magnitude -7 flare we were expecting. (Text by Ken Yanosko with modifications by G. Wheeler).

Russ Owsley setting up his Newtonian reflector in anticipation of a clear night of stargazing. (photo: C. Howatt)

The Whirlpool Galaxy (M51) imaged with the Infinity web camera and viewed on a computer screen (with red night-vision filter). (photo: G.W.)

Astronomy Discovery Day at HSU Natural History Museum, May 20, 2018

This was our second year participating in the Museum’s Astronomy Discovery Day. The museum had a variety of astronomy-related demonstrations put on by their volunteers including a gravity well, cratering demonstrations, spectroscopy of different gases, and rocketry. The AOH's contribution to Discovery Day was our meteorite collection (curated by Russ and Grace), and demonstrating how to distinguish meteorites from “meteorwrongs.” Outside at the museum’s entrance, Ken and Brent showed how lenses and mirrors work in telescopes. Clouds prevented us from our planned viewing of the Sun, Moon, and Venus. Visitors instead used the telescope to view birds in distant trees and a sign posted on a faraway power pole. We had about 150 kids and adults visit our displays. It is always gratifying to see parents and kids learning together.

Russ showing the AOH meteorite collection. (photo: G.W.)

A closer examination of a meteorite sample. (photo: G.W.)

Trying to find birds in a distant tree with a refracting telescope. (photo: G.W.)

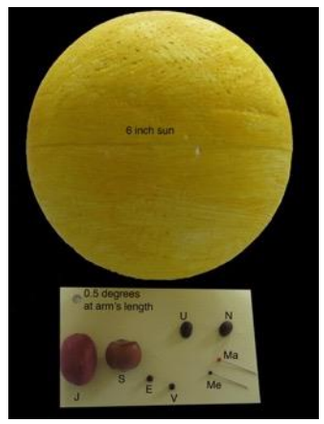
Ken using binoculars to explain how lenses work to gather light and magnify objects. (photo: G.W.)

“What big eyes I have”. Looking at the primary mirror in a Newtonian reflector. (photo: G.W.)

Kneeland School Astronomy Program
May 21, 2018

Kneeland was fogged over so Mark Wilson and I had to scrap our original program of viewing the Sun, Moon, and Venus. We instead did a program on the "scale model of the solar system" using models of planets scaled to a one-meter sun. We then did an exercise on the relative distances between the sun and planets using a variation of "If the Earth was the Size of a Peppercorn". The students paced out the distances of the planets from the Sun to Jupiter. I had to go outside the school parking lot to set up Saturn. The students used the telescope to view Saturn from Jupiter (they couldn't see the filbert without the telescope at that distance). The best comment I heard was from one of the older students who said that she didn't realize that the Earth was so close to the Sun.

Planet walk at the Kneeland School. Image Is from Google Earth with modification (G.W).



If the Sun was a six inch ball this would be approximate size of the planets. (photo: G.W.)

The second program we did was on gravity and the speed of objects moving around a central mass. We set up a gravity well using Lycra stretched over a tub. Students launched beads and watched how the speed and shape of the orbit changed as the bead fell into the central mass. We related this to the orbital speed of the planets in our solar system with Mercury being the fastest and Neptune the slowest. We then used the gravity wells to model escape velocities from Earth (4 oz weight) and the Moon (1 oz weight). The students tried launching the beads out of the gravity well by blowing through straws. They saw it was easier to launch an object from the Moon (shallower gravity well) than from the Earth (deeper gravity well).

Trying to launch a spacecraft (bead) out of Earth's gravity. (photo: G.W.)

It got competitive. She did a good job of launching the bead (photo: G.W.)

It was the first time that we had ever done the two programs. We thank the Kneeland School for inviting us, and the students for being such a fun audience.

Science Night at Morris School, McKinleyville
May 30, 2018

We thought that we had finally caught a break with the weather, and with optimism, we set up telescopes in the Morris School basketball court. We had partly cloudy skies for about 45 minutes in which time many of the parents and students were able to view sunspots (Ken, C8), a small solar prominence (Grace, solar telescope), and Venus in gibbous phase (Mark W., Newtonian reflector). After the skies became overcast, the scopes were pointed at distant objects so that attendees could appreciate the magnifying power of telescopes.

Russ took care of our AOH display area and had a crowd of people gathered around our scale model of the solar system, planet poster, and a gravity well. Visitors were also interested in our table of astronomy books, planisphere, and star charts.

Considering the weather conditions (and having to compete with a cow—another story), we had quite a few visitors to our area.

Telescope viewing on the basketball court (photo: Morris School Facebook).

Finding sunspots through the C-8. (photo: K. Yanosko)

The Sun is big! (photo: G.W.)

Russ curating the AOH display area (photo: G.W.)

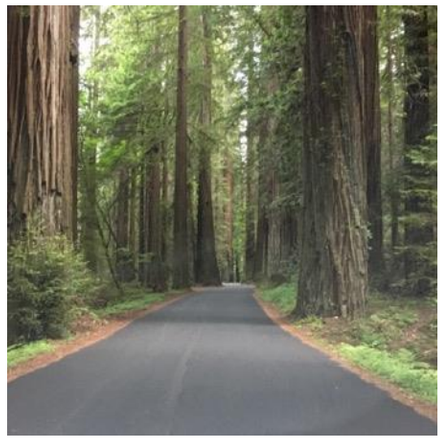
Observing objects orbiting a central mass in a gravity well. (photo: G.W.)

Stargazing Party at Humboldt Redwoods State Park
June 2, 2018

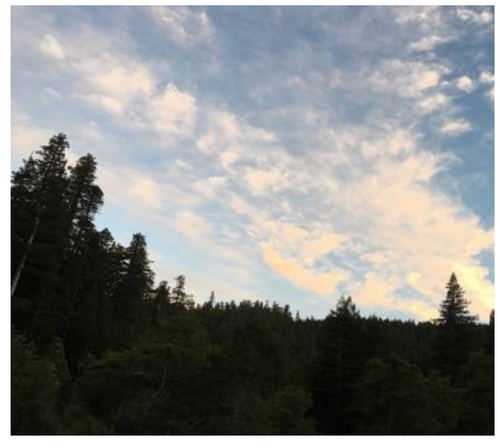
What a fun evening we had at the Albee Creek Campground! Our observing site was a meadow near the entrance to the campground where we had good views of the southern horizon. The AOH volunteers were Becky Chambers (8 inch Dob), Bea Asmundardottir (Astroscan), and Grace Wheeler (8 and 6 inch SCT). Rangers Mary Kaufman and Lily Cetrangolo, and 4 park volunteers (Barbara Bohn, Ralph Bohn, Scott Turner, and Mary Montanus) all helped with running the telescopes, keeping the lines in order, and answering questions. We saw Venus and Jupiter (and its 4 moons) during twilight. As night deepened, we kept three scopes aimed at Jupiter and set up the fourth scope to find deep sky objects (Infinity deep sky web camera and a laptop). We observed the globular clusters (M5, M13), and galaxies (M81, M66). There were 70 astronomy enthusiasts, who were eager to learn about the planets and deep sky objects. We ended after 11 p.m. after which both Becky and Bea were sworn in as "Junior Rangers" by Mary Kaufman. It was a fun evening with beautiful clear skies.

We thank the HRSP and Rangers John Hardcastle and Mary Kaufman for their hospitality and help in putting on this outreach event. The volunteers went beyond the call of duty with helping the visitors and facilitating the use of the telescopes.

