



## The Ford Amateur Astronomy Club Newsletter

Volume 5, Number 6

June 1996

### NEW CLUES TO DARK MATTER

Measurements from the joint NASA/European Space Agency Ulysses mission found a surprisingly small increase in the amount of helium-3 since the formation of the solar system, allowing a more precise estimate of the amount of dark matter in the universe. Drs. George Gloeckler, professor of physics at the University of Maryland, and Johannes Geiss, director at the International Space Sciences Institute in Bern, Switzerland, reported the first measurements of helium-3 in the interstellar cloud surrounding our solar system. They said their findings of this lighter isotope of helium give additional clues to the amount of dark, or invisible matter, that was produced at the beginning of the universe — the Big Bang — 15 billion years ago.

The exact nature of dark matter is one of the most intriguing mysteries in astronomy. Although scientists do not know what it is, their best estimates indicate most of the Universe — perhaps as much as 90 percent — is composed of dark matter. This estimate is based partly on observations showing stronger gravitational attraction between galaxies than should be the case with the amount of matter they can see. The dark matter may be 'ordinary' matter such as planets and burned-out stars too dim to detect, or perhaps exotic objects such as black holes or as-yet-undetected particles which pervade the Universe.

"Basically, our measurements indicate the amount of dark matter in the early universe was fairly high," Gloeckler said. "Visible matter is a small fraction of the total. By measuring the relative portions of the lightest elements and their isotopes, one can infer the amount of ordinary matter in the universe."

"Since current theories of the earliest stages of the universe predict a much larger amount of matter coming out of the Big Bang, the difference is surmised to consist of an entirely different and unfamiliar kind of matter, commonly called dark matter," Geiss said. "The precise nature of this dark matter is not known at this time, because it has eluded so far all efforts of detecting it directly. It could very well have survived to this day, filling the whole universe and dominating its dynamics, yet be invisible to us."

The light elements of helium-3, hydrogen, deuterium — a heavy isotope of hydrogen — and helium-4 were created in the Big Bang, the scientists said. The abundance of helium-3 has been changing ever since because it is both produced and destroyed in stars. The direction and amount of this change have until now remained undetermined. They found, however, that the reported amount of helium-3 indicates a surprisingly small increase — about 50 percent — since the time of the formation of the solar system 4.6 billion years ago.

Since the change was smaller than earlier models indicated, Gloeckler and Geiss said, the density of dark, or unseen, matter relative to that matter which we can see must be greater. "What is so exciting is that we have good numbers for the helium-3 abundance during three time epochs spanning the life of the universe," Gloeckler said. "This gives a firm handle on how matter is processed or 'cooked' in stars." He said current models that predict large amounts of helium-3 are not consistent with the new findings.

The measurements were made over the south pole of the Sun at distances several times the distance of the Sun to Earth. They detected the interstellar gas that made its way deep into the inner solar system and determined the composition of helium-3 in that gas.

The Ulysses mission is managed jointly by NASA and the European Space Agency (ESA). The Jet Propulsion Laboratory manages the U.S. portion of the mission for NASA's Office of Space Science, Washington, DC. ☆

### NEW INSIGHTS TO SOLAR PLUMES

Initial observations by the recently launched Solar and Heliospheric Observatory (SOHO) spacecraft reveal unexpected activity on the Sun and the best views yet of the sources of strange, chaotic "plume" structures that extend from the solar poles to high altitudes within its outer atmosphere, or corona.

SOHO was specifically designed to observe the Sun during a supposedly "quiet" period near the bottom of its 11-year sunspot cycle, when solar disturbances are at a minimum and the undisturbed solar atmosphere and interior could best be studied. To the surprise and excitement of SOHO's scientific investigators, "movies made from SOHO ultraviolet data show that there is continuous motion and action everywhere on the Sun," said Dr. Joseph Gurman of NASA's Goddard Space Flight Center, Greenbelt, MD.

