SIRIUS ASTRONOMER

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The above photograph (by Matthew Ota) gives some idea of the huge number of people attending the Mars Outreach at UCI Observatory on the night of August 27th. This was probably the largest outreach the club has been involved in with up to 10,000 people attending.

OCA CLUB MEETING

The free and open club meeting will be held Friday, October 10th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The featured speaker this month is Mike Weasner of "Weasner's Mighty ETX Site" who will be sharing his experience and expertise in using the diminutive little ETX scope for astrophotography.

STAR PARTIES

The Anza star party is on October 25th. The Black Star Canyon site will be open this month on October 18th. 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 beginners class will be held on Friday October 3rd (and next month on November 7th), at the Centennial Heritage Museum (formerly the Discovery Museum of Orange County) at 3101 West Harvard Street in Santa Ana.

Astrophysics SIG: Oct 17th.
Astro-Imagers SIG: Oct 21st.
The EOA SIG: Oct 15th.
Explore the Stars: Oct 18th

President's Message

By Barbara Toy

October, already! It hardly seems possible that we're going into the tenth month of the year…however, starting with THE astronomical topic of August and September…

Mars Mania

We had some great outreaches related to Mars – the one of historic proportions being the outreach we did with the UCI Observatory on the night after closest approach (i.e. August 27). Fortunately, Irvine Valley College had a viewing event the night before, and was totally swamped by more than 1000 people who wanted to see Mars through the eyepiece for themselves. Liam Kennedy was there and so was able to warn UCI that the turnout was likely to be huge. The university did an excellent job of putting together a parking and traffic control plan in less than a day, but even so they were overwhelmed by the public response to the event. We were told afterward that they estimated that around 10,000 people came to the observatory area over the course of the evening. Volunteers from OCA and from the UCI Astronomy club brought 15 to 20 telescopes in addition to the 24-inch telescope in the UCI observatory, and there were long lines for all of them until well after 1:00 a.m. When I left after 2:00 there was still a long line for the 24" – somewhat ironic since the views through that telescope weren't any better than through our smaller telescopes.

around 10,000 people came to the observatory over the course of the evening.

In spite of the long waits, the crowd at the UCI event was very courteous and well-behaved, and many asked questions that showed a genuine interest in learning more than what they'd seen in the popular press. A lot of people seemed disappointed in their initial view through the eyepiece, and I quickly learned that they could see a lot more when I gave them a description of what was in view and where it was located on the planetary disk – the fact that they could pick out the polar cap caused more incredulity and excitement than picking out any other feature, for some reason.

The Mars outreach we did at the Discovery Science Center on September 7 was a lot different. It was one of our rare daytime outreaches, and ours was one of a number of special Mars-related events going on in the museum. We had a table surrounded by several telescopes and my binoculars on a parallel mount, and we also had a continuous slide show of the Mars pictures taken in the last few months by different club members (along with a good selection of other images). We answered a lot of questions about telescopes and how to use them, about the club, about astronomy in general and the objects shown in the slide show (including Mars) – and spend a lot of time putting the scopes back on the objects we'd found to focus on because the children coming through were so used to touching and playing with the exhibits that they inevitably grabbed and moved the telescopes before we could stop them. In spite of that, a good time was had by all, and we even had a visit from Mars in person, along with one of his moons. Here he is with Craig Bobchin on the left, Mike Bertin on the right and (I believe) Deimos to the left of Craig (Antonio Miro was behind them, demonstrating his small Newtonian telescope):

The Orange County Space Society was very much involved in this event, and this proved a great opportunity to get to know them as well as to get to know people at the Discovery Center. I'm happy to report that we have a lot of interests in common with both entities, particularly our mutual interest in community education and in encouraging children to take an interest in science and to learn about the universe around them. I hope to see some interesting joint projects develop with them both in the future.

So, the final conclusion on Mars Mania – yes, there was a lot of media hype, but it did spark a lot of genuine interest in our sister planet. I think there are a lot of people out there now who look up at the sky with a new perspective – they have actually seen detail on another planet for themselves, and seen it as a genuine world. In the weeks after Opposition, they should have been able to pick it out in the sky for themselves – and maybe just being able to do that will trigger a greater interest in finding and looking at the other wonders that are out there.

Upcoming "How to Use Your Telescope" Class

Since so many people went out and bought telescopes so they could take a look at Mars, we expect our next "How to Use Your Telescope" class will be well-attended. This is now a regular part of our Beginners Class, and this session will be on November 7 at 7:30 p.m. We need volunteers to help out, as this is very much a "hands on" class, where we help people learn to set up their equipment and find some objects with it. It's set in November as this is the first class session after Daylight Savings ends, so the sky should be better for viewing.

"How to Use Your Telescope" class... will be on November 7th at 7:30pm

The class is at the Heritage Museum, which is about one block west of Fairview on Harvard in Santa Ana, between Warner and Edinger. These classes are a lot of fun, and are a great way to help people who are new to astronomy through the early frustrations of our hobby, so please plan to come and help out. And, if you have equipment you'd like some help with yourself – this is the class

to attend! You can contact Antonio Miro (tycmiro@aol.com or 714/898-967) or me (btoy@cox.net or 714/606-1825) for more information.

