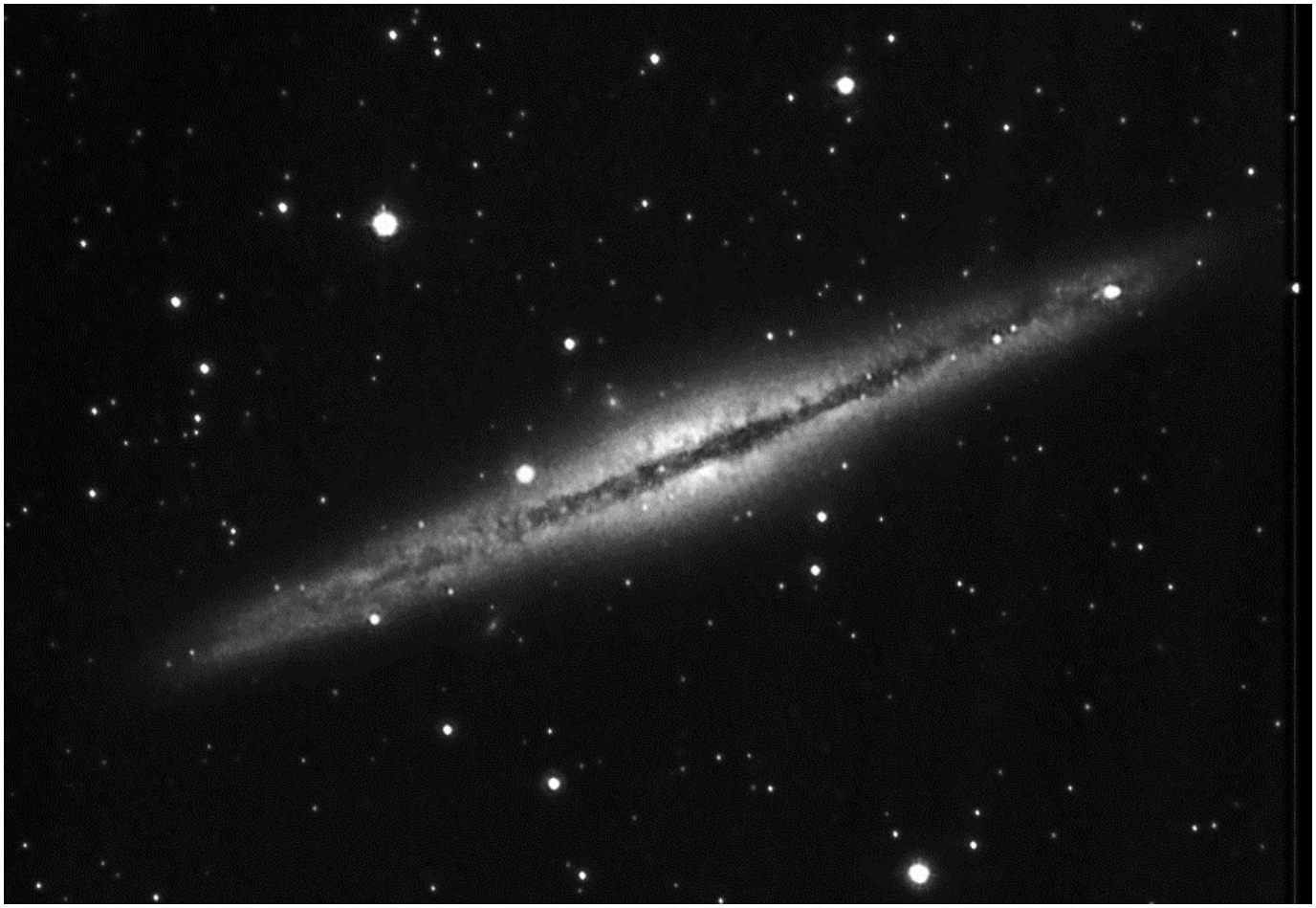
SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

DECEMBER 2012 *Free to members, subscriptions $12 for 12* **Volume 39, Number 12**



This image of NGC 891, a 10.3 magnitude spiral galaxy located 30 million light-years away in the constellation Andromeda, was captured by Bill Hall using an 8-inch f/4 Newtonian with an ST-8300M imager. 5 20-minute exposures were composited to create the image. The image was created from Bill's observing site in Yorba Linda on November 9th.

OCA CLUB MEETING

The free and open club meeting will be held December 14 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month is our annual Members Night! Details on Page 10.

NEXT MEETINGS: January 11, February 8

STAR PARTIES

The Black Star Canyon site will be open on December 8. The Anza site will be open on December 15. Members are encouraged to check the website calendar for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

You are also reminded to check the web site frequently for updates to the calendar of events and other club news.

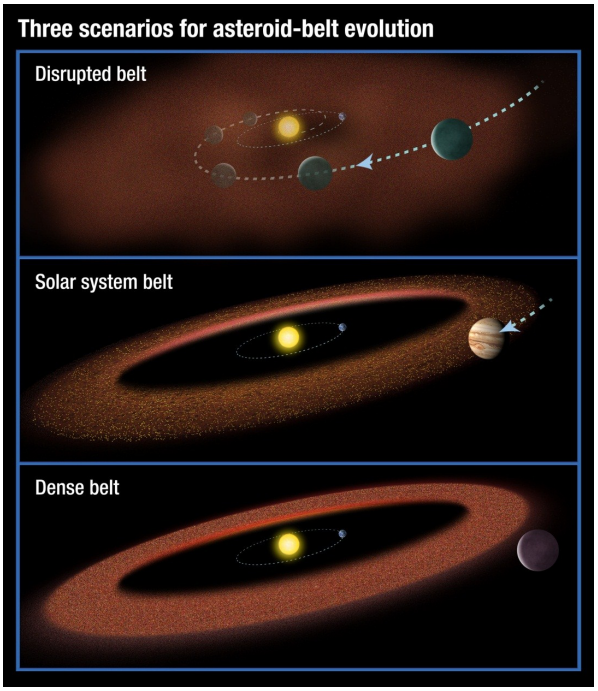
COMING UP

The next session of the Beginners Class will be held on Friday, December 7 at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana.

GOTO SIG: TBA
Astro-Imagers SIG: Dec. 18
Remote Telescopes: TBA
Astrophysics SIG: Dec. 21
Dark Sky Group: TBA

It Takes More Than Warm Porridge to Make a Goldilocks Zone

By Diane K. Fisher



Our solar system is represented by the middle scenario, where the gas giant planet has migrated inward, but still remains beyond the asteroid belt.

