FIRST LIGHT

Journal of the South Bay Astronomical Society - January 2003
on line at www.geocities.com/sbas_elcamino

Monthly General Meeting: Friday, January 10th, 7:30 PM

Guest Speaker: Mr. Chris Ihde (UCLA)

”Cassini Mission to Saturn”

Astronomers Find Life on Earth

Now that the discovery of extrasolar planets, or planets around distant stars, has become relatively routine, scientists are now tackling the next step: finding life-bearing worlds. To do this, observers must know what signs to look for in the feeble light from these faraway planets. Astronomers at the Harvard-Smithsonian Center for Astrophysics (CfA), in collaboration with researchers at the University of Arizona's Steward Observatory, have identified key signatures of life by studying Earthshine-the light of the Earth reflected off the dark side of the Moon. They found clear signs of water and an oxygen atmosphere, as well as tentative signs of plant life. Their findings give a clear indication of what "fingerprints" to search for when seeking life on Earth-like worlds orbiting distant stars.

"Our research is paving the way for future missions like the Terrestrial Planet Finder," says Smithsonian astronomer Wes Traub. "Hopefully, within the next 10 years astronomers will be able to confidently say that some as-yet-undiscovered planet is a living world like our own." So far, astronomers can only detect Jupiter-like planets around other stars because such planets are large and create strong gravitational signals. However, as technology continues to improve, astronomers soon will be able to locate Earth-like extrasolar planets and study their dim light to search for signs of life. To know what to look for, they must use the example of the one planet where life is known to exist: the Earth.

To replicate the view that a distant astronomer would have if studying the Earth from another planet, Traub and his colleagues used the nearby Moon as a mirror. Using the Steward Observatory 90-inch telescope at Kitt Peak, Arizona, they measured both the light of Earthshine from the Moon and the light of the Moon itself, then corrected the Earthshine to determine how the Earth would appear to a faraway observer. They compared this measured spectrum to a model created by Traub and CfA's Ken Jucks. The team found that Earthlight shows strong evidence for water – a necessary ingredient for life as we know it - and for molecular oxygen, which must be continually replenished by the processes of life to remain in the atmosphere. They also found features that suggested the presence of chlorophyll, indicating the existence of land plants. The latter showed up as bright reflections in the far-red region of the visible spectrum. This "red edge" is a well-known signature of chlorophyll, which appears green to us only because our eyes aren't very sensitive at the red end of the visible spectrum.

The team also suggests that changes for finding life-bearing worlds are improved because the signatures can develop early in a planet's history and last for a long time. Our home planet has maintained an oxygen atmosphere for the past two billion years, and has shown a "red edge" since the first land plants evolved 500 million years ago. "If someone out there is watching our solar system," Traub points out, "they could have detected plant life here long before any intelligent life appeared."

These measurements complement those made by the Galileo spacecraft during a 1990 fly-by of Earth. As reported in the October 21, 1993 issue of Nature, instruments aboard the spacecraft also found evidence of gaseous oxygen and land plants. However, the Galileo measurements were made while it was close to the Earth and show

conditions only in limited areas of the planet's surface. Studying Earthlight, on the other hand, yields a spectrum integrated over the entire visible surface of the planet, which matches the view that would be available to a distant astronomer in another star system. The astronomers suggest that follow-up studies be conducted over a longer period of time to see how Earthlight changes as different areas of the planet rotate into view, and as cloud cover changes.

An artist's depiction of our world when the Earthshine measurements were taken, enhanced to show the "red edge" from vegetation, is online at **http://cfa-www.harvard.edu/ep/pressrel/pr0223_image.html.** Headquartered in Cambridge, Massachusetts, the Harvard-Smithsonian Center for Astrophysics (CfA) is a joint collaboration between the Smithsonian Astrophysical Observatory and the Harvard College Observatory. CfA scientists organized into seven research divisions study the origin, evolution, and ultimate fate of the universe.