The OCA Banquet

In hopes that this reaches you before the Banquet – tickets are on sale, and we'd love to see you there! The banquet is on Sunday, October 12, at 6:00 p.m., at the Orange County Mining Co. Contact Charlie Oostdyk for tickets – he can take reservations, or make whatever arrangements are necessary to have you and your tickets meet up so you won't miss out on this great event.

Our speaker, Stephen Edberg of JPL, is currently the Remote Sensing Discipline Scientist for the Cassini Project, and he's obviously in a position to know a tremendous amount about that entire mission. His talk is titled "Cassini – Mysteries of Saturn," and he will be filling us in on what is happening with the Cassini Project and what they are hoping to find when Cassini reaches Saturn. It'll be an exciting and very timely talk – one you won't want to miss!

(Stephen Edbergs) talk is titled "Cassini - Mysteries of Saturn"

As of this writing, Joel Harris and others have already obtained some very nice door prizes for the banquet. Just having the chance to win one of these great prizes (I'm told that one is a refractor – and I'm not saying that it's the grand prize!) is worth the price of admission!

And then there's the mystery guest…who, I'm told, has a great interest in the subject of Dr. Edberg's talk. And, of course, the banquet is an ideal time to visit with fellow members and their Significant Others over good food and drink, meet new people, exchange war-stories, and generally have a wonderful time.

The cost is just $45.00 per person, and it would help us a lot if you contact Charlie about getting them well before the October meeting. We have to give the restaurant a firm count of people attending a week before the banquet, so, if you wait until the October meeting, we'll have a real logistics problem. Charlie can be reached at 714/751-5381 or Charlie@CCCD.EDU.

And, if you don't see this until after October 12, and if you weren't at the banquet – well, we all had a great time, and I'm really sorry you weren't there with us!

Election

Our election may be overshadowed by what's going on at the state and federal levels, but at least we don't have any problem with voting machines or hanging chads… Unless the 9th Circuit decides otherwise, our election schedule is: At the October meeting, we will announce which members of the current Board are running for reelection. Nominations from the membership will then be taken at the November and December general meetings. The nominations will close at the December meeting, and the candidates will each give a brief statement (I expect that we will post written statements by each candidate on the website again, too). You will be getting ballots and instructions either in the January Sirius Astronomer or by a separate mailing in early January. You can cast your vote by mail before the January meeting or at the January meeting – the voting ends at the end of that meeting.

If my own experience is any guide, serving on the Board can be a lot of fun, and can give you a real sense of satisfaction. It's also a great way to learn more about the many facets of the club, and to contribute to its development. Whether you've been on the Board in the past or not, I hope you'll seriously consider running – the club needs your enthusiasm and expertise. The requirements are simple – you have to be a member of the club for at least one year to be eligible to run for a Trustee position, and you have to have served on the Board for at least one year to be eligible to run for any of the officer positions (President, Vice President, Secretary or Treasurer).

We're looking forward to seeing your name on the ballot – and if you need someone to do the nominating for you, let me know and I'll be happy to find you a nominator!

More on OCA on TV…

Those of you in South Orange County have (hopefully) seen the Public Access show that Liam Kennedy started and that he's now doing with the help of the other members of the OCA-TV group. For those who have Cox Cable and haven't seen it yet, it's "Look Up Tonight" and it now has a regular broadcast time: Channel 31, Tuesdays, 11:00 p.m. And I now know first-hand that Liam has an excellent reputation at Cox – I happened to spend some time with a crew that does filming for Public Access programs for Cox, and they all knew who Liam was and had nothing but good things to say about him and the program. In fact, they told me about an incident where a wrong connection had been made so Channel 31 had no sound – this was discovered and corrected before "Look Up Tonight" came on because one of the techs is a real fan of the show and tuned in early so he wouldn't miss it.

Now, the reason I spent some time with the Public Access people is that there is another program, called "Orange County Hidden," produced and hosted by Curtis Weigel, which features interviews with people about various things in Orange County that people might not know about. Someone told him about OCA, and he wanted to do a segment on the club. Somehow this was deemed to fall within my presidential responsibilities, and I duly showed up to be interviewed about the club on the show. This was a live-to-tape production with only one take, so what we said and how we said it was exactly how it wound up on the tape.

Curtis filmed two episodes that night, and ours was the last segment done – he has my utmost respect for maintaining his enthusiasm and focus through the entire process. We don't yet know when our part will be aired, but it will probably be late November or even December. Our segment is about 10 minutes, which is only enough time to scratch the surface of what could be said about the club. Curtis made a game attempt to cover a lot of territory, and showed some pictures from the website for visual interest and read part of Matt Ota's account of the UCI Mars outreach – so hopefully the flavor of the club and its variety of people and activities comes through. And I think I can chalk this up as yet another of those unexpected experiences the club provides…

Relatives or Coincidence?

Myke Collins

On July 27, 2000, Minor White and I discovered two main belt minor planets using the 22.5" Kuhn telescope at Anza. Over time, as further tracking refined their orbits, we noticed a striking similarity in their orbital elements. Does this suggest they are part of a collision-related breakup?