Disturbances are occurring even within so-called "coronal holes," areas of particularly low density, low temperature and open magnetic field lines in the corona, where such disturbances were least expected. An open magnetic field is one in which the lines of magnetic force stretch out indefinitely into interplanetary space, rather than looping back downward onto the Sun.

The dramatic new ultraviolet movies from SOHO also have revealed the source areas of the long, feathery plumes that extend from regions near the poles of the Sun to more than 13 million miles into interplanetary space. The sequences of ultraviolet images, combined into movies by SOHO researchers, show the polar plumes standing in the solar wind, an outward streaming of electrified gas from the corona. The movies clearly reveal the bases of the plumes, never characterized before, to be seething regions of wildly gyrating magnetic fields and turbulent solar gases.

"Polar plumes are a natural laboratory to explore two of the main objectives of the SOHO mission," explained Dr. Craig DeForest of Stanford University, Palo Alto, CA. These goals are to learn how the Sun's corona is heated to about 3.6 million degrees Fahrenheit and why the solar wind in some places reaches speeds of almost two million miles per hour. The plume data may even shed light on the third main goal of SOHO, to determine what occurs below the solar surface to generate the strong flows and intense magnetism that produce solar disturbances such as sunspots and solar flare explosions.

The chaotic conditions discovered by SOHO at the base of the polar plumes also are under analysis. Early data show that often the base of a plume is a bright point in the solar atmosphere, as seen in ultraviolet light. These bright points fluctuate rapidly in intensity and are at locations where magnetic fields are rapidly changing. "These magnetic changes may represent the release of significant amounts of energy on the Sun, and they contribute to the heating of the corona," said Gurman.

A chief aim of the SOHO polar plume research is to see if plumes can be positively identified as the sources of high-speed streams of solar wind that were directly sampled by the European Space Agency's Ulysses spacecraft when it passed over the poles of the Sun in 1994 and 1995. In earlier work with sounding rocket experiments, DeForest concluded that the plumes may contain high-speed outward gas flows. "Now, we are trying to determine whether the plumes are in fact the fundamental source of the high speed streams," he said.

The dramatic changes found at the foot of the polar plumes "appear to include the breaking open of small magnetic arches to form 'jets' that expel mass at (continued on page 6)

# GALILEO FINDS IRON CORE IN IO

Jupiter's volcano-pocked moon Io has been found by NASA's Galileo spacecraft to have a giant iron core that takes up half its diameter. The spacecraft also has detected a large "hole" in Jupiter's magnetic field near Io, leading to speculation about whether Io possesses its own magnetic field. If so, it would be the first planetary moon known to have one.

These newly identified characteristics of Io may be related to the intense heating of the moon caused by the constant squeezing and distortion of Io in Jupiter's powerful gravitational grip, according to Galileo Project Scientist Dr. Torrence Johnson of NASA's Jet Propulsion Laboratory (JPL). Io is the most geologically active body in the Solar System, and though it is less than a third of Earth's size, it generates twice as much heat as the Earth.

"Jupiter's massive gravity field distorts the shape of Io in the same way that tides are raised in Earth's oceans by the gravitational tugs of the Sun and Moon," Johnson said. As Io orbits Jupiter, these so-called "body tides" rise and fall due to subtle changes in Io's orbit which in turn are caused by the gravitational nudges from Europa and Ganymede, other moons of Jupiter. As a result, Io is squeezed like a rubber ball. Friction created by this action heats and melts rock within Io to produce the volcanoes and lava flows seen all over its surface, and huge geysers that spew sulfur dioxide onto Io's landscape.

The large, dense core Galileo found within Io was deduced from data taken during the spacecraft's flyby of the moon last Dec. 7, as Galileo passed by the moon on its way to enter orbit around Jupiter. Precise measurements of the spacecraft's radio signal revealed small deviations in Galileo's trajectory caused by the effects of Io's own gravity field. From these data, Galileo scientists have determined that Io has a two-layer structure. At the center is a metallic core, probably made of iron and iron sulfide, about 560 miles in radius, which is overlain by a mantle of partially molten rock and crust, according to JPL's Dr. John Anderson, team leader of Galileo's celestial mechanics experiment and principal author of the paper published in Science. The core was probably formed from heating in the interior of the moon, either when it originally formed or as a result of the perpetual tidal heating driving its volcanoes.

