The Ford Amateur Astronomy Club Newsletter

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HUBBLE OBSERVES THE FIRE AND FURY OF A STELLAR BIRTH

NASA's Hubble Space Telescope has provided a detailed look at the fitful, eruptive, and dynamic processes accompanying the final stages of a star's "construction." Images from the orbiting observatory reveal new details that will require further refinement of star formation theories, according to several independent teams of astronomers who have used Hubble to observe different embryonic stars. The Hubble observations shed new light on one of modern astronomy's central questions: how do tenuous clouds of interstellar gas and dust make stars like our Sun?

"For the first time we are seeing a newborn star close up — at the scale of our solar system — and probing the inner workings," said Chris Burrows of the Space Telescope Science Institute, Baltimore, MD, and the European Space Agency. "In doing so we will be able to create detailed models of star birth and gain a much better understanding of the formation of our Sun and planets." The Hubble images provide a dramatically clear look at a collapsing circumstellar disk of dust and gas that builds the star and provides the ingredients for a planetary system, blowtorch-like jets of hot gas funneled from deep within several embryonic systems, and machine-gun like bursts of material fired from the stars at speeds of a half-million miles per hour.

The images offer clues to events that occurred in our solar system when the Sun was born 4.5 billion years ago. Astronomers commonly believe that Earth and the other eight planets condensed out of a circumstellar disk because they lie in the same plane and orbit the Sun in the same direction. According to this theory, when the Sun ignited it blew away the remaining disk, but not before the planets had formed. "The Hubble images are opening up a whole new field of stellar research for astronomers and clearing up a decade's worth of uncertainty," added Jeff Hester of Arizona State University, Tempe, AZ. "Now we can look so close to a star that many details of star birth become clear immediately." The key new details revealed by the Hubble pictures:

* Jets originate from the star and the inner parts of the disk and become confined to a narrow beam within a few billion miles of their source. It's not known how the jets are focused, or collimated. One theory is that magnetic fields, generated by the star or disk, might constrain the jets.

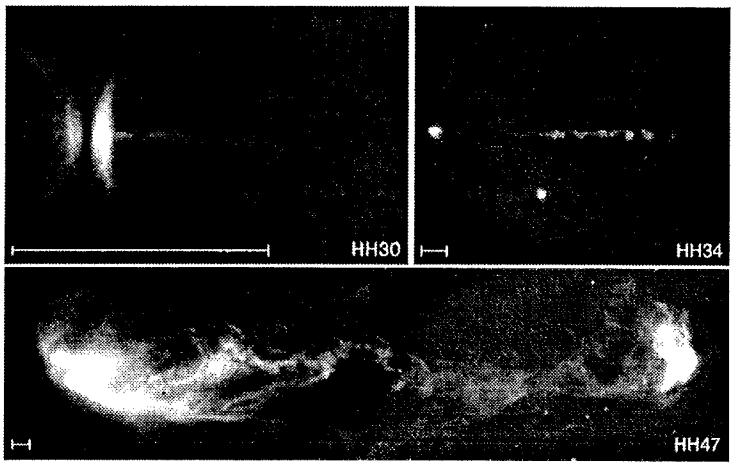
* Stars shoot out clumps of gas that might provide insights into the nature of the disk collapsing onto the star. The beaded jet structure is a "ticker tape" recording of how clumps of material have, episodically, fallen onto the star. In one case, Hubbleallowed astronomers to follow the motion of the blobs and measure their velocity.

* Jets "wiggle" along their multi-trillion-mile paths, suggesting the gaseous fountains change their position and direction. The wiggles may result from the gravitational influence of one or more unseen protostellar companions.

More generally, Hester emphasizes: "Disks and jets are ubiquitous in the universe. They occur over a vast range of energies and physical scales, in a variety of phenomena." Gaining an understanding of these young circumstellar structures might shed light on similar activity in a wide array of astronomical phenomena: novae, black holes, radio galaxies and quasars. "The Hubble pictures appear to exclude whole classes of models regarding jet formation and evolution," said Jon Morse of the Space Telescope Science Institute. A disk appears to be a natural outcome when a slowly rotating cloud of gas collapses under the force of gravity — whether the gas is collapsing to form a star, or is falling onto a massive black hole.

Material falling onto the star creates a jet when some of it is heated and blasted along a path that follows the star's rotation axis, like an axle through a wheel. Jets may assist star formation by carrying away excess angular momentum that otherwise would prevent material from reaching the star. Jets also provide astronomers with a unique glimpse of the inner workings of the star and disk. "Not even the Hubble Telescope can watch as material makes its final plunge onto the surface of the forming star, but the new observations are still telling us much about that process," said Hester.

Burrows, Hester, Morse and their co-investigators independently observed several star birth sites in our galactic neighborhood. "All of these objects tell much the same story," Hester emphasized. "We are clearly seeing a process that is a crucial part of star formation, and not just the peculiarities of a few oddball objects." The researchers agree that the Hubble pictures generally confirm models of star formation but will send theorists back to the drawing board to explain the details. The researchers emphasize that future models of star formation will have to take into account why jets are ejected from such a well-defined region in the disk, why jets are collimated a few billion miles out from the star, and why gas in the jets is ejected quasi-periodically.



Hubble Views of Three Stellar Jets; photo release no.: STSCI-PRC95-24a

[upper left] - This view of a protostellar object called HH-30 reveals an edge-on disk of dust encircling a newly forming star. Light from the forming star illuminates the top and bottom surfaces of the disk, making them visible, while the star itself is hidden behind the densest parts of the disk. The jet emanates from the inner region of the disk, and possibly directly from the star itself. The detailed view shows, for the first time, that the jet expands for several billion miles from the star, but then stays confined to a narrow beam. The protostar is 450 light-years away in the constellation Taurus.

(continued on page 2)

(continued from page 1)
[upper right] - This view of a different and more distant jet in object HH-34 shows a remarkable beaded structure. Once thought to be a hydrodynamic effect (similar to shock diamonds in a jet aircraft exhaust), this structure is actually produced by a machine-gun-like blast of "bullets" of dense gas ejected from the star at speeds of one-half million miles per hour. This structure suggests the star goes through episodic "fits" of construction where chunks of material fall onto the star from a surrounding disk. The protostar is 1,500 light-years away and in the vicinity of the Orion Nebula.

[bottom] - This view of a three trillion mile-long jet called HH-47 reveals a very complicated jet pattern that indicates the star (hidden inside a dust cloud near the left edge of the image) might be wobbling, possibly caused by the gravitational pull of a companion star. Hubble's detailed view shows that the jet has burrowed a cavity through the dense gas cloud and now travels at high speed into interstellar space. Shock waves form when the jet collides with interstellar gas, causing the jet to glow. The white filaments on the left reflect light from the obscured newborn star. The HH-47 system is 1,500 light-years away, and lies at the edge of the Gum Nebula.

The scale in the corner of each picture represents 93 billion miles, or 1,000 times the distance between Earth and the Sun. All images were taken with the Wide Field Planetary Camera 2 in visible light. The HH designation stands for "Herbig-Haro" object — the name for bright patches of nebulosity which appear to be moving away from associated protostars.

SCIENCE BACKGROUND

Stellar jets are analogous to giant lawn sprinklers. Whether a sprinkler whirls, pulses or oscillates, it offers insights into how its tiny mechanism works. Likewise stellar jets, billions or trillions of miles long offer some clues to what's happening close into the star at scales of only millions of miles, which are below even Hubble's ability to resolve detail. Hubble's new findings address a number of outstanding questions:

Where Are Jets Made?
Hubble shows that a jet comes from close into a star rather than the surrounding disk of material. Material either at or near the star is heated and blasted into space, where it travels for billions of miles before colliding with interstellar material.

Why Are Jets So Narrow?
The Hubble pictures increase the mystery as to how jets are confined into a thin beam. The pictures tend to rule out the earlier notion that a disk was needed to form a nozzle for collimating the jets, much like a garden hose nozzle squeezes water to a narrow stream. One theoretical possibility is that magnetic fields in the disk might focus the gas into narrow beams, but there is as yet no direct observational evidence that magnetic fields are important.