At the time that we discovered 2000 OQ_7 and 2000 OR_7, which are now numbered as 32207 and 32208 respectively, we did not notice the similarity in their motion. Both were 18th magnitude, and on the evening of discovery were only 1 arcminute apart in RA, but vertically separated by about ½ degree. Later we recognized a strong similarity in orbital elements, as shown below for the current epoch:

	32207	32208
a, semi-major axis (AU)	2.696486	2.732576
e, eccentricity	0.056819	0.011679
i, inclination, (degrees)	2.109	4.023
ω, perihelion argument	217.28	107.68
Ω, longitude of ascending node	210.84	269.30

Table 1 – Osculating Orbital Elements

Numerical integration shows that these 2 asteroids pass each other in orbit approximately every 225 years. At closest, they can approach within just a few million km of each other in space, a relatively close pass by main belt standards.

Diagram 1 shows their orbital configuration. They have extremely similar orbits that 'overlap', creating a very interesting situation.

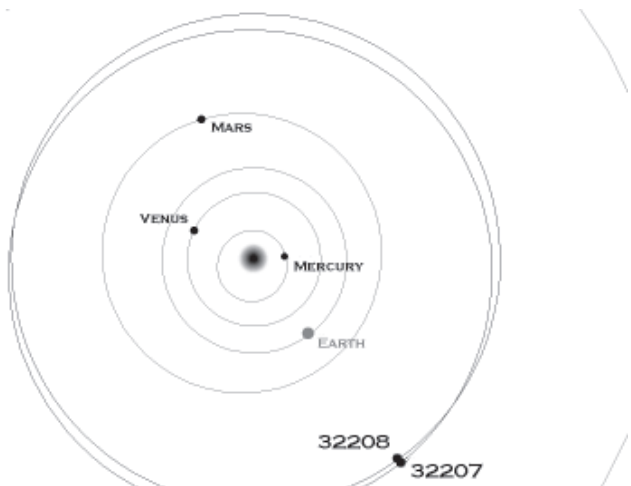

Diagram 1 – shows the positions of the inner solar system on the day these asteroids were discovered, as well as the similar geometries of their orbits

After lagging "behind" 32208 in heliocentric terms for over 2 centuries, 32207 passed it in 04/1994. It only held the lead for 5 months. Then, in 10/1997, it once again caught up and pulled "ahead" of 32208, this time holding the lead until 07/2000, the month that we discovered both objects. In 05/2001 it took the lead again. 32207 is now slowly pulling ahead of 32208, and will eventually work its way around until 08/2219, when the complicated maneuvers begin again. The next cycle after that begins in 2445 AD.

The chance that we would randomly discover these objects so close to their orbital minimum separations is extremely small. And, that they would also both be at opposition the same day is even more of a remarkable coincidence. But is there more to the story? Could their obits suggest common ancestry from a recent collision?

Collisions are inevitable in the asteroid belt. In fact, the vast majority of the objects in the main belt are most likely fragments of perhaps just one or a few original bodies that have been knocked apart over the lifetime of the solar system. This has been the commonly accepted theory for many years now.

Various theories exist for tracing and naming the 'family trees' of the existing asteroids to their proto-parents. This 'genealogy' of sorts is accomplished by grouping asteroids into 'families' by similarity in orbital shapes and orientations. Many such groups have been identified. Over the last handful of years, research has also been able to demonstrate composition similarities to support some groupings.

However, as the fragments from collisions orbit the Sun over time, their orbits slowly evolve and diverge from each other. It mathematically becomes more difficult to definitively relate specific asteroids as we see them today back in time to a common orbit.

The first such 'smoking gun' was finally identified only recently. In 2002, the Southwest Research Institute (**www.swri.org**) successfully proved that asteroid 832 Karin has 38 smaller companions in the main belt in similar orbits that converge 5.8 million years ago. They were even able to estimate the approximate masses and force of the collision that formed the 39 asteroids (and thousands of smaller, not yet discovered pieces). This was possible because of the relatively recent timing of the event. As of this writing, the so-called 'Karin Cluster' is the only published example of this ground-breaking new research field.

In order to see if our two asteroids were recently separated from the same parent body, we first evaluate the orbital elements. Instead of commonly used osculating elements, which are instantaneous, as given in Table 1, we derive the 'proper orbital elements' – meaning that they do not change over time. They are:

	32207	32208
a, semi-major axis (AU)	2.69769	2.73331
e, eccentricity	0.0505	0.0313
i, inclination, degrees	2.757	5.158
g, perihelion precession, "/yr	57.746	58.251
s, node precession, "/yr	-55.010	-55.921

Table 2 – Proper Orbital Elements

The difference in these elements is approximately an order of magnitude greater than the difference observed in the Karin Cluster members today. Since divergence is roughly squared over time, all that can be determined today is that if 32207 and 32208 were results of the same parent body breakup, with an impact similar to that of the Karin Cluster parent, then the originating collision may have been roughly 20 million years ago.

Our research into this field is on-going. More analysis on the long-term evolution of the orbits of these two asteroids, and other objects with similar orbital elements, is being posted at **www.mpc643.org**.