Backyard Observing

Since I hadn't been able to get out to any dark-sky sites this month, I had to settle for a little in-town viewing from my backyard. That's gotten a bit more difficult in the last year as the banana, avocado and orange trees have grown up so much. They do cut down direct view of nearby lights but they also limit the amount of sky I can see. After all the miserable weather, it was a welcome sight to see blue skies again. On the night of the 13th, I set up my Nexstar 5 in the backyard, eager to try out a new polar alignment technique that I and a friend who owns a Nexstar 8 had been working on. I set up and carefully leveled the tripod, then attached the equatorial wedge and made sure the surface was still leveled.

Using the sighting tube on the wedge, I elevated it and sighted in on the North Star, laving it slightly to one side in the FOV and centering it on the approximate location of the celestial pole. Once I knew the wedge was oriented properly to north, I laid it back down level again and attached the scope. The Nexstar basic tripod being rather flimsy, it took a lot of repeated efforts to keep the whole thing level. Once I was sure the base was level, I turned on the Nexstar and elevated the OTA until it was level and made sure it was level in all directions. Then, once again, pointed the OTA towards the North star. This is the one point I realized where error could creep in. Need to work on this part a bit more. With that down, I powered down the scope.

The next step was to elevate the wedge with the scope on it to the required angle so as to align to the celestial pole. Once again, with the offset weight, the tripod tended to compress so I had to make sure the base of the assembly was level. Having down that, was gratified to find the North star in the sighting tube FOV approximately where I wanted it. Now, I turned the scope back on. All the previous effort had been to assure me that the OTA was parallel to its baseplane. As it powers up, its software initializes its azimuth and elevation. I clicked the 'UNDO' button to cancel out of the alignment procedure and manually elevated the OTA until it was a 90 degrees of declination. Before starting out, I'd used my Starry Night software to give me a view of what the precise area of the celestial pole looked like through a 25mm Plossl eyepiece on the Nexstar 5. A couple of very small nudges to the assembly in azimuth and a slight releveling, and I had the star pattern I was looking for! At approximate 45 minutes, it was a rather time-consuming procedure, but I now had the most precise polar alignment I'd ever achieved.

Having completed that portion, I returned the telescope to the position where it was parallel to the baseplane, powered down and back up and went through the two-star alignment procedure. I swung the telescope around, pointed it at a nice tight double star (65 Piscium, 1.7' of separation). The atmosphere was pretty stable in the early evening so even the 25mm could split the double but I put the 10mm eyepiece in anyway and was able to get a very good resolution, with some airy disk. Having completed my alignment procedure, I went back inside, worked on the computer, put the kids to bed, watched a bit of TV and finally came back out about 2 hours later to find the double star still fairly well centered in the 10mm FOV.

Got a fairly good look at Saturn that night before it disappeared behind the banana tree. Was able to see some cloud banding and the Cassini Division. By the time it came out above the tree, the sky had deteriorated as coastal fog began creeping in and the viewing wasn't nearly as good. Did some looks at various double stars from my list. 1.7' was about the tightest separation I was able to split. Used the built-in Tour function but quickly ran out of objects that were above the horizon at that time of the night. As the coastal fog crept in, dew became more and more of a problem and I finally had to call it quits. A pretty satisfying evening after not having hardly seen clear sky in a month.

- ***Ken Munson***

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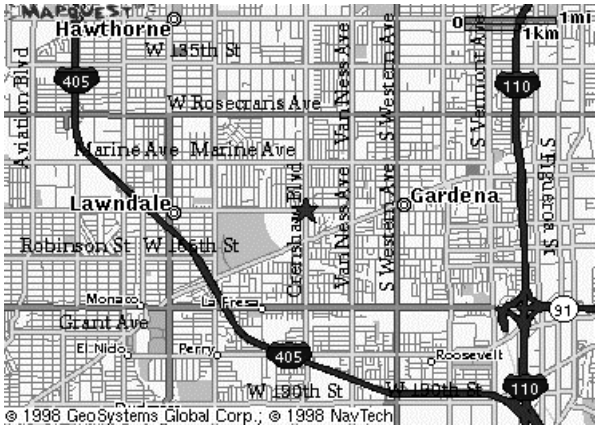
Monthly General Meetings



We normally meet on the first Friday of each month at 7:30 p.m. in the Planetarium at El Camino College. If the first Friday is on or close to a holiday, we usually defer the meeting until the second Friday of the month.