(A version of this was posted on the AOH Facebook Page.)



The drive on the Mattole Road to Albee Creek Campground. (photo: G.W.)



The clouds to the southeast dissipated by nightfall. (photo: G.W.)

Barbara, Lily, and Mary M. in front of the AOH posters. (photo: M. Kaufman)

Becky giving last minute instructions. (photo: G.W.)

Becky setting up the Dob. (photo: M. Kaufman)

Mary K. addressing the crowd (which grew throughout the evening). (photo: G.W.)

Looking at Jupiter through the Dob. (photo: G.W.)

Looking at Jupiter through the C-8. (photo: G.W.)

Becky and Bea being sworn in as Junior Rangers by Mary K. (photo: G.W.)

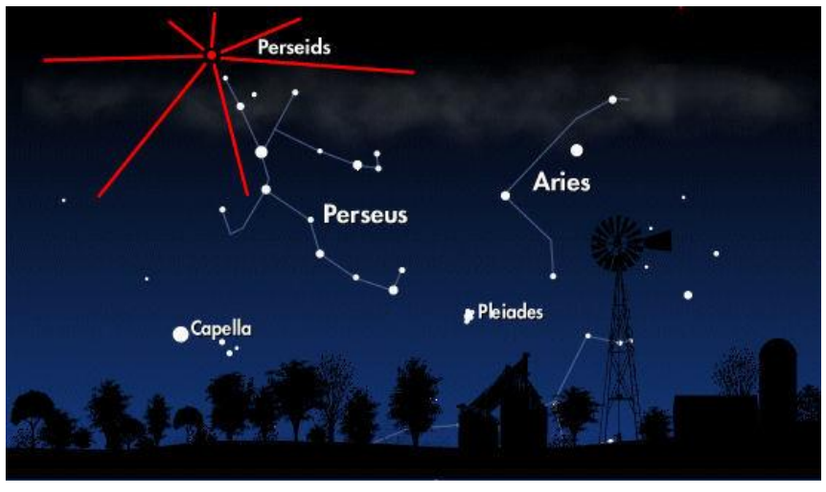
Prepare for Perseids!

Reprinted from the Night Sky Network
and edited to reflect the August 11-13, 2018 sky conditions.

Image of a Perseid meteor shining over Joshua Tree National Park
***Image Credit**: Brad Sutton/National Park Service*

Are you ready for the Perseids? This shower, part of the debris stream of comet Swift-Tuttle, actually starts in mid to late July and extends for most of August. However, while there will only be a few meteors each hour most of those nights (if you are lucky!), the peak time for viewing the shower brings many, many more. How much more? The number actually varies every year; there can be as little as a few dozen per hour, but some rare years bring a brief "burst' of up to two hundred beautiful "shooting stars" per hour.

This year's Perseids (2018) occurs during the new to 1-day old moon so there will be optimal viewing of even the dimmer meteors. You should be able to see quite a few! How many? There's only one way to find out for for yourself how strong the Perseids will be this year; stay up and watch!



Map of Perseid radiant courtesy NASA Science News

If you trace the meteor trails of the Perseids back to their source, you will find they seem to come from a spot near the constellation Perseus - hence their name, and the name of most meteor showers.

We have a few tips on how to make the most of your meteor shower viewing experience:

• **Get out of the city!** Try to get to the darkest location you can. The darker it is where you are, the more meteors you will see streaking across the sky.

• **Check the weather forecast for that night.** You may need to check out two or three areas for predictions on fog, clouds, and temperature. Some weather sites even offer forecasts specially tailored for sky watching. Make sure you have clear skies to go along with those dark ones.

• **Find a meteor shower party!** Go to a gathering of like-minded folks in a local park, or an event hosted by a local astronomy club – especially if it's your first time! Find a Perseids party by searching the Night Sky Network for clubs near you, or by searching for events near you.

• **Stay warm and comfortable outside – be prepared!** You will be out for a good long while, and will want to lie flat on your back to soak up as much of the sky as possible. To stay cozy bring a blanket, jacket, hat, a warm drink, and water. You may think it's silly to bring some warm clothes in the middle of the summer, but late at night the temperature can drop just enough to be chilly. If you are in a buggy area, you will definitely want to apply some bug spray to avoid irritating bites.

• **Bring your friends and family!** Company under starry skies is truly wonderful, and they provide a bonus since there are more eyes on the sky! Groups can spot more meteors than single individuals and help each other find “hot spots" in the sky. (Also, if you are out in the wilderness in the dark, good company helps you feel safer.)

We have a handout you can use at your star parties and outreach events (or even for yourself). You can find it on our Heads up! It's a Meteor Shower resource page (see next page).

For more information on one of our favorite meteor showers, check out NASA's excellent writeup, this video on Space.com, and EarthSky's great guide. You should also check out the August 2016 "What's Up? video from JPL as Jane Houston Jones give out great tips on how to watch the Perseids as well as other objects to look for in the night skies while you wait for brilliant little streaks to cross your field of view. You can also use the handy "Fluximator" meteor shower activity application to try to predict when the peak activity will be for your location.

Have fun – and may you have clear skies and great weather for your meteor shower party!

Heads Up! It's a Meteor Shower

Smaller than grains of sand, meteors vaporize in a bright streak of light as they hit Earth's atmosphere. Meteor showers come from comets, but the sporadic meteors on other nights are mostly asteroid bits.

Observing a Meteor Shower

- ✓ You don't need a telescope, just your eyes.
- ✓ Find a dark spot away from streetlights
- ✓ Get warm — layers are good
- ✓ Lie down on a blanket or reclining chair
- ✓ Look up! Watch the whole sky.

Tips:

- ✓ A bright Moon can wash out meteors, making them hard to see.
- ✓ Give your eyes time to adjust to the dark and you will see more faint meteors.

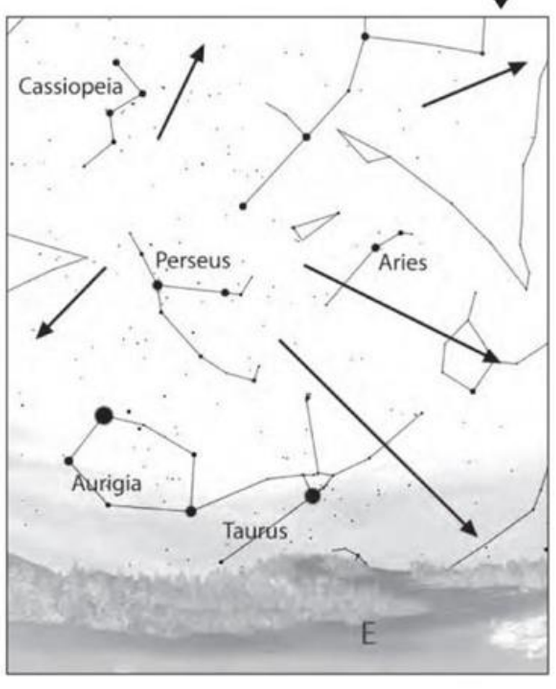
Meteors can be seen all over the sky. If you trace them back, they appear to be radiating from one constellation. That's how they get their names!

If you get up early on August 12th and look to the east, you might see something like this

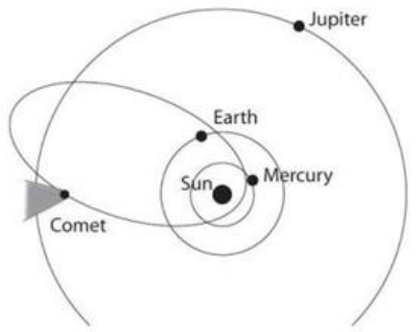
What constellation can you trace the meteors to?