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*The ephemeris data for this study was obtained from the Solar System Dynamics Group of JPL at **http://ssd.jpl.nasa.gov/***

*The in-depth analysis of the long-term evolution of the orbits can be viewed at **www.mpc643.org***

Astronomy to Go

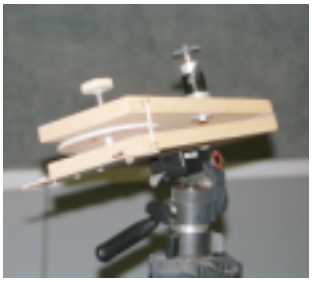
Dave Kodama

To continue our discussion of travel equipment, working our way downwards, now we come to consideration of the mount, assuming of course that you've convinced yourself that it's absolutely necessary to take one.

Selecting a Mount

If you read the standard astronomy books, you'll see that most authors emphasize the need for a sturdy (= heavy) mount. In fact, in the classic series Amateur Telescope Making, famous telescope maker Russell Porter even proposes a mount cast out of concrete! Obviously we'll have to make some compromises here. For travel purposes, a photographic tripod may be the best choice. These are generally already designed with tradeoffs between weight and sturdiness in mind. Just be sure to choose one with the load capacity to match what you intend to put on it, keeping in mind that telescopes tend to be heavier than cameras. When loaded, be sure the legs do not flex and that the head can be panned smoothly. Heads made especially for video are best for tracking with a telescope. Check out Manfrotto/Bogen professional tripods for quality and sturdiness that go beyond the typical department store video tripod offerings. The higher end Velbon video tripods will also serve well for the lightest scopes.

Some of the sturdiness that comes from a massive mount can be gained back even if we have to compromise. First choose a tripod that extends no higher than you absolutely need. This could be very low to the ground if you intend to just use it for video photography and monitoring on a small TV screen. You certainly don't need a tripod so tall that you need to take a ladder along too! The other thing to do on a trip is to use all available objects such as rocks and your carrying cases to anchor the tripod. Sandbags that are filled when you get to the observing location can do wonders to make your viewing platform a solid one. Just make sure your observing location won't be on a golf course or soccer field! And finally, make sure all screws on the tripod are tight! These have a way of working loose during the vibration encountered while traveling.



Barndoor tracker by OCA member Roger Cotton

Byers Camtrak

Equatorial tracking mounts can be a convenience or even necessity if long-exposure photography is one of your goals. Even a solar eclipse may require you to bring a tracking mount if you intend to take magnified exposures of the corona which may take several seconds. However, equatorial mounts will be the heaviest burden for the traveler. It seems particularly torturous to have to carry dead weight in the form of counterweights for a German equatorial mount on a long trip, so use your ingenuity to its fullest. Perhaps the batteries you need anyway can serve as a makeshift counterweight, or local rocks and a liberal application of duct tape could serve you as well. If you plan to shoot just wide-angle night photos with camera lenses, consider picking up a specialized camera tracker such as a Byers Camtrak, which you'll find used at RTMC or on Astromart, or a Kenko Sky Memo tracker. It's a bit more work, but a home made "Scotch mount" or "barn-door" tracker can be even lighter and more compact, though at the expense of you having to manually substitute for a motorized tracker's convenience.

Kenko Sky Memo II tracker

Some Final Travel Mount Tips

Packing a tripod or equatorial mount can be a real challenge, especially on trips involving airline flights. They tend to be too long for normal luggage and have odd projections sticking out everywhere. A golf club bag can serve as a solution in some cases, but usually I've found those too small or too large for my equipment. In the past I've just used sturdy duffel bags with the tripod wrapped in pieces of plush carpeting. The tough backing of the carpeting keeps the tripod parts from harming other contents of the bag and the soft pile of the carpet protects the tripod from impacts.

When setting up your tripod, remember to take into consideration the fact that you may not have a flat hard surface to work with. I take along some small squares of plywood to put under each tripod leg in case I encounter sand, gravel, or grass. The squares are small (just a bit larger than the bottom of the tripod) to avoid having someone step on them and shift the tripod, and each square has holes pre-drilled in the corners so they can be staked into the ground with large nails for stability.

OCA's Astroimagers Tour Palomar Observatory

By Garth Buckles

Scott Kardel from the Palomar Observatory begins our tour at the 200".

Photos contributed by Leon Aslan, Dave Kodama, and Garth Buckles

I was excited! Several weeks ago Dave Kodama announced that he and James Thorp had arranged a special tour of the telescopes on Palomar Mountain. Scott Kardel, Public Relations Coordinator for Palomar Observatory, had given a presentation at the August OCA club meeting about the current research at Palomar. Dave and James spoke with him afterwards and were able to arrange a special tour for the Astroimage SIG with an emphasis toward the imaging done there. The 200" Hale telescope had fascinated me ever since I had read "The Perfect Machine", a wonderful book about the making of this great instrument. Now, we were fortunate enough to get a special tour of it.