Galileo scientists also are trying to determine the cause of the hole they found in Jupiter's magnetic field when the spacecraft was closest to Io. "Instead of increasing continuously as the spacecraft neared Jupiter, the magnetic field strength took a sudden drop of about 30 percent," Johnson said. "It's an astonishing result and completely unexpected," said Dr. Margaret Kivelson of the University of California at Los Angeles, who heads Galileo's magnetic fields investigation team. Preliminary analyses of these data are currently being prepared for formal publication. "The data suggest that something around Io — possibly a magnetic field generated by Io itself — is creating a bubble or hole in Jupiter's own powerful magnetic field," Kivelson said. "But it's not clear to us just how Io can dig such a deep and wide magnetic hole."

Possible explanations for this signature can only be sorted out using data from all the other space physics instruments onboard Galileo, Johnson said. "We're eagerly awaiting the return of data from the magnetospheric measurements taken during the Io flyby to see if we can resolve this mystery," he said. This data, recorded on board the spacecraft, will be transmitted back to Earth in June or July. If analysis of this data eventually proves that Io indeed has a magnetic field of its own, it would be the first moon shown to have one. Io would join the Earth, planet Mercury and the outer giant planets as bodies in our Solar System that generate their own magnetic fields.

Other studies conducted by Galileo during its December flyby of Io have provided new evidence that Io is most likely the source of high-velocity dust streams littering millions of miles of space around Jupiter. In July 1994, Galileo's dust detector began sensing dust streams more powerful than those previously discovered by the Ulysses spacecraft. Dust detectors on Galileo sensed more and more particles during its approach to Jupiter, reaching a peak of 20,000 impacts per day during the longest and most intense interplanetary dust storm ever observed.

These fast-moving particles travel at speeds from 30 to 60 miles per second away from Jupiter — fast enough to escape the Solar System. These dust impacts continued up to the time of Galileo's Io flyby and then ceased, said Dr. Eberhard Grün of Germany's Max Planck Institute in Heidelberg, principle investigator for Galileo's dust detector experiment. "My preliminary interpretation of these observations is that they support the idea that Io is in some way the source of the Jupiter dust streams," Grün said.



## STAR STUFF

Monthly Publication of the Ford Amateur Astronomy Club

Star Stuff Newsletter

P.O. Box 7527

Dearborn, Michigan 48121-7527

## 1996 CLUB OFFICERS

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Vice President:	Patti Forton	84-51740
Secretary:	Harry Kindt	313-835-1831
Treasurer:	Kevan Granat	24-87628

## 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. Members are responsible for opening and closing the gate after the parks 10:00pm closing time. The combination for the lock should be available on our hotline number. Always close the gate behind you after 10:00pm whether entering or leaving the park.

## 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, and discounts at selected area astronomical equipment retailers.

## NEWSLETTER STAFF

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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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## JUNE 1996

SUN	MON	TUE	WED	THU	FRI	SAT
30 						1 
2	3	4	5	6	7	8 
9	10	11	12	13	14	15 
16	17	18	19	20 Summer solstice	21	22 Mini Star Party
23	24 	25	26	27 FAAC Meeting	28	29

