# Southwest Florida Astronomical Society
# SWFAS

# The Eyepiece
# April 2018

**Contents:**



## A MESSAGE FROM THE PRESIDENT

Our main event season has now passed. With the Daylight Savings Time law now awaiting Congress, we are faced with not having early dark skies in the winter months, which will hamper us doing any events aimed at schools/youth.

We had a great turnout at the Rotary Park Star Party and the skies were clear! I would like to thank Tom Klein, Mike McCauley, Chuck Pavlick, Gary McFall, Don Palmer and Walt Winton for coming out to help.

On the 17th at the CRP Star Party Mike McCauley, Joe Dermody and I went out and had a good time. We had several visitors out as well. Skies again were great.

The Calusa Nature Center and Planetarium has a fund raising event at the Bell Tower Shops on April 5th. See the information about the event in the newsletter.

Its annual dues time for 2018. Dues are $20.00 and can be paid at the meeting or mailed to our PO Box: SWFAS, Inc. PO Box 100127 Cape Coral, FL 33910. This is the last general notice. If you haven't paid for 2018, I will be sending you a separate email.

Brian

## Program this Month

The guest speaker for the April 5th meeting of the South West Florida Astronomical Society will be Mr. Charles (Chuck) McClinton. Mr. McClinton, presently an independent aerospace consultant, retired from NASA in July, 2005, after 38 years of service. His last assignment with NASA was as Hypersonic Technology Manager for the Hyper-X Program responsible for vehicle definition, wind tunnel testing, and all hypersonic technology development.

Chuck has authored numerous publications addressing all areas of hypersonic propulsion, propulsion airframe integration, and hypersonic vehicle synthesis. An aviation enthusiast, Mr. McClinton will discuss NASA's history in scramjet vehicle R&D which culminated in the X-43 Research vehicle program and test flights reaching Mach 9.68 at 110,00 feet. Chuck will present details of the X-43 vehicle and its systems, movies and video taken during the flights, flight controller computer visualization of the flight characteristics and maneuvers, flight test measurements, and a vision for use of the fascinating technology.

This is one presentation you will not want to miss. We hope to see you at the Planetarium on Thursday, April 5th at 7:30pm.

Michael J. McCauley

Program Coordinator

SWFAS

## CNCP Event April 5th


Tickets @ https://www.eventbrite.com/e/return-to-nature-tickets-43711086035?aff=eac2

## Photos By Chuck Pavlick

These photos were taken from his house in Cape Coral using the special narrowband filters listed. These allow one to get spectacular images even from heavily light polluted skies! The filters are considered the 'Hubble Palette' as many of the Hubble images use the same narrow band filters. The different filters are assigned to the Red, Blue and Green channels thus creating the spectacular colors.

Great work Chuck!

### Seagull Nebula IC 2177 in Hubble Palette

Scope: Takahashi FSQ106 w/0.73 reducer
Camera": ASI 1600
Filters: Astrodon 7nm Ha,OIII, S2
Subs, Ha 15@300 sec., 03 15@300 sec, s2 15@360 sec
Captured in Nebulosity and Processed in Pixinsight and Photoshop

## Rosette Nebula in the Hubble Palette

Scope: Takahashi FSQ106 w/0.73 reducer
Filters: Astrodon 7nm Ha,OIII, S2
Subs, Ha 18@300 sec./ OIII 35@300 Sec./ 24@300
Captured in Nebulosity and Processed in Pixinsight and Photoshop

## Jellyfish Nebula in Hubble Palette

Scope: Takahashi FSQ106 w/0.73 reducer
Camera": ASI 1600
Filters: Astrodon 7nm Ha,OIII, S2
Subs, Ha 8@600 sec., O3 15@300 sec, S2 10@300 sec,
Captured in Nebulosity and Processed in Pixinsight and Photoshop

## In the Sky this Month

**Moon**:
Last Quarter – Apr 8; New – Apr 16; 1st Quarter – Apr 22; Full – Apr 30
Moon will eclipse some of the stars in Hyades cluster with Venus and Pleiades nearby on evening of April 18.