Check the calendar below to see which meteor shower happens in August.

The Perseids appear to radiate from the constellation Perseus



Meteor Showers Come From Comets

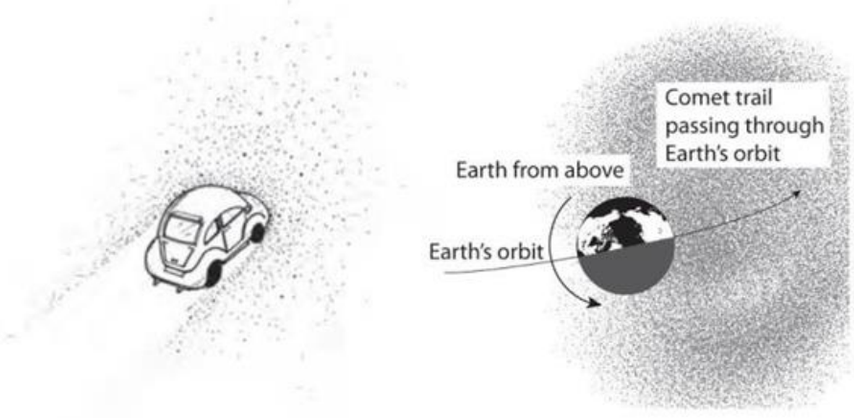


Comets come from the outer Solar System and leave behind a stream of dust as they are warmed by the Sun. Only a few comets pass through Earth's orbit.

The dust left behind by Halley's comet causes the Eta Aquarid and Orionid meteor showers (see calendar below).

Halley's comet passes Earth every 75 years. We will see it again in 2061.

How old will you be the next time it comes around?



Here's how: As Earth runs into these particles, it's like bugs hitting Earth's windshield (or atmosphere). But the comet bits hit Earth's atmosphere so fast, the pieces vaporize in bright streaks — making a meteor shower! We see meteor showers better after midnight because that's when we are facing the direction of Earth's orbit.

Calendar of Major Meteor Showers

Meteor showers are best viewed **after midnight** around the dates listed below.

January 2nd–3rd	Quadrantids
April 22nd–23rd	Lyrids
May 5th–6th	Eta Aquarids
July 29th–30th	Delta Aquarids
August 11–12th	**Perseids***
October 21–22nd	Orionids
November 4–5th	Taurids
November 16–17th	**Leonids***
December 12–13th	**Geminids***
December 22–23rd	Ursids

*** Don't miss these!**

Check **stardate.org/nightsky/meteors** for this year's viewing suggestions, including Moon phases
Find the most exciting astronomy clubs and events: **NightSkyNetwork.org**

What Is the Asteroid Belt?

By Linda Hermans-Killiam

There are millions of pieces of rocky material left over from the formation of our solar system. These rocky chunks are called asteroids, and they can be found orbiting our Sun. Most asteroids are found between the orbits of Mars and Jupiter. They orbit the Sun in a doughnut-shaped region of space called the asteroid belt.

Asteroids come in many different sizes—from tiny rocks to giant boulders. Some can even be hundreds of miles across! Asteroids are mostly rocky, but some also have metals inside, such as iron and nickel. Almost all asteroids have irregular shapes. However, very large asteroids can have a rounder shape.

The asteroid belt is about as wide as the distance between Earth and the Sun. It's a big space, so the objects in the asteroid belt aren't very close together. That means there is plenty of room for spacecraft to safely pass through the belt. In fact, NASA has already sent several spacecraft through the asteroid belt!

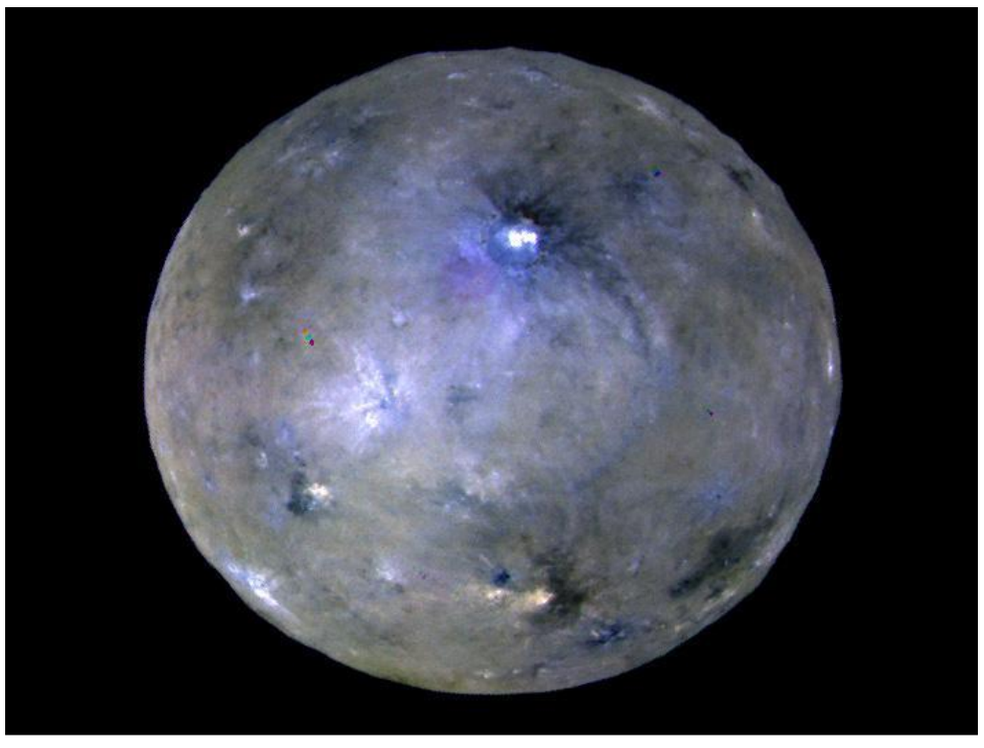
The total mass of objects in the asteroid belt is only about 4 percent the mass of our Moon. Half of this mass is from the four largest objects in the belt. These objects are named Ceres, Vesta, Pallas and Hygiea.

The dwarf planet Ceres is the largest object in the asteroid belt. However, Ceres is still pretty small. It is only about 587 miles across—only a quarter the diameter of Earth's moon. In 2015, NASA's Dawn mission mapped the surface of Ceres. From Dawn, we learned that the outermost layer of Ceres—called the crust—is made up of a mixture of rock and ice.

The Dawn spacecraft also visited the asteroid Vesta. Vesta is the second largest object in the asteroid belt. It is 329 miles across, and it is the brightest asteroid in the sky. Vesta is covered with light and dark patches, and lava once flowed on its surface.

The asteroid belt is filled with objects from the dawn of our solar system. Asteroids represent the building blocks of planets and moons, and studying them helps us learn about the early solar system.

For more information about asteroids, visit: https://spaceplace.nasa.gov/asteroid



This image captured by the Dawn spacecraft is an enhanced color view of Ceres, the largest object in the asteroid belt. Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

This article is provided by NASA Space Place.
With articles, activities, crafts, games and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.
Visit **spaceplace.nasa.gov** to explore space and Earth

What's It Like Inside Mars

by Jessica Stoller-Conrad

Mars is Earth's neighbor in the solar system. NASA's robotic explorers have visited our neighbor quite a few times. By orbiting, landing and roving on the Red Planet, we've learned so much about Martian canyons, volcanoes, rocks and soil. However, we still don't know exactly what Mars is like on the *inside*. This information could give scientists some really important clues about how Mars and the rest of our solar system formed.