The "Goldilocks Zone" describes the region of a solar system that is just the right distance from the star to make a cozy, comfy home for a life-supporting planet. It is a region that keeps the planet warm enough to have a liquid ocean, but not so warm that the ocean boils off into space. Obviously, Earth orbits the Sun in our solar system's "Goldilocks Zone."

But there are other conditions besides temperature that make our part of the solar system comfortable for life. Using infrared data from the Spitzer Space Telescope, along with theoretical models and archival observations, Rebecca Martin, a NASA Sagan Fellow from the University of Colorado in Boulder, and astronomer Mario Livio of the Space Telescope Science Institute in Baltimore, Maryland, have published a new study suggesting that our solar system and our place in it is special in at least one other way.

This fortunate "just right" condition involves Jupiter and its effect on the asteroid belt.

Many other solar systems discovered in the past decade have giant gas planets in very tight orbits around their stars. Only 19 out of 520 solar systems studied have Jupiter-like planets in orbits beyond what is known as the "snow line"—the distance from the star at which it is cool enough for water (and ammonia and methane) to condense into ice. Scientists believe our Jupiter formed a bit farther away from the Sun than it is now. Although the giant planet has moved a little closer to the Sun, it is still beyond the snow line.

So why do we care where Jupiter hangs out? Well, the gravity of Jupiter, with its mass of 318 Earths, has a profound effect on everything in its region, including the asteroid belt. The asteroid belt is a region between Mars and Jupiter where millions of mostly rocky objects (some water-bearing) orbit. They range in size from dwarf planet Ceres at more than 600 miles in diameter to grains of dust. In the early solar system, asteroids (along with comets) could have been partly responsible for delivering water to fill the ocean of a young Earth. They could have also brought organic molecules to Earth, from which life eventually evolved.

Jupiter's gravity keeps the asteroids pretty much in their place in the asteroid belt, and doesn't let them accrete to form another planet. If Jupiter had moved inward through the asteroid belt toward the Sun, it would have scattered the asteroids in all directions before Earth had time to form. And no asteroid belt means no impacts on Earth, no water delivery, and maybe no life-starting molecules either. Asteroids may have also delivered such useful metals as gold, platinum, and iron to Earth's crust.
But, if Jupiter had not migrated inward at all since it formed father away from the Sun, the asteroid belt would be totally undisturbed and would be a lot more dense with asteroids than it is now. In that case, Earth would have been blasted with a lot more asteroid impacts, and life may have never had a chance to take root.

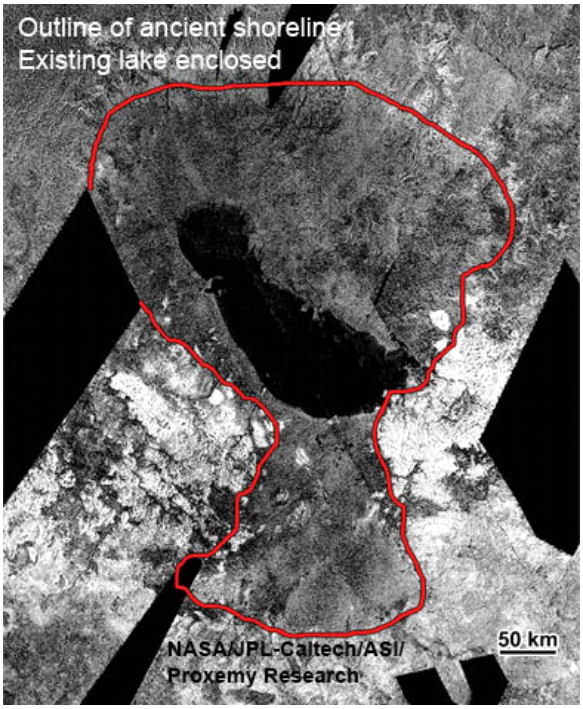
The infrared data from the Spitzer Space Telescope contributes in unexpected ways in revealing and supporting new ideas and theories about our universe. Read more about this study and other Spitzer contributions at spitzer.caltech.edu. Kids can learn about infrared light and enjoy solving Spitzer image puzzles at spaceplace.nasa.gov/spitzer-slyder.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

AstroSpace Update

December 2012

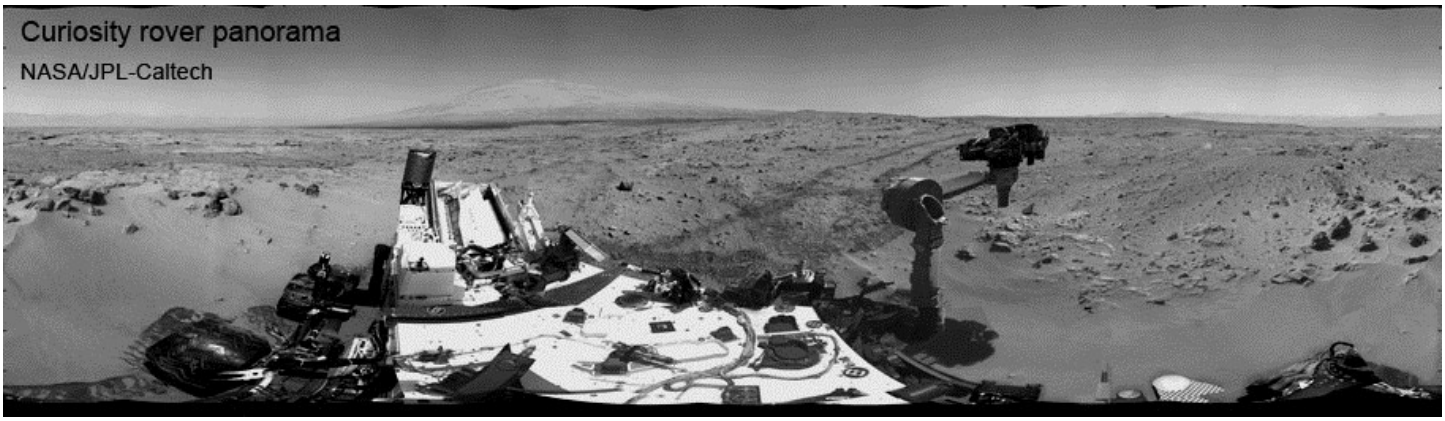
Gathered by Don Lynn from NASA and other sources



Cassini (Saturn orbiter) has taken radar images of the moon Titan showing a feature like a giant hot cross bun and features that are shorelines of 2 ancient seas, now dried up except for a lake in the bottom of one. The seas contained liquid hydrocarbons, including ethane and methane, since Titan is far too cold for liquid water. Scientists have seen features like the hot cross bun on Venus. The Titan bun is about 40 miles (70 km) across, and is probably the result of fractures caused by uplift from below. The dried-up seas are found in the southern part of Titan. All the large liquid bodies on Titan are found in the northern part. Some scientists have theorized that slow changes in the orbit of Titan cause temperature and climate changes over many thousands of years that would favor first one pole then the other for heavy enough hydrocarbon rain to fill such seas. Recent radar images of the northern regions show that the lakes and seas there show extremely little change since images taken 6 years earlier. This shows that the northern lakes are fairly permanent, not like the lakes found in the equatorial region, which fill and empty as rain comes and goes.

