

Southwest Florida Astronomical Society SWFAS



The Eyepiece December 2015

Contents:

Message from the President	Page 1
In the Sky this Month	Page 2
Photos by Chuck	Page 3
Future Events	Page 4
Minutes of SWFAS Meeting – October 1, 2015	Page 5
December Notable Events in Astronomy and Space Flight	Page 6
Comet Catalina Sails Into Northern Skies	Page 11
Our Solar System Is <i>Almost</i> Normal, but Not Quite	Page 15
Club Officers & Positions	Page 17

A MESSAGE FROM THE PRESIDENT

Wow, the year has gone by fast! Welcome back to our part time resident members!

I would like to especially thank Carol Morin for pulling together a program for Cypress Lake Middle that was more on Celestial Navigation. I would like to thank Bob Gossen for the use of the sextant.

I would also like to thank Chuck Pavlick for handling a reporter from the News Press/Tropicalia and providing pictures.

Weather got us again in November for the CRP Star Party. We have another scheduled this month for the 12th (should be good for Geminids too) but I will be out of town, so please contact Bruce Dissette for details that day if it looks in question.

Mike McCauley has been busy getting things scheduled for our programs. In January Jack Berninger will be back with a new program. In February, we are doing a meteorite special to coincide with arrival of the new meteorite display at the Planetarium. March is open, so if you have any ideas, please let Mike know. The presentation at the November meeting was great! We had 0 turnout for the Telescope Renaissance night, so I think we may skip it next year and just tell people to bring things in prior to meetings.

Our business meeting will follow the program this month (and next month too) and is our election meeting. Please contact me if you are interested in a change or are interested in an officer position.

It is also 2016 Dues time. If you joined recently, you joined for 2016. Dues are \$20.00 and can be paid at the meetings or mailed to: SWFAS, Inc PO Box 100127 Cape Coral, FL 33910-0127.

Just a reminder, Tony Heiner, Tom Segur and Tom Burkett help out at the public viewing night the second Friday of the month at Florida Southwestern State College Moore Observatory at dusk. I had a good time up there last month even though the weather was not cooperating. The original C-8's and other equipment that I worked with in the late 70's/early 80's at ECC are up there and I had fun looking through all the old equipment. We even found the 12" F17 mirror from the big scope that was at the Fort Myers Campus.

Johnnie Royal and Carol Stewart are having a school star party at Oasis Middle School in Cape Coral on Jan 15th, 2016 and are looking for help. Please contact him (johnnieroy@yahoo.com) or Carol (cjstewart@mindspring.com) for more information.

Bruce Dissette has SWFAS logo'd shirts and hats available. Contact Bruce for details/pricing.

We are looking for someone to be the ALCOR representative for the Astronomical League. This is primarily a job keeping up with membership information (excel spreadsheets) that are sent in quarterly and handling communications with the AL staff. (We also need someone to be the primary Night Sky Network coordinator to put events on their calendar and then file reports after the events and handle adding any new NSN members.)

Brian

In the Sky this Month

Moon: December – Last Quarter, 3rd; New, 11th; 1st Quarter, 18th; Full, 25th.

The Planets: Most of the planetary action is in the early dawn hours.

Mercury is the only planet visible in the evening sky by mid-month.

Jupiter rises around midnight.

Jupiter, Mars, and Venus are all visible (in that order) in the hours before dawn all month.

International Space Station: The ISS returns to the evening sky early and late in the month. Dates are Dec 1-6, and again Dec 22 - 27.

See this link for specific times: <http://www.heavens-above.com/>

Meteor Showers: The Geminid meteor shower peaks at 1 pm EST Dec 13th; viewing should be good through nights of 13th-14th. This should be a good one since the moon is a waxing crescent only a few days old.

Comet Catalina: This comet should be visible at dawn in eastern Virgo most of the month, moving northward into Bootes Dec. 24th, and near Arcturus Jan. 1. It will be 5th magnitude most of this time, suitable for binocular viewing.

Photos by Chuck: More of Chuck's Photos – incredible detail!



Future Events

Star Party and Event Schedule

Date	Event	Location	Time	Info/Contact
December 3 rd	Dr. Jeffrey Hutchinson Presentation on Dark Matter & Business Meeting	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley & Mike McCauley
December 12 th	Star Party	CRP	Dusk	Bruce Dissette
January 7 th , 2016	Jack Berninger – How we Know: How Old, How Far, How Fast, How Life, How Time & Business Meeting	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
January 9 th	Star Party	CRP	Dusk	Bruce Dissette
January 15 th	Star Party	Oasis Middle School	6:30 pm	Johnnie Royal & Carol Stewart
February 4 th	Monthly Business Meeting – Program on Meteorites	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
February 6 th	Star Party	CRP	Dusk	Bruce Dissette
February 27 th	Burrowing Owl Festival	Rotary Park Cape Coral		Brian Risley
March 3 rd	Monthly Meeting -	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
March 4 th	SWFAS Rotary Park Star Party	Rotary Park Cape Coral	7-10pm	Brian Risley
March 5 th	Star Party	CRP	Dusk	Bruce Dissette
April 9 th	Star Party	CRP	Dusk	Bruce Dissette
May 7 th	Star Party	CRP	Dusk	Bruce Dissette