This spring, NASA is launching a new mission to study the inside of Mars. It's called Mars InSight. InSight—short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport—is a lander. When InSight lands on Mars later this year, it won't drive around on the surface of Mars like a rover does. Instead, InSight will land, place instruments on the ground nearby and begin collecting information.

Just like a doctor uses instruments to understand what's going on inside your body, InSight will use three science instruments to figure out what's going on inside Mars.

One of these instruments is called a seismometer. On Earth, scientists use seismometers to study the vibrations that happen during earthquakes. InSight's seismometer will measure the vibrations of earthquakes on Mars—known as marsquakes. We know that on Earth, different materials vibrate in different ways. By studying the vibrations from marsquakes, scientists hope to figure out what materials are found inside Mars.

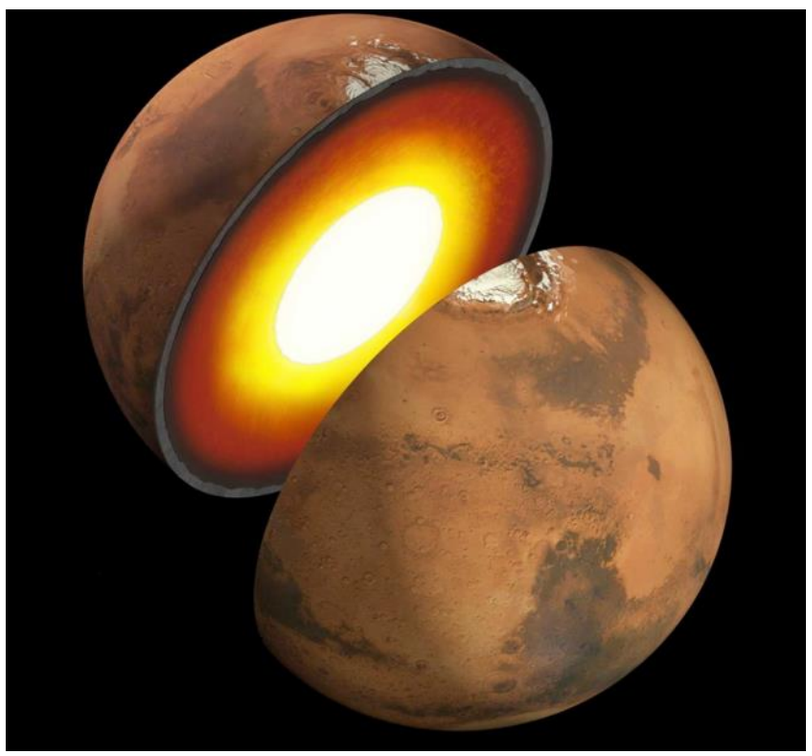
InSight will also carry a heat probe that will take the temperature on Mars. The heat probe will dig almost 16 feet below Mars' surface. After it burrows into the ground, the heat probe will measure the heat coming from the interior of Mars. These measurements can also help us understand where Mars' heat comes from in the first place. This information will help scientists figure out how Mars formed and if it's made from the same stuff as Earth and the Moon.

Scientists know that the very center of Mars, called the core, is made of iron. But what else is in there? InSight has an instrument called the Rotation and Interior Structure Experiment, or RISE, that will hopefully help us to find out.

Although the InSight lander stays in one spot on Mars, Mars wobbles around as it orbits the Sun. RISE will keep track of InSight's location so that scientists will have a way to measure these wobbles. This information will help determine what materials are in Mars' core and whether the core is liquid or solid.

InSight will collect tons of information about what Mars is like under the surface. One day, these new details from InSight will help us understand more about how planets like Mars—and our home, Earth—came to be.

For more information about earthquakes and marsquakes, visit: https://spaceplace.nasa.gov/earthquakes



An artist's illustration showing a possible inner structure of Mars. Image credit: NASA/JPL-Caltech

Mars Visits Earth in 2018: The Best of Three Perihelic Oppositions

by Grace Wheeler

This article is based on "Mars Visits Earth in 2016: the First of Three Perihelic Oppositions" which appeared in the inaugural issue of the AOH Observer. Please refer to Issue 1 of the Observer to find out more about perihelic and aphelic oppositions of Mars.

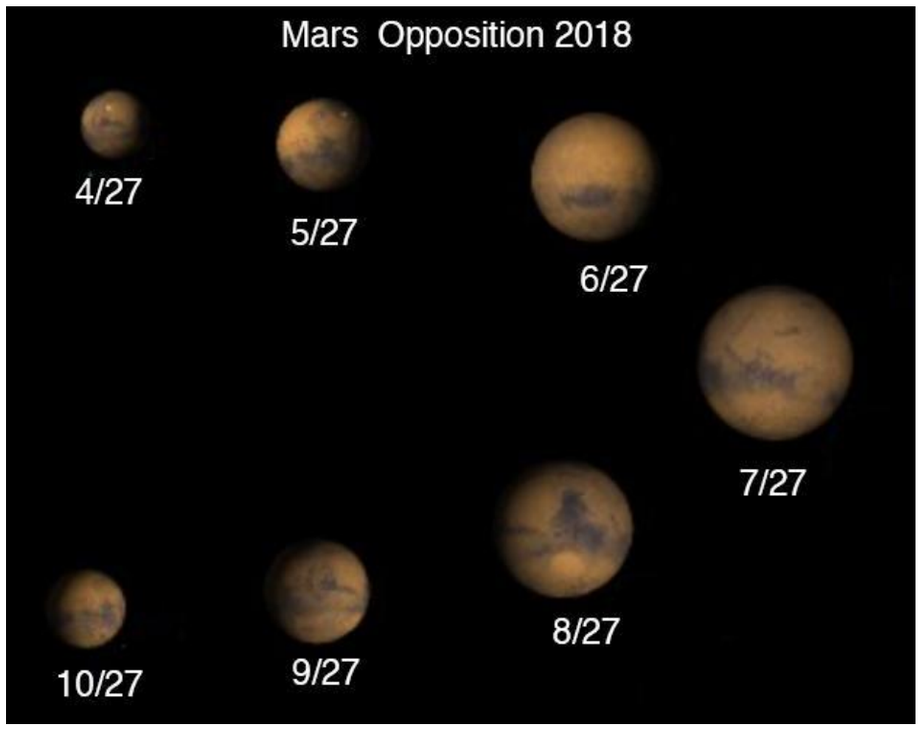


Figure 1. As Mars moves closer to Earth and approaches opposition on July 27, the Martian disk appears to increase in diameter. After opposition, the disk appears to shrink as Mars moves further away from Earth. Mars Images were generated with the JPL Solar System Simulator.

