The Ford Amateur Astronomy Club Newsletter

Astronomical League

FERA
Ford Employees Recreation Association

Ford

Volume3, Number 2 June 1995

HUBBLE PROBES THE WORKINGS OF A STELLAR HYDROGEN-BOMB

Peering into the heart of two recently exploded double-star systems, called cataclysmic variables, NASA's Hubble Space Telescope has surprised researchers by finding that the white dwarf stars at the heart of the fireworks are cooler than expected and spin more slowly than thought.

"This calls for revision of theory," says Prof. Edward Sion of Villanova University, Villanova, PA. "Though these extremely faint explosive white dwarfs have been known about for 30 years, Hubble allows astronomers to observe them directly for the first time and provide observation evidence to test theories."

Each dwarf — incredibly dense, burned-out stars that have collapsed to the size of Earth — is in a compact binary system, called a cataclysmic variable, where its companion is a normal star similar to, but smaller than the Sun. The stars orbit each other in less than three hours and are so close together the entire binary system would fit inside our Sun. This allows gas to flow from the normal star onto the dwarf, where it swirls into a pancake-shaped disk.

When the disk of gas periodically collapses onto the white dwarf, it unleashes a burst of kinetic energy, called a dwarf nova outburst, equivalent to 100 million times the energy of all the warheads in the U.S. and Soviet nuclear arsenal, at the peak of the Cold War. Once dumped onto the dwarf s surface, hydrogen accumulates until it undergoes thermonuclear fusion reactions that eventually trigger the classical nova explosion, which is 10,000 times even more energetic than the dwarf nova outburst. After the detonation, the "fueling" of the white dwarf starts again.

Sion and co-investigators studied the two best known cataclysmic variables, VW Hydri and U Geminorum. Hubble was used to make spectroscopic observations of the dwarf novae just days after their eruption, before another gas disk formed and obscured direct observation of the white dwarf.

The biggest surprise is that the spin rates of the white dwarf stars, as measured by Hubble (slightly less than four minutes for U Geminorum and approximately once a minute for VW Hydri) are so slow there should be violent collisions where the gas disk crashes onto the slower moving white dwarf surface. Since the predicted x-rays from the hot (several hundred thousand to a million degrees centigrade, or greater) colliding gas has never been observed, astronomers thought that the white dwarf was spinning as fast as the disk, so that contact between the disk and surface was less violent. However, the Hubble results contradict this conclusion.

"Despite the fact that several million years of accumulating the swirling gas disks should spin-up the white dwarfs, we just don't see it," says Sion. "Perhaps other mechanisms might be at work to carry away momentum, removing the spin.

Their Hubble observations have also provided the first direct measurements of the cooling of the white dwarfs in response to the heating by the dwarf nova explosion. The researchers found that, even though the gaseous disk heats the white dwarf star surfaces by thousands of degrees Kelvin, this is still well below the predicted heating, according to standard theory. "Somehow this energy is dissipated across the dwarf's surface, rather than being concentrated at the zone where the disk crashes," says Sion.

The Hubble results also show that the proportion of chemical elements in the dwarfs' atmospheres are significantly different from the observed proportions in the Sun's atmosphere. This is probably due to the fact that heavier elements falling onto the dwarf are pulled quickly below the surface layers by the dwarf's enormous gravitational field and turbulence associated with the accumulation of the gas disk.

Further Hubble observations by the team during 1995-96 will attempt to resolve these mysteries. Their work appears in the May 10 and May 20 issues of the Astrophysical Journal Letters.

The research team includes: E.M. Sion and Min Huang (Villanova University); Paula Szkody (University of Washington); Ivan Hubeny (NASA Goddard Space Flight Center); and Fuhua Cheng (University of Maryland).

PRESS RELEASE NO.: STScI-PF95-23

CATACLYSMIC VARIABLE STAR (ARTIST CONCEPT)

PHOTO FILE NO.: STSCI-PF95-23

A Fish Story

by Greg Burnett

It was a dark and stormy night... no, wait,... it was a more or less clear night and, as is my custom on clear Friday nights, I had gone out to Spring Mill Pond for a pleasant evening of amateur astronomy observing. Upon arriving, I found Harry Kindt already set up, waiting for twilight to end. Patti Smith arrived within a few moments and began to set up her scope.

As darkness began to fall I noticed with some pleasure that Spring was finally coming, the evening air was not so cold as it had been recently, and there were even a few folks fishing in the pond. Ah, the eternal parade of seasons, ever changing, never boring!

As I started to unload my car, a few more fishermen (fisherpersons?) drove in and made their way to the water's edge. "Gee, it seems really bright out here tonight." Harry remarked, and we noticed that indeed, there was a fair number of Coleman lanterns deployed around the pond. Even as we spoke, more cars, headlight glaring, were entering the area. "Something must be going on...." I mused. I decided to set up only my Pronto and see what developed.

Even though the park "officially" closes at 10:00 p.m., it was now almost 11:00 and cars were coming in two and three at a time! The typical Spring Mill Pond sky-glow had been replaced by the combined blaze of dozens of lanterns, with more arriving every minute. The pond was taking on the appearence of a carnival midway! Finally, our curiosity getting the best of us, Patti said, "Go ask someone what's happening. It must be a fishing derby or something." So I did.

We should have known! TROUT SEASON! Spring Mill Pond is stocked by the DNR early each spring, and catch-and-release rules apply until the opening of the state-wide trout season on the last Saturday of April. AH-HA! Starting at midnight tonight, they can keep their catch!

Well, there was no way we were going to compete with the blazing conflagration arrayed around the pond. We laughed together at our plight, and packed up to wait for another clear night. Driving out we met another half dozen cars still coming in. Hmmm,... last Saturday in April, eh? I'll note that on the '96 calendar right now!

FROM THE EDITOR

by Paul Mrozek

Starting with this month's issue, there are a few minor changes in the newsletter format. In order to avoid any postage problems, the total length will be kept to a maximum of 5 pages. This limit caused me to lower the type size by one point. I hope nobody finds the smaller print difficult to read. Some other miscellaneous items: I did fix the "a" in the "Star Stuff" logo; the deep sky objects should return in next month's sky map; one complaint is not enough for me to change the font used for the article titles. Comments or suggestions can be sent to me at pmrozek (PROFS) or pmrozek@pms064.pms.ford.com or 313-33-73619.

You might also notice this month that most of the articles are again written by the same people (Greg actually submitted more items than I had room to include). Please do not interpret this fact the wrong way. The newsletter is still very much interested in articles or pictures from OTHER club members. Any subject somehow related to astronomy is appropriate. One suggestion might be to do a short review of the various astronomy books you own. Another idea would be for someone to finally answer one of the "Astronomy Workshop" questions.

Articles can be submitted to me at any one of the previously stated addresses, or through Ford inter-company mail at Room 1150, Building 5. Just about any format is acceptable, and deadline for inclusion in the July issue is June 24 (but I can always use articles for the August, September, ... issues).

STAR STUFF
Monthly Publication of the
Ford Amateur Astronomy Club

Star Stuff Newsletter
P.O. Box 7527
Dearborn, Michigan 48121-7527

1996 CLUB OFFICERS

President:	Chuck Boren	24-83446
Vice President:	John St. Peter	313-535-2755
Secretary:	Harry Kindt	313-835-1831
Treasurer:	Al Czajkowski	84-57886

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.