The Planetarium is on the south side of Manhattan Beach Blvd., one block west of Crenshaw Blvd. (near the center of the map at left). Click on the map to get a display that can be zoomed out for a regional view. The zoom display appears in a separate browser window, which can be closed to return to this page.

The domed roof of the planetarium is visible from the street. There is on-street parking, and we can often use campus parking: check inside to see if you need a FREE parking permit for your car. Park in northeast corner lot, temporarily, due to the construction project.

We enjoy the planetarium facilities through the courtesy of the El Camino College Administration, and have several faculty members of the Astronomy Department as members of our Club. Our meetings always include an informal opening, when new attendees are invited to introduce themselves and let us know about their interests in astronomy. Members share their latest news and observations at this time.

The rest of the evening is devoted to guest speakers, who range from amateur astronomers to professional astronomers to representatives from local aerospace companies to college professors. We are fortunate to have all these talented people in our area who are willing to come and talk to us.

Monthly Planning Meetings

Committee members (and anyone else with an interest in Society activities) meet each month, usually on the Monday following the general meeting. Meetings are sometimes rescheduled due to travel and other circumstances. Exact date and time of each month's meeting will be announced in the schedule of events in *FIRST LIGHT* each month, and should also be verified with a committee member by any member or visitor wishing to attend. All are welcome!

We will meet on Monday, January 13th at 7:30 PM at the home of Joe & Miriam Fierstein. Take Hawthorne Blvd. south past Pacific Coast Hwy. up the hill passing Silver Spur Rd. and Highridge until you get to the light at Eddinghill Dr., then turn right and go downhill to the 'T' intersection at Golden Meadow where you turn left up 2 blocks and turn left on Willow Dr. to 3rd house on the right side from the corner – 7022 Willow Dr., Rancho Palos Verdes.

SBAS Membership Benefits

*"**Welcome**"* to our newest members – Kenneth Obert and Edwin Sabin!

Contact John Collins for subscriptions, at club rates, to "Sky & Telescope" at $29.95 and $29.00 for "Astronomy" magazines! Make your check payable to SBAS and mail payment and your subscription / renewal form directly to SBAS c/o Microcosm, Inc. at 401 Coral Circle, El Segundo, CA 90245-4622.

Part of your SBAS membership dues goes toward membership in the Astronomical League. All paid members should be receiving the "Reflector", the league's newsletter, four times a year. As a member organization, we can participate in a number of award programs they offer. These are based on completing various observing challenges. Check out the Astronomical League website at **www.astroleague.org**

NexStar 8 Available to SBAS Members

All members in good standing (with at least six months of continuous membership) can borrow the club's Nexstar8 for up to 7 days. The fee of $5 for a weekend, or $10 for an entire week, is nonrefundable and will be added to the club's Accessories Fund "Wish List" for future purchases. A fully refundable deposit of $200 cash or check is required. Loss or damage is the responsibility of the borrower. A copy of the complete South Bay Astronomical Society Nexstar 8 Borrowing Rules and Agreement is available upon request. The **Accessories Fund "Wish List"** – Member contributions of any amount or donations will be appreciated, as will any suggestions for new purchases!

"Friends of the Nexstar" is the group of members who have donated equipment or accessories for the SBAS telescope, who have been granted the privilege of a wavier of the deposit & fee for borrowing the Nexstar8.

SBAS Supports "Star Party" at Palos Verdes Art Center

SBAS members will be supporting the P.V. Art Center's "Star Party" on the opening night of "The Cosmos" Art Festival, Friday evening, **January 17th**. The P.V. Art Center is at the corner of Crenshaw and Crestridge Rd. in Rancho Palos Verdes. Take Crenshaw South to Crestridge (traffic light). Turn right on Crestridge and an immediate left into the parking lot of the Art Center. The opening is scheduled for **6:00 PM**. We should probably be there earlier to set up. I don't know where they want us to set up, although the only places I can think of are in the parking lot or in their patio, which would be less convenient. We will finalize the details and announce our plans at the January 10th General Meeting.