I'm starting this article with the key takeaway messages. Right now, if you happen to be up at 2:30 a.m., and it's a clear night, look towards the southeastern sky and you will see Mars. You can't miss it because it is reddish and almost as bright at Jupiter. Mars will get brighter each day, and by July it will outshine Jupiter by 1.8 times. If you know someone with a good telescope (or better yet, join the Astronomers of Humboldt), make plans to be up at Kneeland or somewhere up high to catch a glimpse of Mars on August 27 or 28, the dates of the Mars' opposition/closest approach to Earth. This year's opposition is a close rival to the Martian opposition of 2003 when the distance between Mars and the Earth was the closest in 50,000 years (the last time this happened, Neanderthals were walking the Earth). You will need a decent sized telescope (binoculars won't do) to view the details of the planet's surface (and don't believe the hokum that Mars will be as big as the moon). Your viewing site should have a southeast horizon that is free of obstructions. This is important for us Humboldters because Mars will be in the southern celestial hemisphere so that it won't be transiting the sky at a very high altitude. For those of us at mid-northern latitudes, this might mean having to go south for a better view of Mars. If you have the time to go to as far south as Joshua Tree…take me too! Circle your calendar for August 27 (or 28), because Mars won't be this close to Earth again until 2035.

Not All Oppositions are Created Equal

Planetary oppositions concerning Earth occur only with superior planets: Mars, Jupiter, Saturn, Uranus, and Neptune. During opposition, the superior planet is opposite the sun with the Earth in-between. On the day of opposition, the planet rises as the sun is setting. The weeks before and following a planet's opposition are considered to be the best time to view the planet, as the planetary disk is large and bright, and the planet is mostly out all night.

With respect to Mars, the eccentricity of the Martian orbit will make some oppositions more favorable than others in terms of brightness and size of the disk. Because of the "ovalness" of the Martian orbit, the perihelic (closest point to the sun) and aphelic (farthest point from the sun) distances have a difference of 26 million miles. Since opposition can occur at any point along the Martian orbit, this will have a bearing on how bright and large Mars appears to the observer on Earth. For instance, if opposition occurs when Mars is near aphelion, Mars is farther from the Sun and thus farther from Earth; Mars will not be as bright and the diameter will be smaller. Conversely, oppositions occurring when Mars is close to perihelion, i.e., close to the Sun and Earth, are considered favorable with regards to the brightness and apparent diameter of Mars.

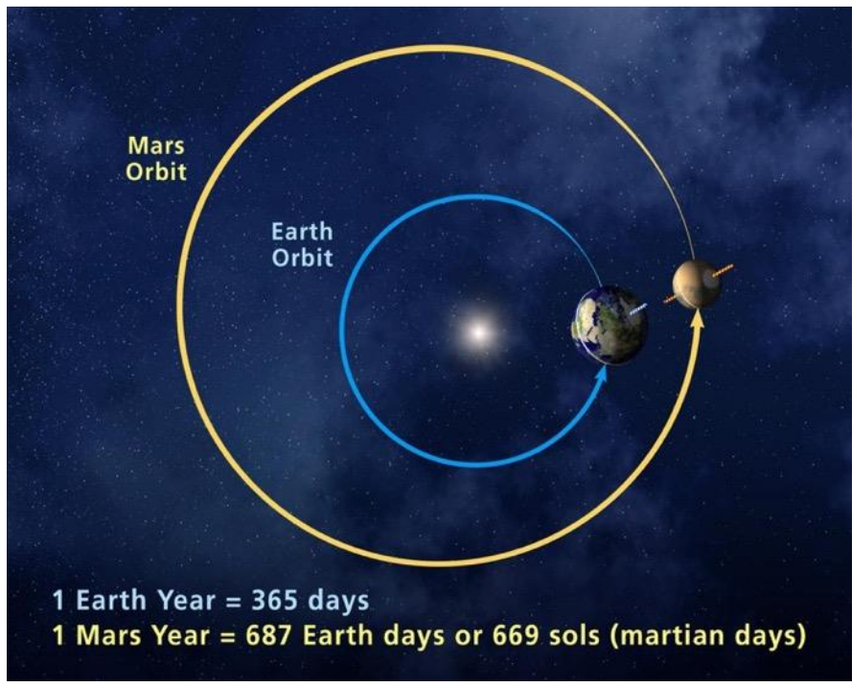


Figure 2. The orbits of Mars and Earth. The Martian orbit has a high eccentricity and is more oval than the Earth's more circular orbit. Every 26 months, an opposition occurs where the Earth comes directly between the Sun and Mars. Image Credit: NASA/JPL

The current series of Perihelic Oppositions: 2016-2020

The current series of three consecutive perihelic Martian oppositions began in 2016 and is followed by ones in 2018 and 2020. The 2016 Martian opposition was considered “middling” as the disk was only a bit larger than the one seen in the aphelic opposition of 2014 (Fig. 3). However, for a novice amateur astronomers like myself, the 2016 opposition was an opportunity to work out the bugs with telescopes and cameras in preparation for the one in 2018. This year’s opposition is the crown jewel in this series of three because of the particularly close encounter between Mars and Earth. In reality, the distance between Earth and Mars at this year’s opposition is only slightly farther than that of 2003. Visually, the diameter of the Martian disk at the 2018 opposition will be comparable to that seen in 2003 (Fig.3). As already mentioned in the introduction, one of the obstacles to viewing this year’s opposition is that Mars is in a southern declination, so viewing is not optimal for those of us at mid-northern latitudes. Another drawback is that the date of opposition coincides with the full moon, and Mars will be very close to the moon. The glare from the moon will interfere with the viewing of Mars through a telescope as features won’t be as pronounced. Finally, as of this date (6/13/18), there is a large dust storm brewing on Mars which could potentially “cloud” out the surface features during the prime viewing period for this year’s opposition.

The last perihelic opposition in this series of three occurs on October 13, 2020. While this Martian disk will not be as large as that of the one presented in the 2018 opposition, it is not considered middling. Moreover, the viewing will be more favorable as the moon will have set before Mars rises for the evening. However, October also marks the beginning of our rainy season in Humboldt, and this one might require a trip southward. After 2020 we enter a period of aphelic oppositions (2022-2031), and sizable Martian disks won’t be seen again until the next series of perihelic oppositions starting in 2033.

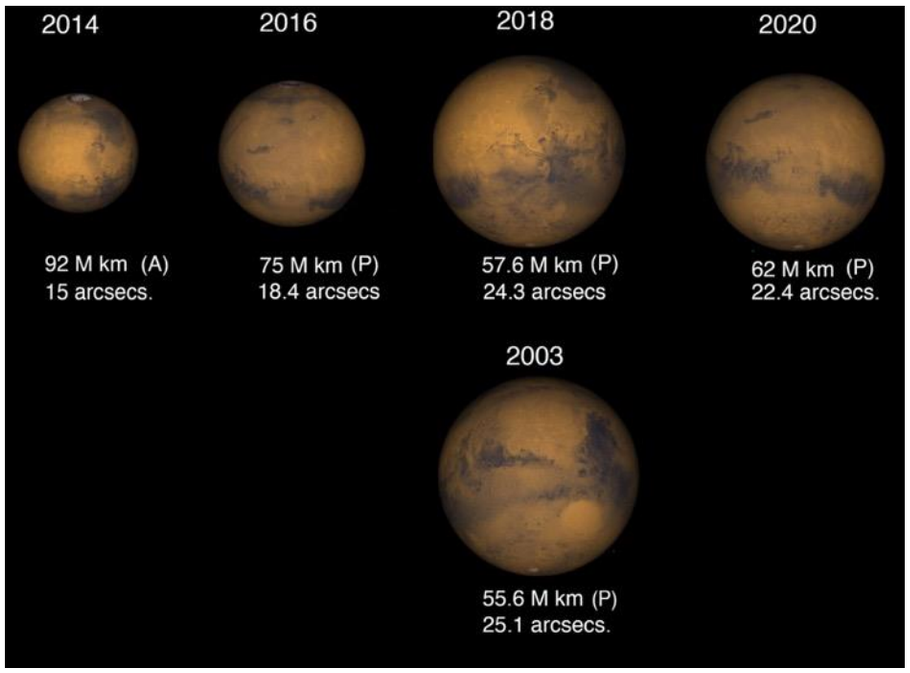


Figure 3. The diameter of the Martian disk is relatively small when opposition is aphelic (2014), and larger when opposition is perihelic (2003, 2016, 2018, 2020). A visual comparison between the diameter of the Martian disk during the 2018 and 2003 oppositions shows that these are comparable.