NEWSLETTER STAFF

Editor:	Paul Mrozek	33-73619
Contributing	Doug Bock	Greg Burnett
Editors:	Brian Gossiaux	Patti Smith

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.

Articles presented herein represent the views and opinions of their authors and not necessarily those of the Ford Amateur Astronomy Club or the Star Stuff Newsletter. Commercial advertisers appearing in the newsletter are not endorsed or in any way affiliated with Ford Motor Company, the FAAC, or Star Stuff newsletter.

JUNE 1995

SUN	MON	TUE	WED	THUR	FRI	SAT
				1 Jupiter at opposition	2	3
4	5 Mercury at inferior conjunt. Moon 6° S. of Mars	6 6:26 am First Quarter	7	8	9 Spica occulted by Moon, 2 am	10
11	12 Moon at perigee. Moon 2° N. of Jupiter	13 12:03 am Full Moon	14 Jupiter 5° N. of Antares	15 Moon 5° N. of Neptune Moon 6° N. of Uranus	16	17
18 Mercury 1.1° N. of Aldebaran Asteroid Juno at opposition	19 6:01 pm Mercury 4° S. of Venus	20	21 Summer solstice at 4:34 pm	22 **FAAC MEETING 5:00 PM**	23	24
25 Moon 0.6° N. of Mercury	26 Moon at apogee Moon 3° S. of Venus	27 8:50 pm New Moon	28 Mercury at greatest western elongation (22°)	29	30	

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, June 22, 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 5/25/95

By Harry Kindt (Sec'y FAAC)

The meeting was called to order at 5:12 pm by our president, Chuck Boren. There were 35 members and guests present. Our treasurer, Al Czajkowski, reported on discounts, up to 1/2 off on selected items, which are available through Sky & Telescope magazine. Contact Al if you wish to take advantage of these offers. Chuck reported on a problem that he and Al had while leaving IL last Friday (5/19/95). Apparently someone was insistent on entering the park while Al and Chuck were trying to close the gate as they were leaving. We are in the process, in cooperation with park authorities, to have a coded combination lock installed at the main gate to the park. The combination will be changed periodically and a method will be found to notify the club members of the combination. Barry Craig suggested that we advertise our upcoming star party in the Observer and Eccentric newspapers, and to look into the possibility of placing a notice on Public Access Cable TV. The club is looking for volunteers to help out at the star party and for more ideas for our club emblem/motto. Two of our members who attended the "Age of the Universe" lecture gave a brief description of that event. Barry Craig described another lecture on the SETI project, given to the DAS by Dr. Teshki at their last meeting. It was moved and seconded that we attempt to get Dr. Teshki to give the same lecture at one of our meetings. The Summer Solstice Party was announced for July 1st at Doug Bocks Northern Cross Observatory beginning at 4:00pm. Bring your own food and drink. Insurance was the next item of discussion. Brian said that he would contact Howard Penn at City Camera to see if he would pick up the cost of the insurance. To reciprocate, we would run an ad for City Camera in our newsletter. Jerimah StPeter described his experiences at NASA Space Camp at the Marshall Space Center. Jeremiah wore his astronauts jump-suit and he brought along some pictures of his adventure. John Paul StPeter then gave a talk on what he described as "Cloudy Night Astronomy and Miscellaneous Musing." (It was one of those "you had to be there" type of lectures, any attempt at trying to summarize the talk would not do it justice. ed.). The meeting was adjourned at 6:55pm. ✪

THE STAR STUFF CATALOG

Conducted by Greg Burnett

Each month another interesting astronomical object is added to The Star Stuff Catalog. Entries include favorite observing targets, objects of current or seasonal interest, and objects with long-standing scientific or cultural significance. Readers are encouraged to submit write-ups on their favorite objects. This month we add the second catalog entry, a star that holds a special significance for almost everyone, the North Star....

SSC 2: Polaris (RA 2^h 31^m 50.4^s DEC $+89^o$ 15' 51" (2000))

Polaris is a super-giant star (luminosity class Ib) of spectral type F8 (white). It's visual magnitude is 2.02 (variable until recently; see below) and its color index (B-V) is 0.60. Polaris has an absolute magnitude of -4.6. Its distance is estimated to be about 360 lightyears, and it has a radial velocity of 17 km/sec in approach. Polaris exhibits an annual proper motion of $+0.232^s$ in right ascension and -0.01" in declination.

Polaris is an oft-ignored double star, with a bluish 9th magnitude companion at a separation of 18.4". (Sky Catalog 2000.0 list two additional minor companions). It is a fine double for small telescopes, but may receive little attention because once you polar-align your equatorial mount it can be difficult, and sometimes impossible, to center Polaris in a high power eyepiece. In 1929 the primary was found to also be a spectroscopic double with a period of about 30.5 years.

In the mid 19th century Polaris was observed to be slightly variable, and in 1913 it was shown to be a Cepheid variable. At that time it's variation amplitude was just over 0.1 magnitudes, with a period slightly under 4 days. Very recent observations show that it's pulsation amplitude has decreased smoothly, and reached zero in 1994 (See "Polaris, the Code-Blue Star" in ASTRONOMY, March 1995). "Constant as the northern star" has now taken on new meaning!

For the record, Polaris, aka the Pole Star, is also known by a number of other identifications: Its Bayer designation is Alpha Ursae Minoris, and it was assigned the number 1 by Flamsteed. It appears in other catalogs variously as ADS 1477 (R.G. Aitken's *New General Catalog of Double Stars*, 1932), HD 8890 (*Henry Draper Catalog*, Harvard), SAO 308 (*Smithsonian Astrophysical Observatory Star Catalog*, 1966), and _ 93 (F.G. Wilhelm Struve's *Dorpat Catalog of Double Stars*, 1827).

Polaris has long held an important position in the affairs of Mankind. Its utility to navigators of classical times goes without saying. Dating from even earlier periods, great monuments in Southeast Asia, India, and elsewhere are believed to symbolize the "Cosmic Mountain" or the "Axis of the World," and ancient texts associated with them refer repeatedly to the pole star as the pinnacle of the mountain or the hub of the universe. But Polaris has not always been the pole star. At the time many of these monuments were believed to have been built, perhaps as much as 3000 years ago, Beta Ursae Minoris (Kochab) was actually closer to the pole than Polaris, and may have been regarded as the pole star.

The position of the celestial pole with reference to the stars changes due the 25,800-year precession cycle of the Earth's axis. When the pyramids of Egypt were being built, Thuban (Alpha Draconis) was the pole star. At present, the true position of the pole is displaced slightly less than one degree in the direction of Eta Ursae Majoris (Benetnasch), the last star in the handle of the big dipper. The exact position of the pole was apparently important also to the ancient Chinese. 3000 years ago they fashioned intricately carved rings of jade, called *hsun-chi*, with notches around the edge corresponding to the locations of several nearby stars. By looking through the central hole of the ring, the exact celestial pole could be located. At that time the desire for such accuracy was almost certainly religious or philosophical rather than scientific in origin.