What Causes a Jet's Beaded Structure?
Hubble is solving the puzzle of a unique beaded structure in the jets, first detected from the ground but never fully understood. "Before the Hubble observations the emission knots were a mystery," said Jeff Hester. "Many astronomers thought that the knots were the result of interactions of the jet with the gas that the jet is passing through, while others thought that the knots were due to 'sputtering' of the central engine. We now know that the knots are the result of sputtering." Hester bases this conclusion on Hubble images which show the beads are real clumps of gas plowing through space like a string of motor boats. Competing theories, now disproved by Hubble, suggested a hydrodynamic effect such as shock-diamond patterns seen in the exhaust of a jet fighter.

What Do Jets Tell Us about Star Birth?
"The jet's clumpy structure is like a stockbroker's ticker tape; they represent a recorded history of events that occurred close to the star," said Jon Morse. "The spacing of the clumps in the jet reveals that variations are occurring on several time scales close to the star where the jet originates. Like a "put-put" motor, variations every 20 to 30 years create the strings of blobs we see," Morse concluded. "However, every few hundred years or so, a large amplitude variation generates a 'whopper' of a knot, which evolves into one of the major bow-shaped shock waves." Other Hubble views by Chris Burrows reveal new blobs may be ejected every few months. "If the circumstellar disk drives the jet then the clumpiness of the jet provides an indirect measure of irregularities in the disk."

STAR STUFF
Monthly Publication of the
Ford Amateur Astronomy Club

Star Stuff Newsletter
P.O. Box 7527
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GENERAL MEETINGS

The Ford Amateur Astronomy Club holds regular general meetings open to the public on the fourth Thursday of the month at 5:00 PM. Meetings are held at the Ford Motor Credit Company (FMCC) building, Northeast of the World Headquarters build in Dearborn, in conference room 1491, lower floor, East side of the building.

OBSERVING SITE

The Ford Amateur Astronomy Club has an established observing site, by permit, at the Spring Mill Pond area of the Island Lake Recreational Area in Brighton, Michigan located near the intersections of I-96 and US-23. Observing at this location is usually held on any clear weekend and holiday evenings or as specified in the observing hotline phone message.

OBSERVING HOTLINE NUMBER - (313) 39-05456

On Friday and Saturday nights, or nights before holidays, you can call the hotline number up to 2 hours before sunset to find out if we will be observing that night. Assume that any clear Friday or Saturday night is a candidate observing night unless something else is going on or none of the club officers are able to make it.

MEMBERSHIP AND DUES

Membership to the Ford Amateur Astronomy Club is open to both Ford and Non-Ford Motor Company employees. The general public is also welcome to join. The dues structure is as follows:

Annual Individual/Family	$20.00
Lifetime Membership	$100.00

Membership benefits include a subscription to the Star Stuff newsletter, discounts on subscriptions to Astronomy and/or Sky & Telescope magazine(s), after hour use of the observing site at Island Lake Recreation Area, and discounts at selected area astronomical equipment retailers.

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NEWSLETTER SUBSCRIPTION

A yearly subscription at a rate of $12.00 is available to those who are not members of the Ford Amateur Astronomy Club. Subscription are free to any other astronomy clubs wishing to participate in a newsletter exchange.

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JULY 1995

SUN	MON	TUE	WED	THUR	FRI	SAT
						1
2	3 Earth is at aphelion (94.5 million miles from the Sun)	4 Moon 4° S. of Mars	5 4:02 pm	6	7	8
9 Moon 2° N. of Jupiter	10	11 Moon is at perigee (215,264 miles from Earth)	12 6:49 am	13	14	15
16	17 Moon 6° N. of Saturn Neptune is at opposition	18	19 7:10 am	20	21 Uranus is at opposition	22
23 Moon is at apogee	24	25	26	27 11:13 am FAAC MEETING 5:00 PM	28	29
30	31					

MEETING ANNOUNCEMENT

The Ford Amateur Astronomy Club (FAAC) holds regular general meetings on the fourth Thursday of each month, except November and December. Our next meeting will be Thursday, July 27, at 5:00 p.m. The program for the meeting has not been determined at this time.

The FAAC meets in the Ford Motor Credit Company (FMCC) building, **conference room 1491**, located on the lower floor on the east side of the building. FMCC is the low building immediately northeast of (but not attached to) Ford World Headquarters in Dearborn.

The FMCC building is secured with a card entry system. The easiest way to enter the building for meetings is to park in the northeast lot (Employee Lot 7) and enter through the lower northeast door or the lower east door. At 5:00 pm no one seems to have much trouble getting in because many people are leaving around that time. At the east door you can dial 0911 on the security phone and say that you are here to attend a Ford club meeting, and security will admit you. You may, of course, find your way into the building any way you see fit, but direction signs will only be posted fromthe lower northeast and lower east doors.

MEETING MINUTES 6/22/95

by Harry A. Kindt (Sec'y FAAC)

The meeting was called to order at 5:00pm by our president Charles Boren. There were 28 members and guests in attendance. President's Report: We are still looking for designs for our club emblem/logo. We've received about a dozen entries thus far. With the submission of a few more entries, we should be able to begin the selection process. The Summer Solstice party is scheduled for July 1, 1995 at 2:00pm at Doug Bock's Northern Cross Observatory. Bring your own food and refreshments. Directions to the observatory will be available via PROFS. Thanks to John Paul StPeter, daily sunspot activity reports are available on PROFS. **We have a new combination lock at the main gate of our Island Lake viewing site.** Board members will have the combination. It should also be available on our hotline number. Members are advised that they will be responsible for opening and closing the gate after the parks 10:00pm closing time. Remember, CLOSE THE GATE behind you after 10:00pm whether entering our leaving the park and regardless of how you found the gate on your arrival. New Business: We are still looking for volunteers to assist in our 3rd Annual Star Party at Island Lake scheduled for Sept. 2, 1995. Help is needed in all areas i.e. parking, cooking, registration, clean-up etc. If you would like to have your name added to the list of volunteers, please contact one of the board members. Several members volunteered to contact their local public access cable channel in order to provide some additional advertising for the Star Party. Flyers for the event are also being prepared. The nucleus of a committee is now in place for a club project that was discussed at earlier meetings. The project involves creating a program that would "bring Astronomy to the public" a sort of Astronomy 101 course package that could be taken to various groups and taught by our membership. Bob MacFarland is the chairman of this committee. If you think that this would be a project that you would like to take part in, contact Chuck Boren or Bob MacFarland via phone or PROFS. Talks and "demos": Barry Craig brought along and described, two old telescope mounts, an alt/azimuth and an equatorial that were hand built with materials one might find around the house. He also brought along some photographs depicting the making of various sized telescopes and mounts that were done by the Detroit Astronomical Society during the late 70's and early 80's. Greg Burnett gave a talk on ancient time keeping methods and sundials, mentioning that a broken watch or clock is right twice a day whereas a sundial is right only four times a year. This led into a discussion of what is known as "The Equation of Time". Through a series of overhead projections and drawings and formulas, he took us on a step-by-step tour of the process by which the equation of time was developed. The meeting was adjourned at 6:30pm.

WEATHER & ASTRONOMY

by Todd Gross
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Starting April 1, I began publishing a series of articles devoted to Weather and Amateur Astronomy. This month's feature "How do I "dew" it" is perhaps the most useful article I will be publishing, because dew, the bane of many amateur astronomers, is easy for the layman to forecast for the night or nights ahead.

Face it, most of us, even Newtonian reflector owners, will at one point or another have to deal with dew. Some of us, like myself, have the worst possible scenario: A moist climate, AND a Schmidt-Cassegrain scope, both perfect for gathering dew and/or frost. Then why is it that I almost never worry about dew? Why do I leave my scope out at 10pm, allowing it to cool down, until my planned observing session at 4am, on some nights without even a dewshield? Dew, or the lack thereof, you see, is fortunately one of the easiest types of weather to predict!

What produces dew (or frost).. Basically, on clear or partly clear, low-wind nights, the temperature falls to a temperature called the "dew point". The dew point, is the lowest the temperature can fall..it is a bottom limit, the only way it can fall lower, is if the dewpoint itself changes. (In actuality the dewpoint often rises somewhat as the temperature drops, but not on clear, calm nights). What is important about the temperature falling to the dewpoint, is what happens when it does: Either fog forms, rain (or snow) falls, or dew/frost form. On a clear, calm night, it is the latter.