December Program – Dark Matter, by Dr Jeffery Hutchinson

At the December meeting of the SWFAS, Dr. Jeffrey Hutchinson, assistant professor of physics at FGCU, will update us on why the search for dark matter is a major objective of modern physics research. His presentation will review current evidence for existence of dark matter. In addition, Dr. Hutchinson will discuss the on-going search for this elusive material and introduce some popular theories for the nature of dark matter.

We encourage all of our SWFAS members to come to the Calusa Nature Center and Planetarium on Thursday, December 3, 2015 to attend what promises to be a very impressive and unforgettable presentation. Bring interested family members and friends to an evening of education and enlightenment. Supporting presentations such as Dr. Hutchinson's through your attendance allows us to continue to schedule local experts in astronomy and cosmology to share their knowledge with us. Dr. Hutchinson's presentation will begin at 7:30pm.

Minutes of the Southwest Florida Astronomical Society – October 1, 2015

The program by Dr. Ken Watanabe on Einstein's Theory of Relativity was presented before the business meeting. Forty-nine people were present, and two visitors were introduced.

The regular monthly meeting of the Southwest Florida Astronomical Society was called to order at 8:27 pm by president Brian Risley in the Calusa Nature Center Planetarium.

Heather Preston Reported the Planetarium is purchasing a gravity well vortex demonstrator and a stony-iron meteorite.

Repairs to the Nature Center and Planetarium are under way. Ron Madl reported it will re-open October 3, though renovations will continue. The Center has received a \$100,000 matching grant. Ron is chair of the Planetarium committee and is seeking others who are interested.

If a scheduled event is listed as "weather permitting," check with the designated contact person if weather seems questionable.

September events listed in the printed agenda were reviewed.

Upcoming events listed in the printed agenda were discussed. The November 5 meeting will be Telescope Renaissance and a program on the August 2017 Solar Eclipse, with no business meeting. The December 3 meeting will have election of officers for 2016.

Vice President Bruce Dissette announced that printed or embroidered club shirts are available. The October 10 star party is moved to Seahawk Park in Cape Coral due to continued wet conditions at Caloosahatchee Regional Park

Ron Madl made a motion, seconded by Bruce Dissette, to approve the September 3 minutes as contained in the newsletter. The motion carried on a voice vote.

Treasurer Tony Heiner reported a September balance of \$1493.33. Brian Shultis made a motion, seconded by Ross Heim, to accept the report. The motion carried on a voice vote.

Anyone planning to go to the Fakahatchee Strand for viewing should get with someone who knows the way because it is tricky.

Equipment Coordinator Brian Risley reported the CPC 800 is not available for checkout generally due to its use for scheduled public events. Brian would like to produce an instructional video for the GT mount for the PST and C90. He needs volunteer(s) to help. Let Brian know if you available.

Bruce Dissette suggested that the Planetarium could sell telescopes at the telescope renaissance night.

Program Coordinator Mike McCauley would appreciate any feedback on programs. Ron Madl suggested advertising programs. Why was the turnout so good for this month's program? Perhaps visitors could be asked how they heard about the program?

In response to a question, Brian Risley will check the possibility of having the January meeting at FGCU.

Carol Morin reported more than 110 "likes" on the club Facebook page.

The business meeting was adjourned at 9:07 pm.

submitted by Don Palmer, secretary

There was no business meeting at the November meeting, so no minutes.

Notable December Events in Astronomy and Space Flight History

Compiled by Mike McCauley

December 1, 2013: Chang'e 3 spacecraft launched to the moon. Chang'e 3 is an unmanned lunar exploration mission operated by the China National Space Administration, incorporating a robotic lander and China's first lunar rover. Launched in December 2013 as part of the second phase of a Chinese Lunar Exploration Program, it was named after Chang'e, the goddess of the Moon in Chinese mythology, and is a follow-up to Chang'e 1 and Chang'e 2 lunar orbiters. The rover was named Yutu (Chinese: "Jade Rabbit") from an online poll, after the mythological rabbit that lives on the Moon. Chang'e 3 achieved lunar orbit on 6 December 2013 and landed on 14 December 2013, becoming the first spacecraft to soft-land on the Moon since the Soviet Union's Luna 24 in 1976.