For modern amateur observers, Polaris remains an interesting observational target. In addition to its duplicity noted earlier, it is the gemstone in an asterism called the "engagement ring" formed by several nearby 7th and 8th magnitude stars. It is thus worth your attention as an observer, but be sure to check it out before you polar align!.

ASTRO TRIVIA

by Paul Mrozek

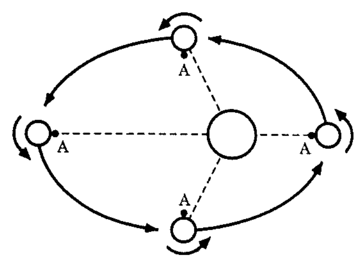
If you have any astronomy trivia you would like to submit, please send you question (and answer is you have one) to Paul Mrozek via pmrozek (PROFS) or mrozek@pms064.pms.ford.com (internet).

This month's answers:

Q: What is periastron?
A: Periastron is the point of closest approach between two stars in a binary system. [1]

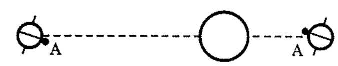
Q: What is libration?
A: Libration is the rocking motion of an orbiting body. For example, libration of the Moon causes 59% of its face to be seen from the Earth over a period of time. This apparent "rocking" has three main causes. Libration in longitude is due to the elliptical nature of the Moon's orbit. One lunar rotation is equal in time to its revolution around the Earth. In this respect, the moon points the same face toward the center of its elliptic orbit, and the Earth is located at one foci.

Libration in longitude (point A appears to move back and forth)



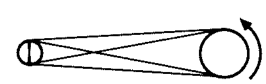
Libration in latitude results from the Moon's axis being inclined to the plane of its orbit. This effect is similar to the change in polar sunlight due to the Earth rotating around the Sun. Libration in latitude also results from the Moon's orbit being inclined to the plane of the Earth's orbit (the ecliptic).

Libration in latitude (point A appears to move up and down)



Diurnal libration is due to differences in line of sight. Because the Earth rotates faster than the Moon revoles in its orbit, slightly different views can be seen at different times of day. [1][2]

Diurnal libration



top view

Q: Are the ocean tides caused by the Moon?
A: Both the Sun and the Moon produce tides in the Earth's atmosphere, oceans, and crust. The moon causes only about two-thirds of the total tidal effects. The cycle of the tides is determined by the Moon, but their relative height is determined by the position of the Sun. High tide comes once under the Moon and once when the Moon is on the opposite side of the earth, from the point of measurement. During a new or full Moon (a syzygy), the tidal forces of the Sun and Moon reineforce each other causing the particularly high tides know as "spring tides" (nothing to do with the season). At the quarter moons, the Sun's effect opposes that of the Moon causing the lower high tides know as "neap tides". The tides in the ocean average about one meter, and the tides in the solid Earth average about twenty centemeters. [3]

References:

[1] *The Penguin Dictionary of Astronomy* by Jacqueline Mitton
[2] *Oxford Illustrated Encyclopedia of the Universe*
[3] *Lightning Never Strikes Twice and other False Facts* by L. Moore

Next month's questions:

Will the Moon eventually spiral away from the Earth?
What is synchronous rotation?
What is a synchronous orbit?
What is the Moon's tail?

ASTRONOMY WORKSHOP

by Greg Burnett
PROFS=GBURNETT
Internet=USFMC6SH@IBMMAIL.COM

Since the flow of answers from readers was a little slow (?!) again this month, I'm including a selection from "The Gadget, Accessory, and Thingy FAQ" (Frequently Asked Questions) by Dave Nash, School of Chemical Sciences, University of Illinois. This material was originally pulled off the internet by Paul Mrozek.

The Gadget, Accessory, and Thingy FAQ (GATFAQ for short)
Latest Revision: January 9, 1995

*** DISCLAIMER *** All this information is accurate to the best of my knowledge; if there are any ommissions or errors, please let me know. This document is intended to be an overview, not the end-all-and-be-all of a given topic. If you want to find out more about a specific gadget, accessory, or thingy, consult the references listed in each section.

Light Pollution Reduction Filters for the Compleat Idiot

(1) Do LPRF's work?
Light-pollution reduction filters (henceforth, LPRFs) *do* work -- on some things. They are not a substitute for a clear sky, but they can and do provide improved views of many objects. Furthermore, filters can be of use even in very dark skies, not just ones that are significantly affected by city lights.

(2) How do they work?
Filters work by rejecting light in certain frequency ranges. As you may already know, many artificial light sources emit over fairly narrow wavelength ranges. Chief among these are the wavelegnths associated with LPS (low-pressure sodium), HPS (high-pressure sodium), and mercury vapor lamps. Sodium lamps produce light centered on the sodium D line at 589 nm (yellow), with HPS covering a much wider range than LPS; mercury lamps produce a number of lines throughout the spectrum, particularly below 450 nm and above 550 nm. All LPRFs are designed to block the wavelength regions associated with these sources. As you might have guessed, there's a catch. The LPR filter has to not only reject the undesired light, but also admit the desired light from your nice, friendly Messier objects (or whatever).

(3) What do LPRF's work best on?
The most favorable circumstance occurs with emission nebulas; these are things like planetaries (e.g., the Ring and Helix Nebulas), supernova remnants (M1, the Veil), and other large diffuse nebulas that emit, rather than merely reflect, starlight (other good examples: M42, the Eta Carinae nebula, M17). These nebulas emit light in only a few wavelengths, predominantly those of oxygen III and hydrogen alpha and beta.

By a fortunate coincidence none of these wavelengths is near significant(*) light pollution lines. OIII and H beta are located near 500 nm well away from most interfering lines; H alpha, at 656 nm (red) is less important visually but important in photography and sometimes in very bright nebulas like M42. Consequently, LPR filters are also designed, in addition to having very low transmittances for lines associated with light pollution sources, to have very *high* transmittances for these nebula lines. Thus LPR filters tend to work well on emission nebulas.

(*) For the technically...shall we say, "thorough," I should point out that HPS lights do put out a line very close to the OIII lines. This line is comparatively minor and does not normally affect the performance of a LPRF designed to admit the OIII region.

(4) What don't they work on, and why?
As already mentioned above, filters work by rejecting the light from various undesirable sources. In general, filters are designed to admit a fairly narrow region of light, called the passband (or bandwidth), around the desired lines. The rest of the visible spectrum, in general, is heavily blocked. As a result, an object that produces much of its light outside the passband will tend to be attenuated strongly, much as a light pollution source would be. Sources of this sort include stars, and anything that is either composed of stars (galaxies, clusters, etc.) or reflects starlight (reflection nebulas, e.g. M78 and the blue portion of the Trifid Nebula).

The degree of attenuation, of course, depends on the object and how much of its light is being rejected. In particular, it is physically possible for an object like a galaxy to be attenuated less than a light pollution source, which should lead to its being enhanced. In practice, however, this does not occur often. Much of the time, in fact, the filter actually makes things worse. This is not a hard and fast rule, but it does hold enough of the time to merit strong mention. In any event, enhancement of these objects is not as great as it is for nebulas. This last statement holds for all currently available LPRF's.