The dew accumulates on your optics, and can render an observing session useless, and it is hard to keep the dew off! Reflectors, and to a lesser degree, refractors both are naturally shielded from the sky, and thus the dew, but as long as the glass is open to the sky at all (especially if you are viewing towards the Zenith), you will eventually "dew up". That is because your optics lose heat even faster than the surrounding air when they face the sky.

Opposite of how you feel warm in the sun on a sunny day, space, with it's near absolute zero temperature, actually draws heat from a surface such as you, or your telescope's objective - it cools you down faster than the air, just like the sun warms you up! Thus, when skies are mostly clear, and winds are light, especially if the "dewpoint" is high, you will have problems, no doubt, on any surface that faces the sky, and the more directly it does, the worse the problem, as the temperature of the glass falls to the dewpoint, condensing moisture from the surrounding air.

Dew and frost are more common in some parts of the country and world, than others. Areas which are typically affected by areas of water such as the Gulf of Mexico, or Pacfic/Atlantic Ocean will have more of a problem than let's say, the desert SW. I think, you will find, that all areas will have at least some dew from time to time. There are a few places such as South Florida that are only very rarely dew-free!

What is the secret to saving the trouble of piling on the dewshield, dew heating equipment, tarps, umbrellas, etc? Well, it's all in the weather systems themselves. While I am the first to admit that there can be situations where it is a tough call, there are a couple of very concrete weather set-ups that will be easy for you to identify. This cannot really apply to the tropics, however. The important dew-less weather scenario that is easiest to recognize happens after a cold front passes by. This may be preceded by rain or snow, but is followed by either clearing, or some lingering clouds. If it DOES clear, the wind often stays fairly brisk for one or more days. On a weather map, we will be BETWEEN a receding cold front or storm center (low pressure system), and an incoming fair weather cell (High pressure system). No, or very limited dew will form in most places in this circumstance.

To make things even better, especially in the upper Midwest of the U.S. and in the Northeastern U.S. these systems often stall in place, (Low pressure to the Northeast, High pressure to the Southwest of you) allowing the wind to keep up for several days. The "catch" is that if you live in cities or towns before a mountain range, such as the Appalachians, you can stay CLOUDY for days in addition to windy. This is the case in places like Charleston, W.VA.. (USA) , and Rochester, N.Y. (USA). On the other hand, many cities in the Northeast U.S. corridor, benefit from the mountain range to the west, and stay mostly CLEAR for several days in this same weather setup, along with the wind. Thus, dewless nights can persist for many days straight prior to a High Pressure, fair weather system finally moving on in.

Once a high pressure cell, or any very weak weather maker with very little wind, does finally arrive - the reverse holds true. While it may be clear, dew will likely form as clear skies and light winds allow for radiational cooling, the culprit which produces the dew or frost. These conditions will persist until the High Pressure cell, or area of very weak weather systems (low or high pressure nearby) moves on.

One very interesting irony is that the very conditions that produce dew or frost to form, will also often produce good stability to the atmosphere. In other words, on a night with lots of dew, check out the planets - seeing should be good! (But don't forget to take precautions again the dew!) This is means that on a night when the stars do not show much twinkle, you can expect that dew WILL form. A night when stars twinkle a lot will be an unsteady night, one where dew will likely NOT form!

ASTRO TRIVIA

by Paul Mrozek
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This month's answers:

Q: Will The Moon eventually spiral away from the Earth?
A: The following quote is from Bill Arnett (billa@znet.com): "The Moon's gravity raises a bulge in the Earth (the tides) but since the Earth rotates faster than the Moon orbits the bulge tends to be slightly ahead of the line between the centers of the Earth and the Moon. The gravitational pull of the bulge then acts to pull the Moon forward (accelerate it to a higher orbit) and to slow the rotation of the Earth. Energy and angular momentum are conserved — the Earth's rotation slows down and the Moon goes into a higher orbit. The radius of the Moon's orbit increases by about 3.5 cm/year."

This process will continue until the Earth's rotational period and the Moon's orbital period are both equal to about forty of the present day's length. Thereafter, the Sun's tidal force will reverse the process bringing the Moon slowly spiraling back towards the Earth. We will never see the end effect of this process since it is estimated to take about 10 billion years. [1]

Q: What is synchronous rotation?
A: In a synchronous, or captured rotation, a planetary satellite rotates in a period equal to its orbital period about the planet. Synchronous rotation causes the same face always to be presented to the parent planet (not counting libration). The Moon's synchronous rotation was brought about by tidal action over a long period of time. Because its shape is an ellipsoid, the Moon's longest axis always points in the general direction of the Earth. [1]

Q: What is a synchronous orbit?
A: In a synchronous orbit, a planetary satellite has an orbital period equal to the planet's rotation. This orbit results in the satellite remaining approximately fixed over the planet. A synchronous orbit around the Earth is called a geosynchronous orbit. The point on the Earth's surface directly beneath the satellite appears to trace out a lissajous figure over the course of a day. If the orbit has very low eccentricity and low inclination to the Earth's equator, then the daily oscillation is very small and the orbit is called geostationary. Superimposed on this oscillation is a slow drift, mainly due to libration. [1][2]

Q: What is the Moon's tail?
A: Astronomers have discovered a 24,000 kilometer tail of sodium atoms streaming from the Moon. Its source is not known, and its faint orange glow cannot be seen by the naked eye. [3]

References:
[1] Oxford Illustrated Encyclopedia of the Universe by Archie Roy
[2] The Penguin Dictionary of Astronomy by Jacqueline Mitton
[3] The Handy Science Answer Book by the Carnegie Library of Pittsburgh.

Next month's questions:
What are the different kinds of month's in astronomy?
What are Moon cakes?
What was the first meal on the moon the Moon?
What is an Einstein's ring?

ASTRONOMY WORKSHOP

by Greg Burnett
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The following article was reprinted from ASTRONET, Issue 14, May 15, 1995. For more information, please contact resource@rahul.net.

A COMPARISON OF TELESCOPE MOUNTINGS
by Steve Coe, Glendale Arizona

So, you have finally acquired that great piece of glass that will open up the heavens and let you see everything that has been on the cover of Astronomy and Sky Telescope magazines for the last five years. However, now you have got to mount up that newly finished optical system on some type of telescope mounting. A good mounting must support the optics but not flex the tube and cause poor images. A good mounting should move across the sky smoothly and allow you to touch up the focus without twanging like a tuning fork. Of course, we want all of this and low cost, too. Who was it said you can't have it all?

A person trying to sort out the styles of telescope mounts can become very confused. Either looking through catalogs from manufacturers or deciding to try and build a mount in the garage can be a difficult and costly decision. In this article I will discuss the three most popular mounting techniques for a modern telescope and look at the advantages and disadvantages of each type. At different times in my life as a telescope maker I have constructed all three mounting styles. I am going to assume you know what a German Equatorial, Fork and Dobsonian mount look like. If not, any issue of Astronomy or Sky Telescope will have plenty of advertisements with these three popular mounts.

The first mounting we will discuss is the German Equatorial. They are moderately priced and several manufacturers offer very well made German mounts, if you are willing to step up in price and performance. A well made German mount is very stable and light enough that one person can set up a Newtonian of 10" aperture in about 10 minutes. The disadvantage is that cheaply made German Equatorial mounts, with small shafts and poorly made gears and clutches are supplied with many factory made telescopes. If you are planing to put a Newtonian on a German mount, plan on a tube rotation system. Without being able to rotate the tube, a Newtonian will get into some very awkward eyepiece positions. The biggest mechanical disadvantage to German mounts is that as they cross the meridian, the tube must be swung to the other side of the mount to avoid hitting the telescope stand. That can occasionally become exasperating, but after a while the user just plans around it by not looking at objects straight overhead from the wrong side of the mount.

