SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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Bill Patterson took this picture of M81 and M82 on December 9, 2004 from OCA's Anza observing site using a Takahashi FSQ106 telescope with SBIG STL11000 CCD camera. A full-size image may be found at http://www.laastro.com/M81_82_spec.html. There are at least 18 galaxies in this picture! (Credit: Bill Patterson). Why not come out to Anza on March 12 and find these (and the other 108 Messier objects) during our annual Messier Marathon?

OCA CLUB MEETING

The free and open club meeting will be held Friday, March 11th 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 Dr. Robert Mills of Lowell Observatory discussing Lowell's new 4.2-meter telescope developed in partnership with the Discovery Channel.

STAR PARTIES

The Black Star Canyon site will be open this month on March 5th. The Anza site will be open March 12th. 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, March 4th (and next month on April 1st) at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: Mar. 21st
Astro-Imagers SIG: Mar. 15th, Apr. 19th
EOA SIG: Mar. 28th, Apr. 25th
Astrophysics SIG: Mar. 18th, Apr. 15th
Dark Sky Group (new!): Mar. 23rd

President's Message

Dave Radosevich

Welcome to the March edition of the Sirius Astronomer. As you know, I am your new president (thanks for voting: I here it was a close race) and I am looking forward to this year's activity in the club. It will be hard to follow in Barbara's shoes (or sandals in her case) due to all her wonderful accomplishments. If you missed the February meeting, the club presented Barbara with a well deserved thanks and plaque. Barbara is not slowing down this year either. She has agreed to do several tasks within the club that I am certain we will all benefit from. She is our new Members Liaison, the new Observatory Custodian, our new Kuhn Systems Consultant, and our new Dark Sky Coordinator. Wow! What energy! Many thanks to Barbara for her continued support!

New Board:
Our new board was installed at the January Board meeting. Welcomed newcomers are: Paul Brewer, Bill Hepner, and Steve Short. Returning board members are: Gary Schones, Tom Kucharski, Tony Obra, and Matthew Ota. Officers are: Craig Bobchin Vice President, Charlie Oostdyk Treasurer, and Bob Buchheim Secretary. Lastly Dave Radosevich as President.

March Madness:
I hope to meet up with folks for this year's Messier Marathon. Date for the event is Star Party March 12th at the Anza site. We have expanded categories for this year. One of the new categories is Film or CCD imaging. Lets see who can photograph or image the most Messier Objects in one night! Forms are available on the website or can be picked up at the observatory during the event. Contact Doug Milar offsite or Barbara Toy on site for more information. Everyone gets a certificate for participating! A special award will be given for top Film/Image Montage taken during this event. Email me for more information.

Anza News:
At the last board meeting, I expressed my thoughts regarding Anza. I let it be known that I intend to expand, develop, and better maintain Anza and bring it to a new level of astronomical performance. Many aspects of Anza are beginning to ware and need updating. Our site has seen hard times in resent history (fire, floods etc.). Our Kuhn observatory needs refurbishment. The broadband Internet coverage will be going thru an overhaul. The Anza house needs some TLC. And our never-ending need for expansion continues with new members seeking personal observing areas. This is not new news and lots of effort has been achieved in maintaining our site, but there is a need for change in how Anza is developed. In the coming months you will begin to see what I propose we do for the future feasibility of Anza. Insurance for the club and the site change yearly and will cause new agreements for pad and observatory owners. Board meetings will have much to say about this new future Anza and invite anyone to help join in.

General Comments:
There has been much talk regarding our General Meeting schedule. Our meetings in the past have run as late as 10:00pm with the main speaker not finishing until sometime after 9:00pm. This makes for a long meeting, for all of us- and the speakers who have to drive home. The February meeting format was an attempt to get our What's-Up and ½ announcements, and main speaker prior to a break. That typically takes us 90 min to complete. Then our break (15min), then the other ½ announcements concluded. Most people left during the break and we felt like the other ½ announcements fell on missing ears. So, next month, we plan to give all announcements before the break. This may run us up to the 100min mark prior to the break. There are other possibilities like changing the meeting time to 7:00pm but that lends to Friday night issues and traffic. If anyone has any ideas or thoughts, please email them to me @ Dave.Radosevich@ngc.com . I will be happy to hear your suggestions.

Call for a Volunteer:
As you know, we have the Anza House for the comforts of home at Anza. As with any house, there comes general maintenance and care. We are currently looking for an Anza House Coordinator. If you want to know more, please contact me.