December 7, 1905: Gerard Kuiper was born. Kuiper was a Dutch American astronomer, planetary scientist, selenographer, author and professor. He is the eponymous namesake of the Kuiper belt. Kuiper is considered the father of modern planetary science. He discovered two natural satellites of planets in the Solar System, Uranus's satellite Miranda and Neptune's satellite Nereid. In addition, he discovered carbon dioxide in the atmosphere of Mars and existence of a methane-laced atmosphere above Saturn's satellite Titan in 1944. Kuiper also pioneered airborne infrared observing in the 1960s. Astronomers refer to a region of minor planets beyond Neptune as the "Kuiper Belt", since he suggested that small planets or comets may have formed there.

December 11, 1972: Apollo 17 lands on the moon. Apollo 17 was the final mission of the United States' Apollo program, the enterprise that landed the first humans on the Moon. Launched at 12:33 am EST on December 7, 1972, with a three-member crew consisting of Commander Eugene Cernan, Command Module Pilot Ronald Evans, and Lunar Module Pilot Harrison Schmitt, it was the last use of Apollo hardware for its original mission. After Apollo 17, extra Apollo spacecraft were used in Skylab and Apollo-Soyuz Test Project programs. Apollo 17 was the first night launch of a U.S. human spaceflight and the final manned launch of a Saturn V rocket. Apollo 17 remains the last manned moon landing and last time humans travelled beyond low Earth orbit.

December 11, 1863: Annie Jump Cannon, born in Dover, Delaware, was an American astronomer whose cataloging work was instrumental in development of contemporary stellar classification. With Edward C. Pickering, she is credited with creation of the Harvard Classification Scheme, which was the first serious attempt to organize and classify stars based on their temperatures. She classified more stars in a lifetime than anyone else, with a total of around 500,000 stars. She also discovered 300 variable stars, five novae, and one spectroscopic binary, creating a catalogue that included about 200,000 references. Cannon could classify three stars a minute just by looking at their spectral patterns and, using a magnifying glass, could classify stars down to ninth magnitude, around 16 times fainter than the human eye can see. On May 9, 1922, the International Astronomical Union formally adopted Cannon's stellar classification system, and with only minor changes, it is still used today.

December 14, 1546: Tycho Brahe was born in Dania, Denmark, now part of modern-day Sweden. He was a Danish nobleman known for his accurate, comprehensive

astronomical and planetary observations. Tycho was well known in his lifetime as an astronomer, astrologer and alchemist, and has been described more recently as "the first competent mind in modern astronomy to feel ardently the passion for exact empirical facts." He was the last of the major naked eye astronomers, working without telescopes for his observations. Tycho's observations of stellar and planetary positions were noteworthy both for their accuracy and quantity. His celestial positions were much more accurate than those of any predecessor or contemporary. He was assisted by Johannes Kepler who later used Tycho's astronomical data to develop his three laws of planetary motion.

December 15, 1970: Venera 7 lands on Venus. Venera 7 was a Soviet spacecraft, part of the Venera series of probes to Venus. When it landed on the Venusian surface, it became the first spacecraft to land on another planet and first to transmit data back to Earth. Upon entering the Venusian atmosphere the parachute opened at a height of 60km and atmospheric testing began with results showing the atmosphere to be 97% carbon dioxide. The parachute failed during descent. As a result, the lander struck the surface of Venus at a speed much greater than planned. The probe appeared to go silent on impact but its recording tapes kept rolling. A few weeks later, after review of the tapes, another 23 minutes of very weak signals were found. The spacecraft had landed on Venus and probably bounced onto its side, leaving the medium gain antenna not aimed correctly for strong signal transmission to Earth. The only data returned from the surface were temperature readings, which gave a temperature of 475 °C (887°F).

December 16, 1857: Edward Emerson Barnard, born in Nashville, Tennessee, was an American astronomer. Commonly known as E. E. Barnard, he was recognized as a gifted observational astronomer. He is best known for his discovery of Barnard's Star in 1916. The faint Barnard's Star was named for him after he discovered in 1916 that it had a very large proper motion relative to other stars. It is the second nearest star system to the Sun, second only to the Alpha Centauri system. In 1892 he made observations of a nova and was the first to notice the gaseous emissions, thus deducing that it was a stellar explosion. The same year he also discovered Amalthea, the fifth moon of Jupiter. He was the first to discover a new moon of Jupiter since Galileo Galilei in 1609. This was the last satellite discovered by visual observation (rather than by examining photographic plates or other recorded images).

December 17, 1903: First powered flight by Orville Wright. The Wright Flyer was the first successful heavier-than-air powered aircraft. It was designed and built by the Wright brothers. They flew it four times on December 17, 1903, near Kill Devil Hills, about four miles south of Kitty Hawk, North Carolina. Today, the airplane is exhibited in the National Air and Space Museum in Washington D.C. The U.S. Smithsonian Institution describes the aircraft as "the first powered, heavier-than-air machine to achieve controlled, sustained flight with a pilot aboard."