**Venus** shines at -3.9 magnitude in the west as it increases altitude from 18° to 24° through the month. It will move to a position halfway between the Hyades and Pleiades on the 27th.

**Jupiter** rises 3 hrs after sunset early in the month, but closes the month rising only half an hour after sunset. It will be shining at a magnitude of -2.5 by month's end. It is still in retrograde motion

**Uranus** will be lost in the Sun most of the month, having conjunction with the Sun on the 18th.

In Sagittarius early in the morning, **Saturn** comes up with **Mars** both situated slightly above the teapot early in the month. Although **Saturn** appears much wider, its magnitude brightens from +0.5 to +0.3 while Mars moves to the east brightening from +0.3 to -0.4 magnitude.

**Mercury** will be going from inferior conjunction with the Sun as April begins to greatest western elongation of 27° by month's end. It will only be visible in the dawn hours.

**International Space Station**: The ISS is only visible in the evening skies over Ft Myers from April 11th to the 16th. Best days will be 13th and 14th. See this link for specific times and routes for the ISS:
http://www.heavens-above.com/

The **Hubble Space Telescope** appears in the evenings from April 23rd to May 4th; best viewing dates are 25th through 28th. See this link for specific times and routes for HST:
http://www.heavens-above.com/

# Southwest Florida Astronomical Society, Inc. Event Schedule for 2018

| Date | Event | Location | Time/Note |
|---|---|---|---|
| April 5th, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| April 14th, 2018 | Solar Observing | Harbour Heights Park Port Charlotte | 9am-12noon |
| April 14th, 2018 | Monthly Star Party | Seahawk Park - Cape Coral | Dusk |
| April 20th, 2018 | Public Observing | Moore Observatory FSW, Punta Gorda | Dusk |
| May 3rd, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| May 12th, 2018 | Solar Observing | Ponce DeLeon Park Punta Gorda | 9am-12noon |
| May 12th, 2018 | Monthly Star Party | Caloosahatchee Regional Park | Dusk (Arrive before gate closes, park fee) |
| May 18th, 2018 | Public Observing | Moore Observatory FSW, Punta Gorda | Dusk |
| June 7th, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| June 9th, 2018 | Monthly Star Party | Seahawk Park - Cape Coral | Dusk |
| July 5th, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| July 14th, 2018 | Cape Coral Parks and Rec Day | Austen Youth Center (Near SunSplash) | 9 am to Noon |
| July 14th, 2018 | Monthly Star Party | Seahawk Park - Cape Coral | Dusk |
| Aug 2nd, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| Aug 11th, 2018 | Monthly Star Party | Seahawk Park - Cape Coral | Dusk (Perseid Meteor Shower!) |
| Sept 6th, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| Sept 8th, 2018 | Monthly Star Party | Seahawk Park - Cape Coral | Dusk |
| Oct 4th, 2018 | Monthly Meeting | Calusa Nature Center Planetarium | 7:30pm |
| Oct 6th, 2018 | Monthly Star Party | Seahawk Park - Cape Coral | Dusk |
| Oct 14th, 2018 | Ding Darling Days' Family Fun Day | Ding Darling Wildlife Refuge - Sanibel | 8am – 3pm |
| | | | |

***All events are Weather Permitting. If it is cloudy, we may not setup at all. There may be no way to provide advance notice of cancellation.***

**Monthly Star Parties:** These are held at either Caloosahatchee Regional Park (CRP) off SR78 7 miles east of SR31 or at Seahawk Park in Cape Coral. Other than park fees noted, these are free and open to the public.

**CRP** has a gate that closes at dusk, you can check the county's website for current gate closing times and the status of the park's Northside entrance as that is where we observe from. (They may close the area if there are issues with the trails.) There is a parking fee of $1/hr or $5/day at CRP. Park in the main Northside parking lot. We sometimes setup down the dirt road that goes to the east. That area is grassy and may not be level, so one should walk on the dirt road as much as possible and watch their step.