- ***Joe Fierstein***

Ridgecrest School Light Pollution

Saturday, Nov. 30th was the monthly viewing session at Ridgecrest School. No one showed up after some time so I went home only to be contacted by Jim Madison saying that he had arrived after I left. We decided to meet up there Sunday night. Sunday ended up a very nice night with one exception. Floodlights have been added to the concrete block elevator tower that has been under construction for some time now. Unfortunately, these floodlights light up the basketball courts and most of the volleyball courts. This leaves a dramatically reduced area to set up scopes and be shadowed from the light. This is far worse light pollution than the coke machine had caused, which is now gone.

I've contacted Mr. Pete Lyons, the P.V. School District Representative about renewing our permit for Ridgecrest School. He will look into the issue of the new lights on the elevator tower, whether there is any way to turn them off on the nights that we use the school or my suggestion of installing some sort of light shield if they cannot be turned off. He also pointed out that since we are getting close to the holiday shutdown, it might be difficult to make anything happen by the next viewing session on Dec. 28th.

- Greg Benecke

Jupiter's Dark Rings

In 1974, NASA's Pioneer 11 spacecraft plunged through the rings of Jupiter and no one noticed. Jupiter's dark rings--as wide as Saturn's yet nearly invisible--hadn't been discovered yet. Indeed, it wasn't until five years later that cameras onboard Voyager 1 caught sight of them for the first time. On Mar. 5, 1979, the spacecraft swung behind Jupiter, and from inside the planet's shadow the faintly sunlit rings were visible--but just barely. Ever since, researchers have wished for another flyby like Pioneer 11's. NASA's Voyager, Cassini and Galileo spacecraft have photographed the rings many times, but always from a distance. No probe had actually entered the rings for 28 years.

On Nov. 5, 2002, Galileo took the plunge and flew through Jupiter's rings. "We've been looking forward to this flyby for a while," says Joe Burns, a planetary scientist at Cornell University and a member of the Galileo imaging team. "It's an opportunity to study the particles that make up these rings and to learn about their environment." Unlike Saturn's rings, which are made of bright, icy chunks as large as houses, Jupiter's rings consist of fine dust akin to the particles in cigarette smoke. The dust grains are dark (they reflect barely 5% of the sunlight that hits them) and they are spread so thin that the rings are almost transparent. This is what makes the rings so hard to study.

The origin of Jupiter's rings was revealed by Galileo's cameras more than five years ago. "The dust comes from small rocky moons orbiting Jupiter," says Burns. These moons are constantly pelted by meteoroids, which burrow into the ground and explode. Jupiter's rings are the debris from those impacts. In fact, Jupiter has several rings: The main ring is the brightest. It's close to Jupiter and made of dust from the satellites Adrastea and Metis. Two wide gossamer rings encircle the main ring. These come from the satellites Thebe and Amalthea. There is also an extremely tenuous and distant outer ring that circles Jupiter backwards. No one is certain, but that ring might be made of captured interplanetary dust.

When Galileo approached Jupiter for the spacecraft's close approach to Amalthea, it passed through one of the gossamer rings. Saturn's rings probably formed from the total breakup of an icy moon about the size of Amalthea but Jupiter's rings, on the other hand, are merely dust from the surface of such moons. "Saturn's rings are millions of times more massive than Jupiter's," notes Burns. Meteoroids have been striking Jupiter's moons and kicking up dust for billions of years. So why isn't there more "stuff" in Jupiter's rings? Why are Jupiter's rings so much less massive than Saturn's? Burns explains: "Dust grains ejected into Jupiter's rings don't stay in the rings forever. The grains spiral in toward Jupiter and eventually disappear."

They lose orbital energy for several reasons: Sunlight is one. Dust grains absorb and re-emit sunlight, losing momentum in the process. Scientists call this "Poynting-Robertson drag." Plasma collisions are another reason. Jupiter's magnetosphere (a magnetic bubble that surrounds the planet) is filled with electrified clouds called plasmas. The dust grains in the rings are themselves charged--like the static-charged dust that accumulates on your computer screen. When charged grains collide with plasma clouds, the grains can lose orbital momentum.