Cassini has also taken images of Titan in the dark, showing a very faint glow emanating from throughout the atmosphere. This glow persisted even after subtracting light reflected off Saturn. Something like aurora had been expected from the upper atmosphere, above 400 miles (700 km), but this was mostly from lower in the atmosphere. Scientists' best guess is that the glow is being caused by cosmic rays or else by some chemical reaction.

Cassini has tracked for nearly a year the rare massive storm that wrapped all the way around Saturn in a band. Such storms typically happen only once in a Saturn year (29 Earth years). This observation revealed record-setting disturbances in the planet's upper atmosphere long after the visible signs of the storm abated. Infrared data shows that the temperature in the stratosphere soared 150° F (83° C) above normal. This part of the atmosphere is usually quite stable in temperature. There was also a huge increase in the amount of ethylene gas. That gas is not typically observed on Saturn.

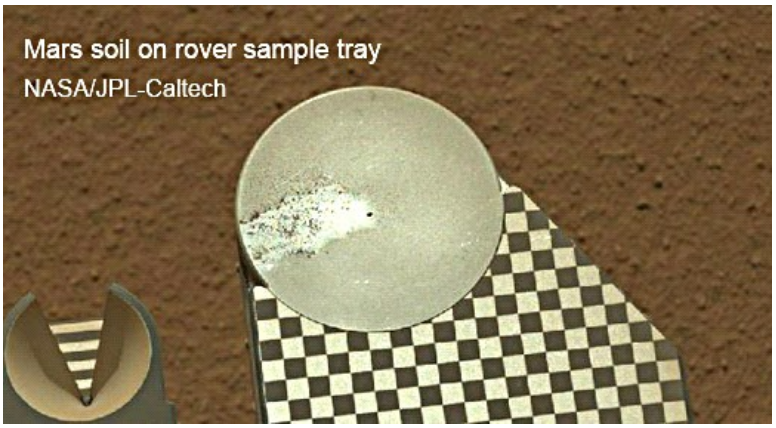


Mars rover Curiosity has measured the mix of isotopes in the air of Mars, and has found a 5% enrichment of heavy isotopes of carbon from what the atmosphere probably formed with. Argon was also found to be enriched with heavier isotopes. Mars now has about 140 times lower atmospheric pressure than Earth, but geologic evidence suggests in the distant past the red planet had much

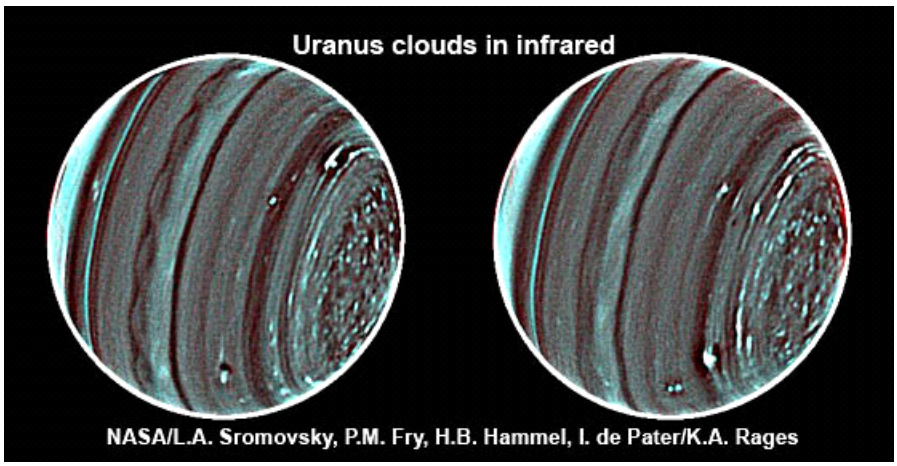
more atmosphere. The means by which much of Mars's atmosphere was lost have to favor loss of lighter isotopes in accordance with the new measurements. Further data that will indicate the exact method of atmospheric loss is expected from MAVEN, a mission to Mars that is scheduled for 2014.

Curiosity's atmospheric measurements also looked for **methane**, traces of which have been detected in some places on Mars at some times by past spacecraft and telescopes. The new measurement showed 1 part per billion of methane, with uncertainty of 5, which likely means that no methane was present. Theory has it that methane should break down in the atmosphere of Mars in a matter of decades, and that any new methane released should spread around the planet in months. This does not fit with finding no methane now after detections in recent years. What it probably means is that methane is disposed of much faster than thought, but it could mean that the previous detections were in error, or that released methane does not distribute to all parts of the planet. Curiosity will continue to periodically sample for methane throughout its mission to see if measurements vary with place or time. There is also an enrichment mode of atmospheric measurement, which has much lower uncertainty, and this will be performed. Methane is of interest because one possible source of it would be underground microbial life, if that exists on Mars. However non-living processes also make methane.

Curiosity completed its first analysis of Martian soil that used the X-ray diffraction instrument, which measures the spacing of atoms in crystals, and so can identify minerals. It found the sandy, dusty soil contains feldspar, pyroxenes and olivine mixed with roughly half non-crystalline material (probably volcanic glass and erosion products of it). This is similar to volcanic soils found in Hawaii. The sample collection scoop also placed some soil on the inspection tray on the rover, and then took close-up images of it. Scooping was briefly delayed when 2 types of foreign-appearing objects were seen in images of the soil. 1 was identified as a piece of the rover, probably a spot of glue used to hold wiring that apparently shook loose during landing. The other was a light-colored large grain that contrasted with most of the sand, but is probably of natural Martian origin. The scoop of soil used for analysis was chosen to have neither type of object in it.