**Seahawk Park** is in North Cape Coral off Wilmington Blvd. (Nelson Rd or Chiquita Blvd are the nearest cross streets.) There is a brown sign in the center median at the entrance to the park. (GPS may not get you to the park, as some of the local roads have been closed.) You will make a big J hook before getting to the parking area. Seahawk Park is utilized by the Radio Controlled Planes and they have priority. They are usually done by sunset but may be there before sunrise. Park in the lot and transport your equipment to the concrete staging area before the runway. This park is handicap capable as there is level concrete leading from parking to the staging area.

**Big Cypress:** The Big Cypress Visitor Center is located off US41 5 miles east of SR29 about 25 miles east of Naples. Big Cypress has earned a Dark Sky Park designation. They hold observing events down the road that extends south of the Visitor Center during the winter months. This is a real dark sky site. Their observing events are free.

**Solar Events:** We have daytime solar events where one can safely look at the Sun. Things such as sunspots and prominences may be visible. These are free unless tied to another event that may have an entrance fee.

**Rotary Park Star Party:** This is a free public star party held at Rotary Park at the south end of Pelican Blvd in South Cape Coral. Park to the west of the main building and walk to where we are setup to the east of the main building.

**Moore Observatory, FSW Punta Gorda Campus:** The campus is located off Airport Rd just east of I-75. Go to the right around the lake and park. The observatory is located down the path along the lake. Besides the telescope in the observatory, additional scopes may be setup around the observatory. This is a free event.

**Star Party Etiquette:** Bright white flashlights are not welcome. We use red flashlights to preserve our night vision. At the parks, please use just your parking lights if possible. As there may be cords and tripod legs that are hard to see in the dark, we ask that all children be well behaved and cautious around the telescopes. If you need help in moving around in the dark, just ask. Someone will be happy to guide you with a red light. If you have a telescope and need help with it, just ask. Someone will be glad to show you how to use it.

**Golden Rules to Telescope Observing**: Move your eye to the telescope, don't try to move the telescope to your eye! Ladders/chairs are there for your support, the telescopes do not provide support and should not be touched.

## Minutes of the Southwest Florida Astronomical Society – March 1, 2018

The regular monthly business meeting of the Southwest Florida Astronomical Society was called to order at 7:28 pm by president Brian Risley in the Calusa Nature Center Planetarium.

Thirty-two people were present, including three visitors.

Brian Risley reminded us that annual dues for 2018 should have been paid by now.

Heather Preston reported on events that have occurred at the Nature Center / Planetarium and announced some upcoming events.

The past events listed in the printed agenda were reviewed. Several of them were very successful and well attended.

Upcoming events listed in the printed agenda were discussed.

Brian Risley reported that he obtained a free printer, but it needs some repairs that he can do himself. Tony Heiner made a motion, seconded by Jean Pilon, to authorize $100 for parts. The motion passed on a voice vote.

Vice President Bruce Dissette brought up the state law changing us to year-round Daylight Saving Time. Several people pointed out reasons against the idea.

Brian Risley reminded anyone with pictures for the newsletter to get them to him or Ron Madl.

Mike McCauley made a motion, seconded by Joe Senich, to approve the minutes of the February 1 meeting as published in the March newsletter. The motion carried on a voice vote.

Treasurer Tim Barrier reported a February ending balance of $1828.77. Joe Senich made a motion, seconded by Bruce Dissette, to accept the report. The motion carried on a voice vote.

We were reminded that viewing from Fakahatchee Strand requires being with a member of the Everglades Astronomy Society. Viewing from Seahawk RC Park or Caloosahatchee Regional Park outside of our scheduled events requires special permission. There is a parking fee at CRP.

Several books have been donated to the club library.

Various telescopes are available for checkout.

Matthew Knight will be helping Bill Francis with the Club website.

Becky Brooks reported the Facebook group is doing well. Remember to "like" the page.