December 20, 1978: Venera 12 lands on Venus. The Venera 12 was a USSR unmanned space mission to explore the planet Venus. Venera 12 was launched on 14 September, 1978, at 02:25:13 UTC. Separating from its flight platform on December 19, 1978, the lander entered the Venus atmosphere two days later at 11.2 km/s. During the descent, it employed aerodynamic braking followed by parachute braking and ending with atmospheric braking. It made a soft landing on the surface at 06:30 Moscow time

(0330 UT) on 20 December after a descent of approximately 1 hour with touchdown speed was 7–8 m/s. It transmitted data to the flight platform for 110 minutes after touchdown until the flight platform moved out of range while remaining in a heliocentric orbit. The Venera 12 descent craft carried instruments designed to study chemical composition of the atmosphere, the nature of the clouds, and thermal balance of the atmosphere. Among the instruments on board were a gas chromatograph to measure atmospheric composition, instruments to study scattered solar radiation and soil composition, and a device named Groza which was designed to measure atmospheric electrical discharges. Results reported evidence of lightning and thunder, a high $\text{Ar}^{36}/\text{Ar}^{40}$ ratio, and discovery of carbon monoxide at low altitudes. Both Venera 11 and Venera 12 had landers with two cameras, each designed for color imaging. Each failed to return images when the lens covers did not separate after landing due to a design flaw.

December 20, 1996: Carl E. Sagan, the David Duncan Professor of Astronomy and Space Sciences and director of the Laboratory for Planetary Studies at Cornell University, died of pneumonia this day in Seattle, Wash., after a two-year battle with a bone marrow disease. Sagan, 62, had received a bone marrow transplant in April 1995 for treatment of myelodysplasia, a pre-leukemic syndrome.

Astronomer, educator and author, Sagan was perhaps the world's greatest popularizer of science, reaching millions of people through newspapers, magazines and television broadcasts. He is well-known for his work on the PBS series *Cosmos*, the Emmy- and Peabody-award-winning show that became the most watched series in public-television history. It was seen by more than 500 million people in 60 countries. The accompanying book, *Cosmos* (1980), was on The New York Times bestseller list for 70 weeks and was the best-selling science book ever published in English.

"A gifted scholar and researcher, Carl Sagan inspired thousands of students across the world to open their minds to the wonders of science and the universe. Through his writings and television productions, he brought the excitement and challenges of scientific discovery to millions of families. He used these talents effectively, becoming a major force in support not only of planetary exploration but also in behalf of environmental protection here on Earth." said Cornell President Hunter R. Rawlings III.

Yervant Terzian, chairman of Cornell's astronomy department, said: "Carl was a candle in the dark. He was, quite simply, the best science educator in the world this century. He touched hundreds of millions of people and inspired new generations to pursue science."

Sagan published more than 600 scientific papers and popular articles and is author, co-author or editor of more than 20 books, including *The Dragons of Eden* (1977), for which he won the Pulitzer Prize in 1978. *Pale Blue Dot: A Vision of the Human Future in Space* appeared on best-seller lists worldwide and was selected as one of the "notable books of 1995" by The New York Times. His reading of an abridged audiocassette version was nominated for a Grammy and was cited by Publisher's Weekly as one of the "two best audiobooks of the year."

This year, he published *The Demon-Haunted World: Science as a Candle in the Dark* (Random House), which became Sagan's eighth New York Times best-seller. With his wife, Ann Druyan, he co-produced a major motion picture from Warner Brothers based on his novel *Contact*. The movie was released in 1997.

Carl Edward Sagan was born Nov. 9, 1934, in Brooklyn, N.Y. At Cornell since 1968, Sagan received a BS degree in 1955; a master's degree in 1956, both in physics; a PhD in astronomy and astrophysics in 1960, all from the University of Chicago. He taught at Harvard University in the early 1960s before coming to Cornell, where he became full professor in 1971. Sagan played a leading role in NASA's Mariner, Viking, Voyager and Galileo expeditions to other planets. He received NASA Medals for Exceptional Scientific Achievement and twice for Distinguished Public Service and the NASA Apollo Achievement Award.

His research focused on topics such as the greenhouse effect on Venus; windblown dust as an explanation for seasonal changes on Mars; organic aerosols on Titan; the long-term environmental consequences of nuclear war; and the origin of life on Earth. A pioneer in the field of exobiology, he continued to teach graduate and undergraduate students in courses in astronomy and space sciences and in critical thinking at Cornell.

Sagan received 22 honorary degrees from American colleges and universities for his contributions to science, literature, education and the preservation of the environment and many awards for his work on the long-term consequences of nuclear war and reversing the nuclear arms race.

Among his other awards have been: the John F. Kennedy Astronautics Award of the American Astronautical Society; the Explorers Club 75th Anniversary Award; the Konstantin Tsiolkovsky Medal of the Soviet Cosmonauts Federation and the Masursky Award of the American Astronomical Society. He also was the recipient of the Public Welfare Medal, the highest award of the National Academy of Sciences, "for distinguished contributions in the application of science to the public welfare.