At 10 AM on Saturday, September 6th, Scott met about thirty of us in the parking lot on Palomar Mountain in San Diego County. We caravanned in several cars up to the parking lot at the back of the 200" Hale telescope observatory. There, he pointed out a large concrete disk lying in the dirt at the edge of the parking lot. It was

originally installed in the telescope before the mirror had been finished and was used to simulate the weight of the mirror for the initial balancing of the telescope. After the mirror was delivered, the concrete disk was discarded outside where it sets to this day.

We entered the huge observatory through a small service door and found ourselves in a large storeroom.

It reminded me of someone's gigantic basement with lots of very cool stuff lying around. Scott pointed out two large gears hung on the wall that were spare RA and Dec gears that were made were made at the same time as the installed ones. There was also a large vacuum chamber that was used to aluminize all the mirrors on the mountain except the 200" mirror. A huge structure of steel beams stretched from floor to ceiling some twenty feet up. These provided the support for the massive weight of the 200" telescope on the floor above. They connected to a concrete base that went down twenty feet to bedrock.

Scott led us through a hallway with a series of rooms on either side. Large framed prints of Russell Porter's wonderful drawings of the inner workings of the telescope lined both sides of the hallway. A old fashioned poolroom was behind one door for those cloudy nights. Behind another, Scott told us were stored many of the original glass photographic plates. Unfortunately, we didn't get in there but he did lead us into a small storeroom that contained a treasure from the past. He had recently discovered the original wooden fixture that had been mounted at the focal plane of 200" telescope. This was used to hold the glass plates that were used by Edwin Hubble and others to take their images. It had long since been replaced by CCD cameras and set aside in this small storeroom. Eventually, Scott hopes to put it on public display.

Prime focus pho
plate holder for
Hale telescope.

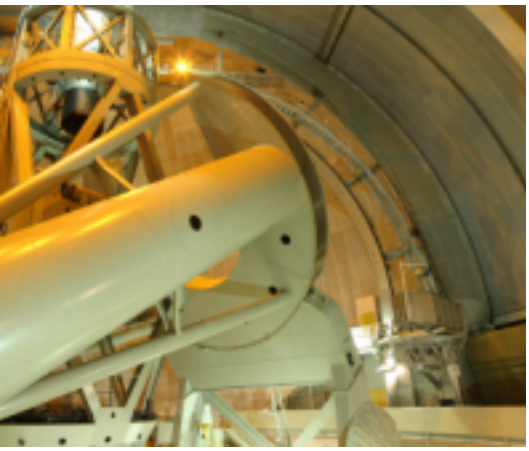
In another room just down the hall was the adaptive optics unit. This large unit was used on many of the imaging projects to improve the image. It was quite a contrast to the old glass

image holder we had just viewed in the previous room and illustrated how well the telescope has been updated with the latest equipment to keep it viable as a scientific instrument.

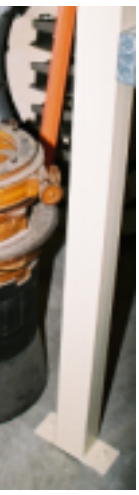
We climbed a staircase that followed the arc of the

observatory wall to the main floor. The first thing we saw was the original control panel that was used when the telescope operator was on the main floor responding to commands called down from the astronomer high above in the observer's seat. Amazingly, all the controls still worked except for the clocks. Just beyond that was the 200" telescope itself.

I have always been impressed with the design of the 200" telescope. To walk out across the large open floor with this giant telescope towering above me was quite a thrill.



Scott told us all kinds of interesting details and stories about it over the course of at least forty-five minutes. Many of us took the opportunity to photograph it from all kinds of angles. Interestingly, there was also a technician there preparing a camera cooled with liquid nitrogen to be mounted on the scope. Scott led us up a flight of stairs to a second level that was on the same plane as the huge domed roof. From here, we were able to get a very dynamic view of the instrument. He told us to wait a minute while he went back to the first floor control panel where he turned on the motors that rotated the massive dome and the area we were standing on. When we looked up at the telescope, we got a great optical illusion that the scope was turning instead of us! Then, he opened a small doorway that led out onto the steel catwalk that went all the way around the outside of the observatory high above the ground. We got a terrific panoramic view of the mountaintop and all the observatories as the dome rotated around. And we tried to figure out where Anza was with several different opinions.



otographic
the 200"

As we wove our way past shelves of old style oilcans and tools on our way out of the 200" observatory, it reminded me of how successfully this wonderful instrument that was designed and built in the first half of the twentieth century has bridged the decades into the twenty first century.

Everyone piled back into their cars and followed Scott's car out a meandering road to the newest observatory housing the 60" telescope. The observatory is perched on a point overlooking a spectacular view of two valleys. Scott is fortunate enough to have his office in this observatory with a great view out across this expanse. The instrument housed here was originally built with funds provided by the Oscar Mayer Foundation. It didn't

take long for it to be known as the "wiener scope". The telescope is quite dramatic when you first see it because the entire tube is wrapped in a highly reflective foil material to keep its temperature stabilized. Interestingly, I was surprised to see it had huge eyepiece mounted on it. The telescope is being modified to be fully robotic. During that downtime, Scott has been using it for organized viewing sessions. Matt Ota had been fortunate enough to go to one several weeks earlier and said the views were very impressive.