Dave Radosevich

AROUND OCA

By Barbara Toy

To inaugurate this new series of articles, I'd like to start with something of a romance – of the "Girl Meets Telescope" variety. Of course, in this instance I'm using "girl" as my grandmother used it when speaking of my great-aunts (as in "I went to lunch with the girls on Tuesday …"), and the "girl" in question actually had already met the telescope – in fact, had operated it many times. Let's just say that this is about the cementing of the relationship. So, let me tell you about –

The Night The Kuhn Burned Out

First, some context. Going back to the summer of 2002, Liam Kennedy was OCA President, and I was Vice President. It was a busy summer, and in addition to the club's usual summer activities, we were preparing for the AstroImage 2002 conference, which (thanks to the efforts of a lot of industrious and creative people) was a very successful event that started on August 23rd. The particular period I'm speaking of, however, was July – we had the July Star Party and Starbecue Potluck at Anza on July 13, with members of the Riverside Astronomical Society as guests, Liam and I shared the running of the Kuhn for what I recall as a busy evening with a lot of people coming through the observatory, and a good time was had by all.

My attendance at the July star party was actually a victory of desire over duty, as I was part of a team that was starting trial on a big case that had been consuming most of my attention for months. So, on Sunday after the star party I was back in the office, working on final preparation for Monday morning. Monday I was in court, arguing pre-trial motions, and then I headed back to the office to meet with my boss, expecting to work with him on jury selection and opening statements – but discovered instead that, as the last one hired, I was the first of five attorneys the firm had to lay off that week.

So, in the space of a few minutes, I went from being consumed by the trial to being concerned about how to pay my mortgage – a situation that all too many of our members have faced over the last few years. I was more fortunate than many, as I found another job very quickly, but I didn't know that yet as that week was ending. In fact, as I was starting the job-hunt and tying up loose ends from the old job, including saying good-bye to the wonderful group of people I'd been working with, I was pretty depressed.

Fortunately, the Kuhn was available that Friday night. Nobody else was free, so I went out to Anza alone, and I had the site pretty much to myself. There was a lot of moon that night – we were past third quarter – but it was beautifully clear, and, although I'd been operating the Kuhn for star parties and other events for a year, that night was the first time I'd spent any time on the telescope just observing for myself. To give you the flavor of the night, here's part of the email I sent to the ocastronomers email group the next day:

> Last night was even clearer than I'd expected from the Clear Sky Clock – clear enough that, in spite of the moon, I was able to see a lot of detail in clusters outside the immediate vicinity of the moon (so, other than in Scorpius and Sagittarius, unfortunately). Diffuse nebulae and most galaxies were pretty washed out, but denser nebulae like the Ring and Dumbbell showed up well.

The cluster I remember most was M13 in Hercules, which seemed particularly lovely that night. I spent a long time tracing out the streamers of stars that made it look almost flower-like, wondering if they were connected by anything more than my imagination and a chance association as they all orbited their common center. It was a mesmerizing (and comforting) view, and I returned to it several times.

WAA Board Meeting Notes

by Tim Hogle

Those of you who have been reading the Sirius Astronomer for awhile may recall my discussions of the Western Amateur Astronomers (WAA). WAA is an umbrella organization of astronomy clubs, primarily in the Western US, but open to membership to all interested clubs. The WAA's purpose is to promote communication between astronomy clubs for their mutual benefit, to give awards for recognition of outstanding achievement in the world of amateur astronomy and to promote astronomy in general. OCA has been a longstanding member club. WAA recently held its winter Board meeting at the Starhome observatory of our own longstanding member and several times OCA president, John Sanford in Springville, CA. John has settled into Springville as a very good astronomical area and has started somewhat of an enclave of other amateurs moving into the area.

Probably WAA's most well known function is annually awarding the prestigious G. Bruce Blair Medal to an individual who has made truly outstanding contributions to amateur astronomy. The Board recently began allowing email voting on this award, and as a result of the delay this causes after the meeting, the honoree has not yet been selected. However, I can say that we have some very deserving candidates, as usual. The list of past recipients goes back to 1954 and is listed on the WAA web site at http://www.waa.av.org. It includes several OCA members and nominees. We expect the award to be presented at the Riverside Telescope Makers Conference in May.

The Blair medal itself is produced by WAA as a very substantial, gold plated, etched bronze medallion. For the past decade it has been difficult to get additional medals produced to the high quality standards that the award deserves. Efforts in this area have paid off, as the medal has now been reproduced in an electronic (AutoCad) format, making it much easier to produce in the future.