Sagan was elected chairman of the Division of Planetary Sciences of the American Astronomical Society, president of the Planetology Section of the American Geophysical Union and chairman of the Astronomy Section of the American Association for the Advancement of Science. For 12 years he was editor of *Icarus*, the leading professional journal devoted to planetary research.

He was co-founder of The Planetary Society, a 100,000-member organization and the largest space-interest group in the world. The society supports major research programs in the radio search for extraterrestrial intelligence, the investigation of near-Earth asteroids and, with the French and Russian space agencies, development and testing of balloon and mobile robotic exploration of Mars. Sagan also was Distinguished Visiting Scientist at the Jet Propulsion Laboratory in California and was contributing editor of *Parade* magazine, where he published articles about science and about the disease that he battled for two years.

December 21, 1968: Apollo 8, the second human spaceflight mission in the United States Apollo space program, was launched. It became the first manned spacecraft to leave Earth orbit, reach the Earth's Moon, orbit it and return safely to Earth. The three-astronaut crew, Commander Frank Borman, Command Module Pilot James Lovell, and Lunar Module Pilot William Anders, became the first humans to travel beyond low Earth orbit, the first to see Earth as a whole planet, the first to directly see the far side of the Moon, and then the first to witness Earthrise. The 1968 mission, the third flight of the Saturn V rocket and that rocket's first manned launch, was also the first human spaceflight launch from the Kennedy Space Center, Florida, located adjacent to Cape

Canaveral Air Force Station. Apollo 8 took three days to travel to the Moon. It orbited ten times over the course of 20 hours, during which the crew made a Christmas Eve television broadcast where they read the first 10 verses from the Book of Genesis. At the time, the broadcast was the most watched TV program ever. Apollo 8's successful mission paved the way for Apollo 11 to fulfill President John F. Kennedy's goal of landing a man on the Moon before the end of the 1960s. The Apollo 8 astronauts returned to Earth on December 27, 1968, when they splashed down in the Northern Pacific Ocean. The crew was named *Time* magazine's "Men of the Year" for 1968 upon their return.

December 25, 1642: Isaac Newton born. Sir Isaac Newton was an English physicist and mathematician widely recognized as one of the most influential scientists of all time and as a key figure in the scientific revolution. His book *Philosophiæ Naturalis Principia Mathematica* ("Mathematical Principles of Natural Philosophy"), first published in 1687, laid the foundations for classical mechanics. Newton made seminal contributions to optics, and shares credit with Gottfried Leibniz for development of calculus. Newton's *Principia* formulated the laws of motion and universal gravitation, which dominated scientists' view of the physical universe for the next three centuries. By deriving Kepler's laws of planetary motion from his mathematical description of gravity, and then using the same principles to account for the trajectories of comets, the tides, the precession of the equinoxes, and other phenomena, Newton removed the last doubts about validity of the heliocentric model of the Solar System. This work also demonstrated that the motion of objects on Earth and of celestial bodies could be described by the same principles. Newton built the first practical reflecting telescope and developed a theory of color based on the observation that a prism decomposes white light into the colors of the visible spectrum. He formulated an empirical law of cooling, studied the speed of sound, and introduced the notion of a Newtonian fluid.

December 27, 1571: Johannes Kepler born. Kepler was a German mathematician, astronomer, and astrologer. A key figure in the 17th century scientific revolution, he is best known for his laws of planetary motion, based on his works *Astronomia nova*, *Harmonices Mundi*, and *Epitome of Copernican Astronomy*. These works also provided one of the foundations for Isaac Newton's theory of universal gravitation.

December 30, 1906: Sergei Korolev was born. Korolyov was the lead Soviet rocket engineer and spacecraft designer in the Space Race between the United States and the Soviet Union during the 1950s and 1960s. He is considered by many as the father of practical astronautics. Arrested for alleged mismanagement of funds (he spent money on unsuccessful experiments with rockets), he was imprisoned in 1938 for almost six years. Following his release, he became a recognized rocket designer and a key figure in development of the Soviet intercontinental ballistic missile program. He was then appointed to lead the Soviet space program, made Member of Soviet Academy of Sciences, and oversaw early successes of the Sputnik and Vostok projects that included launching Yuri Alexeevich Gagarin into orbit 12 April 1961, the first human in space. By the time he died unexpectedly in 1966, his plans to compete with the United States to be the first nation to land a man on the Moon had begun. Before his death he was often referred to only as "The Chief Designer", because the Soviet leadership feared that the United States would send agents to assassinate him. Only many years later was he publicly acknowledged as the lead man behind Soviet success in space.