(5) Who makes them?
Many places. Most large telescope/accessory manufacturers or resellers, such as Celestron, Meade, and Orion, offer some. The dominant company in the filter market, however, is Lumicon, which has (at last count) five distinct LPRF's, all with different technical specifications and performance on various types of objects.

(6) What does all that technical stuff mean?
The most important technical specifications for a filter are:

a) the width of the passband(s),
b) the transmittances in and outside the passband(s).

For determining general usage, (a) is the most important, as this detail tends to dominate the effectiveness (or lack thereof) on various objects. LPRF filters are characterized as being either broadband or narrowband, depending on how wide the bandwidth is around the desired lines. These descriptions are a bit vague; here are values for some popular filters.

Name	Type	Bandwidth
Celestron Type A	Br	47nm (at 50% trans)
Meade #908	Br	35nm
Lumicon Deep Sky	Br	68nm
Lumicon UHC (Ultra High Contrast)	Na	27nm
Lumicon OIII (Oxygen III)	Na	11nm
Orion Sky Glow	Br	85nm
Orion UltraBlock	Na	24nm

(figures taken from *Astronomy*, Feb. 1991, p. 77)

Extremely narrowband filters, such as the Lumicon OIII and H Beta, are sometimes called "line" filters, since they only admit one or two emission lines and reject nearly everything else. These are the ultimate for enhancing dim objects -- provided said objects happen to emit an appreciable amount of that particular line...

In general, the following holds true for narrowband filters when compared to broadband ones:

1) Superior enhancement of emission nebulas.
2) Darker sky background and greater blockage of light pollution.
3) Worse performance on non-nebulas (galaxies, stars, clusters, etc)

You would thus want to use something like the UHC, OIII, or UltraBlock for viewing dim planetaries (e.g., the Helix) under difficult conditions, but using one on a galaxy or globular cluster is not a swift move!

(7) Which one should I get?
If you have only enough money for one filter, I suggest a good narrowband version, such as the Lumicon UHC or OIII. One of these will optimize viewing of nebulas under all sky conditions. If you have enough to buy two, you might consider a complementary pair (one broad, one narrow), but in this case I'd recommend trying some filters first (e.g., at an astronomy club meeting) before making to a purchase. This is particularly true for broadband models, since the benefits are more subtle.

Some filters are "specialty" filters, which work well on a small (but possibly important) class of objects. The most notable example of this is the Lumicon H Beta filter, which strongly enhances a few emission nebulas (notably IC 434, the emission nebula surrounding the Horsehead in Orion), but does not work as well as other narrowband filters on most others. These are not recommended for a first purchase.
(continues on page 6)

(continues from page 5)
(8) Other possibly useful information
Light pollution isn't limited to cities. There are naturally occurring sources of light (no, I mean *besides* the Sun and Moon, etc. :-), most notably something called "airglow" or "auroral" glow. This is fluorescence produced by the air itself (more precisely, by molecules in the upper atmosphere). As with many light pollution sources, airglow predominatly occurs at a small number of frequencies, particularly at 465, 558, 630 and 636 nm. Since many filters block these regions, or at least reduce it significantly, they can be helpful even in very dark skies with little artificial light. The line at 558 gets munched by all filters; most narrowband filters will also eliminate the one at 465 nm as well. Judging from transmission tests, filters that attenuate the red (630 and 636 nm) airglow lines include the Orion Ultrablock and (to a noticeably lesser extent) the Lumicon UHC and DeepSky filters.

Dim nebulas seen from dark skies frequently benefit from filtration because of the removal of this natural airglow. This is most noticeable on large, low surface brightness nebulas such as the Veil Nebula and many planetaries, e.g., Jones 1 or any of those little #$%@#$&*!! things labeled with a P-K number in Uranometria.

Another tip: Unlike ordinary color filters, which work by absorption, LPRF's are highly reflective. As a result, observing with a LPRF requires some extra care in screening out stray light. Light that enters the eyepiece from the outside, e.g. around your eyes, will be reflected back by the filter and interfere with viewing.

Since LPRFs work on the same principles as interference filters, the exact position of the bandpass depends on the angle the filter's surface makes with the incoming light. (You can demonstrate this for yourself by taking a LPRF, looking at a light through it, then watching its color change as you tilt the filter.) This is not a problem for normal use, with the filter inside the eyepiece, but if you're using it to "blink" for nebulas (i.e., rapidly moving the filter in front of and away from the eye end of the eyepiece), you'll want to make sure the filter is parallel to the eye lens. Furthermore, if you're "blinking" with a wide-angle eyepiece (a Nagler, say), light emerging from the edges of the field of view might experience enough of a path length difference at the filter than light coming from the center. This applies only when the filter is used *after* the eyepiece, as in blinking; there is no problem when the filter is mounted normally. In theory this could lead to a change in the position of the bandpass, making nebulas harder to see at the edge of the field of view. I haven't observed this effect myself; owners of wide-field eyepieces and filters are encouraged to try this and comment.

Finally, remember that filters never make things brighter; they make *everything* dimmer, to varying degrees. What happens, of course, is that things like nebulas are scarcely dimmed at all, whereas the sky background (containing light from artificial sources, airglow, etc.) is greatly darkened, thus leading to improved contrast. However, the resulting image may still be fairly dim, especially in a smaller telescope. Patience is advised. Before hunting dim, challenging objects with a filter, practice on easier targets first. Try a big bright nebula like the Lagoon or M42 to get a feel for how much the filter improves things.

(9) Where can I find more information?
* On the sci.astro.amateur USENET newsgroup. There are always lots of people willing to answer even the most basic of questions.
* Any "analog" equivalent of s.a.a., such as local astronomy groups.
* *Astronomy*, Feb. 1991. A review article of popular brands of LPRF's with test results. Useful for surveying the field, but few technical details.
* Roger Clark, "Visual Astronomy of the Deep Sky" has a section on LPRF's, include transmission spectra (a la the *Astronomy* article above) of various filters, as well as spectra of light pollution sources. I haven't reviewed this reference myself, but from what I've heard it seems to be at least as comprehensive as the aforementioned article, and possibly more so. This agrees with what I've read so far of his.
* For *that* matter, Mr. Clark appears to be on the Net himself. Look around on sci.astro.amateur.
* The Fall, 1990 issue of the now-defunct *Deep Sky* magazine had a review and summary of LPRFs available at the time. Because of the limited circulation of this magazine, I have been unable to find a copy for inspection; one correspondent recalled that it was less thorough than the other sources given above.

Left-over (still!) questions, getting stale........

Q31. What is meant by an Astrometric night and a Photometric night, are they the same? What are the differences and what type of astronomy are they related to? *[John Paul will be disappointed if SOMEONE doesn't take a stab at this question!]*

Q32. What is the best way to secure a tripod (I have a SCT) so that it doesn't move if you accidentally bump it?

Q33. Has anyone ever looked through one of those StereoScope Binocular Viewer attachments for a telescope? Is the supposed 3-D like effect similar to those "Magic Eye" images.

NASA SPACE NEWS

SATURN'S RINGS: NOW YOU SEE THEM, NOW YOU DON'T

The rings of Saturn will all but disappear for a few moments on May 22 during a rare astronomical event that will allow astronomers to look for new moons and other features that are normally obscured by the glare of the dazzling rings. Many of the world's major telescopes, including NASA's Hubble Space Telescope, will focus on Saturn during the 24-minute event.