Jun 01 Moon Passes 0.8 Degrees North of Asteroid Ceres  
 Jun 01 Full Moon (4:19 pm)  
 Jun 03 Comet Gunn, Closest Approach to Earth (1.469 AU)  
 Jun 06 Comet Hyakutake Crosses the Earth's Orbit  
 Jun 07 Asteroid 498 Tokio Occults 8.9 Magnitude Star in Ophiuchus  
 Jun 08 Last Quarter Moon (6:37 am)  
 Jun 10 Mercury At Its Greatest Elongation (24 Degrees)  
 Jun 11 Asteroid Icarus Near-Earth Flyby (0.1012 AU)  
 Jun 14 Mercury Passes 3 Degrees South of Mars  
 Jun 15 New Moon (9:08 pm)  
 Jun 16 Asteroid 1990MU Near-Earth Flyby (0.2499 AU)  
 Jun 16 Mars Passes 3 Degrees NW of Mercury  
 Jun 20 Summer Solstice (9:52 pm)  
 Jun 22 F.A.A.C. Mini-Star Party (Island Lake Recreation Area)  
 Jun 23 Mercury Passes 1.5 Degrees North of Venus  
 Jun 24 First Quarter Moon (12:55 am)  
 Jun 25 Comet Parker-Hartley Perihelion (3.05 AU)  
 Jun 29 Asteroid Metis at Opposition  
 Jun 30 Asteroid 7074 Interamnia Occults 10 Mag. Star in Triangulum  
 Jun 30 Full Moon (Blue Moon) (11:30 pm)

## 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 27, at 5:00 pm**. 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 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 or lower east doors. At 5:00 pm no one seems to have 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 you are here to attend a Ford club meeting, and security will admit you. You may find your way into the building any way you see fit, but direction signs will only be posted at lower northeast and lower east doors. ☆

## MEETING MINUTES 5/23/96

from Harry Kindt, Sec'y FAAC, (hkindt@voyager.net)

The meeting was called to order by our president, Bob McFarland at 5:05 PM. There were 21 members and guests present.

Due to the absence of our treasurer, no report was available.

Bob McFarland reported on the upcoming events in which our club has an interest. On June 15, the Annual Summer Solstice star party and bar-b-que will be held at Doug Bocks' Northern Cross Observatory. On June 22 our club will be holding a mini-star party at our viewing site at Island Lake. Any one with an

interest in Astronomy will be welcome to this event. The park will be notified and announcements will be going out to the public. We hope to include Boy & Girl Scout Troops who have members that would like to qualify for their Astronomy badges. A questionnaire will be available, and a certificate will be awarded to those individuals who can pass the quiz. Our objective is to have our telescopes all pointed to different objects in the evening sky, and then move them to other objects so that we give the viewers a "bunch of stuff to look at". Bob also reported on the Forth Annual F.A.A.C. Star Party, which is scheduled for September 7th.

Club members who attended the star party in Bad Axe at the Justin's Family Campground, reported on their experiences. Plans are in the works to schedule another outing at this campground in September. Tentative dates are September 12, 13, 14.

At this point, the members present, introduced themselves and briefly discussed their viewing experiences since our last meeting. Randy Allen showed the group a set of CCD images taken by him and his ST-6 CCD camera attached to a LX-200 10" Meade fork-mounted telescope. Barry Craig entertained us with a video tape of the star party at the Justin's Family Campground.

Greg Burnett brought along a slide show of images taken by the Hubble telescope. These images showed the startling differences between those taken before and after the repairs were made to the telescopes' optics. Thanks to all, great show!

The meeting was adjourned at 6:50 PM. ☆

## FAAC WWW PAGE

from Paul Mrozek (pmrozek)

The Ford Amateur Astronomy Club now has its own web page in the Ford intranet at the following address:

<http://av3168.pd8.ford.com:8080/faac/faac.html>

This site contains the following information:

General Club Info  
 Latest Information from the Internet (items that will probably not be included in the newsletter)  
 FAQs and Other Info  
 Pictures

A copy of past issues of the Star Stuff newsletter will also eventually be there in Adobe Acrobat format. Please contact Paul Mrozek (see the bottom of page 2 for address) if you would like to collect and scan pictures from club members for this web site. ☆

## JUNE 1996 SPACE EVENTS

The following June 1996 events come from the 4/29/96 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov). Note that launch dates are subject to change.