The business meeting was adjourned at 8:06 pm.

Bruce Dissette presented a program on the Omega Centauri globular cluster.

The meeting was adjourned at 8:27 pm.

Submitted by Don Palmer, secretary

# Stephen Hawking, 1942–2018

By: **Monica Young** in S & T

***Stephen Hawking, renowned physicist, famed science communicator, and all-around inspiration, has passed away at the age of 76.***

Stephen Hawking speaks to a crowd at Northeastern University in 1991.
S&T*: Kelly Beatty*

Professor Stephen William Hawking passed away on the morning of March 14, 2018, in the comfort of his home in Cambridge, UK. He was 76.

The physicist-become-international-icon spent decades defying expectations after his 1963 diagnosis with Lou Gehrig's disease. He lived a remarkably full life, with a brilliant career in physics and science communication, and is survived by three children, Robert, Lucy, and Timothy, and three grandchildren.

Hawking was born on January 8, 1942, in Oxford, England. Though he exhibited natural intelligence (his schoolfriends nicknamed him "Einstein"), he didn't apply himself in his early years, generally ranking at the lower end of his classes. But science intrigued him and left him with a hunger to understand the universe. That early interest served as the inspiration that led to him receiving a scholarship at the University College Oxford,

where he studied physics and graduated with honors. He went on to graduate school at the University of Cambridge, where he studied cosmology and in 1966 published a thesis titled, "Properties of Expanding Universes." Hawking became a research fellow at Cambridge after graduation and remained a fellow for the rest of his life.

Yet it was during this time period, in 1963, when at age 21 Hawking was diagnosed with amyotrophic lateral sclerosis (ALS, also known as Lou Gehrig's disease). ALS is a motor neurone diseases, a group of disorders that affect the nerves in the brain and spinal cord. As the body's muscles stop receiving messages from the brain, they weaken and waste away.

The diagnosis was devastating, as Hawking was told at the time that he would have one, maybe two years to live after the onset of symptoms. Decades later, doctors are realizing that the disease appears to progress differently in younger patients. Nevertheless, Hawking continued to surprise the medical community til the end: "I am not aware of anyone else who has survived with [ALS] as long," Nigel Leigh, a professor of clinical neurology at King's College London, told the *British Medical Journal* in 2002.

Yet rather than slowing him down, the diagnosis only spurred him on. Hawking focused on his research more than ever before. In his best-selling *A Brief History of Time*, Hawking noted that in 1965, "…two years had gone by and I was not that much worse. In fact, things were going rather well for me . . ."

Indeed, that year Hawking was engaged to be married to a "very nice girl" named Jane Wilde, whom he had met at a college party in 1962. Needing a job, and hence first a PhD, he was casting about for a thesis idea when he came across the work of Roger Penrose (then at Birkbeck College in London). Penrose had used mathematical formulas to show that a star collapsing under its own gravity must become a singularity in spacetime. It didn't take long for Hawking to cast these equations backward in time, proving that the expanding universe must have originated in a Big Bang singularity.