On another topic, the WAA Board would like to replace our 50 year old logo with a more up-to-date, modern one. I mentioned this in a previous column, and not much response has come forward - only one entry and none from OCA. If you would be interested in creating a logo and have some artistic skills, contact me. My contact info is on the back of the Sirius Astronomer.

And finally, WAA is beginning discussions with Griffith Observatory regarding helping to sponsor a major astronomy educational event in a couple of years. More on this as it takes shape.

WAA will again have an information booth at RTMC this year. Stop by and say hello. For more info about WAA, log on to the Web site at http://www.waa.av.org.

ABOUT OUR SPEAKER

Dr. Robert Millis will speak on the observatory's newest project to design and construct a modern, 4.2-meter telescope in partnership with Discovery Communications, Inc. The Discovery Channel Telescope (DCT) is Lowell Observatory's newest project to design and construct a modern, 4.2-meter telescope 45 miles southeast of Flagstaff, Arizona.

Currently under development in partnership with Discovery Communications, Inc., the DCT will significantly advance Lowell's scientific research capabilities while providing real-time broadcasting features to promote world-wide educational programming about astronomy and technology. Among other things the telescope, when finished in 2009, will provide real-time broadcasting features to promote world-wide educational programming about astronomy and technology.

For more information, please see: http://www.lowell.edu/DCT/

ASTROSPACE UPDATE

March 2005

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.

Huygens (Titan lander) – Further analysis of images and data from the January 14 landing on Saturn's moon Titan shows: the spacecraft landed in mud or wet sand (the liquid being methane, not water), which is covered by a thin crust; the rocks are mostly water ice; there is probably volcanic activity that spews liquid water and ammonia rather than lava; the dark areas near the landing site are probably temporary lakes that fill with liquid methane when it rains, which appears to be often, then dry up; the methane rain flows down to the lakes causing erosion channels, similar in shape to Earthly stream beds. This erosion probably explains why there are very few impact craters visible on the surface, and why there are only hills, no mountains. Chunks of dirty water ice near the landing spot showed evidence of liquid erosion, indicating that liquid methane commonly flows through the area. Photochemical smog seen in the atmosphere apparently falls or condenses on the ground, giving it a dark coating. But flowing liquid, when it rains methane, washes the dark coating off the higher ridges and concentrates it in the bottom of the erosion channels. There are short stubby erosion channels that may indicate they are caused more by springs of liquid methane than by rainfall. Methane concentrations in the atmosphere near the ground are much higher than concentrations high in the atmosphere. This indicates that methane is evaporating from the ground, rising, then raining down again when it reaches a certain altitude. Huygens detected spurts of methane coming out of the ground when the probe warmed the soil beneath it. Considering that the temperatures and chemistry are vastly different, it is surprising that so many similarities exist between Titan and the Earth in the areas of rain, clouds, frost, lakes, wet soil, erosion from rivers, and resulting land forms.

About half the images were lost because one of the two radio channels was never received, probably the result of an error in computer programming. Because of planned overlap of the images, little image coverage was actually lost. The Doppler tracking experiment that used only the lost channel was essentially duplicated by radiotelescopes on Earth that managed to track the signal during the entire descent. It had been thought the signal would be too weak to do this. So enough data and images were returned to fulfill all the primary science objectives.

The microphone on board recorded many sounds, among them the wind rushing by the spacecraft as it descended through the thick atmosphere of mostly nitrogen. The descent took almost 2 hours 28 minutes and encountered winds of 16 mph near the ground, but as high as 270 mph at an altitude of 75 miles. Winds at almost all altitudes flowed in the direction of Titan's rotation, from west to east. The probe was expected to drop through the last haze layer at 30 to 40 miles altitude, but was under 20 miles when this happened. Huygens hit the ground at 10.1 mph. The air temperature at ground level was minus 290.8 degrees F. The spacecraft turned on a 20-watt spotlight at 230 feet above the ground to obtain better pictures of the landing and surroundings. Because Titan is over 9 times as far from the Sun as Earth is, and because of the thick haze layers in the Titanian atmosphere, natural lighting on the surface is about 1000 times dimmer than daylight on our planet, and so needed help from the light.