Jun ?? Intelsat 709 Ariane 4 Launch  
 Jun ?? Intelsat 801 Ariane 4 Launch  
 Jun 01 TOMS Pegasus XL Launch  
 Jun 01 Progress M-32 Launch (Russia)  
 Jun 12 Galileo, Orbital Trim Maneuver #5 (OTM-5)  
 Jun 20 STS-78, Columbia, Life & Microgravity Spacelab (LMS)  
 Jun 27 Galileo, 1st Ganymede Flyby (Orbit 1)  
 Jun 30 GPS-10 Delta Launch ☆

## HELP WANTED!

As with any other non-profit organization, our club will only do that which our members have the energy to do. Whether it is in the planning and execution of the various club activities, helping to get speakers or just helping to get refreshments to the meeting, most everyone can help in some way. Getting involved is a great way to have fun and to get to know everyone better. Please pitch in however you can. Let one of the officers know that you will help. ☆

# BILBERRY: VISUAL BOOST?

The following articles are reprinted from ASTRONET, Issue 37, April 15, 1996. For more information, please contact [resource@resource-intl.com](mailto:resource@resource-intl.com).

From: [mystery2@ix.netcom.com](mailto:mystery2@ix.netcom.com)

Bilberry is it "the stuff of legends" or can this so called "mytical" substance actually help astronomers peer deeper into the night?

This is the question I've been plagued with ever since I read about astronomers at a certain Ultimate Star Party in Texas who claimed a greater than one magnitude increase from using bilberry! The article, which appeared in Astronomy Magazine in February 1995 - and was entitled "Big Eyes on a Lone Star Night" got me thinking. Let's see, one magnitude, that'd be about the difference between a 15" and a 20" scope if I'm not mistaken...certainly no small amount, especially for those into deep sky visual astronomy. Well, with my interest peaked I decided to set out on the internet and search out information relating to Bilberry. This post will summarize some of what I've found.

\*\*\*Please note: I am not suggesting people use or not use Bilberry; I am ignorant as to whether it is safe or unsafe in its different forms. I am simply interested in encouraging discussion and learning more about this substance from those of you with information about it. I'll begin with a brief intro, then give some more detailed info along with references to scientific studies & web pages...

## Intro:

Bilberry jam was supposedly used successfully during World War II by RAF (Royal Air Force) spitfire pilots and crews prior to night time bombing runs into Germany in order to enhance their night vision. Apparently, bilberries are closely related to blueberries (whortleberry in England) and even more closely related to "huckleberries" here in America. Some books however give a different genus name for them, so it seems they are somewhat different than all of these.

## Studies & References:

I found internet references to a number of studies on bilberry. Allegedly, bilberry works to increase retinal purple (rhodopsin) dramatically, within 20 minutes or less. A study conducted by Sala D. et al. Minerva Oftalmologic <1979> 21:283 reportedly showed bilberry resulted in 80% of study participants improving on their visual acuity exam and passing a night vision test. In another study, (Jayle and Aubert <1964>) of 37 healthy subjects, a "marked" improvement in retinal adaptation curve and improvement in visual acuity in dim light was found. (I found many other studies that were referred to) In one internet post, a reference was made to Earl Mindell's Herb Bible which on page 51, apparently talks about the acceleration of the regeneration of retinol purple (aka visual purple). That post went on to warn that the leaves can be toxic if consumed over a long period of time, and urged people to stay with berries. \*\*\*here again, I do not know whether bilberry is safe or unsafe in its varied forms.\*\*\*

Internet pages with references to bilberry and to scientific studies conducted on it can be found at:

<http://www.crl.com/~robbee/bilart.html>

[http://silver.ucs.indiana.edu/~aeulenbe/i\\_see/bilart.html](http://silver.ucs.indiana.edu/~aeulenbe/i_see/bilart.html)

For those of you who are skeptical or perhaps scientists, you may wonder whether these & other studies were conducted with proper controls, e.g. double blinds, etc. Were they both valid & reliable...were they ever replicated by other researchers? My answer is: I don't know...I have not reviewed the original studies, I've only read about them here on the net ... perhaps some of you might have access to the right books and be able to offer an opinion. In fact, I hope that those who have info regarding bilberry or an interest in it will post a reply as I'm interested in learning more.