The next mount is a Fork. Fork mounts are very popular as standard equipment on most catadioptric telescopes. They work pretty well because the tube assembly is short and the fork arms can be kept short. Long fork arms will start having problems with the tuning fork effect, the stability of the image in a poorly made fork is terrible. There have been several makers of large fork mounts for Newtonians on the market. You will notice none are still in business. Every once in a while someone tried putting large Newtonians on a fork. The fork arms must be massive and a stable mount of this type is a real hernia maker. Two advantages of the fork are: it does not have a problem crossing the meridian and no counterweight is needed to balance the tube assembly. Our last mount to consider is the Dobsonian. These simple alt-az mounts have one overwhelming advantage that makes them the mount of choice for setting up a large mirror and getting it working. That advantage is that they are inexpensive to build. Amateur telescope makers came to the conclusion ten years ago that there is no easier or less expensive way to get a piece of glass gathering light from the stars. I am on the cover of Telescope Making #26 (an obvious oversight by the editor, Richard Berry) with my 17.5" Dobsonian that was constructed in about four weekends. The obvious disadvantage is that they do not track the stars. This makes photography impossible and drawing or observing at higher powers difficult.

Let me conclude with a few thoughts. If you are not planning on trying to take photos, then a Dobsonian is a great starting point or they make a fine second telescope. On those nights when you don't plan to take pictures and you just want to be an astronomical tourist, a simple Dobsonian is easy to set up and tear down. If you are mounting up a Newtonian telescope which is going to be used for astrophotography, there are several makers of very high class (and high price) German mounts which will keep you in pictures for years to come. The best is Byers, a very well made unit. Most commercial units are OK, but the stability of both fork and German mounts could be improved by making some of the parts sturdier. Of course, then the scopes would be more expensive. Oh Well.

If you are considering buying a scope with a particular mount, try the thump test. Give the tube near the eyepiece a tap with your finger and see how long an image at about 200X takes to calm down. Less than five seconds is good. Longer that ten seconds is pretty poor. These three mounts became the most popular because they meet the needs of a wide variety of applications for astronomers. One of them should take care of your applications as well.

A COMPARISON OF FINDER SCOPE CONFIGURATIONS
by Greg Burnett

Straight-Thru vs. Right-Angle: No Contest! (In my humble opinion...) I wish to resolve the seemingly eternal debate over which is the better configuration for finder scopes, the "straight-through" design, or "right-angle" arrangement.

A finder scope is a small refracting telescope attached to a larger instrument to aid in pointing the main instrument at the desired observing target. Finders operate at very low power, usually between 6x and 12x, and their (hopefully) wide field of view allows the user to find their way around on the sky (in theory) more easily than with the main instrument alone. They are customarily equipped with a cross-hair reticle to allow precise aiming. The straight-thru finder is simply a small, straight refractor that requires the observer to position their head and eye behind it, thus looking in the same direction as the main objective. The right-angle finder includes a 90-degree diagonal mirror (or prism) at the eyepiece end that turns the light path away from the axis of the main instrument and affords the user a more convenient viewing position.

To my way of thinking, the right-angle finder has little to recommend it, while the straight-thru finder confers a number of advantages on the user who knows how to apply it. Consider the following characteristics:

VIEWING POSITION: Admittedly, the position of the observer's head when using a straight-thru finder is sometimes a bit awkward, but that position becomes the most important advantage over the right-angle finder. With both eyes looking in the same direction as the main instrument, one through the finder and one unaided, the observer gets a "Telrad" zero-power effect through the unaided eye, which sees a very large portion of the sky. Stereoscopic vision superimposes the finder reticle on the unmagnified sky, and allows the observer to navigate easily over large angular distances, much larger than can be seen through the finder alone. As the desired object approaches alignment, it enters the field of the finder and becomes visible to the other eye, which then positions it on the cross-hair.

With a right-angle finder on the other hand, only what falls within the finder's field can be seen. This is comparatively a very small piece of the sky, usually not enough to allow the observer to orient themselves without careful reference to a star chart, which brings us to the next point...

IMAGE ORIENTATION: The image in a straight-thru finder is inverted but not reversed, because there are no reflecting surfaces in the optical path. Thus, objects in the finder bear the same relationships to one-another as they do on a chart or in the sky, the view is just rotated 180°. In a right-angle finder, the image is reversed by the diagonal mirror. The resulting left-becomes-right-or-is-it-up-becomes-down-or-is-it-both image can make consulting a chart somewhat challenging. Yes, the image does match that seen through the main instrument, which is usually also equipped with a star diagonal, but this coincidence is seldom of any real value.

COST: Optically and mechanically, the two configurations are the same except for the diagonal mirror, which adds cost to the right-angle finder.

If you have used both types of finders, I think you will agree that the physical flexibility required by the straight-thru finder is a small price to pay for the increased capability it provides. (Feel free to remind me of this fact the next time you see me kneeling in the dirt with my neck twisted around like a pretzel! ;-)

FISH LAKE REPORTS

Rain, Rockets and Moonlight at Fish Lake, by Gery Kissel

The annual Eastern Michigan University Astronomy Club Fish Lake Under the Stars Star Party took place on the nights of June 3 and 4. For those club members who did not make it, which would be everyone except Harry Kindt, his wife Ada and me, here is a short report. June 3rd, rain, rain, rain, rain, enough said. June 4th rain, rain, rain. I sat home watching the Weather Channel until 2:00 p.m. when I finally decide to go for it. While driving through Lake Orion the sky opened up and dumped what felt like a foot of rain. When I finally arrived at Fish Lake at about 4:00 p.m. things were quiet, cloudy and wet. I ran into Harry immediately. As a seasoned one day veteran (Harry arrived Friday night) he showed me the Fish Lake ropes. I laid claim to a bunk in the same area as Harry (big mistake, Harry saws logs like a lumber jack) and we went to dinner. I informed the rest of the gang that I was optimistic that the weather would clear and sure enough after dinner the first confirmed sighting of blue sky was made. With the skies clearing the rocket launches that were on hold since the afternoon were once again a go and we proceeded to the launch site.

After 2 or 3 "conventional" launches, it was time to put the "serious" rockets on the pad. The seriousness of the rockets are illustrated by their 6-8 foot height and their multi-engine single stage power plants. The first two launches were text book perfect, soaring into the sky with a pin point of light marking their progress and the eventual sighting of a parachute to mark the end of a successful flight. The final launch of the day, however, was not so perfect but none the less most exciting. With the winds blowing north to south the launch team decided to angle the launch pad towards the north so that the wind would not carry the rocket into a neighboring subdivision while parachuting back to earth. The angle of the launch pad and the unanticipated failure of 1 or 2 of the 3 engines made for an interesting flight. Upon ignition of the engine(s), the rocket rose slowly off the pad angling more and more toward the woods. The rocket flew right into the woods leaving a trail of smoke behind it like bread crumbs! All of us ran after it and finally retrieved it in relatively good condition. The event made a great video and we were grateful we did not raise the dander of any local Michigan Militia members!

With the sky clear of both clouds and rockets we began to set up our scopes. There were an estimated 8 to 10 scopes set up. The place looked like a mirror salesman's dream come true (sorry Greg). There was a variety of Newtonians, Dobsonians and SCTs. Everyone's first object was the moon which was about first quarter. With the moon in my sights I had my Meade 8 inch SCT cranked up to 285x. Considering dew was already beginning to soak everything in sight I was most satisfied with the view. Mars was being a bit more of a challenge though. It never got better than an orange blob, the only difference was whether it was a small blob or big blob depending on the magnification. Once the moon set it was deep sky time. All the usual goodies were there, M104, M51, M101/102, M13, M92, M57... The skies at Fish Lake are darker than at our Island Lake site but still not as dark as I was hoping. When 2:20 a.m. rolled around I was ready for bed. I fell asleep quickly, but awoke about an hour later by a noise that sounded a lot like snoring. I also noticed Harry had gone to bed. Coincidence? Maybe.