Saturn – Images of Saturn made in infrared light with the Keck I telescope in Hawaii show that the hottest spot on the planet is a small spot at the south pole. The hot spot appears to be at the center of a polar vortex, a persistent circulation of atmosphere about the pole. Earth, Jupiter, Mars and Venus have polar vortices too, but they are all colder than surroundings, so Saturn's hot spot is unique. More observations are planned, both Earth-based and from the Cassini spacecraft, to try to explain the hot spot.

Cosmic rays - A region of the sky near the Big Dipper has been found to be the source of repeating ultra-high energy cosmic rays, the first time a source has been found for such. Normally magnetic fields in intergalactic space bend cosmic rays until their source cannot be determined, but there appears to be a region of low magnetic field strength in this direction. It is hoped that further research will be able to determine what object emits these cosmic rays, since the high energy ones such as this have so much energy that their production is difficult to explain. Theories include a gamma ray burst, a quasar or decay of dark matter exotic particles. Only about 100 cosmic rays of this high energy have ever been observed. If enough such cosmic rays can be observed, the energy distribution of them could distinguish between bursts or quasars as the source.

Milky Way's black hole – It has been known for many years that there is a supermassive black hole at the center of our Milky Way galaxy, with a mass of more than a million Suns, but activity from matter falling into it is relatively quiet. Supermassive black holes at the centers of other galaxies are often far more active. The Integral orbiting gamma ray observatory has detected a gamma ray reflection off a cloud of hydrogen gas located about 350 light-years from our galaxy's center that indicates the black hole was about 1 million times as active just 350 years ago.

Usually when I run the telescope for star parties or classes, we do a lot of long slews, as people inevitably want to look at things in different parts of the sky. That night, for the first time in all the times I'd run it, all my slews after I aligned the scope were short, as I went from one object to another in close proximity to it. This was more by chance than the result of good planning, but it proved to be a fortunate strategy for that evening…

Well, the night and the telescope worked their magic, but exhaustion set in after several hours, and I closed the observatory around 1:30. The Kuhn went to its "park" position like a dream – it had been working perfectly all evening – but as I turned off the power, there was a smell like burned wiring. I felt some warmth near the base of the telescope, but couldn't tell where it came from, and after checking around awhile and confirming that there wasn't any actual fire, I gave up on locating the source.

As I found out two weeks later, when I had planned to run the Kuhn for a class, that slew to its "park" position was the last gasp of the system John Hoot had built to run the Kuhn by acting as the interface between the telescope and the program we actually use to control it, TheSky. The Kuhn didn't respond to anything after that last "park" maneuver, and when John Hoot checked into it, he found that the circuit board for the control system had not just failed, but parts were actually melted. Dave Radosevich did some additional investigation, and found a lot of mechanical problems that contributed to the failure. Dave's done the lion's share of the physical work to renovate the Kuhn since then, including cleaning and re-aligning gears, installing the new drive motors and control system, and having the optics recoated. John has done fine-tuning of the software, and tested the tracking for use with the CCD camera that he generously donated. And, as I write this, Dave tells me that we now have the replacement chip that should solve the last significant problem with the new drive system, an intermittent "jump" – if all goes well, by the time you read this, that problem should be history.

The Kuhn is a telescope, not really a living entity, though it sometimes seems to be – but I'm still very grateful to it for the gift of that night of wonderful viewing when I needed it most, and for ending the night perfectly by getting to its "park" position before the system expired. If it hadn't, the night would have ended on a much less pleasant note, as I wouldn't have been able to get the observatory roof closed until I somehow got it into the right position.

Time passes, and circumstances change – now, besides Star Member Trainer, I'm the Observatory Custodian, with overall responsibility for the observatory and the Kuhn. John Hoot, who held that position before me, will continue to provide assistance as the Kuhn Systems Consultant. Dave Radosevich is now the club President, but will continue to help with the mechanical aspects of the Kuhn.

Romance or not, this particular girl has definitely bonded with the telescope – and would be delighted if all of you did, too! The Kuhn is even easier to control now than it was that July night, the optics are brighter, and it's a pleasure to use. All you need to do to have the privilege of working with it yourself is to become a Star Member, go through the training and then spend some time running it with a more experienced Star Member. I'm sure you'll find, as I have, that the $150.00 cost of a Star Membership (which helps to maintain the observatory and telescope) is money very well spent!