The phenomenon is known to astronomers as a Saturn ring plane crossing. This year and next, the rings will be seen edge-on from the Earth's perspective on three occasions — May 22 and August 10, 1995, and Feb. 11, 1996. This event only happens about every 15 years.

Ring plane crossings provide astronomers with unique views of the Saturnian system. With the rings temporarily invisible as viewed from Earth, faint objects near the planet are easier to see. Thirteen of Saturn's 18 known moons have been discovered during past ring plane crossings. The faint, outermost E-ring also is easier to detect when viewed edge-on due to the greater amount of material in the line-of-sight. Thus, observations made over the course of the ring plane crossing also can be used to gather new information on the thickness of the rings and to search for new rings.

The event is of special interest to scientists and engineers at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, who are fine-tuning the flight path of the Cassini spacecraft. Cassini is scheduled for launch on a mission to Saturn in 1997, jointly conducted by NASA, the European Space Agency and the Italian Space Agency. Any new data on the location and density of material in the rings will help the Cassini team plan the most advantageous and safest course for the spacecraft to take when it flies through the rings upon arrival at Saturn in 2004.

"We're going in awfully close with Cassini," said mission scientist Dr. Linda Horn of JPL, "so the more we know about the boundaries of the rings, the more confident we'll be." Plans call for the spacecraft to fly through a 15,500-mile (25,000-kilometer) gap between the F- and G-rings, then closely over the broad C-ring. Later, the spacecraft will make several passes through the E-ring. Astronomers hope to refine measurements of Saturn's small, inner moons during the ring plane crossing. Better estimates of the moons' sizes will be useful in targeting Cassini's observations of those satellites, according to Horn.

Saturn's rings are known to be numerous, dynamically complex and made up of countless particles of ice ranging in size from boulders to snowflakes, with some rock mixed in. They are thought to be the remains of comets, meteoroids and possibly small moons that have been captured and torn apart by Saturn's gravity.

The rings are a prime target for the science instruments aboard the Cassini spacecraft, whose mission is to study the Saturnian system while orbiting the planet for four years. Cassini also will carry the European Space Agency's Huygens Probe to be dropped into the atmosphere of Saturn's large moon Titan. As it parachutes downward, the Huygens Probe will return information about Titan's atmosphere and surface. In some ways scientists believe Titan resembles Earth as it existed in a primordial stage before life developed.

WEATHER & ASTRONOMY

by Todd Gross
Toddg@shore.net
WHDH-TV Meteorologist, Boston, Ma.

WEATHER AND AMATEUR ASTRONOMY - PART 2
"Planning your observing sessions. (Based on the weather!)"

Starting last month, I began publishing a series of articles devoted to Weather and Amateur Astronomy. This month's feature "Planning Your Observing Sessions, Based On the Weather - Part 2" is perhaps the most fundamental topic, dealing with planning on what KIND of weather systems will produce the best skies.

Have you ever noticed Don Parker's outstanding photograph's in popular astronomy magazines? While Don does outstanding work, one of the things that he has going for him is that he lives in Florida. Florida tends to have some very steady viewing, due to large, broad high pressure areas that settle over the Southeastern United States. Florida is towards the "termination" of what we call the westerlies, that is the progression of weather systems generally from west to east, and near the beginning of the "easterlies", that of course being the slow but steady movement of weather systems from east to west in the Tropics. Being near that intersection means many a time when there is little going on aloft, and thus very little turbulent air to deal with.

Weather systems elsewhere in the U.S. and all over the world, sometimes "mimic" this stalling out of weather systems, and we will discuss that and sky clarity issues here, to help determine the best opportunities for viewing. In part 1 of this 2 part series I suggested what kinds of objects you should view given different kinds of weather scenarios. Here, in part 2, I will outline the weather features for much of the United States and the world, that should deliver the best skies!

I have definitely taken up a new weather hobby: Trying to figure out which systems will produce the most STABLE weather conditions for astronomical viewing. I have to admit, that I haven't quite figured it out yet, it may take years of trial and error.. but there are a couple of hard and fast rules, that you can use, to help plan on what to view in advance. Below I will discuss the easy weather features that you can pick off on your local weathercaster's weather map... and what they will likely do to your skies:

1. Cold frontal passages
Atmospheric clarity is pretty easy to forecast, so let's start with the simple stuff. If you have a cold front that has just come through, with High Pressure on it's way in.. you know you are in for some good clarity. As long as skies clear behind the front, you should be in for some good viewing of deep space objects, because as moderate to strong cold fronts first sweep in, they do the needed housecleaning to get the haze out, and the pollutants too.(no, not the light pollution, sorry!) However, if you are doing planetary work, look out! The air is often unsteady behind these fronts, especially in the winter. Also, scopes that do not have a super steady mount will suffer from gusty winds in this kind of weather setup, so take appropriate action! (ie.. shelter the scope from the wind using a car, or other obstacle, etc)

On the other side of the coin, when cold fronts first approach, the loss of atmospheric stability can be a particular problem, especially in the summer, as thunderstorms may brew. In addition to the approaching thunder, clouds and rain often precede cold fronts, so your best bet is to wait until it passes by.

2. Warm frontal passages
Warm fronts are usually associated with clouds as they move in, but often it clears behind them. Especially in the Eastern U.S. though, this will be followed by hazy conditions, not condusive for deep sky viewing, but often satsifactory for planets, especially if the winds go light.

3. High pressure systems
These are what good skies are made of, but often not until they pass by! Assuming you are reading this in the mid-latitude Northern Hemisphere, then you would be best off for planetary viewing just after the High has moved over you and on it's way to the east. (to the west in S. Hemisphere..) This will usually produce stable and clear skies. When High pressure first moves in, often the skies are the most clear, but somewhat unsteady. This is because the air is cold aloft relative to near the ground, so much so, that the atmosphere tends to "churn", and mix, to try to make up for this imbalance.

The one catch with High pressure systems, is that after they move by, cirrus clouds, or summer haze may follow suit. Thus, just when you are about to get the most stability, you lose some clarity to the sky.. so timing is everything!

4. Low pressure systems
More commonly known as "storm systems", these cyclones produce bad weather, and lots of clouds. Breaks in the cloud deck often occur nearby low pressure systems though, especially on their south side. You may find decent viewing in these breaks, especially in summer, when the wind is less of a problem.

One interesting note:

You can actually view right through certain kinds of clouds. Fast moving, low cumulous clouds (the cottony ones) are sometimes thin enough to see through, but more often, you have to settle on viewing between them. That goes for broken stratus (layers) clouds as well, you should pick out the breaks. Cirrus clouds, made of ice crystals will blur the vision of objects, but when very thin can be successfully viewed through. When they start thickening up to an overcast of cirro-stratus though, you are out of luck! You will often see a "halo" around the moon as the cirrus deck thickens..and rain or snow may follow the next day.