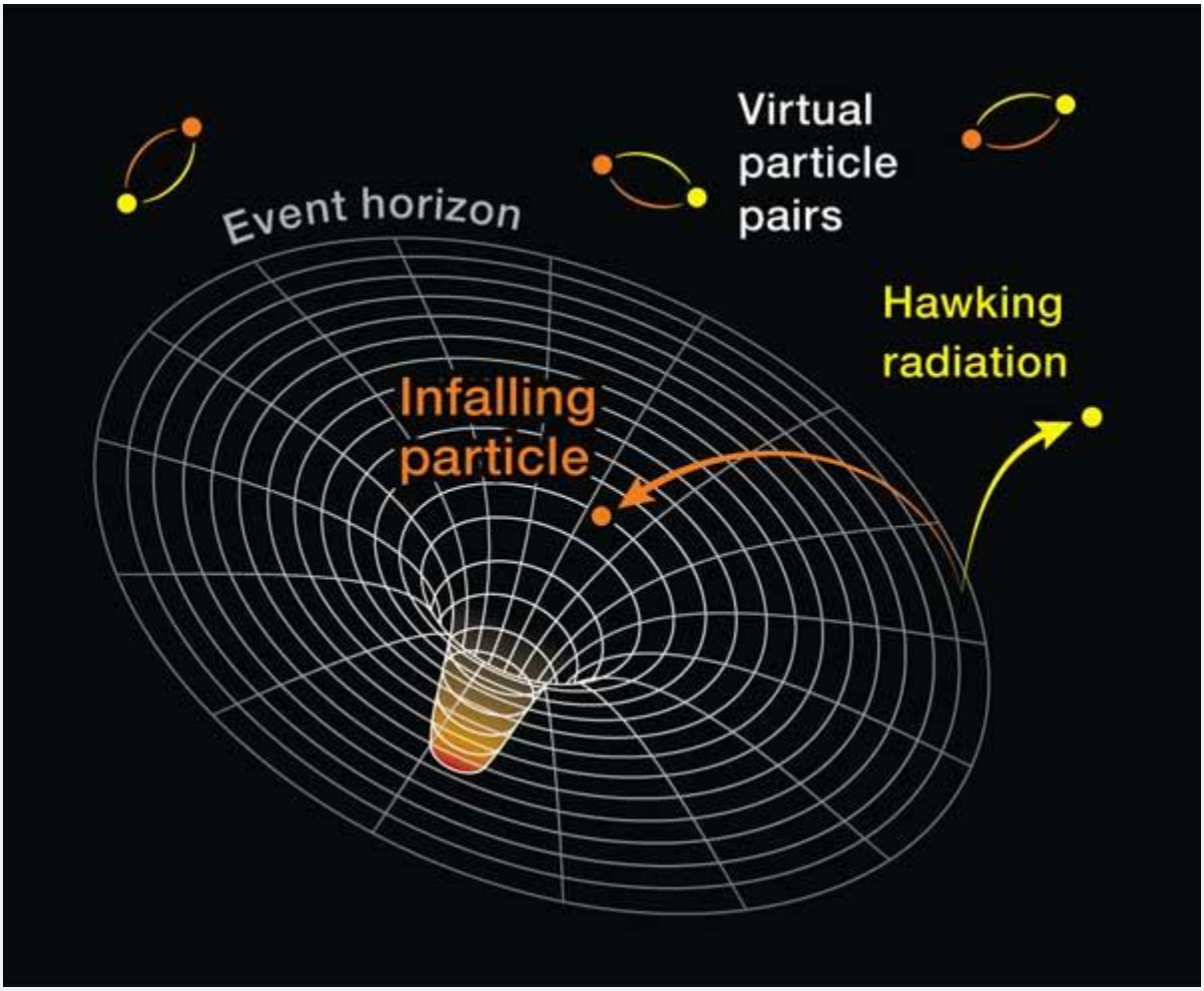
**Black Holes: Not So Black**

Hawking's interest in singularities naturally led him to black holes. Even as ALS put him in a wheelchair by 1969, Hawking was piecing together the ideas behind the idea that earned him fame: Hawking radiation.

Hawking happened across the idea of not-so-black black holes as he was arguing against an idea posed by Jacob Bekenstein, a student at Princeton. The second law of thermodynamics tells us that the disorder of any closed system increases over time. The equations of general relativity also tell us that a black hole's *event horizon*, the radius that measures the "point of no return" around the singularity, only grows as a black hole feeds on matter. So Bekenstein proposed that a black hole's event horizon was a measure of its entropy, as both grow over time. In 1972 Hawking argued this relation couldn't be true, as black holes don't radiate. As he notes in *A Brief History of Time*, "…in writing this paper I was motivated partly by irritation with Bekenstein."