Moving into the Future at the Observatory…

…of course there are the plans for the new roof, which, if all goes as we hope, should have the side benefit of being able to close even if the Kuhn isn't in its proper "park" position (not that we won't still have to park it when closing it down, but we'll have more leaway in case of problems). And the new roof will be lighter and easier to open and close than the current roof, and may even be more rodent-proof – there are lots of benefits, beyond the mere fact that the old roof is visibly deteriorating each month (and the heavy rains and wind this winter haven't helped!). So, especially if you haven't yet donated any spare objects you might have around the house to help us out on this great cause (plus the cause of the Anza site fence, of course), please use this as an opportunity for some spring cleaning, and get your unused belongings to Larry McManus – you get a tax deduction, some freed-up space and a noble sense of having done a good deed, and we get closer to our goal for financing these much-needed projects.

There are some lesser projects we need, too, though. The Observatory phones have been out of action for several months now – if you've got any expertise with phones and would like to lend a hand, please let me know! The lighting in the warming room needs work – what I'd really like to have there is separate white light and red light systems, similar to what we have in the observing area and the observatory bathroom, controlled by separate switches – any electricians out there, I could use your

help! And then there's the issue of the front door to the observatory – if you've ever tried to open or close it, you've probably noticed that the frame is doing its best to separate entirely from the wall, and the door itself is collapsing off its hinges. Energetic as they are, Don Lynn and Gary Schones can't handle everything that needs to be done out at Anza – if you've got the expertise and can help us out with this long-standing problem, we'd really appreciate it! My contact information is the same as before – btoy@cox.net, or 714/606-1825 – and I look forward to hearing from you!

OCA's Own Dark Sky Group!

Yes, indeed, OCA now has its very own Dark Sky group – so, if you've ever been annoyed by excessive light around Anza or anywhere else you like to observe (even around your home), put that sense of annoyance to good use by joining us! One easy way to start is to join our email group – ocadarksky@yahoogroups.com. To join, if you're already a Yahoo member, send an email to ocadarksky-subscribe @yahoogroups.com. If you aren't yet a Yahoo member, you can sign up on the Yahoo Groups page, at http://groups.yahoo.com/ – and after you do that and join the Dark Sky group, you should also think about joining the club's other major emails groups. The more general group is ocastronomers@yahoogroups.com, and the group dedicated to imaging is AstroImagers@yahoogroups.com.

We're having our first actual meeting on Wednesday, March 23, 2005 at 7:30 p.m. Anyone with an interest in preserving (or even improving!) our night skies is very welcome. The meeting is at my office, at 500 W. Santa Ana Blvd., Suite 350, Santa Ana. Please email me at btoy@cox.net for a map and specific directions, or telephone me at 714/606-1825. And please keep an eye on the website for updated information, in case there are any changes!

One of the purposes of our Dark Sky group is to help all of us learn more about the issues related to light pollution and the efforts to control it, resources that might help us, and information that we can use whenever we have a chance to educate others about this problem. We've already had a number of informative exchanges in the email group, especially since Scott Kardel joined it, as he's been able to let us know about several developments he's aware of because of his position at Palomar, and he's sent us with some interesting links to such things as light shields that were developed to reduce the glare from a common type of flood light. He also posted a picture he took showing the light dome that Palomar is increasingly faced with from all of the new development in north San Diego and east Riverside Counties; he kindly gave us permission to include it in the Sirius Astronomer, and there should be a copy of it near this article.

Our email group isn't limited to OCA members, as one of my goals is to build alliances with people and groups outside our club that are likely to have their own reasons for wanting to limit light pollution, as well as other astronomy clubs that have an interest in lighting in Orange County and the areas of Riverside and San Diego Counties that are of greatest concern to us. Bird watching groups and groups with strong environmental concerns, such as the Nature Conservancy and the Sierra Club, should be natural allies, as excessive light creates problem for the wider environment (two known effects are disruptions of migratory patterns for some types of birds, and skewing of food supplies for insect-eating birds and bats because of the effects of light on nocturnal insects). I hope that, over time, we'll discover more groups that have reasons to share our concern about protecting the night sky. If you have ties with any group outside OCA that you think could be an ally on these issues, please let me know!

It's early days yet, but we can already see a lot of projects that we could get involved with. Besides large scale projects, such as working to get good lighting ordinances passed in local jurisdictions, or making a concerted effort to work with developers to get them to use good outside lighting in their developments as a matter of course, there are problems on a smaller scale that are of more immediate concern to a lot of people. One is dealing with neighbors – I expect that all of us at one time or another have had a problem with a neighbor whose lights are a nuisance, and we could all use good strategies to help us deal with that kind of problem without making an enemy of that neighbor. One of our goals for the upcoming meeting is to decide where we want to focus our initial efforts – so come to the meeting and be a part of this important phase of OCA's efforts to protect the skies we all depend on!