Curiosity has monitored the **weather**, including wind patterns, in Gale Crater. It was expected that different heating at different elevations would cause winds to blow up or down slopes, but instead winds generally blow through the low zone between the central mountain and the crater rim, perpendicular to the upslope directions. 20 atmospheric events have been recorded that show at least some of the characteristics of whirlwinds, though none have been seen visually in Gale Crater. A daily cycle of higher atmospheric pressure in the morning and lower pressure in the evening has been recorded by the rover. As morning works its way westward around the planet, so does a wave of heat-expanded atmosphere, known as a thermal tide. That tide correlates with higher and lower radiation levels detected by Curiosity; thicker atmosphere shields the ground from some of the incoming charged-particle radiation. As the season changes, carbon dioxide that had been frozen in the southern ice cap turns to gas, resulting in a seasonal increase in pressure, which the rover has measured.



Uranus weather – Using the Keck II Telescope in Hawaii, operating in infrared, astronomers have made the best images from Earth of the weather on Uranus. In visible light, the planet is quite bland, with very few clouds ever showing. Observations were made with 2 different filters that penetrate to different depths in the atmosphere. Winds were measured at up to 560 mph (900 kph), in spite of the low level of sunlight at the planet to drive winds. Cloud-top tempera-

tures are near minus 360° F (-218° C). Some weather systems stay at fixed latitudes while others drift toward the equator. New features found included a scalloped band of clouds just south of the equator and a swarm of small convective features in the north polar regions. No similar features have ever been seen in the south polar regions.

Lunar water – A new study of the water detected near the poles of the Moon has concluded that the source is solar wind. Protons, which are hydrogen atom nuclei, make up much of the solar wind. When this strikes oxygen in the Moon's surface, it creates hydroxyl (OH). This can react with other material to form water (H_20) or hydrated (water-bearing) minerals. These minerals may be stable, particularly at low temperatures found in lunar polar craters, but the water has to have a layer of dirt over it to be stable even at low temperatures. But there is plenty of dirt (regolith) on the Moon. The new study used infrared spectroscopy and mass spectrometry to analyze lunar samples. These samples were not from the polar regions, and most of the "water" in the samples was actually hydroxyl.

Moon formation – Since analysis of Apollo moon rocks, astronomers have generally believed that the Moon was formed fairly early in the history of the solar system when a smaller planet collided with Earth, throwing much melted rock into orbit, which then conglomerated into the Moon. One of the predictions of this theory is that some elements should be enriched in heavier isotopes in lunar material. This is because heavier isotopes condense from vapor to solid a little faster than light isotopes. No one had found this enrichment until now. A new study of Apollo moon rocks and meteorites that came from the Moon found them to be enriched in heavy isotopes of zinc. This ties up a loose end in the theory of lunar formation by impact. The study also found depletion in moon rocks of elements that are more easily vaporized, another prediction of the impact theory. However this depletion had already been seen in previous studies.

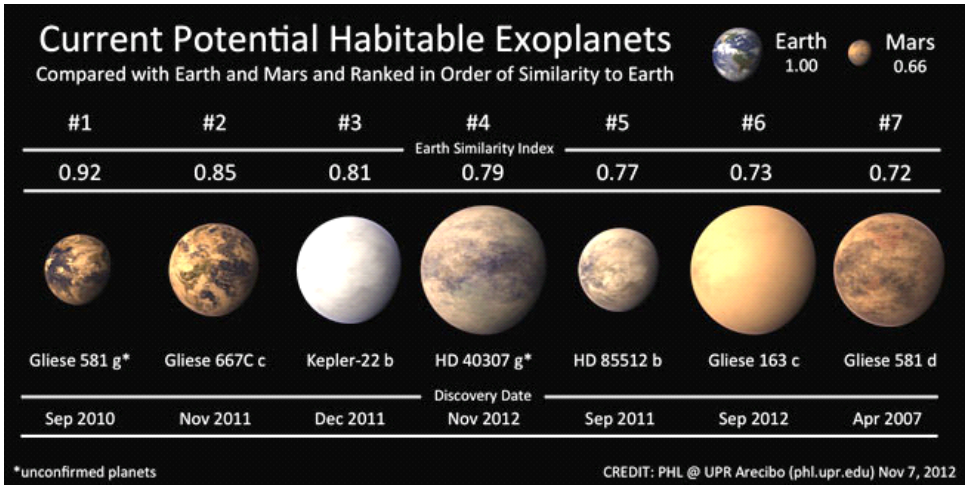
Dawn (asteroid mission) data shows that space weathering, the darkening that affects many airless bodies, such as the Moon, does not seem to occur on the surface of Vesta. It is known that small impacts continually mix the outer layer of broken debris. Also Vesta has unusually steep topography, which leads to landslides, which further mix the surface material. Apparently these differences allow Vesta to always present a fresh surface. Also Dawn data has explained the dark splotches on the surface. These are likely deposits of carbon-rich material from small asteroids colliding with Vesta. From the amount of dark splotches, it is estimated that roughly 300 carbon-rich asteroids of between 0.6 and 6 miles (1-10 km) have collided with Vesta during the past 3.5 billion years.

Nearest exoplanet – Our nearest neighbor star, Alpha Centauri, only 4.3 light-years away, was found to have a planet. Alpha is actually a triple star, and the planet orbits the "B" star (2^{nd} in brightness of the 3). The planet has about the mass of Earth, but is not very Earth-like because it orbits quite close to its sun (3 ½ million miles, or 6 M km), having a year of only 3.2 Earth days. This keeps the planet quite hot. It is the smallest mass exoplanet known to orbit an ordinary star (smaller ones are known orbiting a pulsar). The discovery was made using the HARPS spectrograph at the La Silla Observatory in Chile by measuring the wobble in the motion of the star due to the gravity of the planet. Because rocky planets tend to be found in groups, it is hoped that eventually other planets may be found orbiting Alpha Centauri, perhaps even ones in the habitable zone (where temperatures would allow liquid water to exist).

Ex-exoplanet – Astronomers using the 9-meter Hobby-Eberly Telescope in Texas have found material, including lithium, in the surface of a star, which would not be there unless the star had recently devoured a planet. The star still has a planet orbiting it, but in a highly elliptical orbit. The devouring of one planet and disturbing another into such an orbit may be related.