For those of you wondering, no I have not yet tried bilberry myself. I am currently awaiting the completion of a new 18" scope...but once it's ready, I may just have a big slice of huckleberry pie prior to heading out for first light in search of Palomar Globulars under dark skies :) Who knows what I'll see...

From: [Andy Domonkos \(domonkos@access1.digex.net\)](mailto:domonkos@access1.digex.net)

Yes, Bilberry, in its original form, as a jam, or extracts, have definite positive impacts on increasing night vision. I began taking the extracts in January, and after 10 days began noticing a substantial improvement in night vision. The

pupils don't dilate any more than normal, the activity is at the retinal level. Now I take one capsule in the AM and 2 before I go out for my observing (an hour before). I noticed I didn't have the need to turn on more than one light in my living room as before. Now, I squint when the 2nd light is turned on. Amazing improvements, but as always, your mileage may vary.

BTW, this was used during WWII by RAF pilots to increase their night acuity during their bomb runs over Germany. Bilberry jam sandwiches before each flight!

From: [Dennis Ward \(dward@comet.ucar.edu\)](mailto:dward@comet.ucar.edu)

Bilberry extract, as found in prepackaged form is not only safe, it promotes healthier blood vessels in the eye. When I told my Optometrist that I was taking it, she said "great!" (I was nervous, as I had just come down with viral conjunctivitis, and was worried that the bilberry might have played a part in that.)

My dark adaptation time has been reduced by 10-15 minutes since using it. It's important to note that you CANNOT just take a capsule and run outside — it requires a steady dosage (or at least 5-7 hours if you insist on megadosing before an observing run).

☆

## MEASURING YOUR EXIT PUPIL

The following articles are reprinted from ASTRONET, Issue 37, April 15, 1996. For more information, please contact [resource@resource-intl.com](mailto:resource@resource-intl.com).

From: [Jim Schneringer \(schner@c-zone.net\)](mailto:schner@c-zone.net)

I asked an eye surgeon friend of mine how you go about measuring my dark pupil size. Here is what he told me to do:

Go in the bathroom to use the mirror, lights off, make sure no light is coming from around the door or anything else. Next, take a millimeter rule and place it under your pupil, almost touching the eye. Then, use a pen light wrapped in a cloth to dim the light as much as it takes to barely see the pupil and the rule. Also to block it from shining in the mirror. Place the pen light long ways across your forehead and use your eye socket to shield the pupil from the light. Then practice pulling the light away from your forehead slowly just enough to read the rule and see your pupil. If you do it right, you will see your pupil moving around and you just measure the largest.

When I tried it, I got a reading just a hair over 1/4" close to 9/32. I didn't have a mm rule. I used an architect scale. It allowed me to rest it on my upper cheek and keep the hash marks right above my pupil. I think I could have gotten better results if I would have given my eyes longer than a couple minutes to fully adjust to the dark. With this measurement technique there is still light shining in the eye but, I think this will get you close.

From: [James W. Burrows \(burrjaw@halcyon.com\)](mailto:burrjaw@halcyon.com)

I think it's easier to get a metric ruler (join the USA metric crowd), prick rows of two holes an increasing number of mm apart on a piece of paper:

..  
..  
..

Go into a closet, close the door until just a crack of light comes through, hold the paper up to your eye and see which circles of light just touch. The iris response is very fast, so you don't have to "dark adapt" (that's a retinal function). Try both eyes; my left eye just makes 5 mm, while the right doesn't. ☆

## DARK ADAPTION

The following article is reprinted from ASTRONET, Issue 38, May 1, 1996. For more information, please contact [resource@resource-intl.com](mailto:resource@resource-intl.com).