In Closing…

Besides Observatory Custodian and OCA Dark Sky Coordinator, I'm now the club's Member Liaison. Part of that job is informational – if you've got questions about the club or any of its activities, please feel free to contact me. And, of course, if you're having some kind of problem with the club, please let me know, and I'll do my best to help work it out.

And I guess I should note that, whatever else may have changed this year, the length of my articles, however titled, has not…

This is an indication that the activity level of black holes can change dramatically in such astronomically short time periods.

Supermassive black holes – It has been known for several years that the mass of a supermassive black hole found at the center of most galaxies is always about the same percentage of the total mass of the galaxy, but the physical mechanism that causes this is not known. A new computer simulation of the formation of galaxies appears to explain this relationship and also explains why the quasar phase is short in relation to the life of a galaxy. Large galaxies are formed by merging of smaller galaxies that collide. Each time this happens, the supermassive black holes at the centers of the colliding galaxies merge into a larger black hole. This larger black hole then captures a great deal of material that swirls into the black hole, emitting huge amounts of light (including X-rays, etc) on the way, and we know the brilliant light as a quasar. The disturbance of gas and dust from the galaxy collision causes a rash of star formation at this same time. But the huge amount of light from the quasar soon blows much of the gas to the outer reaches of the galaxy, turning off the quasar and turning off star formation, both from running out of gas. So the total mass of stars and the total mass of the central black hole both depend on how many times this collision process has taken effect, and so they remain proportional.

Dust disks – About half of all newborn stars have a dust disk about them, from which planets can form. After planets form, debris disks are left, which dissipate over very long time periods. Although 70% of all stars are red dwarfs, much smaller and fainter than our Sun, almost no red dwarfs have debris disks. Until now no one could explain why red dwarfs are so successful at getting rid of the debris disks. Red dwarfs are known to have much stronger stellar winds than our Sun. New calculations show that these stellar winds can dissipate dust, even though the Sun's stellar wind had negligible effect on dissipating the dust that was left after our planets formed over 4 billion years ago (effects other than stellar wind cleared out the Solar system).

Chandra (X-ray telescope) – Computer simulations of the formation of galaxies somewhat after the Big Bang showed that most of the ordinary matter (protons and neutrons) of the universe should have formed into extremely diffuse web-like system of gas clouds from which galaxies and clusters of galaxies formed. But a substantial fraction of that matter would not form galaxies, and so would remain as very thin gas clouds. Such clouds have been detected in our Local Group of galaxies, but until now they were too thin to detect at greater distances to substantiate the computer simulations. Chandra observed a bright quasar-like galaxy known as Markarian 421 and found that the X-ray light from it had passed through 2 such gas clouds, detected by their absorption spectrum impressed upon the galaxy's light. Astronomers were able to calculate the size and density of the clouds from the spectra. If this observation is typical of the universe, then the amount of matter adds up to about the amount expected from the simulations.

Mars Rover Opportunity found a rock the size of a basketball, which is made of iron and nickel, and it was confirmed to be a meteorite by using the Mössbauer and alpha particle spectrometers. Since stony meteorites are much more common on Earth than iron meteorites, scientists are wondering if there are stony meteorites among the rocks seen here and there on the plains being explored by the rover. So they will be examining pictures of the plains for possible meteorites.

Mars Express (European Mars orbiter) has discovered ultraviolet light emission from the nighttime atmosphere of Mars. An effect with the same spectrum was detected years ago on Venus, and was found to be caused by the combination of nitrogen and oxygen atoms into nitrogen oxide molecules. The nitrogen and oxygen atoms were produced by ultraviolet light from the Sun breaking apart molecules of carbon dioxide, nitrogen and oxygen during the daytime. It is thought that the Mars nightglow is from the same process as that on Venus.

Spacecraft controllers for Mars Express have decided to deploy the radar antennas in May, so that it can begin studying subsurface material, including possible water, and studying the ionosphere. This step has been delayed for more than a year due to fears that deploying the antennas could whiplash the spacecraft. The year was spent computer simulating the deployment, and the conclusion is that the antennas could strike the spacecraft, but the chances of substantial damage are very small. The antennas are on 2 masts over 65 feet long and a shorter mast.