Report on fish lake, by Harry A. Kindt

Friday, June 2nd, 1995—Despite the predictions for another weekend of unfavorable weather for any type of astronomical viewing, my wife Ada and I decided to take our chances and head out to Fish Lake for the E.M.U. Astronomy Club's Star Party. We figured that at least it would be a quite, peaceful weekend away from the noise and pollution of the big city, even if we didn't set up the telescope or get in any viewing time. Clouds and intermittent rain were the order of the day and followed us all the way to Lapeer. We stopped in Lapeer, had dinner, and arrived at Fish Lake around 6:30pm. We then registered at the Dinning/Conference Hall where we met our host, Norbert Vance and other members of the E.M.U. Astronomy Club. After unpacking our gear and finding our bunks in the dormitory, we headed back to the Hall. As you might expect, the topic of conversation around the Dinning Hall was the weather. Several members were at their computers, pecking away at the keyboards, searching the Internet for any local weather information that at least would provide a glimmer of hope that the weather was about to change and that we might still be able to get in some viewing time. Alas, the forecasts were about as dismal as the present weather and would probably continue to be the same well into Saturday afternoon. The rest of the evening was spent relaxing, playing Euchre, Gin Rummy and in friendly conversation. Ada and I passed around our club's photo album and I got the feeling that a lot of people were impressed by the effort our club put forth during last years Annular Eclipse to bring this event to the public. Congratulations, gang. Sack time for us was around 12:30am. Saturday, June 3rd, 1995—This day dawned pretty much as had been predicted, cloudy, overcast and with light showers. After awakening and peering out the dorm window from my bunk, to check out the weather conditions, I shook off a sincere desire to remain right where I was, got up, dressed, and went to breakfast. After breakfast, a lot of people headed back to the dormitories to read, do homework and, no doubt, get in a little extra "shut-eye". I stayed behind at the dinning hall to peer over the shoulders of the guys, who were already back at the key boards of their computers trying to find some good weather over the Internet. Their persistence finally paid off, the forecasts began to call for partial clearing during the day and for completely clear weather during the early evening hours lasting throughout the night. One could almost hear a sigh of relief from Norbert and our E.M.U. hosts. The rest of the morning was spent greeting new arrivals, discussing astronomy and sundry other subjects. We also did a little "armchair astronomy" on Norbert Vance's spiffy new laptop computer. Believe it or not, the hours slipped by very quickly and the next thing I knew it was lunch time. After lunch Ada and I decided that it was time to explore the area. We set out on the paths that were cut through the underbrush and found most of the sights that were indicated on the maps we were given upon registration. Fish Lake, Missing Pond, bogs, and kettle holes, were some of the terrestrial features we encountered. Apparently this area and the surrounding area were left behind after a huge glacier passed through this part of Michigan during the last Ice Age. Since this is a protected area, much of the vegetation is left undisturbed and looks much like it must have looked many, many years ago. We saw small stand of Scotch Pine, Jack Pine, and White Pine in addition to a small mixed forest. But enough of Geology and Botany, we were here to "do Astronomy". After our tour, we headed back to the dorms to catch a well deserved nap before our eagerly awaited all night (we hoped) viewing session. The afternoon passed rather quickly and it was now nearing the dinner hour. It was at about this time that Gery Kissel from our club arrived on the scene bringing with him what appeared to be patches of blue sky overhead. (yes Gery, it was duly noted that you arrived in time for dinner ed.). The topic of discussion at the dinner table was the possibility that we might have the opportunity to launch some model rockets after our meal and before we began to set up our telescopes —obviously the weather was much improved by this time. The actual launching of these model rockets proved to be one of the highlights of the weekend. We had four successful launchings with progressively larger rockets. The fifth and by far the largest rocket, however, malfunctioned, healed over on its launch pad and headed off in a horizontal attitude into the underbrush, narrowly missing the pick-up truck that had delivered the rockets to the launch site. A few seconds after whooshing and crashing on its "flight" through the brush, we heard a final psssssssst and then silence. Forty people rushed forward into the underbrush to try to help locate the "remains" of the rocket. Following little puffs of smoke left behind in the brush by the rocket engines, we located the nose cone and rocket fuselage wedged against a small tree, its parachute partially deployed, about fifty yards into the brush. Speculation was—later confirmed by slo-mo video—that only two of the three engines ignited on launch, sending the rocket off on its weird horizontal trajectory, the last sound we heard was probably the third engine being ignited by the heat from the other two. Only damage, the loss of two of the three tail fins, both were recovered and this rocket will soar again (vertically the next time, hopefully).

By this time dusk had begun to settle in, a small crescent moon was barely visible in our western sky, a definite sign to start setting up our telescopes. If memory serves, by the time we were all set up we had eight telescopes at the ready. These included, two 8" SCTs one 11"SCT, an 8" and a 10" Newtonian on dobsonian mounts, two 10" newtonians on equatorial mounts and a 12.5" Newtonian a huge equatorial mount. Since it wasn't dark enough to Polar align, most of the "scopes" were pointed towards the Moon. It was at this point that a young boy and his mom approached Ada and I and asked if it would be all right if the could look through our telescope at the Moon. He said that he was working towards his scout merit badge in Astronomy and that he wanted to make several sketches of the craters and the mountains, visible along the terminator. We of course obliged him. He spent several minutes peering through the scope and came away with a group of neat drawings of what he saw. The next half hour or so were spent, still looking at the Moon, and moving to progressively higher power lenses to zero in on some of the unique features of the Moon's surface. By this time

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it was dark enough that we could now polar align our "scopes". Alignment completed, our evenings viewing session began in earnest as we started to locate some of our favorite celestial objects. As the folks manning the telescopes slewed around the sky, the rest of the group would move from scope to scope catching a look at whatever object happened to be in the eyepiece at the time. This routine continued all evening and into the early morning hours, the size of the group gradually getting smaller as more and more people headed back to the dormitories for their bedtime. Gery Kissel and I decided to call it quits around 3:30am and began packing up our gear. (An action, by the way, for which we were good naturedly chastised the following morning at breakfast). The rest of "real astronomers" stayed up until dawn. Sunday, June 4, 1995—Ada and I managed to get up in time in order to get the van packed and still make it in time for breakfast. After breakfast we said our good-byes, thanked our E.M.U. hosts and invited them to attend our clubs star party on September 2nd. Impressions: Save for the weather on Friday and most of Saturday, Ada and I thoroughly enjoyed our first visit to Fish Lake and are looking forward to next years event. As far as viewing conditions go, we found the skies transparent with very little light pollution. I was, however, a little disappointed in the limited horizon in all directions due to the growth of the vegetation surrounding the area. My thoughts were in order to create an ideal viewing site, one would have to move the dark skies from Fish Lake to our site at Island Lake or move our horizon to Fish Lake. Harry.

THE NEW COULTER ODYSSEY 2

by John Paul StPeter

Whats up with the new 16" Coulter Odyssey 2? As an owner of of a Coulter 17.5", Odyssey 2, my eye always catches their ad in the magazines. I keep looking for prices to go up. They haven't in the several years I've owned my scope. They never change their ad either. So it was a shock to see a new ad showing off the new 16" Odyssey 2. Did this mean the end of the 17.5"?

First thing I did was check the chatter on the "net". There were about a half dozen messages about the new scope. They had quite a few facts and figures for something so new. It was worth a call to Coulter to get the story straight. Kathy at Coulter was more than glad to supply any information. It seems the biggest problem is in delivery of Pyrex glass from Corning. They buy the 1 3/4" glass in sheets that can have from 24 to 48 of the big disks cut from it. Recently Corning moved their production of the glass fron the U.S. to England. Since the move Coulter has received only about one in three or four shipments intact. Kathy related seeing a sheet that made it across the pond and the continent only to be dropped while unloading off the truck. Ouch! This has led to delays of over 12 months for the mirrors.

The new 16" mirror is made from 7/8 to 1" thick precision plate glass. The same as all the smaller Coulters. Their experience with the 13.1" has allowed them to scale up to the 16" with no problems. The mirror is held by a 9-point flotation open cell, an improvement over the closed cell 3-point mounting on the 17.5". The cost is an unbelievable $695.00 with shipping being $110.00 to any point in the U.S. (Shipping on my monster was $275.00) Delivery is running about four to six months now due to a delay in getting the tubes. The first is coming of the line at the end of June. As for the 17.5". My "Classic" is NOT for sale at any price!

BURSTING BUBBLES

by Greg Burnett

It was a pleasant Wednesday evening, with a first quarter Moon suspended in the bright blue sky, nearing culmination. I brought the Pronto out onto my deck, not quite in time to use it on a high flying jet that grazed the Moon's southern edge. "Oh, well." I thought, "Maybe there'll be another." I just wanted to get in a few minutes observing on a work night before turning in. I focussed on the Moon at 50x, using a polarizing filter to darken the early evening sky. At ninety degrees from the Sun, the light from the blue sky is highly polarized; detail on the quarter Moon jumped out with a twist of the eyepiece. I used the very simple Moon map in the R.A.S.C. Observers Handbook to identify some major feature. I enjoy finding the Apollo landing sites, and imagining the adventure. Copernicus was just off the terminator, and the Straight Wall, which is visible under almost any illumination conditions, was also easy to find.