Next stop was the 18" Schmidt camera observatory. This is the oldest instrument on the mountain. It went into operation in 1936 and was used continually until it's recent retirement from active use. Many famous astronomers used this venerable old instrument to discover comets and asteroids and map the sky. Eugene and Carolyn Shoemaker and David Levy used it to discover the comets that eventually struck Jupiter. A bronze plaque mounted on it commemorates the discoverers for their achievements.

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ASTROSPACE UPDATE

October 2003 *Gathered by Don Lynn from NASA and other sources*

To find out more on these topics, or those of past months' columns, through the World Wide Web, send your Web browser to our OCA Web site (http://www.ocastronomers.org), select Space Update Online, and the topics are there to click on.

Gamma-Ray Bursts - Further analysis of the observations of the afterglow of a very nearby gamma-ray burst (GRB) in March show it matches the characteristics of a hypernova, which is a supernova of a very massive type of star (Wolf-Rayet type). It is the most powerful type of supernova known, and forms a black hole during the collapse of the star at the end of its life. The jets from the black hole apparently generate the burst of gamma rays, but the exact mechanism is still not known. These results apply only to longer gamma-ray bursts, since the afterglows of short GRBs (under about 2 seconds) have yet to be detected, and have different gamma-ray characteristics.

Pulsar Distance - Using the Very Long Baseline Array of radio telescopes, the parallax of a pulsar, and therefore its distance, has been measured for the first time. The parallax is the amount of apparent shift in position of an object caused by our motion on Earth about the Sun. A pulsar is a spinning neutron star, which is the core left after a supernova explosion of a certain size range of star at the end of its life. This distance (about 1000 light-years) allowed measurement of the size of the pulsar, identification of its supernova remnant (cloud of gas thrown off during the explosion), and possible identification of one source of cosmic rays. The size of the pulsar is 16 to 25 miles in diameter. The energy of particles thrown off by a supernova remnant of this age and distance matches the excess of cosmic rays that have long been known to have this particular energy. The sources of cosmic rays cannot be measured directly because their paths are bent by magnetic fields of the Sun and other stars.

X-ray Flashes - Astronomers using X-ray, radio, and optical telescopes have announced they have found the source of X-ray flashes. These phenomena were discovered by the BeppoSAX X-ray observatory 2 years ago, but until now no one knew their source. Two X-ray flashes were found to originate in galaxies between 6 and 11 billion light-years away. Both galaxies were quite blue, which indicates they are rich in star-forming regions. The energy we receive from X-ray flashes is considerably less than gamma-ray bursts, so either the phenomena emitting the X-rays is less powerful, or less efficient in X-rays, or more spread out (less beamed), or we are viewing them off the beam.

Gamma-ray bursts - A study of HETE 2 (gamma-ray burst satellite) and BeppoSAX (X-ray observatory) data and computer simulations came to these conclusions: 1) gamma-ray bursts when the Universe was only a billion years old were 1000 times brighter than ones occurring today, 2) long duration gamma-ray bursts, X-ray rich gamma-ray bursts, and X-ray flashes are all symptoms of supernovae of very massive stars (only the first of these has previously been proved), the difference being that the first are tightly beamed, the second loosely beamed, while the last spread out in all directions. Announcement of these conclusions raised substantial skepticism, so further study is required.

Dark gamma-ray bursts - Since the visible-light afterglows of gamma-ray bursts were discovered a few years ago, only about 1/3 of the afterglows searched for have been found. The other 2/3 were termed "dark gamma-ray bursts". A new study of searches for afterglows of gamma-ray bursts reported by HETE, a gamma-ray burst satellite that produces fairly accurate positions very quickly, found that 14 of 15 of these afterglows were found. So there are far fewer dark gamma-ray bursts than thought. The authors of the study believed that the reasons for missing so many afterglows in the past were that many of them faded in the hours before the visible-light search was made, and HETE's instruments tend to find bursts that are brighter in both X-rays and visible-light than previous satellites that discovered bursts.

Early Universe Star Formation - A study of a new HST deep field image and Chandra X-ray images of the same area shows that: 1) the average size of galaxies increased continuously from the time the universe was 1 billion years old until it was 6 billion years old; 2) the rate of star formation rose by a factor of 3 between age 1 billion years and 1.5 billion, then remained steady until 7 billion years ago, then dropped by a factor of 10; 3) the theory that galaxies formed from mergers of smaller galaxies is supported; 4) 7 X-ray sources are invisible with HST in visible light; 5) active black holes in distant relatively small galaxies were rarer than expected.

Planets like ours - A planet system most like our Solar system has been discovered. It has a planet about double the mass of Jupiter at about 3/5 of Jupiter's distance from its star (HD70642), which is a Sun-like star. Its orbit is nearly circular. No previous planet has been found with near Jupiter's mass and near its orbital size. The question remains as to whether the planets we have found in the past are typical (most are considerably larger than Jupiter, far closer to their stars, and in very elliptical orbits), or are simply the easiest kind of planets to find with current techniques.