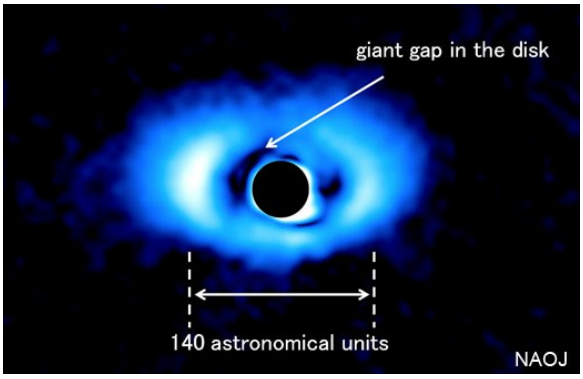
Reinstated exoplanet – I reported here in 2008 that a planet had been imaged orbiting the star Fomalhaut, and then last March that a second group of astronomers felt the object was just a dust cloud, not a planet. A 3^{rd} team has examined the data and made more observations, and concluded that such a cloud would dissipate in astronomically short time, unless there is a planet inside the cloud. They, like the 2^{nd} team, were unable to image the planet/cloud in infrared, this time using the Subaru Telescope in Hawaii. But instead of concluding that this casts doubt on the existence of a planet, they felt that it simply limited the size of the planet. Anything below twice Jupiter's mass would be below detectability in both the new and previous infrared observations. Objections by the 2^{nd} team regarding the path of the object were remeasured in the new study, and found this time to be consistent with a planet that is affecting the ring about the star in the way observed. Yet another team is observing Fomalhaut with the Hubble Space Telescope, so we can soon expect a 4^{th} opinion on the planet.

Habitable zone planet – Astronomers trying to confirm 3 possible planets found by their transiting the star HD 40307 have found 3 more planets orbiting the same star. All are super-Earths, that is, planets more massive than Earth, but not so large that they are likely gas giants. The outermost of them is in the star's habitable zone, that is, at a distance where temperatures would allow liquid water to exist on its surface. It is far enough from its star that it is likely not tidally locked; that is, it probably rotates to produce night and day, rather than sticking one side toward its sun forever. The new discovery has been added to the official list of Earth-like planets, and has been ranked as 4th most Earth-like. Average temperatures are estimated to be about 9°C (48°F), assuming a similar atmosphere to Earth, but scaled up. It orbits at 60% the distance from its star as Earth does from the Sun, but the star is cooler than the Sun. Its year is about 200 Earth days, and its mass is estimated as 7 times that of Earth. More observations are needed to confirm estimates and better characterize the planet.



Planet Hunters is a group of volunteers from the public who examine data from the Kepler exoplanet-finding mission to try to recognize really subtle or unusual changes in light level that are overlooked by the computer programs. The 1st planet found by this group is orbiting both stars of a binary pair, which in turn has another pair of stars orbiting much farther away. On this planet, one would see 2 suns and 2 extremely bright stars that slowly circle the sky. This is the 1st planet found in such a system. Follow-up observations with the Keck Telescope in Hawaii show that the planet is a gas giant a little larger than Neptune, having a mass about 170 times that of Earth, making it quite dense. It orbits its suns in 138 Earth days. The suns orbit each other every 20 days. One sun is somewhat more massive and brighter than our Sun, and the other is considerably smaller and dimmer than our Sun. The stars eclipse each other, and it took a person, rather than a computer, to figure out the combined eclipse and planet transit.

Kepler (planet-finding space telescope) is finding planet candidates far faster than they can be confirmed, so is a rousing success. But unexpected noise in the data is causing problems. Scientists are able to process out this noise, but it takes more observations over longer time to do so. Also, sun-like stars have been found to be more variable than thought, which also adds to the observations needed to separate star variability from planet transits. The Kepler team believes that they can meet all the goals of the mission, including finding several Earth-like planets, but estimate that it will take 8 years instead of the planned 4 years. The question is whether the spacecraft will last 8 years. It has already had one reaction wheel fail, and there was only one spare. Operating procedures are being changed to reduce stress on the remaining reaction wheels. Kepler completed its originally planned mission in November, and has been approved for an extended mission that could last up to 2016 if the hardware holds out.



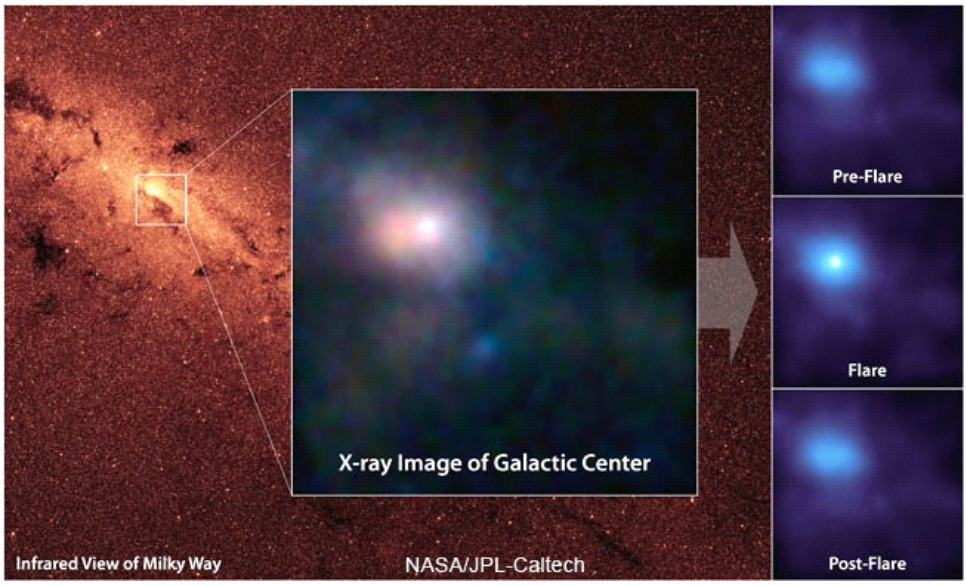
More exoplanets – The high contrast adaptive optics instrument on the Subaru Telescope in Hawaii has been used to image in infrared disks about the star PDS 70, a young star about the mass of the Sun. It is located 460 light-years away in Centaurus. There are several large gaps at varying distance from the star. These are thought to be the result of newly-formed planets having cleared the surrounding space of dust. It is believed that multiple planets may be present at the largest gap, since no single planet could have created such a large gap.