Only, Hawking soon realized, black holes *do* radiate, and in a way that's exactly in line with the second law of thermodynamics. In 1974 Hawking formalized this understanding by relating the singularities of general relativity to the peculiar notion in quantum mechanics that a vacuum isn't empty. Rather, what appears to be empty space is, thanks to quantum uncertainty, actually a bath of virtual particles that exist for a fraction of a second. Particles can't come from nothing, so these virtual particles come in pairs, one with positive energy and one with negative energy.

What Hawking realized was that in the presence of a black hole, the immense gravitational field will lend these vacuum particles energy, making them real. If one falls into the black hole, its partner can escape. To a distant observer, the once-virtual particle will appear to emanate from the black hole itself. And the black hole itself would appear to lose a tiny bit of mass.




Hawking radiation occurs when two virtual particles pop into existence near a black hole's event horizon. The black hole's tidal gravity pulls the pair apart, boosting their energy such that they become real, long-lived particles. If one particle falls into the black hole, the other may escape, carrying away some of the black hole's energy/mass. *S&T: Gregg Dindermann*

Weirdly, this Hawking radiation depends on the black hole's mass in the opposite way that you'd think: a stellar-mass black hole would take $10^{66}$ years to evaporate, just a tad

bit longer than the age of the universe (which is $10^{10}$ years, roughly speaking). Only microscopic, perhaps primordial black holes could be spotted by their Hawking radiation — theoretically, anyway, as it hasn't been done yet.

But Hawking radiation wasn't important so much for practical observations as for what it meant for physics in general. Black holes can feed on any kind matter — gas, stars, the kitchen sink — so they hold an incredible amount of information. As Hawking told me during the inauguration of Harvard University's Black Hole Initative in April 2016, "[Black holes] are the most efficient hard drives in the universe. All the information in Google databanks would be stored in a black hole smaller than a millionth of a millionth of an inch. Exactly how they are able to store so much information is one of the great mysteries of the universe that we are now working very hard to unravel." Yet, if Hawking radiation is real, then all of that data is eventually sent away in a sea of informationless particles. In other words, black holes can destroy information itself. This idea, which Hawking published in 1981, led to far more controversy than the idea of Hawking radiation. Even now, physicists are still struggling to understand the implications, not just for black holes but also for the basic precepts behind quantum mechanics and general relativity.

**Fame and the Future**

In 1985 Hawking suffered an infection that led to a tracheotomy, a procedure that saved his life but cost him the ability to speak. Soon after, he began to use a computerized voice system, first controlled by his thumbs and in 2008, when the nerve that allowed his thumbs to move degraded, a muscle in his cheek.

These setbacks didn't set him back — in 1988, he published *A Brief History of Time*, a survey of the complexities of general relativity, quantum mechanics, and the origin and structure of the universe. It stayed on the Sunday Times best-sellers list for 237 weeks, and is estimated to have sold 10 million copies in more than 40 languages. The clear, often witty descriptions of fundamental concepts granted him international fame, and he later made guest appearances in *Star Trek: The Next Generation* in 1993 and *The Big Bang Theory* in 2012, in addition to appearing in the Opening Ceremony of the London 2012 Paralympics.

His personal life became tumultuous following his fame: he separated from Jane, his wife of 25 years in 1990, and they divorced in 1995. He married his one-time nurse, Elaine Mason, the same year, but they divorced in 2006. Nevertheless, Jane and Stephen Hawking maintained a good working relationship. Jane's autobiography, titled *Travelling to Infinity: My Life with Stephen*, resulted in the 2014 movie celebrating Hawking's life, *The Theory of Everything*. Eddie Redmayne won an Oscar for his role as Hawking.

Fame may have brought some turbulence to Hawking's life, but it also brought its perks. On April 26, 2007, Hawking had the opportunity to fly NASA's KC-135, a modified jet fondly called the Vomit Comet, to achieve four minutes of weightlessness.

"The chance to float free in zero-g will be wonderful," Hawking said during a pre-flight news conference. "I want to demonstrate to the public that anybody can participate in this type of weightless experience."