Hubble Space Telescope (HST) - has for the first time caught a dwarf galaxy being torn apart by the gravity of a large galaxy and its dark matter halo, a process theoretically long believed to occur. Previously only large galaxies being torn apart had been seen. This process with dwarf galaxies had not been seen before because of the faintness of the dwarfs and their debris, and because of how rare the process is now (it probably happened more often in the early history of the Universe). The stars stripped from the "victim" galaxy become part of the visible halo of the large galaxy, in a process that explains how large galaxies got large faint halos of stars.

Kuiper Belt Objects (KBOs) - HST has completed a search of a small region of space to determine how common KBOs (those icy asteroids beyond Neptune's orbit) are. Extrapolations from the numbers of larger KBOs predicted that about 60 small ones should have been detected in the area searched, but only 3 were. These are the 3 smallest and faintest KBOs known, each in the range of 15 to 28 miles across. If this sample is representative, then there are a half million KBOs larger than 10 miles across. This does not appear to be numerous enough to produce the number of comets that we see from KBOs that get perturbed into the inner solar system.

Eclipsing star - Last year astronomers announced discovery of a star that underwent a 20 day eclipse every 48 days. This was too long an eclipse to be caused by a companion star in orbit, so was explained by a very large gas cloud in orbit about the star. Now astronomers have examined old images of the star and found to their surprise that it did not eclipse in the first half of the 20th century. They are busy looking for more recent images to determine exactly when this behavior started. Theorists are scrambling for an explanation for such a rapid change. One possibility is that a ripple is forming in a protoplanetary disk, and we are seeing the beginning of a planetary system formation.

Supernova flattened - The Very Large Telescope in Chile has for the first time monitored the polarization of light of a Type Ia supernova as it brightened and dimmed. A flattened, or non-spherical, explosion will cause polarization of the light, so this observation allowed calculating how flattened the explosion was. At peak brightness, it was about 10% shorter in one dimension than the other, but a week later was nearly spherical. It did not actually change shape, but over the week's time we were seeing into a different layer of the explosion, and only some layers are non-spherical. Type Ia supernovae are used to determine distances to far galaxies, since they are thought to all be the same intrinsic brightness, so that apparent brightness is entirely due to its distance. But theoretically, a supernova that is not spherical should have a slightly different brightness than a spherical one. So it may be important to take polarization (which implies flattening) into account in future distance measures using these supernovae.

Milky Way center - Using new equipment, including adaptive optics, on the Keck II Telescope in Hawaii, astronomers got their first look at the center of our Milky Way galaxy in a new range of wavelengths, between the near infrared and mid infrared. The center, which harbors a super-massive black hole (3 million times the mass of the Sun), is visible in radio and X-ray wavelengths, but is hidden in visible light and some ranges of infrared by thick dust. Radio and X-ray observations have shown a calm but steady flow of plasma (charged gas) are falling into the black hole. Some astronomers felt this looked too calm compared to other similar galaxies' central black holes, which were swallowing large chunks violently. The new observations showed more violent and turbulent falling of plasma. Apparently the violent processes emit only infrared in the newly imaged wavelength range.

Black hole sound waves - Chandra (X-ray observatory) has detected ripples in the hot gas filling the Perseus galaxy cluster that are caused by sound waves emitted by a super-massive black hole. The sound waves are the deepest tone every detected, being quadrillions of times lower in pitch than we can hear. These sound waves may answer the long-standing question of how heat is transferred to the clouds of (hot) gas found surrounding galaxy clusters.

Asteroid spin - A new study of several members of the Koronis family of asteroids has shown that they all fall into 3 classes of spin about their axes: almost stopped, spinning so fast they may fly apart, and locked into a resonance with their orbit (that is, the spin axis wobbles at the same rate as the orbit wobbles caused by gravitational perturbations of the planets). Members of an asteroid family have such similar orbits that they must have formed by the breakup of a common parent. The Koronis family has to have formed over 2 billion years ago, so the spins of its members should theoretically have been randomized by the random collisions that surely occurred in that length of time. The new observations can only be explained if some other force overcomes the random forces of collisions. Computer studies were done and it was found that the force of sunlight hitting asteroids for millions of years could produce the 3 classes of spins found. So sunlight effects are now thought to control the spin of smaller asteroids (those in the study were 15 to 25 miles across).

Europa ice domes - Astronomers believe they have explained how the giant ice domes (up to 4 miles across and 300 feet high) formed on the surface of Jupiter's moon Europa. Impurities in the ice, such as salt or sulfuric acid, will change the melting point of the ice, therefore reducing its stiffness at a given temperature. Heat from the interior of the moon tries to rise, and prefers these soft spots, pushing them up into the domes we see.

Antimatter on the Sun - Analysis of images taken by RHESSI (solar X-ray/gamma-ray observatory) of a solar flare last year showed that the flare generated about one pound of antimatter, containing more energy than all our country's power plants produce in 2 days. When antimatter hits matter, they destroy each other with tremendous energy. Antimatter is created when ordinary matter accelerated by the flare collides with slow-moving matter in the Sun's atmosphere. Theory says that the antimatter should soon collide with regular matter, giving off X-rays. However the new analysis showed that the X-rays from this process were coming from a much less dense region than where the antimatter should be created. Now the theorists have to decide if the antimatter is created in less dense areas than thought, or the temperature or density measurements are wrong. Another surprise was that the ordinary matter thrown off by the flare seemed to be sorted into clumps of similar mass or charge.