Free-floating planet – Astronomers have identified a body that is very probably a planet wandering through space without a parent star. Though a few others are known, this is the closest yet found, at about 100 light-years away. Its proximity, with no bright star close, has allowed the team to study its atmosphere. It is difficult to distinguish such a free-floating planet from a brown dwarf. One way is to determine the age of the object, but this is rarely possible. In this case, it was found that the motion of the object through

space matched that of a nearby moving group of young stars (the AB Doradus Moving Group), a stream with a common birth place and time. The Group's age has been measured as being between 50 and 120 million years. A brown dwarf of that age would not match the observations, so the object is very probably a planet. Given that it is a planet of that age, its temperature would be about 430°C (800°F), and its mass would be 4-7 times that of Jupiter. The astronomers were executing a project to find brown dwarfs, but came up with an even more unusual object.

Puffed-up galaxy – Astronomers using the Hubble Space Telescope have observed a galaxy 10 times the diameter of our Milky Way, with the largest core known. The core is diffuse with a fog of starlight, and not concentrated about a central black hole. It is about 3 billion light-years away, and is the brightest member of the galaxy cluster known as Abell 2261. Astronomers have proposed 2 theories explaining why the core is so puffed up: 1) a pair of merging black holes gravitationally stirred up and scattered stars, 2) merging black holes were thrown out of the core, leaving it without sufficient mass to hold it together, so it spread out. The astronomers are now conducting further observations with the Very Large Array radiotelescope in New Mexico. If a black hole is still present in the core, it should show up in radio observations.

Galaxy evolution – A study of hundreds of galaxies observed by the Keck Telescopes and the Hubble Space Telescope has revealed that today's spiral galaxies have undergone changes in form over the past 8 billion years. Many astronomers had thought that spiral galaxies had settled into their present forms by 8 billion years ago, but the new data shows that is generally not true. The study selected blue galaxies, those with stars forming. The range of distances to galaxies in the study was up to 8 billion light-years, so the astronomers could put together the history of blue galaxies for the last 8 billion years. In this time period the number of mergers between galaxies large and small has decreased sharply, as has the overall rate of star formation. Early in this time span the blue galaxies tend to exhibit disorganized motions in multiple directions, and over time steadily shifted toward greater organization, settling into well-behaved disks.



Chandra (orbiting X-ray telescope) – The black hole at the center of our Milky Way galaxy (or more precisely, its surrounding accretion disk) gives off a steady low level of X-rays from material falling in. About once a day a bigger chunk falls in, giving off a small flare of X-rays. Chandra happened to catch it emitting a huge flare for more than an hour, 150 times the background level. Further observations will be made to try to catch more of these larger flares, since that may allow greater understanding of how these occur, through observing spectra, rise and fall of X-ray emission, etc.

Chandra and other telescopes have identified a supermassive black hole with one of the lowest known masses in the center of a galaxy. That galaxy, NGC 4178, is a spiral galaxy without a central bulge. This type is not expected to harbor a supermassive black hole. The mass of the black hole was estimated using relationships between mass and the amount of X-rays and radio emission, the result being less than 200,000 times the mass of the Sun. Most supermassive black holes are millions up to billions of Sun masses. Only a handful of galaxies without bulges are known to contain supermassive black holes, and 2 of those are also at the low end of supermassive black hole masses.

Fermi (gamma-ray space telescope) has measured the total amount of visible and ultraviolet (UV) light ever emitted by stars. To gamma rays, visible and UV light look like a thin fog that occasionally absorbs a gamma ray photon, turning it into an electron-positron pair of particles. By measuring the rate at which gamma rays absorb at different times in the history of the Universe, the history of starlight emitted can be constructed. The Fermi observations tracked gamma rays emitted by 150 very distant blazars. The

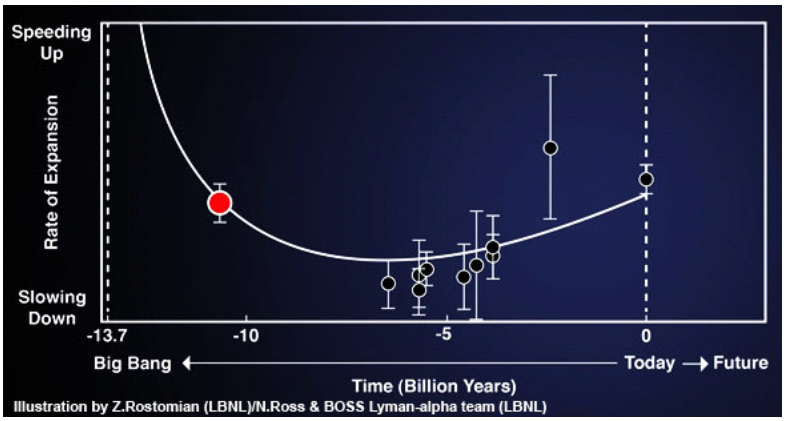
result is that the average stellar density in the cosmos is about 1.4 stars per 100 billion cubic light-years. Measuring the background of starlight was one of the primary mission goals for Fermi.

Spitzer (infrared space telescope) – A new study using Spitzer data suggests a cause for the glow of infrared light seen across the entire sky: the light from isolated stars beyond the edges of galaxies. These stars are thought to have once belonged to the galaxies before violent galaxy mergers stripped them away into relatively empty space outside their former homes. Individually the stars are too faint to see, but their collective glow is seen by Spitzer. This study disagrees with a previous one that attributed the infrared glow to light from the very first stars and galaxies to form after the Big Bang. The new study observed a larger portion of the sky and found the pattern of the background light did not match that expected from first stars and galaxies. More research is needed to confirm that stars tossed outside galaxies indeed make up a substantial part of the background infrared. Finding a similar pattern in visible light, or observing infrared with greater resolution (such as with the future Webb Telescope) might confirm it.

Stolen stars – Observations looking for MACHOs (massive compact halo objects) about the Large Magellanic Cloud (LMC) did not find enough of them to substantially contribute to the missing mass problem, but instead found a stream of stars gravitationally stolen from the Small Magellanic Cloud (SMC) during a close pass hundreds of millions of years ago. The observations used microlensing, the brightening of background stars when a massive object passes in front. A bridge of gas between the LMC and SMC has long been known to exist, another indication of this past encounter. The stolen stars that were microlensed have not been directly imaged, but a number of teams of astronomers are attempting to do this.

Dusty star – Young stars often are surrounded by a disk of dust and gas. But these disks dissipate quickly as stars age. Additionally, if a star becomes a red giant, it swells to huge size and engulfs any material near the star. Astronomers have found a white dwarf, which is the result after the red giant phase, and is a very old star, and it has dust and gas around it. The star was found in data from WISE (now retired infrared space telescope). The star is a member of a binary, orbiting closely about a red dwarf star every 3 hours. This is the only example known of a binary containing a star post-red-giant-phase that has a dust disk. The dust extends out to about the same distance as Venus's orbit about our Sun. Since the red giant phase would have destroyed such a disk, there must be a new source of dust. One possibility is that multiple asteroids that orbit farther away collide. Another is that the companion star is releasing large amounts of gas, which then cool and condense to form dust.