From: [Ian Gore \(gore@trucks.enet.dec.com\)](mailto:gore@trucks.enet.dec.com)

Iris widening is the first effect of dark adaption, but it's not the main one. The eye produces a chemical called visual purple, or rhodopsin, which in normal light conditions is rapidly bleached. In dark conditions the rhodopsin survives and makes the rods in the retina more sensitive. This process takes about 20 min, which is why you'll hear people commenting on "the stars coming out", even after it's completely dark.

☆

# BINOCULARS FOR ASTRONOMY

by Jay Reynolds Freeman (freeman@netcom.com) via sci.astro.amateur

The most important advice is to seek out a local astronomy club — perhaps from the annual directory in Sky and Telescope or Astronomy. Go to some of their star parties to try out other peoples' telescopes, binoculars and other stuff. Sometimes people will be so eager to show you things that you can put off spending any money on equipment of your own for years and years.

The frequently-asked questions list for telescope purchasing, that appears on the usenet newsgroup, "sci.astro.amateur", has a good deal of information about binoculars. It includes a section on how to hold them steady. I recommend you wade through it and look for the sections you need. [NOTE: The Purchasing an Amateur Telescope FAQ is in the F.A.A.C. WWW page mentioned on page 3]

Any binocular you happen to have lying around will provide much better viewing than the naked eye. So possibly you should not buy one at all, just mooch from friends or family for a while, till you know what you are doing.

Binoculars are intrinsically low-power instruments, that do not show a great deal of planetary detail. The moon will look wonderful, and you will be able to see the moons of Jupiter and the phases of Venus, but probably no other planetary stuff. Yet there are plenty of deep-sky objects well within the range of a small binocular — I have seen all of the Messier objects with a 7x50 (but some were very difficult), and more besides. The Andromeda Galaxy, the Orion Nebula, and the summertime Milky Way will be wonderful.

The "right" binocular for most people is about a 7x50 (that means it magnifies seven times and has front lenses 50 millimeters in diameter). The idea is to get as large front lenses as possible, so as to gather more light and see fainter objects, but with lenses much larger than 50 mm, or magnifications much greater than ten, the whole instrument starts getting too big and heavy to hold steady. Some people like more magnification than seven — 10x50s are pretty common. I have a 10x70 which I like, but it weighs twice as much as a 7x50, and not everyone can hold it steady. It is also more expensive. If you are older than forty or fifty, the pupils of your eyes may not be large enough to take in all the light emerging from a 7x50 binocular; in that case a 10x50 might be best for you.

Some people pay as much as \$1000 for a 7x50 binocular, but cheap and sleazy imports can be had new for as little as \$50, and sometimes real bargains show up at garage sales and the like. If you are on a budget, do not worry if you have to buy the cheapest and sleaziest binocular you can find — it will be lots better than the naked eye — but expect your friends and fellow net-posters to be critical and condescending. Ignore us: We believe that having fancy gadgets makes us morally superior, we are dumb enough to think that more money always makes things better, and we are too cowardly ever to admit wasting money on something that wasn't worth the high price.

On the other hand, if you like high-tech gadgets, or if you are willing to pay a lot for the best binocular possible, and if you are certain you know exactly what you want, then go ahead and buy a more expensive binocular — it will give noticeably better performance than a cheap one, but expect your friends and fellow net-posters to be critical and condescending. Ignore us: We believe that using inexpensive technology makes us morally superior, we are dumb enough to think that more money never makes things better, and we are too cowardly ever to admit that our needs and desires have outstripped our budgets.