Comet Catalina Sails Into Northern Skies

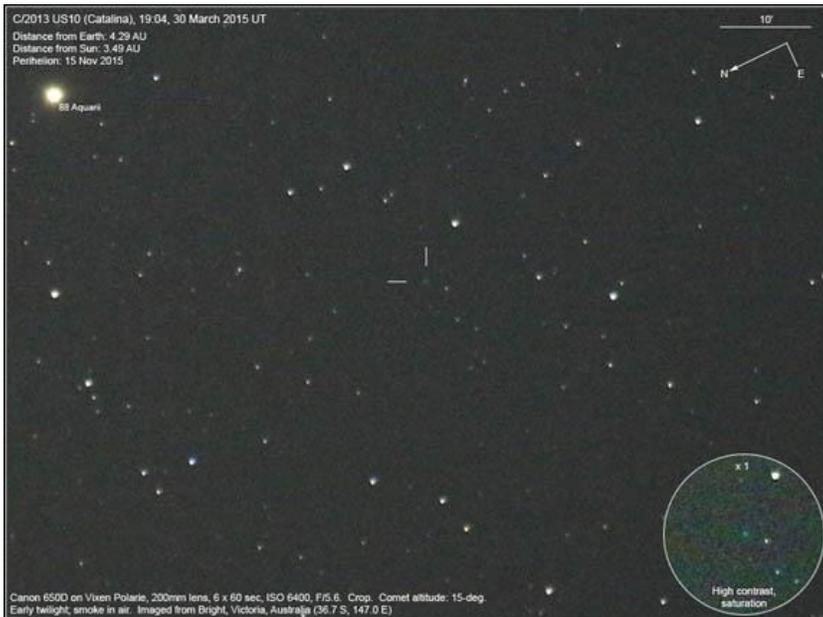
By: [Bob King](#) from Sky & Telescope

Comet Catalina returns this month with naked-eye potential.



Comet Catalina (C/2013 US10) on October 1, 2015, shines near 7th magnitude and shows a greenish coma due to emissions from [diatomic carbon](#) (C_2). The tail stretched 3° across the rich star fields of Centaurus and Lupus at the time. [José J. Chambó](#)

Get ready to lose some sleep — [Comet Catalina \(C/2013 US10\)](#) will be arriving soon! After making a hairpin turn around the Sun at perihelion on November 15th, the comet will surge into the dawn sky for Northern Hemisphere skywatchers and put on a great show by month's end. Early on, binoculars will show the comet's small, bright coma with a whisper of a tail. Naked-eye sightings may be possible by mid-December.

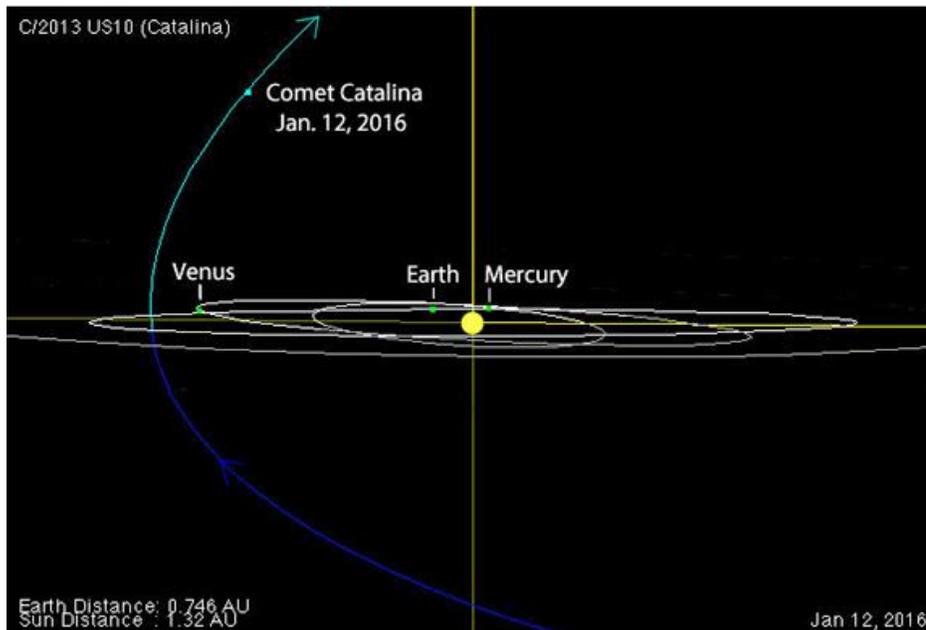


Back on March 30th, when the comet first became accessible to amateur astronomers, it was a 13th-magnitude smudge. *Rob Kaufman*

There's been a lot of buzz about the comet, since many of us expected Comet Catalina to depart the solar glare pumped up to magnitude 3, making it the brightest expected fuzzball of the year. Maybe it will still. But in September, the comet's rate of brightening began to flag. [Revised estimates](#) now call for it to top out between magnitude 5 and 6 by year's end.