I looked up periodically to watch for jets, and was alerted to a couple of F-16's out of Selfridge ANG Base by their unmistakable sound. The Pronto swung into action, and revealed red practice air-to-air rockets under the left wings of two '16's in wide formation as they soared out over Lake St. Clair. Looking back to the Moon I saw to my delight that a commercial jet was on a collision course from the west! Zoooooom! Direct hit! The size and motion of the jetliner gave a rare sense of depth and dimension to the view of the Moon. A few wispy clouds were approaching, and my interest in the Moon was beginning to wane. About twenty degrees above the Moon, maybe halfway to the zenith, I spotted a bright, white object that was clearly not an airplane (not moving) or a star (too bright) or a planet (wrong position, although its appearance strongly recalled Jupiter at low magnification). "MUST be a UFO!" I mused, "What ELSE could it possibly be?!" I focussed the Pronto on it and discovered the ubiquitous Nemesis of all UFO hunters, a genuine weather balloon!

What luck! It was clearly the exact same kind of balloon we has seen at the National Weather Service open house a few weeks ago. The small red parachute was visible halfway down the suspension line, with the white radiosonde module at the lower end. It must have been very high, because at 50x it still appeared quite small. I watched it drifting gently on the upper winds for a while, and then noticed that the balloon was not quite round, but had taken on a double-lobed shape, rather like a brain, apparently due to a seam or binding of some sort running vertically around its circumference. Could this mean it was reaching a high internal pressure? I only had to wait a moment more for my suspicion to be confirmed. Right before my eyes the balloon burst! The membranous shell split in half and unwrapped itself from its invisible helium cargo, now abruptly abandoned to the sky. One piece of the balloon drifted away on the wind, and the other, still attached to the equipment line, began descending with the payload toward the ground. The little red parachute kept trying to inflate, but the tattered remnant of the balloon was flailing around and the whole assemblage was swinging in a large circular arc. The poor little chute seem entirely inadequate for the task!

I watched the gyrating package descend for perhaps ten minutes (it must have been REALLY high!) hoping I might be able to estimate its distance as it disappeared behind the local ground clutter (my neighbors' houses) and maybe (long shot!) have a chance of finding it. Unfortunately, the clouds I had noticed earlier had thickened somewhat, and, still about forty degrees above the horizon, it disappeared into a patch of clouds. I wasn't able to locate it again. Well, it wasn't even dark yet, and I had seen several amazing sights with my little telescope, even including one astronomical object! I packed in under darkening clouds and a rising wind, satisfied with a better-than-average observing session. It just goes to prove that Jack is right: "Keep looking up!" You never know WHAT you might see!

COMET COMMENTS (6/8/95)

by Don Machholz

Periodic Comet d'Arrest continues to brighten as it heads south in our morning sky. It reaches perihelion on July 27, while it is closest to the earth at 0.41 AU in early August.

Only one comet has been discovered so far this year, and that was a faint photographic find from Kitt Peak in January. Since 1975, there have been only three other years with so few finds for the first five months of the year. In both 1979 and 1982, a photographic discovery occurred early in the year, followed by a second comet discovery in June. In each case this second comet was a visual find by a Southern Hemisphere observer: William Bradfield of Australia in 1979 and Rodney Austin of New Zealand in 1982. Then in 1985 the first comet discovery didn't take place until May, and that was a visual find by myself. The next find was a photographic discovery in June.

EPHEMERIDES 6P/d'ARREST

DATE(00UT)	R.A. (2000)	DEC	EL	SKY	MAG	
06-27	21h52.7m	+09d01m	119d	M	10.2	
07-02	22h06.8m	+08d12m	121d	M	9.9	
07-07	22h21.3m	+07d01m	123d	M	9.7	
07-12	22h35.9m	+05d26m	126d	M	9.5	
07-17	22h50.6m	+03d27m	128d	M	9.4	
07-22	23h05.3m	+01d02m	131d	M	9.3	
07-27	23h19.7m	-01d47m	134d	M	9.2	(Perihelion)
08-01	23h33.5m	-04d57m	136d	M	9.1	

STATISTICALLY SPEAKING

Location(Dearborn, MI): 42°22'00" N, 83°17'00" W, 180 meters elevation
Local Time = Universal Time - 4.00 hours (Eeastern Daylight Standard Time)

Abbreviations used in reports:

FM	Full Moon	FQ	First Quarter Moon	LQ	Last Quarter Moon
MR	Moon Rise	MS	Moon Set	NM	New Moon
SR	Sunrise	SS	Sunset	ZHR	Zenithal Hourly Rate

Calendar Report for July 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2	3	4	5	6	7	8
SR: 6:00	SR: 6:01	SR: 6:01	SR: 6:02	SR: 6:03	SR: 6:03	SR: 6:04
SS: 21:14	SS: 21:13	SS: 21:13	SS: 21:13	SS: 21:13	SS: 21:12	SS: 21:12
MR: 10:36	MR: 11:38	MR: 12:41	MR: 13:46	MR: 14:53	MR: 16:02	MR: 17:12
MS: 23:41	MS: None	MS: 0:10	MS: 0:41	MS: 1:13	MS: 1:49	MS: 2:30
9	10	11	12	13	14	15
SR: 6:05	SR: 6:05	SR: 6:06	SR: 6:07	SR: 6:08	SR: 6:08	SR: 6:09
SS: 21:12	SS: 21:11	SS: 21:11	SS: 21:10	SS: 21:10	SS: 21:09	SS: 21:08
MR: 18:20	MR: 19:24	MR: 20:21	MR: 21:10	MR: 21:53	MR: 22:30	MR: 23:03
MS: 3:18	MS: 4:15	MS: 5:19	MS: 6:29	MS: 7:41	MS: 8:53	MS: 10:04
16	17	18	19	20	21	22
SR: 6:10	SR: 6:11	SR: 6:12	SR: 6:13	SR: 6:14	SR: 6:15	SR: 6:15
SS: 21:08	SS: 21:07	SS: 21:06	SS: 21:06	SS: 21:05	SS: 21:04	SS: 21:03
MR: 23:35	MR: None	MR: 0:05	MR: 0:36	MR: 1:08	MR: 1:43	MR: 2:21
MS: 11:11	MS: 12:16	MS: 13:19	MS: 14:19	MS: 15:18	MS: 16:14	MS: 17:08
23	24	25	26	27	28	29
SR: 6:16	SR: 6:17	SR: 6:18	SR: 6:19	SR: 6:20	SR: 6:21	SR: 6:22
SS: 21:02	SS: 21:01	SS: 21:00	SS: 20:59	SS: 20:58	SS: 20:57	SS: 20:56
MR: 3:03	MR: 3:49	MR: 4:39	MR: 5:34	MR: 6:30	MR: 7:29	MR: 8:30
MS: 17:58	MS: 18:45	MS: 19:27	MS: 20:06	MS: 20:42	MS: 21:14	MS: 21:45
30	31			Lunar Events		
SR: 6:23	SR: 6:24			FQ: 16:03 July 5		
SS: 20:55	SS: 20:54			FM: 6:49 July 12		
MR: 9:31	MR: 10:34			LQ: 7:10 July 19		
MS: 22:15	MS: 22:45			NM: 11:13 July 27		