The distance of Mars from the Earth is given in (M)illions km, disc size in arcseconds, (A)phelic, (P)erihelic. Images of Mars were generated using the JPL Solar System Simulator.

Mars Watching from My Backyard

Mars watching from my backyard was off to a late start because of the weather. The earliest observation I have of Mars is from April 4th when the planet was almost 2 weeks past western quadrature and was only 8.7 arcseconds in diameter. Observing Mars when it is still months away from oppositions is always challenging. My telescope is an 8-inch Schmidt-Cassegrain which has a decent size aperture for viewing most planets and deep sky objects. However, the appearance of Mars through the 8-inch SCT telescope can be disappointing because the Martian disk is tiny. Even at this year’s opposition, Mars will still be a relatively small target. Figure 4 approximates how Mars appears through an 8-inch SCT with a 12.5 mm eyepiece. I have included Jupiter as a comparison.

Tips on how to see Mars with a telescope can be found here at the One-Minute Astronomer.

Figure 4. Simulation of the appearance of Mars at 47 days before opposition (6/10/18), and on the day of opposition (7/27/18). Note that the size of Mars on 6/10 is almost as large as the Martian disk in the 2016 opposition (18.4 arcsecs). Jupiter is included for a comparison. The planet images were generated on Stellarium using the view through an 8-inch SCT with a 12.5 mm eyepiece.

To overcome the challenges of viewing Mars, I have been using a ZWO ASI 290 MC planetary web camera and a laptop computer. The sensor in the camera is more sensitive than the eye so that the camera can pick up more details on the Martian disk than can be seen through a telescope. Even though captured images of Mars have a fuzzy appearance on the computer screen, the recorded frames can be stacked and sharpened in Registax to bring out the planetary features (Fig. 5). So far my best image of Mars was on June 1, 2018, at 3:15 a.m. (Mars was 15.3 arcseconds in diameter). I am looking forward to more weekly observations of Mars now that summer is here and hopefully clearer skies will prevail. Check back here in the fall when I continue with the second part of my Martian adventure.

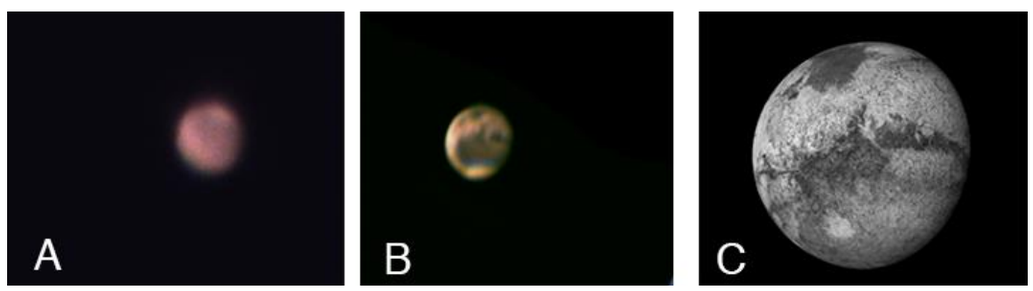


Figure 5. (A) is a snapshot of the Mars image captured with an 8-inch SCT and a ZWO ASI 290 MC planetary camera. (B) is the Mars image generated by the stacking and processing of 400 frames in Registax; note the image has been flipped from (A) to give the proper orientation. The final image was cross checked with (C) Mars image from USGS Astrogeology.

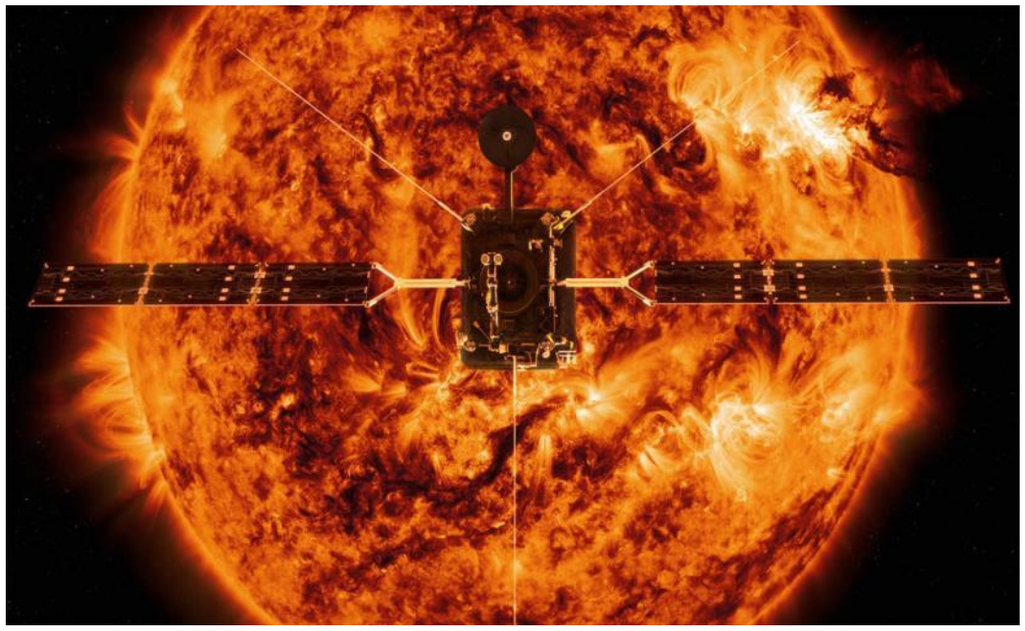


Illustration of the Parker Solar Probe spacecraft approaching the Sun. **Credit: Johns Hopkins University Applied Physics Laboratory**

More Than 1.1 Million Names Installed on NASA's Parker Solar Probe

By Sarah Frazier
NASA's Goddard Space Flight Center, Greenbelt, Md.

Throughout its seven-year mission, NASA's Parker Solar Probe will swoop through the Sun's atmosphere 24 times, getting closer to our star than any spacecraft has gone before. The spacecraft will carry more than scientific instruments on this historic journey — it will also hold more than 1.1 million names submitted by the public to go to the Sun.

"Parker Solar Probe is going to revolutionize our understanding of the Sun, the only star we can study up close," said Nicola Fox, project scientist for Parker Solar Probe at the Johns Hopkins Applied Physics Lab in Laurel, Maryland. "It's fitting that as the mission undertakes one of the most extreme journeys of exploration ever tackled by a human-made object, the spacecraft will also carry along the names of so many people who are cheering it on its way."