Gassy star – Only 2 stars more than about 10 million years old have long been known to have surrounding gas disks, one of those being 49 Ceti, a naked-eye star. One of the same astronomers who discovered the disk about 49 Ceti 17 years ago believes he has now explained how the disk formed after young-star disks should have dissipated. The new explanation is that the star has a cloud of comets similar to our Sun's Kuiper Belt, but with about 4000 times the number of comets. This would create collisions every few seconds, sending a huge amount of matter, including a lot of carbon monoxide gas, flowing in toward the star and forming the disk we observe. It is estimated that the collisions and rain of material has been going on for about 10 million years.



Expansion of the Universe – The Sloan Digital Sky Survey III has mapped the locations of giant gas clouds along lines of sight from 50,000 very distant quasars from the effects of the clouds on the quasar spectra. Astronomers then analyzed the clustering patterns of these clouds to determine the expansion rate of the Universe at a time only 3 billion years after the Big Bang. This is the farthest back in the past that the expansion rate has been measured. This was at a time when gravity was a stronger force than dark energy, and thus the expansion rate was slowing. The expansion rate was known from previous work to be speeding up during the most recent 5 billion years due to dark energy.

Star formation – Data from 3 different ground-based observatories has allowed astronomers to snapshot the star-forming rates of the Universe when it was 2, 4, 6, and 9 billion years old (after the Big Bang). By comparing the snapshots, astronomers were able to accurately track changes in the rate over the past 11 billion years. This was the most complete survey ever made of star-forming galaxies at different distances. The rate of production of stars was found to have continuously declined over the past 11 billion years, being 30 times lower today than at its likely peak, 11 billion years ago. If the measured decline continues then no more than 5% more stars will ever form. Half of the stars present were born in the boom that took place between 11 and 9 billion years ago, and the rest of the stars took about 5 times as long to form.

Hubble Space Telescope has mapped out a giant filament of dark matter in 3D for the 1st time. Extending 60 million light-years from one of the most massive galaxy clusters known, the filament is part of the cosmic web that constitutes the large-scale structure of the Universe. If the high mass measured for the filament is representative of the rest of the Universe, then these filaments may contain more than half of all the mass in the Universe. Computer simulations of the development of the Universe predict that dark matter condensed into these filaments, and massive galaxy clusters formed at their intersections. The dark matter was mapped by its effects in bending light (gravitational lensing) from objects behind. Using ground-based telescopes, spectra were taken of the galaxies embedded in the dark matter, and then computer simulations adjusted dark matter location in 3D until it duplicated the galaxy motions measured.

More Hubble – Astronomers using Hubble observed one of the most distant and brightest quasars known and were unable to see the galaxy hosting the quasar. The best explanation is that the entire galaxy is shrouded in so much dust that the starlight is completely hidden. The quasar is so distant that we are seeing it as it was less than 1 billion years after the Big Bang. Previous observations in submillimeter radio showed that the quasar is quite dusty. This would be a good candidate to observe with the future Webb Space Telescope, since it will observe in longer infrared wavelengths than Hubble can, and will be more sensitive, and so might find the galaxy surrounding the quasar.

Yet more Hubble – A program to observe 25 huge galaxy clusters with Hubble, in order to see what very distant objects behind the clusters are gravitationally lensed, has found a very small galaxy that is the most distant one known. The best estimate is that we are seeing light from that galaxy which was emitted only 420 million years after the Big Bang. It has a redshift of 11, meaning that wavelengths of light have been stretched to 12 times as long by the expansion of the Universe that has occurred while the galaxy's light was on its way to us. The lensing effect of the gravity of the cluster in front has produced 3 separate images of the galaxy, and has magnified the brightness of the images up to 8 times. Without this magnification, the galaxy would be too dim to find. The light from the galaxy passed the lensing galaxy cluster 8 billion years after it was emitted. The galaxy is tiny: only about 600 light-years across. It is likely just a building block later combined with others to form a larger galaxy. The observing program uses 17 filters passing different wavelengths of light to find extremely red objects, which are likely very distant objects whose light has been strongly redshifted. The newly found object showed up in only the 2 reddest (actually infrareddest) filters. A map of the gravity of the lensing cluster was made, and computer simulation of light passing through it from an extremely distant galaxy was found to match the 3 lensed images actually seen. The galaxy was then observed by the Spitzer infrared space telescope. Then months were spent ruling out other possible sources (objects inherently red without substantial redshift) that could produce the observations. The galaxy was barely seen by Spitzer, so longer exposures will be made with that same telescope to estimate its age and dust content. The same observation program announced the previous record holder earlier this year.

Instant AstroSpace Updates

A new study finds that most planetary systems that have a Jupiter-like planet have experienced that planet migrating through the region where an asteroid belt would form, thereby most likely destroying the belt. So systems like our Solar System with a giant planet and a still-existing **asteroid belt** are probably rare.

NuSTAR (recently launched short wavelength X-ray space telescope) has begun observing the center of our Milky Way galaxy, and serendipitously found it flaring up in X-rays. The flare indicated material was falling into our galaxy's central black hole.

Observations using the Gemini Telescope in Hawaii have resolved at least 4 distinct pieces in the nucleus of **Comet Hergenrother**, indicating that it is breaking up. This has thrown more dust into the comet head and brightened it.

The Radiation Belt Storm Probes, twin spacecraft to measure the Van Allen radiation belts about the Earth, have been renamed, appropriately enough, the **Van Allen Probes**, after the discoverer (in 1958) of the belts of charged particles. Van Allen was the principal investigator on 24 spacecraft, and discovered radiation belts at Saturn also.