Low mass stars – A new high-contrast camera on the Very Large Telescope in Chile has imaged a low-mass companion that had been too close to its star (named AB Doradus A) to be seen with previous technology. The companion had been known to exist because its star had been observed spectroscopically to be wobbling due to gravitational attraction by the companion. The Hubble Space Telescope had tried and failed to image this companion object. By tracking the orbit of the object with the new camera, its mass has been calculated, and it is 93 times the mass of Jupiter. This makes it a little too massive to be a brown dwarf, and so it is a real star, that is, one that shines by nuclear burning of hydrogen. Using near infrared, the temperature and brightness of the object were measured. Theory had predicted that an object of this mass should be 2.5 times brighter and 700 degrees F. hotter than it is. This means the theorists have a lot of work to rethink. It also means that many of the objects classified as brown dwarfs by their brightness or temperature now have to be reclassified as stars. This could also mean that objects classified as planets by their temperature may also be more massive and therefore be reclassified as brown dwarfs.

Great extinction – The largest mass extinction the Earth has seen occurred about 250 million years ago, just before the rise of the dinosaurs. 90% of all marine life and nearly 3/4 of land-based plant and animal life went extinct. Previous work has shown some evidence that this extinction was caused by the collision with Earth of a comet or asteroid. New work done on rock layers formed at this time in what is now South Africa have revealed no evidence of such a collision. Instead it shows that the atmosphere warmed considerably and the oxygen level dropped, making much of the Earth uninhabitable. These effects appear to have been cause by massive volcanic activity in what is now Siberia. The volcanism released gases, which warmed the Earth, which in turn released methane gas frozen on the ocean floors, which increased the greenhouse effect, further warming the atmosphere. This warming persisted for a long time, and the extinction appears to have occurred over this long time period (10 to 15 million years), not as briefly as would be expected from a collision. Another team of scientists studying sediments of this same age found near the coasts of Australia and China, found evidence for lowered oxygen and increase in sulfur-eating microbes, corroborating these findings.

Regulus – It has long been known that the star Regulus is roughly 5 times the diameter of our Sun, and that it rotates in only 16 hours. It was thought that this would cause the star to be quite elliptical rather than spherical, and now that has been measured. The CHARA array, a group of telescopes on Mt. Wilson connected as an interferometer, has measured the equatorial diameter to be 1/3 larger than the polar diameter. The star was observed to exhibit gravitational darkening, a phenomenon previously observed only in double stars, not single stars like Regulus. This means that the reduced gravity at the equator, caused by bulging farther from the center, causes the equatorial regions to be cooler and therefore darker than the polar regions. CHARA measured the poles to be 9000 degrees F. hotter and 5 times brighter than the equator. CHARA located where the poles of the star are, and they coincide with the direction Regulus is moving through space, but no one know why this would be.

Magnetars are neutron stars that have extremely powerful magnetic fields, about 1000 times that of an ordinary neutron star, that is, a quadrillion times as strong as the Earth's magnetic field. Only about 10 magnetars have been discovered. Magnetars are distinguished from ordinary neutron stars because they spit out burst of X-rays and gamma rays instead of just beams of radio waves. Magnetars also form with a much faster spin than ordinary neutron stars, although both slow down as they age. Both are thought to form when a large star reaches the end of its life and explodes as a supernova, leaving behind just the core of the original star as a neutron star. It has been a mystery why a small percentage of neutron stars form as magnetars, even though they both form the same way. One theory is that very large mass stars become the magnetars. The problem with this is that very large mass stars after they explode as supernova should theoretically become black holes rather than neutron stars. A new study of a magnetar by radiotelescopes in Australia confirms that this magnetar formed from a very massive star, and also showed how it avoided becoming a black hole. The observations showed a hole in surrounding gas that had been carved out by extremely powerful stellar winds before the supernova explosion, apparently dropping the remaining mass of the star below what is needed to become a black hole. The characteristics of the hole matched what should be expected from a star of 30 to 40 times the mass of the Sun (very massive as stars go). It appears that larger original mass causes a faster spin when the star collapses, and that generates a stronger magnetic field (due to dynamo action), which results in the magnetar instead of an ordinary neutron star. Another result of the study was an estimate of how common magnetars should be given this formation mechanism, and that indicates that they are not very common, and so we probably have found all or nearly all of the nearby magnetars.