Galileo (former Jupiter mission) - As I write this, the Galileo spacecraft has only hours left before it crashes into Jupiter at over 100,000 miles per hour, as planned to end its 14-year mission. It has circled Jupiter 35 times in the first orbiting mission beyond Mars (others were brief flybys), and still the only one until Cassini orbits Saturn next year. Galileo was about to run out of fuel that controls its orientation, and would no longer be useful. So it was

decided to hit Jupiter rather than risk hitting Europa or other satellites and possibly polluting them, ruining further missions there. Galileo is programmed to transmit magnetic field, particles, star tracker images of the moon Amalthea, and other data as it is measured until it disappears behind Jupiter, minutes before impact. Over 30 gigabytes of data, including 14,000 images, have been returned, an amazing amount considering that the main antenna never opened, the tape recorder barely works, and the spacecraft has suffered 4 times the radiation that it was designed to take. Discoveries include the first close-up images of an asteroid, first image of an asteroid satellite, 70 more volcanoes on Jupiter's moon Io (beyond the 20 some discovered by Voyager), spewing melted rock (not just sulfur as previously thought), probable liquid layers under the ice of 3 moons, only direct images of Comet Shoemaker-Levy 9 impacting Jupiter, unexpected erosion in surface features of Callisto, the first moon (Ganymede) with its own magnetic field, lightning 1000 times as powerful as that on Earth, first in-place study of Jupiter's atmosphere (by the probe that detached from Galileo and descended to the planet back in 1995), high tectonic activity on Ganymede, and metallic cores in Io, Europa and Ganymede (but not Callisto).

Instant AstroSpace Updates:

Chandra (X-ray observatory) - will be turned toward Earth to observe X-rays from here, mostly from fluorescence high in the atmosphere, since interesting X-ray phenomena have been found on planets from Venus to Jupiter; Chandra will have to be guided without its star tracker, since Earth will block the view of all stars that direction.

Space Infrared Telescope Facility (SIRTF), the last of the Great Observatory series (included Hubble, Compton & Chandra) long planned to cover essentially all wavelengths from space, was launched the end of August; it is 100 to 1 million times more sensitive than previous infrared observatories.

An amateur astronomer in South Africa became the first amateur to locate the visible afterglow of a gamma-ray burst, using his 12-inch telescope and an email sent by the HETE satellite when it detected the burst.

Comet Halley was imaged in a 9 hour exposure by the Very Large Telescope in Chile 17 years after its passage by the Earth and Sun; it will fade only one more magnitude (to 29) in the next 20 years until it reaches the far point in its orbit, so should never leave our view.

Rosetta (European comet lander mission) has found a new target (Comet Churyumov-Gerasimenko), after launch delays caused it to miss the opportunity for its original target of Comet Wirtanen; launch is now planned for next February, to reach the target about 10 years later. ■

... continued from page 7. **OCA's Astroimagers Tour Palomar Observatory** *by Garth Buckle*s

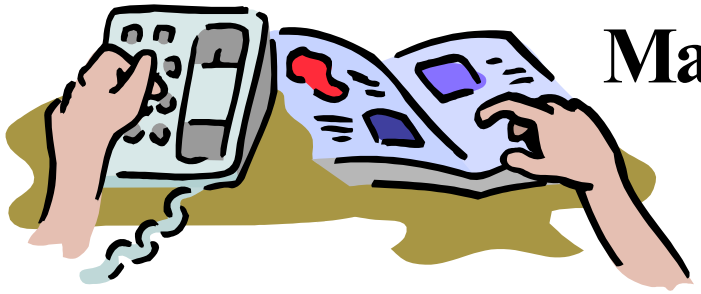
A final drive over to the other side of the mountaintop brought us to the observatory housing the famous 48" Schmidt camera. This telescope has been completely converted from film to CCD instruments. And it is fully remotely controlled from a university back East. Scott warned us to be careful, as it could start moving to a position without warning. I was really struck with how big it is. I have seen many photos of it but they didn't convey the size of it. When I mentioned this to Dave Kodama later he thought the wide-angle lenses used to capture the whole instrument tended to make it look shorter. Makes sense to me.

It too was dramatically coated in the reflective foil to keep it cooler. And with the nitrogen vapor ominously venting out from its cameras inside, it gave the most dynamic sense of being active and ready to image.

After everyone had made their way back outside, we lined up in front of the observatory for a group shot. At this point Scott wrapped up the tour. I think all of us were surprised to hear that this was the first time Scott had put on this kind of specialized tour. Several of the club members who had been on previous Palomar tours said this one was the most extensive and best one they had experienced.

Back at the parking lot, many of us lingered around to get in a few more photographs, shop at the gift shop, visit the museum and personally thank Scott for the extraordinary tour that had lasted more than three hours!

We're very fortunate to belong to great club in an area with these kinds of treasures nearby. Many thanks to CalTech and Scott for the extraordinary opportunity and to Dave and James for arranging it. What a treat! ■



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