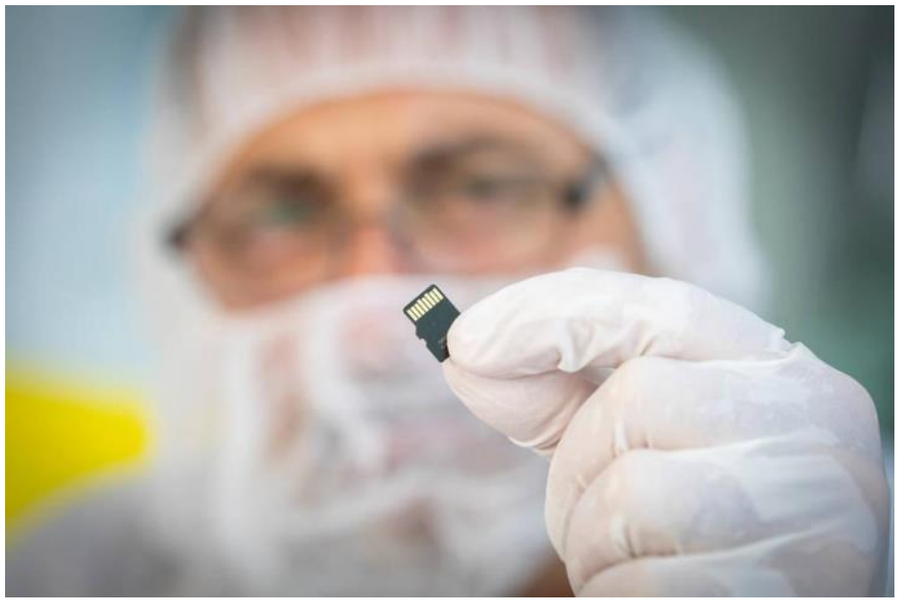
Back in March 2018, the public were invited to send their names to the Sun aboard humanity's first mission to "touch" a star. A total of 1,137,202 names were submitted and confirmed over the seven-and-a-half-week period, and a memory card containing the names was installed on the spacecraft on May 18, 2018, three months before the scheduled launch on July 31, 2018, from NASA's Kennedy Space Center in Florida. The card was mounted on a plaque bearing a dedication to and a quote from the mission's namesake, heliophysicist Eugene Parker, who first theorized the existence of the solar wind. This is the first NASA mission to be named for a living individual.

Though our understanding of the Sun and the solar wind has vastly improved since Parker first theorized the solar wind, there are still questions left unanswered. Two of the most fundamental mysteries – which scientists hope Parker Solar Probe will help solve – are the coronal heating problem and the mechanism behind solar wind acceleration.

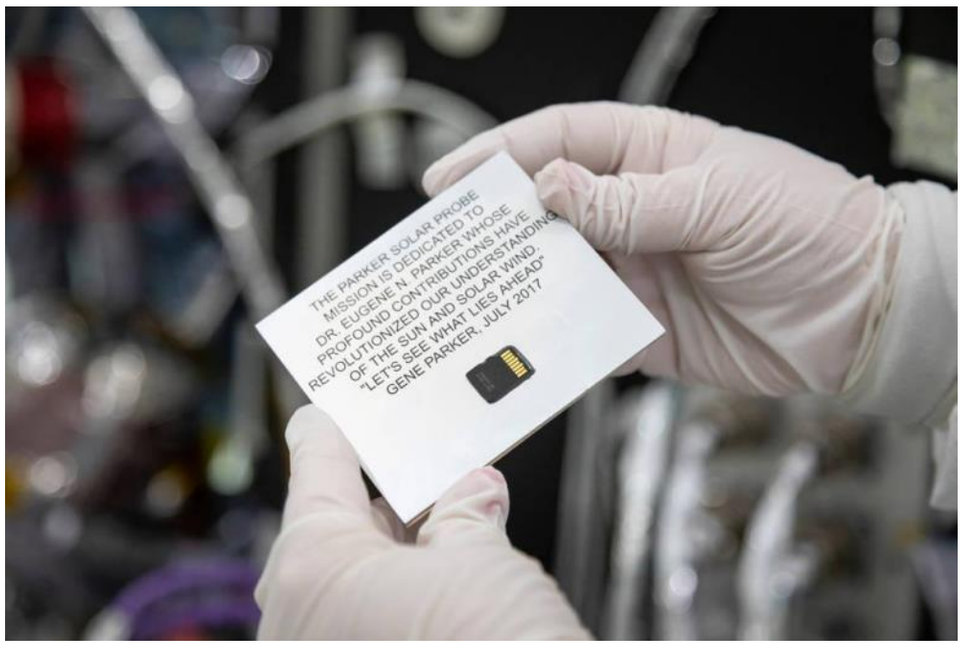
Reprinted from NASA

https://www.nasa.gov/feature/goddard/2018/more-than-11-million-names-installed-on-nasa-s-parker-solar-probe

"Let's see what lies ahead."
– Gene Parker, July 2017



A memory card containing 1,137,202 names submitted by the public to travel to the Sun was installed on Parker Solar Probe on May 18, 2018. ***Credits: NASA/Johns Hopkins APL/Ed Whitman***
More images available from NASA Goddard's Scientific Visualization Studio



In addition to a chip containing submitted names, the plaque installed on the Parker Solar Probe spacecraft also contains a dedication to and quote from Eugene Parker, the mission's namesake. It reads: "The Parker Solar Probe mission is dedicated to Dr. Eugene N. Parker whose profound contributions have revolutionized our understanding of the Sun and solar wind. 'Let's see what lies ahead' Gene Parker, July 2017"
Credits: NASA/Johns Hopkins APL/Ed Whitman
More images available from NASA Goddard's Scientific Visualization Studio