Planet View Info Report for 7/1/1995 to 7/31/1995

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
Mercury							
7/ 8/1995	4:45	19:46	5h41m45s	21°45'10"	19°41'52"	0.589	1.0191
7/15/1995	5:03	20:17	6h33m03s	23°04'56"	14°28'18"	0.798	1.1727
7/22/1995	5:39	20:48	7h34m27s	22°44'31"	7°08'37"	0.956	1.2895
7/29/1995	6:26	21:11	8h37m17s	20°17'27"	1°59'42"	0.997	1.3423
Venus							
7/ 8/1995	5:10	20:24	6h14m33s	23°22'55"	12°03'31"	0.978	1.6827
7/15/1995	5:21	20:32	6h51m53s	23°10'19"	10°09'42"	0.984	1.6976
7/22/1995	5:34	20:38	7h29m02s	22°24'17"	8°15'50"	0.990	1.7097
7/29/1995	5:49	20:40	8h05m42s	21°06'03"	6°22'31"	0.994	1.7190
Mars							
7/ 8/1995	11:47	0:20	11h32m38s	3°39'10"	66°52'40"	0.906	1.7008
7/15/1995	11:40	0:01	11h47m10s	1°57'55"	64°12'19"	0.910	1.7489
7/22/1995	11:34	23:39	12h02m00s	0°14'30"	61°36'53"	0.913	1.7950
7/29/1995	11:27	23:20	12h17m09s	-1°30'40"	59°05'56"	0.917	1.8390
Jupiter							
7/ 8/1995	18:03	3:32	16h18m56s	-20°41'33"	141°03'07"	0.996	4.4939
7/15/1995	17:34	3:02	16h16m59s	-20°38'17"	133°55'24"	0.995	4.5652
7/22/1995	17:05	2:34	16h15m37s	-20°36'25"	126°55'34"	0.994	4.6458
7/29/1995	16:37	2:06	16h14m52s	-20°36'04"	120°03'52"	0.993	4.7346
Saturn							
7/ 8/1995	0:26	11:59	23h42m49s	-4°11'00"	110°59'29"	0.998	9.2442
7/15/1995	23:54	11:31	23h42m38s	-4°14'12"	117°43'22"	0.998	9.1381
7/22/1995	23:26	11:03	23h42m08s	-4°19'16"	124°32'18"	0.998	9.0385
7/29/1995	22:58	10:34	23h41m22s	-4°26'05"	131°26'23"	0.998	8.9467
Uranus							
7/ 8/1995	21:50	7:16	20h05m15s	-20°54'11"	166°21'01"	1.000	18.7318
7/15/1995	21:22	6:48	20h04m06s	-20°57'39"	173°17'03"	1.000	18.7124
7/22/1995	20:53	6:19	20h02m55s	-21°01'08"	179°22'11"	1.000	18.7073
7/29/1995	20:25	5:50	20h01m45s	-21°04'34"	172°44'37"	1.000	18.7167
Neptune							
7/ 8/1995	21:29	6:57	19h44m53s	-20°41'10"	170°58'24"	1.000	29.1647
7/15/1995	21:01	6:29	19h44m06s	-20°43'12"	177°46'49"	1.000	29.1533
7/22/1995	20:33	6:00	19h43m18s	-20°45'16"	175°15'01"	1.000	29.1562
7/29/1995	20:04	5:32	19h42m31s	-20°47'17"	168°23'40"	1.000	29.1734

Planet/Moon Apsides Report for 7/1/1995 to 7/31/1995

7/ 5/1995	Earth @ Aphelion	Distance from Sun: 1.02 AU	
7/20/1995	Mercury @ Perihelion	Distance from Sun: 0.31 AU	
7/11/1995	Moon @ Perigee	Distance = 358792 (km)	Diameter = 0.5551°
7/23/1995	Moon @ Apogee	Distance = 405733 (km)	Diameter = 0.4909°

Planet Conjunction/Opposition Report for 7/1/1995 to 7/31/1995

Mercury	7/27/1995	Hour = 22	Event = Superior Conjunction
Uranus	7/21/1995	Hour = 20	Event = Opposition
Neptune	7/17/1995	Hour = 1	Event = Opposition

Meteor Showers Report for 7/1/1995 to 7/31/1995

Date	Meteor Shower	ZHR	RA	DEC	Illum. Frac.	Longitude
7/15/1995	Capricornids	5	20h44m	-15°	0.85	113°
7/20/1995	alpha-Cygnids	5	21h00m	48°	0.37	118°
7/25/1995	Capricornids	5	21h00m	-15°	0.03	123°
7/29/1995	delta-Aquarids	20	22h36m	-17°	0.05	126°

SKY & TEL. NEWS BULLETIN

from the editors of SKY & TELESCOPE magazine

SATURN'S THIN RINGS

Earth's first of three passages through the plane of Saturn's rings occurred as predicted on May 21st, and astronomers around the globe were watching. Giant reflectors like the 10-meter Keck telescope, took images as the rings tilted edge-on. According to Imke de Pater of the University of California at Berkeley, images with the Keck telescope taken just before and after the ring-plane crossing reveal several small moonlets within the rings. If you observe Saturn right now you're not likely to see much except the planet's distinctly flattened ball. Saturn rises only a few hours before dawn, so it's not well placed for viewing. If you have a good-size telescope you might try to watch the planet's larger satellites play tag. Tethys, Dione, Rhea, and Titan are undergoing eclipses and occultations by Saturn and one another.

NEW SMALL STAR

A new low-mass star has been found, just tipping the scales to allow thermonuclear reactions. Using a coronagraph to block the light from the star Gliese 105A — a dwarf star 27 light-years away — David A. Golimowski of Johns Hopkins University and three Caltech colleagues discovered a 16th-magnitude star only 3.3 arcseconds from it. While the companion was expected on the basis of observed wobbles in the primary's proper motion, the companion, dubbed Gliese 105C, evaded detection by other high-resolution techniques. While this star's characteristics are not known to high certainty, its provisional near-infrared brightness suggests a mass at most 10 percent above the minimum required to sustain nuclear fusion. The star's physical quantities will become better known as astronomers follow the 60-year orbit of this possibly substellar component.

THE STEAMY SUN

A team of solar observers has found water on the Sun — or, more precisely, they have identified water in spectra of the dark umbra of sunspots. The water molecule is stable below temperatures of about 4,000 K. The Sun's photosphere is quite a bit hotter than that, nearly 5,800 K, at which water breaks down into hydrogen and OH radicals. But sunspots are relatively cool oases on the photosphere, and the sunspot umbra studied by Lloyd Wallace and his colleagues had an estimated temperature of only 3,300 K, cool enough for water to exist stably. The sunspot observations were actually made years ago, in July 1991. But the Sun's spectrum is so complex that it's taken this long to find the absorption lines due to water, and show that they were *not* due to water in Earth's atmosphere. Other molecules already known to exist on the Sun include carbon monoxide, hydrogen fluoride, hydrogen chloride, and silicon oxide.