Swift (gamma-ray burst observatory) has for the first time observed a gamma-ray burst in X-rays while it was still bursting in gamma-rays. All previous X-ray observation has occurred on the afterglow left after the burst ends. But Swift automatically turns its X-ray telescope to the area in the sky where it detects gamma-ray bursts, making this possible. At the time, the ultraviolet telescope on board the spacecraft was still undergoing checkout, so the burst was not seen in ultraviolet. But that should happen soon.

Extrasolar planet – Last April the Very Large Telescope in Chile, using adaptive optics in infrared, detected a dim object next to a brown dwarf star, which appeared to be a planet orbiting the brown dwarf. Now follow-up observations with the Hubble Space Telescope at shorter wavelengths of infrared have shown it is quite likely a planet rather than the other possibility of a very distant cool star that by chance appeared near the brown dwarf. It appears to be 30% farther from its star than Pluto is from the Sun, and would therefore take about 2500 years to complete one orbit. The color and temperature match that of a planet 5 times the mass of Jupiter and only 8 million years old. Further observations are planned. If confirmed, this would be the first directly imaged planet outside the solar system.

Smallest extrasolar planet – The first extrasolar planet found in 1992 orbited a pulsar (neutron star), and was found by the wobble in the star induced by the gravity of the orbiting planet. This is similar to the technique commonly used to find planets about Sun-like stars, except the wobble is measured in the timing of the radio pulses from the neutron star instead of measured by Doppler shift in the light. Because the pulses can be measured much more precisely than Doppler shift, the technique on neutron stars is able to detect much smaller planets. The

discoverer (Alex Wolszczan) has continued to track the pulsar and has now found the fourth planet in the pulsar data. It is only 1/5 the mass of Pluto, our smallest planet, and so is the smallest extrasolar planet known. It is farther from its star than the other 3 planets there, about the distance our asteroid belt is from the Sun. The discoverer is now convinced that he has found all the planets that can be found in the tracking data for this pulsar. It is amazing that the 4 planets survived the supernova explosion necessary to turn an ordinary star into a neutron star. It is surprising that this system orbiting a neutron star is more like our solar system in terms of planet size and orbits than any of the roughly 100 planetary systems found orbiting Sun-like stars.

Spitzer (infrared space telescope) has found a dusty disk, that is possibly forming planets, circling about a very low mass brown dwarf star, only 15 times the mass of Jupiter. This is the smallest star known that appears to be forming planets. This raises the question of whether planets could form about a planet. That is, could the star formation process produce a body such small mass that it did not even qualify as a brown dwarf, and still be able to form planets orbiting about it? A body is generally not considered massive enough to be called a brown dwarf unless it has over 13 times the mass of Jupiter, though there is some dispute about exactly where the limit should be placed.

Escaping star – Observations made with the MMT telescope in Arizona show a star that is speeding away from the Milky Way at twice the escape velocity of the galaxy, the first star ever seen to escape our galaxy. The composition and path of the star show that it formed near the center of the Milky Way and then nearly 80 million years ago was gravity slingshot to this speed when it passed close to the supermassive black hole at the galactic center. The orbital mechanics of such a slingshot require that it was once a double star, and that the companion was left orbiting the black hole during the encounter.

Pluto – All of the moons of our solar system have tiny masses as compared to their planets (at least thousands of times smaller), except Moon-Earth and Charon-Pluto. It is believed that most moons formed along with their planet from dust and gas collapsing from gravity. It has been known since conclusive evidence from Apollo Moon rocks that our Moon had to have formed when a planet about the size of Mars collided with the Earth soon after our planet's formation, and that knocked material off the Earth that formed the Moon. So this difference in how the Moon formed explained how its mass was relatively much bigger than other moons. It has been speculated for many years that a collision with Pluto early in its history could explain its relatively massive moon Charon. A new computer simulation has shown for the first time how all the properties of Pluto and Charon that are seen today can be explained by such a collision, thus tending to confirm this theory. The body colliding would have to have been almost as large as Pluto.

Instant AstroSpace Updates:

A study of 12 star clusters containing very **large stars**, the largest study of this kind, has found that statistically there is very little chance of finding any stars more than about 120 to 200 times the mass of the Sun. It has long been known there seems to be an upper limit to the mass of a star, but this study puts a better limit on it. The physics that imposes this limit is not understood.

The **Hubble Space Telescope** has imaged for the first time ever in the Small Magellanic Cloud (a satellite galaxy to our Milky Way) infant stars still forming from gravitationally collapsing gas clouds. Over 2500 such stars were imaged in the nebula NGC 346.

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