Stephen Hawking enjoyed zero gravity during a flight aboard a modified Boeing 707 aircraft known as KC-135, or more popularly, the Vomit Comet. *NASA*

In fact, in his later years, Stephen Hawking began advocating that humanity move to the stars, largely because of his concerns over global warming, overpopulation, and epidemics, not to mention the rise of "artificial intelligence." As part of his advocacy, Hawking helped launch Breakthrough Initiatives in 2015 and was a member of the board of Breakthrough Starshot, a project founded in 2016 with designs on visiting the nearest star system, Alpha Centauri.

At the launch of Breakthrough Starshot, Hawking spoke of transcending limits, saying "Nature pins us to the ground. But I just flew to America. Nature forbids me from speaking. [Pause.] But here I am."

Friends and colleagues have paid tribute to Stephen Hawking today. Neil de Grasse Tyson said on Twitter, "His passing has left an intellectual vacuum in his wake. But it's not empty. Think of it as a kind of vacuum energy permeating the fabric of spacetime that defies measure. Stephen Hawking, RIP 1942-2018."

NASA's acting administrator Robert Lightfoot also issued a statement, saying "Today, the world lost a giant among men, whose impact cannot be overstated. . . . His loss is felt

around the world by all he inspired with his work and his personal story of perseverance.”

But we are perhaps best left with the words of Hawking himself, a passionate advocate for understanding the universal laws that govern us all.

“I want to share my excitement and enthusiasm about this quest. So remember to look up at the stars and not down at your feet. Try to make sense of what you see and wonder about what makes the universe exist. Be curious, and however difficult life may seem, there is always something you can do, and succeed at. It matters that you don’t just give up.”

## Measuring the Movement of Water on Earth

By Teagan Wall

As far as we know, water is essential for every form of life. It's a simple molecule, and we know a lot about it. Water has two hydrogen atoms and one oxygen atom. It boils at 212° Fahrenheit (100° Celsius) and freezes at 32° Fahrenheit (0° Celsius). The Earth's surface is more than 70 percent covered in water.

On our planet, we find water at every stage: liquid, solid (ice), and gas (steam and vapor). Our bodies are mostly water. We use it to drink, bathe, clean, grow crops, make energy, and more. With everything it does, measuring where the water on Earth is, and how it moves, is no easy task.

The world's oceans, lakes, rivers and streams are water. However, there's also water frozen in the ice caps, glaciers, and icebergs. There's water held in the tiny spaces between rocks and soils deep underground. With so much water all over the planet—including some of it hidden where we can't see—NASA scientists have to get creative to study it all. One way that NASA will measure where all that water is and how it moves, is by launching a set of spacecraft this spring called GRACE-FO.