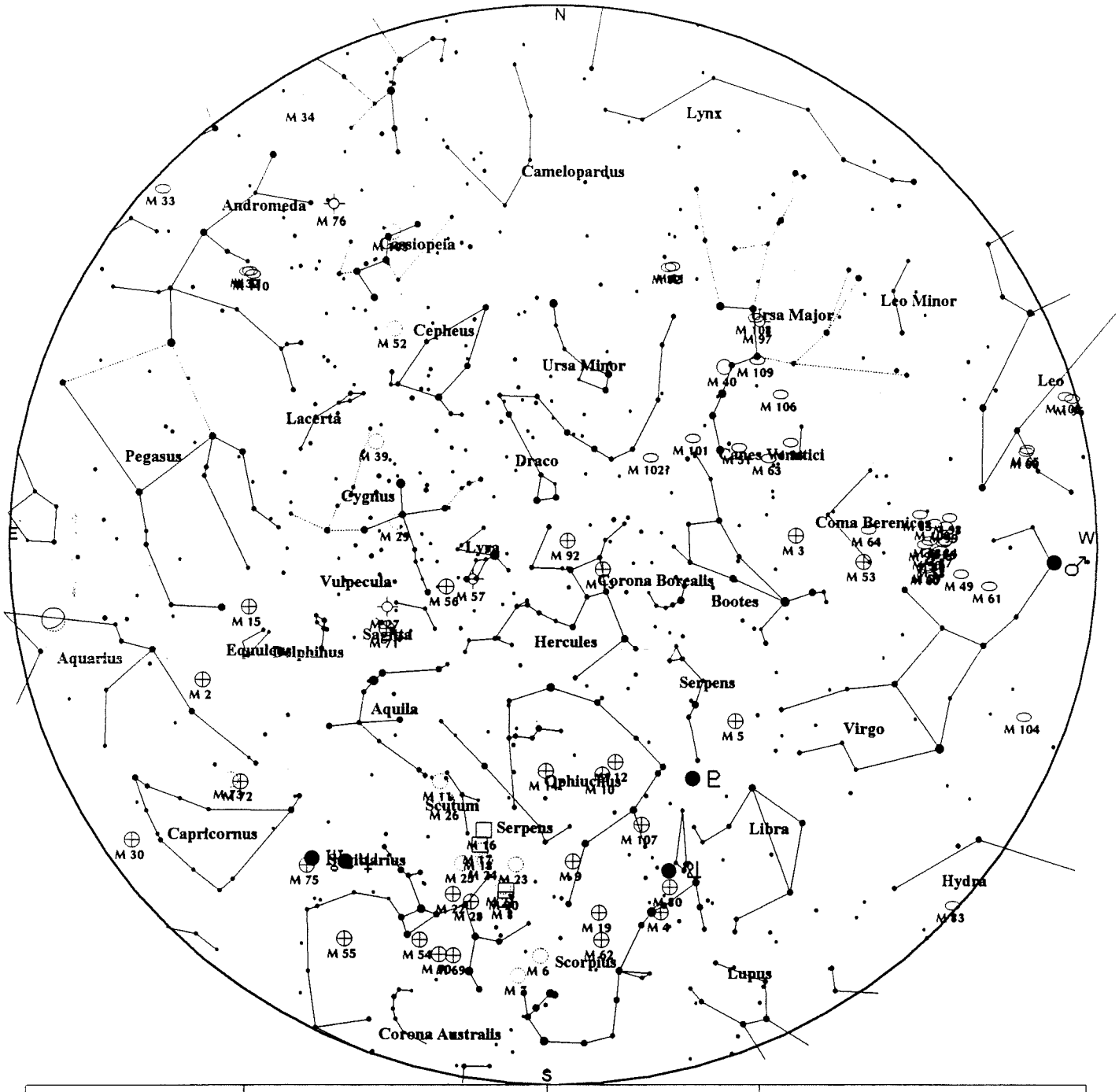
BROWN DWARF IDENTIFIED

Pointing the world's largest optical telescope at one of our galaxy's dimmest sources has revealed the best evidence yet for a brown dwarf. These are starlike bodies whose masses don't quite generate the central pressure and temperature required to sustain nuclear fusion. At this week's meeting of the American Astronomical Society, Gibor Basri, Geoffrey Marcy and James Graham announced that the 10-meter Keck telescope had obtained spectra of the faintest, reddest stars in the Pleiades star cluster, M45, in Taurus. The signature of lithium turned up in only one object, the dimmest one sampled, which is dubbed PPL 15. Since it has lithium while its slightly brighter neighbors do not, this object presumably has not developed the fusion engine to convert the lithium into other elements and allow it to graduate from brown-dwarfhood to true stellar rank.

ANCIENT HELIUM

The signature of intergalactic helium in the early universe has been seen in data obtained last March during the Astro-2 mission. Arthur Davidsen, Gerard Kriss and Wei Zheng announced that the Hopkins Ultraviolet Telescope found firm spectroscopic evidence for helium gas lying along the line of sight to a distant quasar. In theory, reactions during the first minutes after the Big Bang would have produced roughly one helium atom for every twelve of hydrogen. This ratio is seen in stars throughout our galaxy. However, Astro-2 was looking for primordial gas that never collected into stars, and the helium spied by Astro-2 left its mark on the itinerant ultraviolet light when the universe was less than one fifth its current age. Although helium absorption in another quasar was seen last year using the Hubble Space Telescope, the new, higher-quality data have enabled the Hopkins team to estimate its density. That value implies that the intergalactic medium in the early universe contained nearly all the baryonic (normal) matter from which galaxies, stars and planets later formed.

JULY'S SKIES



STARS	SOLAR SYSTEM			NOTES
• <1 • 3.5	☿ Mercury	♅ Uranus	⬭ Galaxy	
• 1.5 • 4	♀ Venus	♆ Neptune	⊕ Globular Cluster	
• 2 • 4.5	♂ Mars	♇ Pluto	◌ Open Cluster	
• 2.5 • >5	♃ Jupiter	☄ Comet	⌖ Planetary Nebula	
• 3	♄ Saturn	⚲ Asteroid	□ Diffuse Nebula	
			○ Other Object	

Local Time: 23:30:00 15-Jul-1995 UTC: 03:29:59 16-Jul-1995 Sidereal Time: 17:30:54
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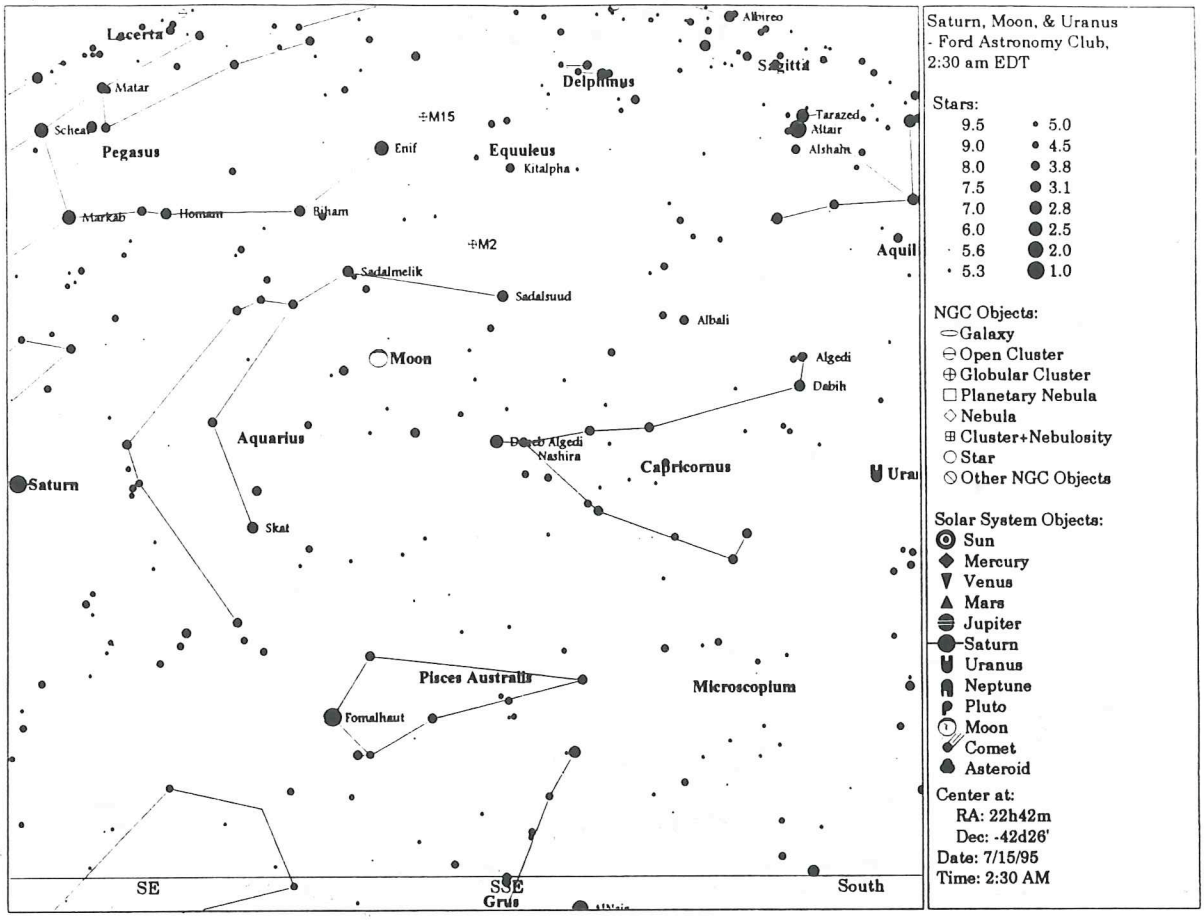
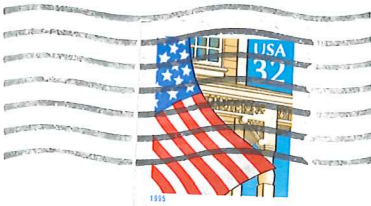
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