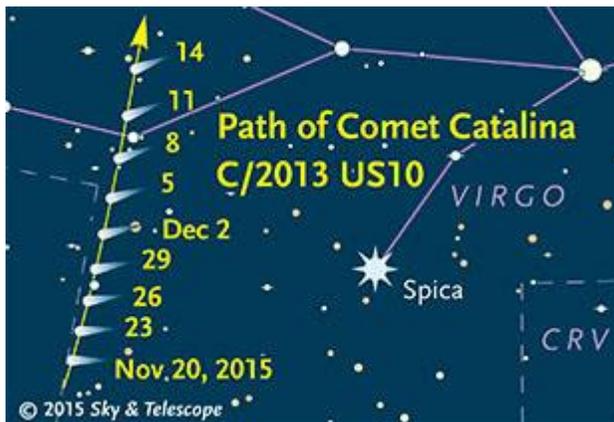
From late March through mid-October, Catalina's path confined its visibility to southern eyes only. Chris Wyatt of New South Wales, Australia, made one of the last visual observations on October 16th before the comet disappeared in the solar glare. Using 10×70 binoculars, he estimated a magnitude of 7 with a 7'-wide, well-condensed, greenish coma, and short ion tail pointing southeast.

Through his 10-inch Dobsonian reflector, the coma expanded to 8.2' with a longer 35' tail. Wyatt noted that Catalina responded well to a [Swan Band filter](#), a narrow bandpass filter tuned to oxygen and carbon emissions that enhances the view of gassy (versus dusty) comets. With the filter in place he saw significant brightening in the inner coma.



C/2013 US10 is an Oort Cloud comet with a steeply inclined orbit of 149°. It's spent much of its time lately below the plane of the solar system, out of view of Northern Hemisphere skywatchers. After solar conjunction at mid-month, it will transition to northern skies and arc over the inner planets. On January 12, 2016, the comet comes closest to Earth at 66.9 million miles (107.7 million km). *NASA / JPL*

Discovered by the [Catalina Sky Survey](#) on Halloween 2013, the comet received the "US10" designation because it was initially thought to be an asteroid in a short period orbit. After more observations to refine its path and additional photographs that revealed telltale comet fuzz, astronomers realized they'd run into a denizen from the [Oort Cloud](#), knocked our way by the close passage of some nameless star long ago. At the time of discovery, Catalina glowed at only 19th magnitude some 7.7 a.u. from Earth. Typical of new arrivals, it dove into the inner solar system on a steeply inclined orbit.



C/2013 US10 spends its first few weeks after conjunction climbing northward through Virgo near Spica. Ticks mark its position at 0^h Universal Time every three days. Stars are plotted to 6th magnitude. *Sky & Telescope*

The comet pursues a northerly track through Virgo when it returns at dawn around November 24th, appearing 8° high in the southeastern sky 70 minutes before sunrise. By the 28th, it will have climbed to 10° in a dark sky shortly *before* the start of dawn.

A bright Moon will put a temporary damper on the comet's rise to fame from November 24th through December 3rd. From there on out, though, it's smooth sailing until the Moon returns for Round 2 at the winter solstice.

Catalina glides northward at nearly 1° per day in late December as it crosses from Virgo into Boötes on a beeline for Arcturus. On the morning of January 1st, the comet skims ½° southwest of that orange luminary in a remarkable conjunction highlighting the arrival of the new year. Photo anyone?



After a relatively slow start in Virgo, the comet races across the sky, becoming a circumpolar object in Ursa Major by mid-January and visible all night long from mid-northern latitudes. *Sky & Telescope*

The comet passes closest to Earth at 0.72 a.u. on January 12th, then buzzes Mizar in the Big Dipper's handle on January 14–15, hurrying along at the rate of 2° per day or $5'$ an hour — fast enough to easily detect motion in 30 minutes or less. After mid-month, it's expected to fade quickly.

In this dark time of year, when the Sun bows low in the south, we welcome a potentially bright comet to lift our spirits and add celestial pizzazz to the seasonal holidays of Thanksgiving, Christmas, and New Year's.

Who really knows how bright Comet Catalina will get? Will it break into multiple comets after perihelion? First-time visitors from the Oort Cloud often do surprising things. No matter what Catalina has up its sleeve, its tour will be a brief one.

After several million years of inbound travel, perturbations induced by the planets will boot it out of the solar system and into interstellar space. We're glad for the chance to share our table with a visitor who spent so much time getting here but can only stay a short while.