Steve Condrey

The Development of Astronomy During the Middle Ages and Early Renaissance

Among the topics to be covered:

- The development of mechanical timekeeping, which would be critical to the development of astronomy as a whole
- Development of the astrolabe, armilliary sphere, and various models of the universe
- Notable figures from the period

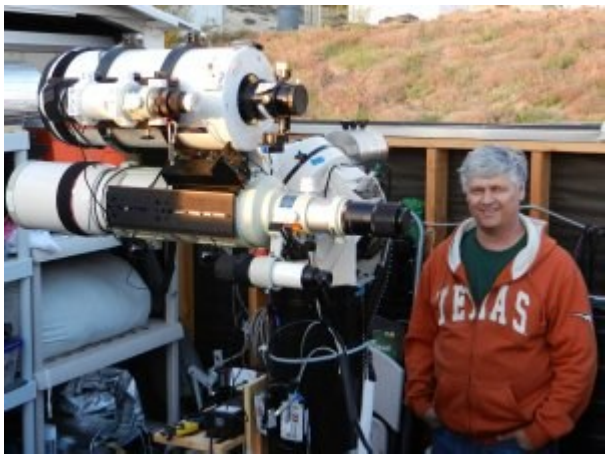
I have been an OCA member for 18 years; editor of the Sirius Astronomer from 2003-present; and have served two terms as a Trustee (2006-2007). I am a graduate of UC San Diego (1991) with a degree in the history of science, emphasizing medieval and Early Modern scientific development. Although I enjoy observing, recent developments including graduate school and relocation to the not-so-dark skies of Anaheim have forced me into armchair astronomy. In addition to studying the history of astronomy, I am active in the Astrophysics SIG. For my day job, I am a quality system manager with the US Food and Drug Administration and am an ASQ Certified Quality Engineer. I have been married to my wonderful wife Sandy since 2004 and have two children, Alex (age 6 and a frequent visitor to Anza) and Morgan (age 2, who still needs to be initiated).

Kyle Coker

Watching an Aurora

I have a brief explanation of the Aurora followed by a travelogue of our Alaska trip last year. I end with the photos and video I made of the Aurora.

I've been a member since 2003, just before the great Mars opposition when it was as big as the moon. I'm on the board for I think 4 years now, I'm an observatory holder, and my main interest is astroimaging. I have taught the beginner's class in astrophotography for over 6 years now. I graduated from the University of Texas with a degree in biology and went to medical school at the University of Texas at Galveston. I did my internship and residency at LAC-USC and a hand fellowship in Los Angeles. I have been practicing orthopedic surgery with a specialty in hand surgery in the Laguna Hills area since 1983. I'm married to Diane who is a physical therapist specializing in hand therapy and have 2 grown children Chris and Becky.



Perennial crowd-pleaser Jupiter is well-placed for observation throughout the night in December. This image captured by Pat Knoll also features Jupiter's moon Io and its distinctive reddish-orange coloring. Pat used a 10-inch Meade LX200 at f/25, compiling the image from 2680 frames using Registax. This image was taken from Kearney Mesa, near San Diego, on November 21st under what Pat called 'the best seeing conditions yet.'

The stars arch over Arches National Park in Utah in this image created by Leon Aslan on November 15th. Leon used a Canon 5Di imager with a Zeiss ZE 21mm lens to create this image.

FOR SALE

Skywatcher 100ED f9 Refractor with Celestron CG-4 mount. Scope comes with a hard case, 8x50mm finder; 2 LET eyepieces, 2-inch dielectric diagonal; Baader solar filter. CG-4 mount has motor drives on both equatorial and declination axes. All in excellent shape for $650 or best offer.

Celestron Sky Prodigy 90mm Maksutov with all attachments, $375.

Vixen Porta II Altazimuth Mount, $100; Telrad finder, $25.

Contact Val Akins (949) 382-1869

SIRIUS ASTRONOMER
www.ocastronomers.org
The Newsletter of the Orange County Astronomers

Nonprofit Organization
U.S. Postage
PAID
Santa Ana, CA
Permit No. 1468

NEWSLETTER OF THE
ORANGE COUNTY ASTRONOMERS
P.O. BOX 1762
COSTA MESA, CA 92628

RETURN SERVICE REQUESTED

DATED MATERIAL
DELIVER PROMPTLY

HANDY CONTACT LIST

CLUB OFFICERS (to contact the entire board at once, send an email to board@ocastronomers.net)

President	Reza AmirArjomand	reza@ocastronomers.net	646-494-9570
Vice-President	Greg Schedcik	gregs@ocastronomers.net	714-322-5202
Treasurer	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Secretary	Bob Buchheim	Bob@RKBuchheim.org	949-459-7622
Trustee	Kyle Coker	kcoker@cox.net	949-643-9116
Trustee	Sheila Cassidy	rivme@pacbell.net	951-360-1199
Trustee	Sam Saeed	sam@isismagna.com	714-310-5001
Trustee	Gary Schones	gary378@pacbell.net	951-687-7905
Trustee	Steve Short	nightskytours@hotmail.com	714-771-2624
Trustee	Alan Smallbone	asmallbone@earthlink.net	818-237-6293
Trustee	Barbara Toy	btoy@cox.net	714-606-1825

COMMITTEES, SUBGROUPS, AND OTHER CLUB VOLUNTEERS

Anza House Coordinator	Doug Acrea	dougcarola@att.net	949-770-2373
Anza Site Maintenance	Don Lynn	donald.lynn@alumni.usc.edu	714-775-7238
Beginner's Astronomy Class	David Pearson	astrodwp@dslextreme.com	949-492-5342
Black Star Canyon Star Parties	Steve Short	nightskytours@hotmail.com	714-771-2624
Explore the Stars OCA Contact	Bob Nanz	bob@nanzscience.com	760-751-3992
Librarian	Karen Schnabel	karen@schnabel.net	949-887-9517
Membership, Pad Coordinator	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Observatory Custodian/ Trainer/Member Liaison	Barbara Toy	btoy@cox.net	714-606-1825
OCA Outreach Coordinator	Jim Benet	jimbenet@pacbell.net	714-693-1639
Sirius Astronomer Editor	Steve Condrey	startraveler68@yahoo.com	714-699-1243
Telescope Loaner Program	Mike Myers	loanerscopes@twow.com	714-240-8458
WAA Representative	Tim Hogle	TimHogle@aol.com	626-357-7770
Webmaster	Reza AmirArjomand	reza@ocastronomers.net	646-494-9570

SPECIAL INTEREST GROUPS (SIG's)

AstroImagers SIG	Alan Smallbone	asmallbone@earthlink.net	818-237-6293
Astrophysics SIG	Bob Sharshan	RSharshan@aol.com	714-845-6573
Dark Sky SIG	Barbara Toy	btoy@cox.net	714-606-1825
Remote Telescopes	Del Christiansen	DelmarChris@earthlink.net	714-895-2215
GoTo SIG	Mike Bertin	MCB1@aol.com	949-786-9450