The "age" of Jupiter's rings depends on which of these mechanisms dominates. Plasma collisions might de-orbit ring particles in only a few years. Poynting-Robertson drag, which Burns favors, takes longer, perhaps 100,000 years. (The age of Saturn's rings is likewise controversial. Jupiter's rings are constantly replenished by meteoroid impacts, so they won't disappear any time soon. Next year's rings, however, might be made of different "stuff" than this year's. In that sense, Jupiter's rings might be younger than you are.

When Galileo flew through the rings, the spacecraft's suite of electromagnetic sensors and its Dust Detector were working well. The spacecraft itself, bombarded by radiation from Jupiter, went into safe mode near the end of the ring encounter, but not before data had been collected. Burns hopes the unprecedented in situ measurements will finally solve the puzzle, or they might reveal more surprises. Jupiter's dark rings remain, after all, unexplored territory.

Featherweight Jupiter Moon is Likely a Jumble of Pieces

NASA's Galileo spacecraft continues to deliver surprises with the discovery that Jupiter's potato-shaped inner moon, named Amalthea, appears to have a very low density, indicating it is full of holes. "The density is unexpectedly low," said Dr. John D. Anderson, an astronomer at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "Amalthea is apparently a loosely packed pile of rubble." The empty gaps between solid chunks likely take up more of the moon's

total volume than the solid pieces, and even the chunks are probably material that is not dense enough to fit some theories about the origin of Jupiter's moons.

"Amalthea now seems more likely to be mostly rock with maybe a little ice, rather than a denser mix of rock and iron," said JPL's Dr. Torrence Johnson, project scientist for Galileo. This red-tinted moon measures about 270 kilometers (168 miles) in length and half that in width. Anderson and colleagues estimated Amalthea's mass from its gravitational effect on Galileo, when the spacecraft passed within about 160 kilometers (99 miles) of the moon on Nov. 5. Dr. Peter Thomas at Cornell University, Ithaca, N.Y., had calculated Amalthea's volume from earlier Galileo images of the moon.

Amalthea's overall density is close to the density of water ice, however, the moon is almost certainly not a solid hunk of ice. "Nothing in the Jupiter system would suggest a composition that's mainly ice," Anderson said. Amalthea's irregular shape and low density suggest the moon has been broken into many pieces that now cling together from the pull of each other's gravity, mixed with empty spaces where the pieces don't fit tightly together. "It's probably boulder-size or larger pieces just touching each other, not pressing hard together," Anderson said.

Johnson said, "This finding supports the idea that the inner moons of Jupiter have undergone intense bombardment and breakup. Amalthea may have formed originally as one piece, but then was busted to bits by collisions." Amalthea does not have quite enough mass to pull itself together into a consolidated, spherical body like Earth's moon or Jupiter's four largest moons. The density estimate obtained from Galileo's flyby extends an emerging pattern of finding irregularly shaped moons and asteroids to be porous rubble piles. What's more of a surprise, Johnson and Anderson said, is the density estimate is so low that even the solid parts of Amalthea are apparently less dense than Io, which orbits about twice as far from Jupiter.

One model for the formation of Jupiter's moons suggests moons closer to the planet would be made of denser material than those farther out. That's based on a theory that early Jupiter, like a weaker version of the early Sun, would have emitted enough heat to prevent volatile, low-density material from condensing and being incorporated into the closer moons. Jupiter's four largest moons fit this model, with the innermost of them, Io, also the densest, made mainly of rock and iron. However, the new finding suggests that even if Amalthea is mostly gaps, its solid chunks have less density than Io.

Galileo left Earth aboard NASA's Space Shuttle Atlantis in 1989 and the flyby of Amalthea brought the spacecraft closer to Jupiter than at any other time since it began orbiting the giant planet on Dec. 7, 1995. After more than 30 close encounters with Jupiter's four largest moons, the flyby was the last for Galileo. Galileo has been put on course for a mission-ending impact with Jupiter's atmosphere on Sept. 21, 2003.