Comet Catalina highlights:

- * November 24 — Approximate date of first visibility in the dawn sky
- * December 7 — Catalina gets company! The comet pairs up with the planet Venus and the waning crescent Moon this morning. From the central United States, Venus shines 4° southwest and the Moon 5° southwest of the comet.
- * December 23–24 — Comet crosses into Boötes
- * January 1, 2016 — Close pass (0.5°) of Arcturus on the first day of 2016
- * January 9 — Comet crosses into Canes Venatici
- * January 12 — Closest to Earth at 66.9 million miles
- * January 14 — Comet crosses into Ursa Major
- * January 14–15 — Passes just 1° north of Alkaid, the star at the end of the Big Dipper's handle
- * January 16 — Passes 2° southwest of the 8th-magnitude galaxy, M101
- * January 17 — Passes 3.4° northeast of the double star Mizar in the bend of the Big Dipper's handle
- * January 21 — Comet crosses into Draco
- * January 25 — Comet crosses into Camelopardalis

Our Solar System Is *Almost* Normal, But Not Quite.

by Ethan Siegel



It was just over 20 years ago that the very first exoplanet was found and confirmed to be orbiting a star not so different from our own sun. Fast forward to the present day, and the stellar wobble method, wherein the gravitational tug of a planet perturbs a star's motion, has been surpassed in success by the transit method, wherein a planet transits across the disk of its parent star, blocking a portion of its light in a periodic fashion. Thanks to these methods and NASA's Kepler spacecraft, we've identified many thousands of candidate planets, with nearly 2,000 of them having been confirmed, and their masses and densities measured.

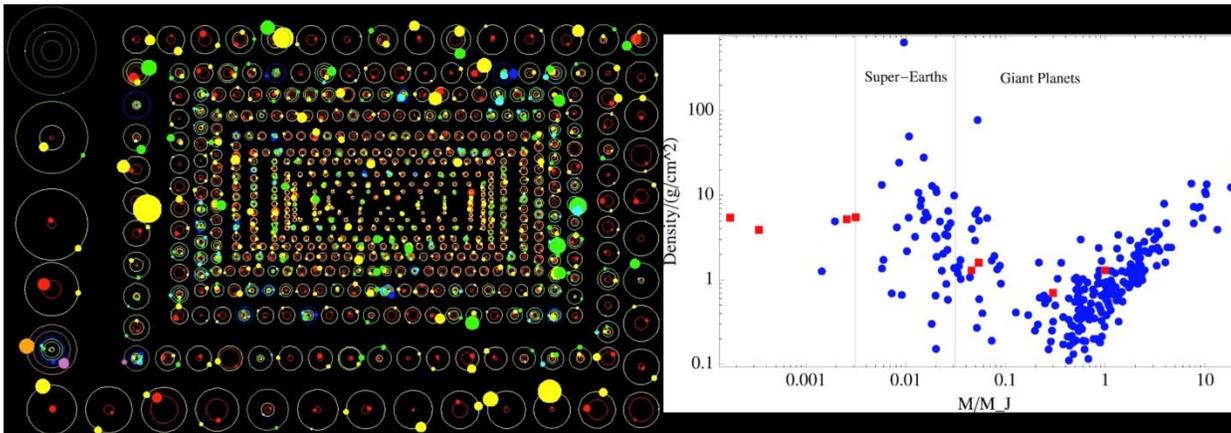
The gas giants found in our solar system actually turn out to be remarkably typical: Jupiter-mass planets are very common, with less-massive and more-massive giants both extremely common. Saturn—the least dense world in our solar system—is actually of a fairly typical density for a gas giant world. It turns out that there are many planets out there with Saturn's density or less. The rocky worlds are a little harder to quantify,

because our methods and missions are much better at finding higher-mass planets than low-mass ones. Nevertheless, the lowest mass planets found are comparable to Earth and Venus, and range from just as dense to slightly less dense. We also find that we fall right into the middle of the "bell curve" for how old planetary systems are: we're definitely typical in that regard.

But there are a few big surprises, which is to say there are three major ways our solar system is an outlier among the planets we've observed:

- All our solar system's planets are significantly farther out than the average distance for exoplanets around their stars. More than half of the planets we've discovered are closer to their star than Mercury is to ours, which might be a selection effect (closer planets are easier to find), but it might indicate a way our star is unusual: being devoid of very close-in planets.
- All eight of our solar system's planets' orbits are highly circular, with even the eccentric Mars and Mercury only having a few percent deviation from a perfect circle. But most exoplanets have significant eccentricities, which could indicate something unusual about us.
- And finally, one of the most common classes of exoplanet—a super-Earth or mini-Neptune, with 1.5-to-10 times the mass of Earth—is completely missing from our solar system.

Until we develop the technology to probe for lower-mass planets at even greater distances around other star systems, we won't truly know for certain how unusual we really are!



Images credit: NASA / Kepler Dan Fabricky (L), of a selection of the known Kepler exoplanets; Rebecca G. Martin and Mario Livio (2015) ApJ 810, 105 (R), of 287 confirmed exoplanets relative to our eight solar system planets.

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