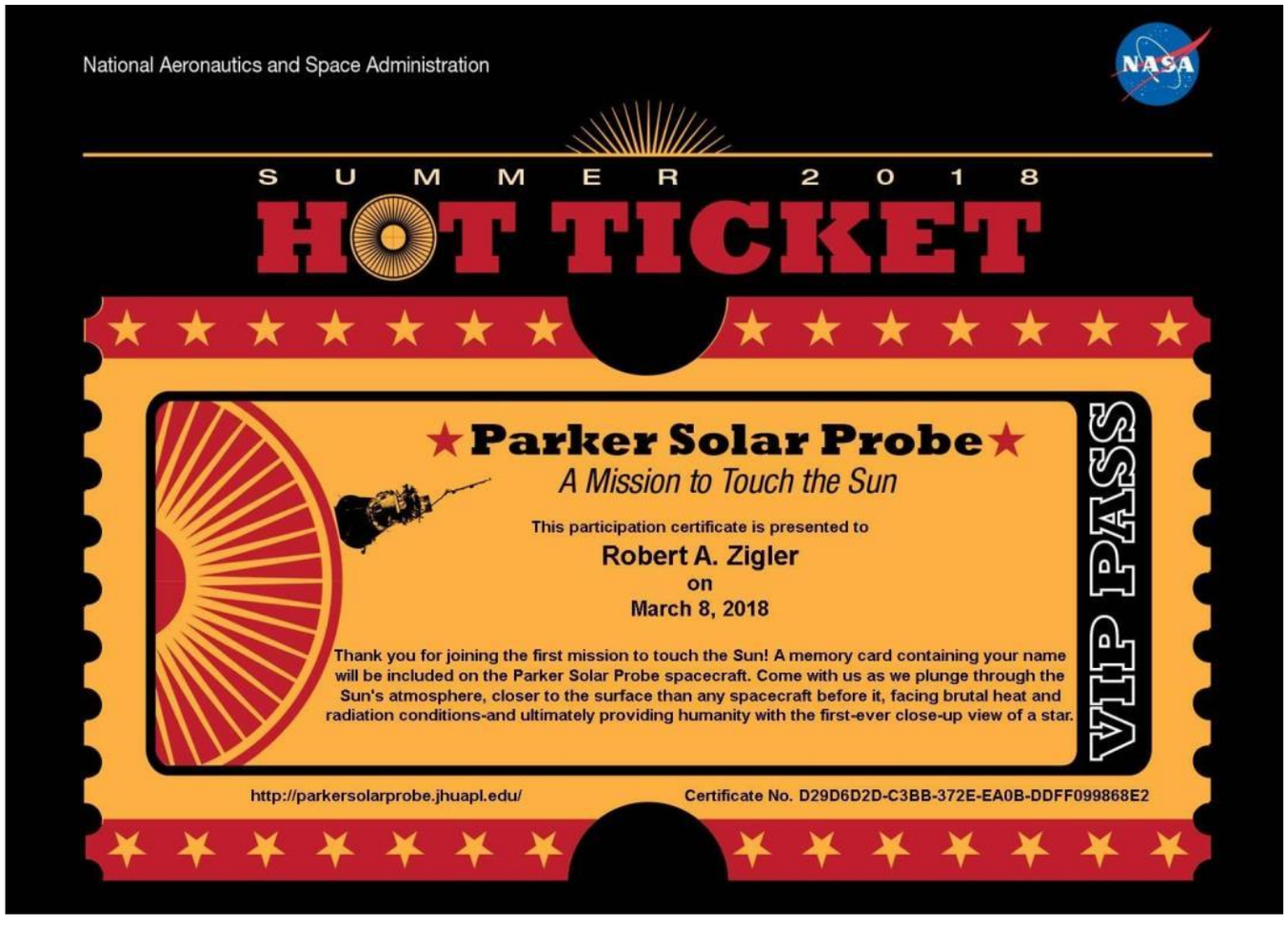
The coronal heating problem is what scientists call the apparent mismatch between the temperature of the Sun's photosphere — the visible "surface," measuring about 10,000 degrees Fahrenheit — and the much higher temperature of the corona — the Sun's atmosphere, which reaches temperatures of up to 10 million degrees Fahrenheit. Since the Sun's energy source is at its core, this increase is similar to walking away from a campfire and suddenly feeling a thousand times hotter — completely counterintuitive. This implies that some other process is continually adding more heat to that solar atmosphere.

Scientists think that the mechanism behind this as-yet unexplained heating happens in the lower corona — and Parker Solar Probe will get closer to this region than any spacecraft has before. Getting a closer look at this region should help scientists identify the source of this coronal heating, along with pinpointing the process that accelerates the solar wind to enormous speeds as it leaves the Sun.

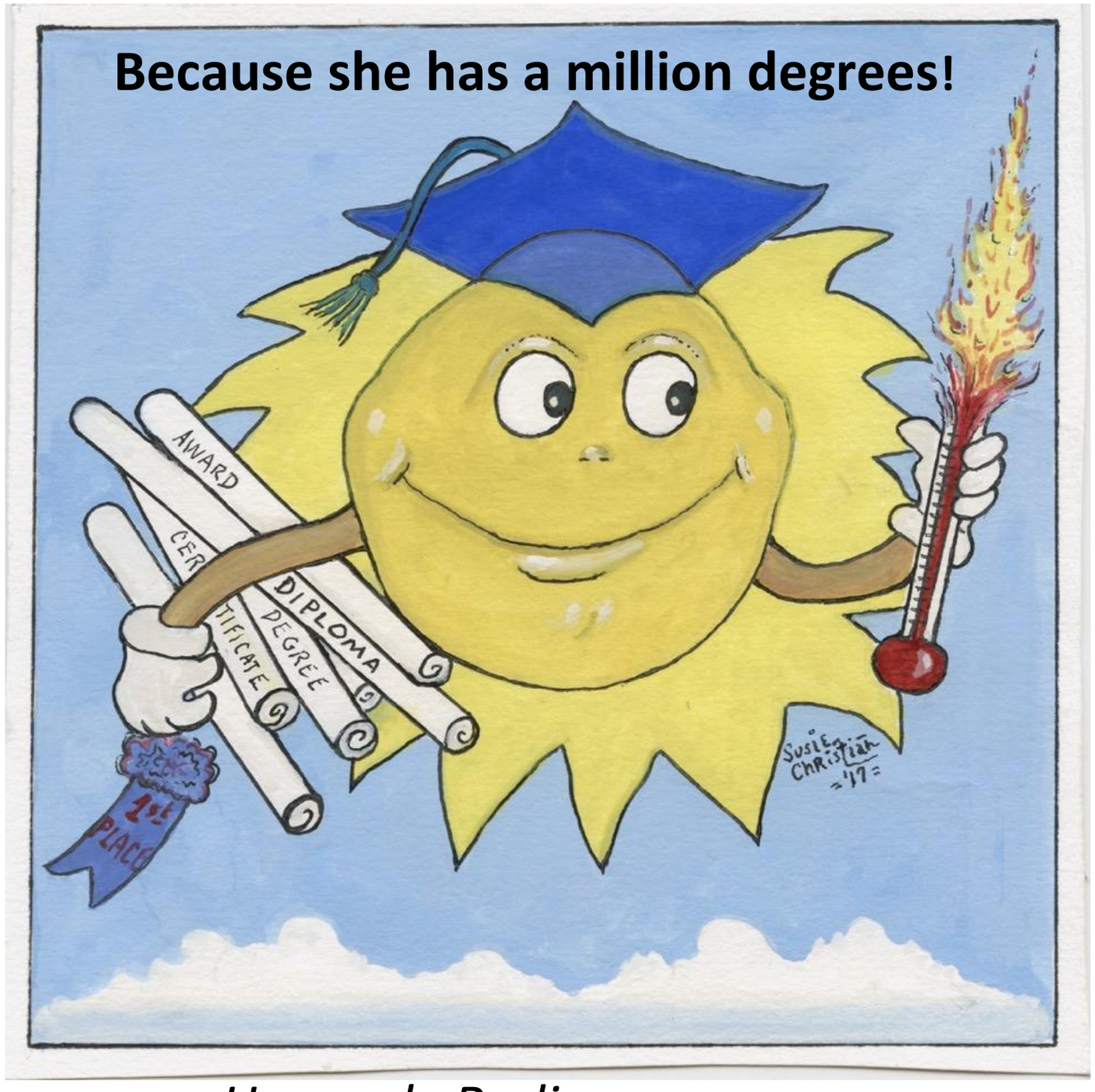
A commemorative reproduction of the plaque bearing an identical memory card — minus the submitted names — was presented to Parker at the Johns Hopkins University Applied Physics Lab in October 2017 by the mission team.
"From the experience of seeing the probe up close, I understand now the difficult task you are undertaking, and I am sure you will succeed," said Parker after visiting the spacecraft in the clean room.

The plaque containing names submitted to travel to the Sun is mounted below Parker Solar Probe's high-gain antenna (the round object with gray covering), which the spacecraft will use to transmit data back to Earth.
Credits: NASA/Johns Hopkins APL/Ed Whitman
More images available from NASA Goddard's Scientific Visualization Studio

AOH Treasurer Bob Zigler is on his way!



Why is the Sun so smart?



Heavenly Bodies *by Susie Christian*

Have a great summer everybody. The Observer will be back in the fall. Until then, the staff at the AOH Observer and the AOH Officers and Board Members wish you all clear skies!