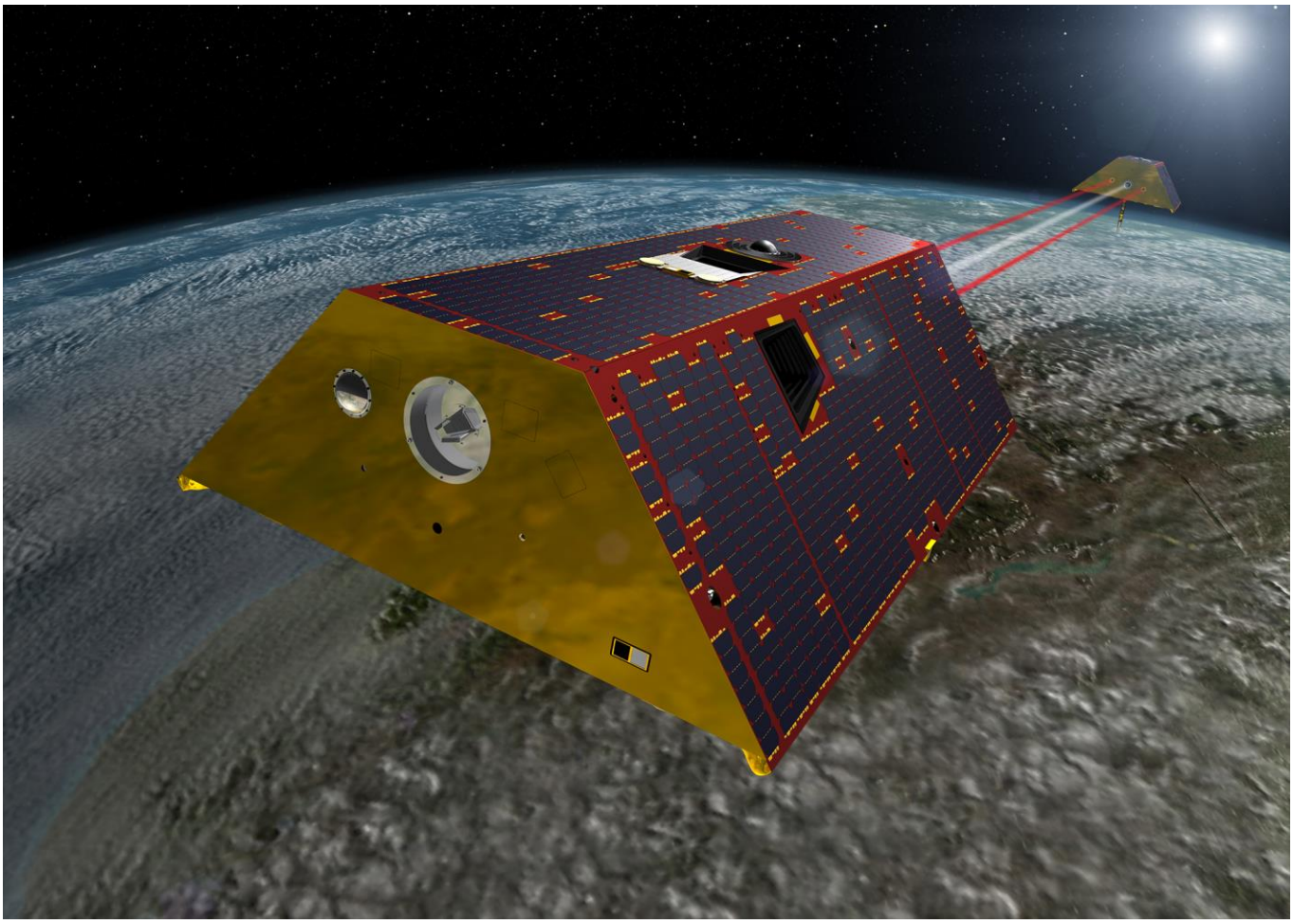
GRACE-FO stands for the "Gravity Recovery and Climate Experiment Follow-on." "Follow-on" means it's the second satellite mission like this—a follow-up to the original GRACE mission. GRACE-FO will use two satellites. One satellite will be about 137 miles (220 km) behind the other as they orbit the Earth. As the satellites move, the gravity of the Earth will pull on them.

Gravity isn't the same everywhere on Earth. Areas with more mass—like big mountains—have a stronger gravitational pull than areas with less mass. When the GRACE-FO satellites fly towards an area with stronger gravitational pull, the first satellite will be pulled a little faster. When the second GRACE-FO satellite reaches the stronger gravity area, it will be pulled faster, and catch up.

Scientists combine this distance between the two satellites with lots of other information to create a map of Earth's gravity field each month. The changes in that map will tell them how land and water move on our planet. For example, a melting glacier will have less water, and so less mass, as it melts. Less mass means less gravitational pull, so the GRACE-FO satellites will have less distance between them. That data can be used to help scientists figure out if the glacier is melting.

GRACE-FO will also be able to look at how Earth's overall weather changes from year to year. For example, the satellite can monitor certain regions to help us figure out how severe a drought is. These satellites will help us keep track of one of the most important things to all life on this planet: water.

You can learn more about our planet's most important molecule here: https://spaceplace.nasa.gov/water



*An artist's rendering of the twin GRACE-FO spacecraft in orbit around Earth. Credit: NASA*

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