I have been contacted by many folks hoping I can shed some light on what kind of viewing to expect when local weather phenomena happen, ie. seabreezes, Santa Ana winds, etc. Well, I have not figured it all out yet, and will probably spend much of my life "second guessing" local weather conditions, and what kind of skies they will produce. The best I can say is that when you introduce a layer of air that is not like the rest, as in a seabreeze, you are likely to cause "some" distortion as the light moves from one temperature air mass, to the other. Hopefully, I will be able to follow up with even more info. on atmospheric conditions and astronomy at a later time!

SKY & TELESCOPE BULLETIN

COMET-CRASH MEETING
Two hundred scientists from around the world gathered in Baltimore last week to pore over data gathered during Comet Shoemaker-Levy 9's collision with Jupiter. The researchers debated a host of unresolved questions about the comet's composition, what actually happened during the collisions, and why Jupiter was affected so dramatically. For example, the huge dark stains that surrounded many impact sites may have been a thin veneer of dusty debris created from the remains of each comet fragment, or they may represent an entirely new set of compounds synthesized when giant fireballs cooled and fell back into Jupiter's atmosphere with an energetic, high-speed "splat." There was more debate on the size of the comet before its disruption, and on where it might have come from. Based on several lines of evidence, most investigators feel the progenitor was probably in the range of 1.5 to 2 kilometers across, though 4 or 5 km is still favored by some.

DO PULSARS HAVE JET ENGINES?
Some pulsars have been observed to be traveling through the Milky Way at several hundred kilometers per second. While a lopsided supernova explosion could send these stars hurtling away at such extraordinary speeds, the recent discovery of a pulsar with a powerful jet provides an intriguing alternative. University of Wisconsin astronomers Craig Markwardt and Hakki Ogelman studied observations by the Rosat X-ray satellite of the Vela pulsar. Images reveal a 20-light-year-long jet extending from the spinning star. Although its axis is not aligned with the pulsar's observed proper motion, the Vela pulsar's jet might still have had a hand in driving the star from its birthplace. Their report, in the May 4th issue of the journal NATURE, also notes that the jet may also explain the gradual slowdown seen in the pulsar's spin rate.

STATISTICALLY SPEAKING

Latitude: 42°22'00" N Longitude: 83°17'00" W (Dearborn, MI)
Local Time = Universal Time - 5.00 hours (Eeastern Standard Time)
Elevation: 180 meters

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 June 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1 SR: 4:59 SS: 20:03 MR: 7:50 MS: 22:27	2 SR: 4:59 SS: 20:04 MR: 8:45 MS: 23:03	3 SR: 4:58 SS: 20:05 MR: 9:43 MS: 23:36
4 SR: 4:58 SS: 20:05 MR: 10:43 MS: None	5 SR: 4:57 SS: 20:06 MR: 11:44 MS: 0:07	6 SR: 4:57 SS: 20:07 MR: 12:47 MS: 0:37 FQ: 5:26	7 SR: 4:57 SS: 20:07 MR: 13:52 MS: 1:07	8 SR: 4:56 SS: 20:08 MR: 15:00 MS: 1:39	9 SR: 4:56 SS: 20:09 MR: 16:11 MS: 2:14	10 SR: 4:56 SS: 20:09 MR: 17:23 MS: 2:53
11 SR: 4:56 SS: 20:10 MR: 18:34 MS: 3:39	12 SR: 4:56 SS: 20:10 MR: 19:42 MS: 4:33 FM: 23:04	13 SR: 4:56 SS: 20:11 MR: 20:42 MS: 5:35	14 SR: 4:56 SS: 20:11 MR: 21:35 MS: 6:43	15 SR: 4:56 SS: 20:12 MR: 22:20 MS: 7:54	16 SR: 4:56 SS: 20:12 MR: 22:58 MS: 9:06	17 SR: 4:56 SS: 20:12 MR: 23:32 MS: 10:15
18 SR: 4:56 SS: 20:13 MR: None MS: 11:22	19 SR: 4:56 SS: 20:13 MR: 0:03 MS: 12:26 LQ: 17:02	20 SR: 4:56 SS: 20:13 MR: 0:33 MS: 13:29	21 SR: 4:56 SS: 20:13 MR: 1:03 MS: 14:29 JSO:15:35	22 SR: 4:56 SS: 20:14 MR: 1:34 MS: 15:28	23 SR: 4:57 SS: 20:14 MR: 2:06 MS: 16:25	24 SR: 4:57 SS: 20:14 MR: 2:42 MS: 17:21
25 SR: 4:57 SS: 20:14 MR: 3:21 MS: 18:13	26 SR: 4:58 SS: 20:14 MR: 4:05 MS: 19:02	27 SR: 4:58 SS: 20:14 MR: 4:53 MS: 19:47 NM: 19:51	28 SR: 4:58 SS: 20:14 MR: 5:45 MS: 20:28	29 SR: 4:59 SS: 20:14 MR: 6:40 MS: 21:06	30 SR: 4:59 SS: 20:14 MR: 7:37 MS: 21:39	

Planet View Info Report for 6/1/1995 to 6/30/1995

Mercury

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	5:30	20:18	5h01m22s	21°19'06"	6°27'26"	0.015	0.5591
6/ 8/1995	4:57	19:25	4h46m20s	19°04'05"	5°17'30"	0.010	0.5537
6/15/1995	4:25	18:44	4h36m04s	17°44'17"	14°05'59"	0.080	0.6016
6/22/1995	4:00	18:23	4h38m46s	17°52'46"	19°54'31"	0.199	0.6946
6/29/1995	3:45	18:22	4h56m41s	19°15'36"	22°00'32"	0.350	0.8223

Venus

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	3:58	18:08	3h04m42s	15°56'53"	21°51'48"	0.927	1.5603
6/ 8/1995	3:55	18:24	3h38m56s	18°17'48"	20°03'03"	0.939	1.5888
6/15/1995	3:54	18:40	4h14m03s	20°15'58"	18°12'50"	0.949	1.6149
6/22/1995	3:55	18:56	4h50m02s	21°47'46"	16°21'24"	0.959	1.6386
6/29/1995	4:00	19:09	5h26m43s	22°50'01"	14°29'04"	0.968	1.6596

Mars

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	11:31	1:04	10h21m28s	11°40'23"	82°51'46"	0.894	1.4156
6/ 8/1995	11:21	0:44	10h34m06s	10°17'46"	79°32'56"	0.895	1.4731
6/15/1995	11:12	0:24	10h47m10s	8°50'51"	76°23'22"	0.897	1.5290
6/22/1995	11:04	0:04	11h00m36s	7°19'58"	73°21'47"	0.899	1.5833
6/29/1995	10:56	23:42	11h14m24s	5°45'26"	70°27'19"	0.902	1.6359

Jupiter

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	19:48	5:12	16h36m09s	-21°13'29"	179°04'55"	1.000	4.3207
6/ 8/1995	19:16	4:41	16h32m22s	-21°06'35"	172°48'27"	1.000	4.3239
6/15/1995	18:45	4:10	16h28m43s	-20°59'46"	165°16'52"	0.999	4.3416
6/22/1995	18:13	3:40	16h25m17s	-20°53'20"	157°48'08"	0.999	4.3733
6/29/1995	17:42	3:10	16h22m13s	-20°47'33"	150°24'14"	0.998	4.4182