NASA Science News

Desert Sunset Star Party - May 1-4, 2003

The Desert Sunset Star Party (DSSP) is one of the newest amateur astronomer star parties in the U.S., scheduled for May 1-4, 2003 at the Kartchner Caverns State Park in Benson, AZ. We invite you all to come and enjoy the dark southern Arizona skies and the many attractions in this area.

In the late afternoons as we wait for dinner, we will have a few of the seasoned amateurs and professionals demonstrating specialized techniques. We will have a swap meet on Saturday afternoon followed by a contest for your homemade innovative astronomy gadget. After dinner, attendees can listen to speakers at the amphitheater while we wait for the sun to set. We still have openings for speakers – please contact us if you are interested. We should have a good selection of door prizes donated from some local businesses and other vendors we have contacted in our star party travels.

During the days, we are encouraging attendees to visit places like Kitt Peak, the UA Mirror Lab and Flandrau Planetarium, the Pima Air and Space Museum and Titan Missile Silo, and of course the many non-astronomy related sites such as the Arizona Sonora Desert Museum, Old Tombstone and much more. If you plan to tour Kartchner Caverns (advanced registration is required for this very popular tour) you can access the Cavern tours through our Day Trip links for details). Additional information and registration forms are now on our website: **http://chartmarker.tripod.com/sunset.htm.**

Schedule of Coming Events

28 December Saturday Evening	**In-Town Dark Sky Observing at Ridgecrest School** – Weather Permitting: If the weather conditions are marginal, contact Greg Benecke to confirm that he will be opening the gate! Take Hawthorne Blvd. south across Pacific Coast Hwy.; continue up the hill past Silver Spur and turn left at Highridge. Go one mile and turn left on Whitley Collins, up one block and turn left on Northbay Rd., the new parking lot is at the end on the left. Enter parking lot and turn left, the gate is at the east end (it should be open about 15 minutes before sunset) and a paved road leading into the playground where we have traditionally set up. If at all possible, drop your equipment off and park your car in the new parking lot (less than 200 feet away). If you are absolutely certain that your vehicle does not drip anything you can park with your equipment. ***Drive with care*** to avoid steel pillars supporting basketball nets.
1-4 January Saturday Evening	**Out-of-Town Dark Sky Observing Trip –** New Moon Jan. 2nd Contact Greg Benecke to arrange dates and site locations.
10 January Friday 7:30 P.M.	**Monthly General Meeting:** UCLA Instructor, Mr. Chris Ihde, is our guest speaker on the "Cassini Mission to Saturn".
13 January Monday 7:30 P.M.	**Monthly Planning Meeting** See page 3 for location and directions.
17 January Friday 7:00 P.M.	**P.V. Art Center "Star Party"** SBAS is supporting "The Cosmos" Art Festival's opening night "Star Party" for the public. See page 4 for detailed instructions and directions to the site.
25 January Saturday Evening	**In-Town Dark Sky Observing at Ridgecrest School –** Weather permitting. Refer to December 28th entry for directions to this site and instructions on weather conditions.
1 February Saturday Evening	**Out-of-Town Dark Sky Observing Trip –** New Moon Contact Greg Benecke to confirm scheduled date and site location.
7 February Friday 7:30 P.M.	**Monthly General Meeting:** Our celebrated speaker of the evening will be Mr. John Dobson!
10 February Monday 7:30 P.M.	**Monthly Planning Meeting** Location to be scheduled.
20 February Thursday Evening	**Monetemalaga Elementary School "Star Party"** Details will be published in the February newsletter!
22 February Saturday Evening	**In-Town Dark Sky Observing at Ridgecrest School** – Weather Permitting. Refer to December 28th entry for directions to this site and instructions on weather conditions.

South Bay Astronomical Society

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General Meeting at El Camino College Planetarium:
Friday, January 10th at 7:30 P.M.

Guest Speaker: Mr. Chris Ihde (UCLA)

"Cassini Mission to Saturn"

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South Bay Astronomical Society
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