Saturn

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	1:48	13:20	23h38m54s	-4°25'55"	76°40'21"	0.997	9.8495
6/ 8/1995	1:21	12:54	23h40m15s	-4°19'05"	83°01'07"	0.997	9.7349
6/15/1995	0:55	12:28	23h41m20s	-4°14'03"	89°25'28"	0.997	9.6187
6/22/1995	0:28	12:01	23h42m07s	-4°10'55"	95°54'00"	0.997	9.5024
6/29/1995	0:01	11:34	23h42m37s	-4°09'42"	102°27'10"	0.997	9.3875

Uranus

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	23:19	8:48	20h10m03s	-20°38'52"	129°52'24"	1.000	19.0502
6/ 8/1995	22:51	8:20	20h09m22s	-20°41'08"	136°44'19"	1.000	18.9653
6/15/1995	22:23	7:51	20h08m34s	-20°43'45"	143°37'09"	1.000	18.8908
6/22/1995	21:55	7:22	20h07m39s	-20°46'41"	150°31'08"	1.000	18.8278
6/29/1995	21:27	6:54	20h06m39s	-20°49'52"	157°26'15"	1.000	18.7772

Neptune

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	22:57	8:27	19h48m25s	-20°32'06"	134°48'42"	1.000	29.4468
6/ 8/1995	22:29	7:59	19h47m53s	-20°33'28"	141°38'33"	1.000	29.3674
6/15/1995	22:01	7:30	19h47m16s	-20°35'02"	148°28'34"	1.000	29.2992
6/22/1995	21:33	7:02	19h46m36s	-20°36'46"	155°19'00"	1.000	29.2431
6/29/1995	21:05	6:34	19h45m52s	-20°38'38"	162°09'56"	1.000	29.2000

Pluto

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
6/ 1/1995	18:12	5:34	15h58m54s	-6°18'06"	162°13'32"	1.000	28.8712
6/ 8/1995	17:44	5:06	15h58m11s	-6°17'12"	157°21'45"	1.000	28.9003
6/15/1995	17:16	4:38	15h57m29s	-6°16'46"	151°42'17"	1.000	28.9425
6/22/1995	16:47	4:10	15h56m50s	-6°16'50"	145°39'12"	1.000	28.9973
6/29/1995	16:19	3:41	15h56m14s	-6°17'24"	139°23'32"	1.000	29.0639

Planet Apsides Report for 1995

Mercury

6/ 6/1995 Aphelion Distance from Sun: 0.47 AU

Planet Conjunction/Opposition Report for 6/1/1995 to 6/30/1995

Date	Planet	Hour	Event
6/ 5/1995	Mercury	0	Inferior Conjunction
6/ 1/1995	Jupiter	4	Opposition

Moon Apsides Report for 6/1/1995 to 6/30/1995

Date	Hour	Apsis	Distance (km)	Diameter
6/12/1995	20	Perigee	357029	0.5578°
6/26/1995	5	Apogee	406426	0.4900°

Meteor Showers Report for 6/1/1995 to 6/30/1995

Date	Meteor Shower	ZHR	RA	DEC	Illum. Frac.	Longitude
6/ 9/1995	Ophiuchids	5	17h56m	-23°	0.84	79°
6/20/1995	Ophiuchids	5	17h20m	-20°	0.41	89°

Twilight Report for 6/1/1995 to 6/30/1995

Date	Sun		Astronomical		Nautical		Civil	
	Rise	Set	Begin	End	Begin	End	Begin	End
6/ 1/1995	4:59	20:03	2:46	22:17	3:37	21:25	4:20	20:42
6/ 8/1995	4:56	20:08	2:40	22:25	3:33	21:32	4:17	20:48
6/15/1995	4:56	20:12	2:36	22:31	3:31	21:36	4:16	20:52
6/22/1995	4:56	20:14	2:37	22:34	3:31	21:39	4:16	20:54
6/29/1995	4:59	20:14	2:40	22:33	3:34	21:39	4:19	20:54

COMET COMMENTS 05-08-95

by Don Machholz (916) 346-8963

Periodic Comet d'Arrest brightens in our morning sky as it approaches perihelion on July 27. Meanwhile, the faint Comet Chiron remains in our evening sky.

You might have recently heard about the Kuiper Belt, a band of material in orbit around our sun near the orbit of Neptune. A couple of dozen such objects have already been discovered from earth, they are at about magnitude 22. This translates to a diameter of about 100 km. While many consider them to be comets rather than minor planets, their orbits seem to be rather circular and it seems unlikely that they will approach close the the sun and develop cometary features. A question arises: How many objects are there in the Kuiper Belt?

According to IAU Circular 6163, the Hubble Space Telescope conducted a limited search for objects in the Kuiper Belt. The test covered a small section of sky, four square arc-minutes in size. The limiting magnitude was 28, about the brightness of the nucleus of Halley's Comet at that distance. Thirty-four images were recorded over two days last August, they were stacked after the galaxies and stars were removed. Of the many objects remaining, statistical studies were done to determine which "spots" matched up with objects in a typical Kuiper Belt orbit. Some 244 objects were found in such paths, compared to only 185 in a "control" group. The result: "If our 59 excess candidates are indeed real members of the Kuiper Belt, there must be about 60,000 such objects per square degree, or at least a total of 100 million comets brighter than our limiting magnitude in the restricted range of orbits similar to the ones studies here."

EPHEMERIDES

6P/d'ARREST

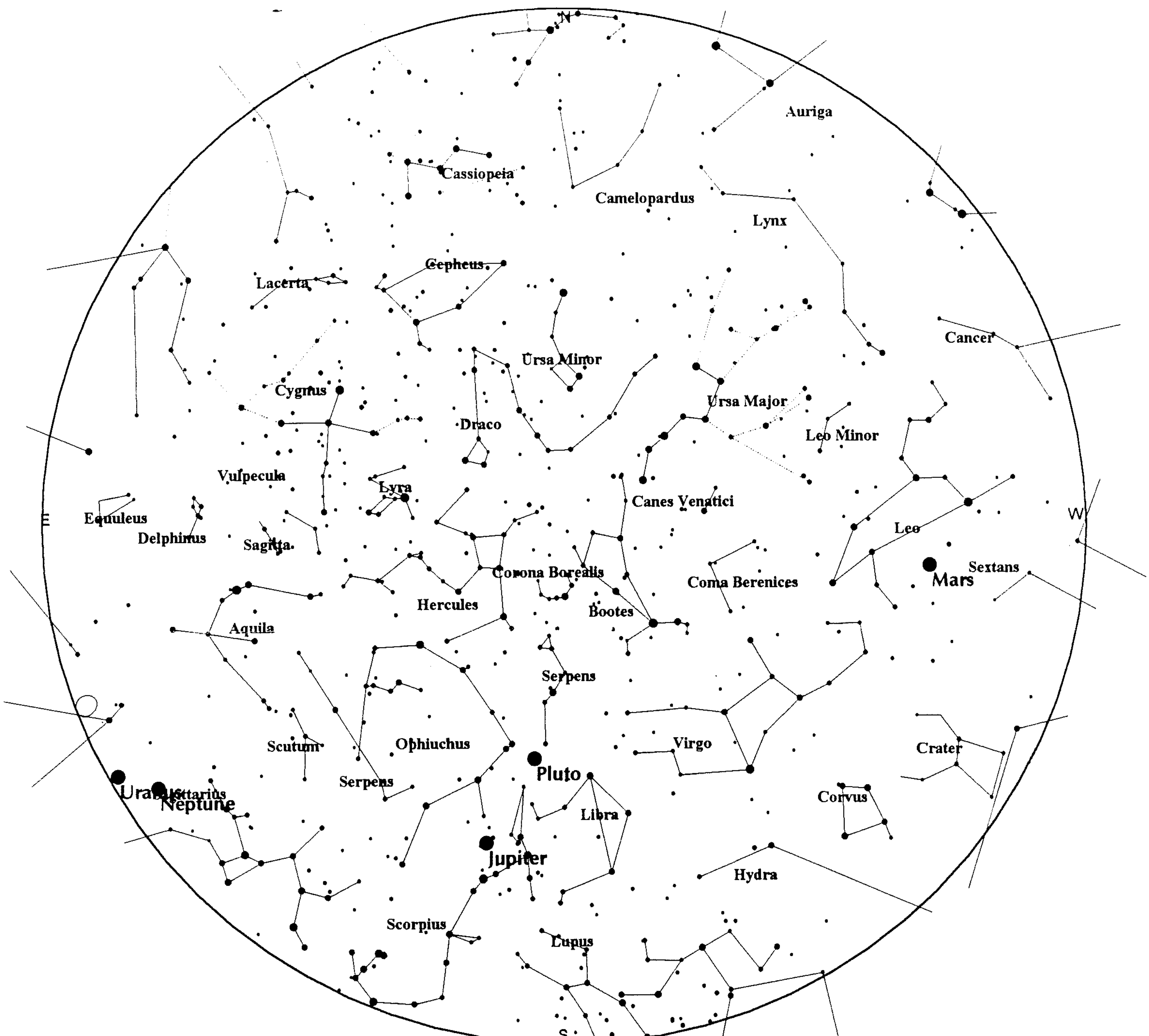
DATE	R.A.(2000)DEC		EL	SKY	MAG
06-02	20h47.0m	+09d09m	112d	M	11.5
06-07	20h59.4m	+09d31m	113d	M	11.2
06-12	21h12.2m	+09d44m	114d	M	10.9
06-17	21h25.3m	+09d45m	116d	M	10.6
06-22	21h38.8m	+09d31m	117d	M	10.4
06-27	21h52.7m	+09d01m	119d	M	10.2
07-02	22h06.8m	+08d12m	121d	M	9.9

95/CHIRON

DATE	R.A.(2000)DEC		EL	SKY	MAG
06-02	11h18.2m	+00d21m	99d	E	15.7
06-07	11h18.8m	+00d21m	95d	E	15.8
06-12	11h19.7m	+00d19m	90d	E	15.8
06-17	11h20.7m	+00d16m	85d	E	15.8
06-22	11h21.9m	+00d13m	81d	E	15.9
06-27	11h23.2m	+00d08m	77d	E	15.9
07-02	11h24.6m	+00d02m	72d	E	15.9

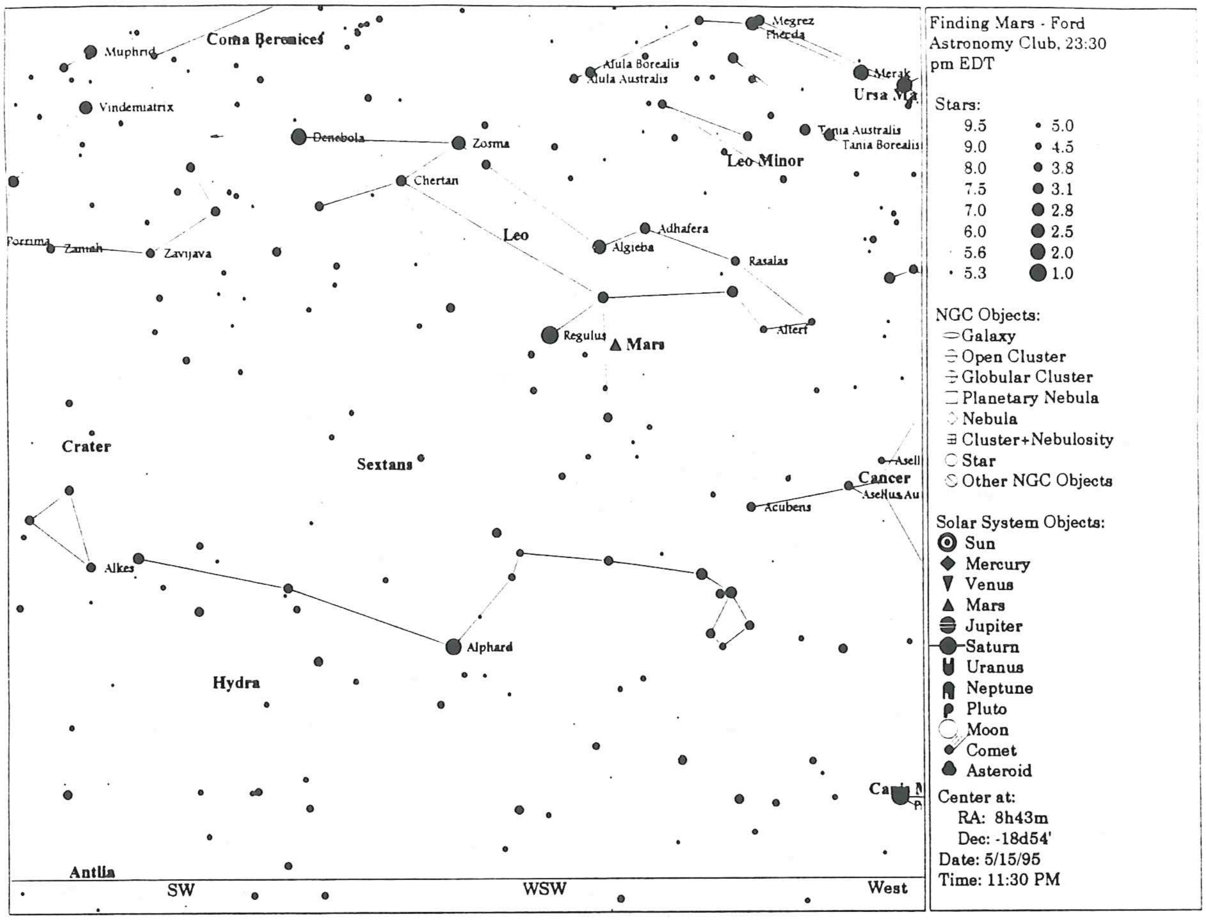
Reprinted fromASTRONET, Issue 14. For more information, please contact resource@rahul.net.

JUNE'S SKIES



Local Time: 23:30:00 15-Jun-1995 Location: 42° 22' 0" N 83° 17' 0" W	UTC: 03:29:59 16-Jun-1995 Centre Az: 180.0° Alt: 90.0° Field: 180.0°	Sidereal Time: 15:32:37 Julian Day: 2449884.6458

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



Ford Amateur Astronomy Club
Star Stuff Newsletter
P.O. Box 7527
Dearborn, MI 48121