Take care of your binocular. Things that will hurt it include heat (don't leave it in the sun, even in the case, especially inside a car), moisture, dust and dirt (do use the lens caps and case), vibration (don't toss it on the bed of your pickup for the drive up the mountain), and raccoons. Only the latter will take protection payments. When you are about to buy a binocular, I recommend a few simple tests:

- 1) If it rattles when you shake it, you are about to make a mistake. Put it back and try another one. Don't laugh, a bad unit from even a reputable manufacturer may slip through quality control now and then, and who knows how many times the one in your hands has been dropped, and how far, in shipping and setting up for display.
- 2) Move everything that is supposed to move. Does anything feel loose and sloppy? Does anything feel like the only reason it is tight is that some unscrupulous manufacturer tightened it down too much, to cover up looseness and slop? These are all no-nos.

3) Can "you" get good images out of it? Take it to a door or window, preferably an open one, and focus it on something far away. If you had to take off glasses to use the binocular, are the images still clear? If you are using glasses, can you get your eyes close enough to the eyepieces to see the whole field? Is there any hint that the two sides are not perfectly parallel, so that only a chameleon can look through it without eyestrain? These are more no-nos.

4) Is it too heavy for "you" to hold steady? (Be sure you have read the FAQ section on how to do so.) Will you still feel that way after observing for an hour? Even when it's cold and you are tired?

5) Now a virtual test: Don't really do this, it's for experts only. Hold the binocular out at arm's length and drop it on the floor. I say again, don't really do it, just pretend that you are going to. If you have a virtual heart attack, or experience virtual financial ruin, perhaps you should consider a less expensive model. The theory here is that if you worry too much about loss or damage, you may end up babying the instrument so much you don't use it, in which case you are a collector of scientific instruments — a fine and enjoyable hobby in its own right — but not an astronomer.

Have fun, keep your dark adaptation, and remember raccoons like Oreos.☆

## KITT PEAK TELESCOPE CLOSURES

From: Brian Skiff (bas@lowell.edu)

The following article was reprinted from ASTRONET, Issue 38, May 1, 1996. For more information, please contact resource@resource-intl.com.

Readers may find this announcement from the American Astronomical Society to be of interest. The implication is that the cluster of instruments on Kitt Peak will become nothing more than a collection of mothballed telescopes by the turn of the century. N.B. that all the smaller telescopes at CTIO and on Kitt Peak (including the 1.3-meter) are already shut down.

### AURA ANNOUNCEMENT - PROJECTED TELESCOPE CLOSURES AT KITT PEAK AND CERRO TOLOLO

NSF has projected the budget for the astronomy division for the next five years based on an assumption of level dollar funding, and has asked NOAO to plan based on this assumption. Assuming 3% annual inflation in the US and 8% in Chile, the result of level dollar funding is a cut in spending capability on the order of 16% of the present budget by 1999, but with much deeper cuts required at KPNO in order to provide support to CTIO and the US Gemini Program. While the recently published OIR Panel report (McCray 1995) examined the consequences of constrained budgets on NOAO, the depth of the cuts projected now exceeds the worst case considered in that report, because the base from which the projection is to be taken is already substantially lower than it was at the time of the writing of that report. If these projections are realized, then NOAO will be compelled to close or privatize telescopes on the following schedule:

1996 KPNO share of the Burrell Schmidt; CTIO 0.6-m  
1997 KPNO 0.9-m; CTIO 1.0-m  
1998 KPNO 2.1-m and Coude' Feed  
1999 KPNO 4-m

This conclusion has been reached after a detailed study of cost-saving measures and "benchmark" comparisons with operating costs at other observatories carried out by NOAO management. AURA has reviewed the budget analysis, benchmark comparisons, and priorities presented by NOAO management and agrees that these consequences are unavoidable unless the priorities or the budget projections change, which appears unlikely. The effects of tight budgets are being felt across astronomy, in terms of shortages in grant funds as well as pressure on national facilities. By providing budget projections five years ahead, NSF has given astronomers an unprecedented opportunity to anticipate the effects of present trends on the field as a whole — grants as well as centers.

A detailed discussion of the priorities, calculations and constraints that have led us to these conclusions, including a zero-based budget for NOAO for 1999, is posted on the world wide web at: [www.aura.noao.edu/aura/forum](http://www.aura.noao.edu/aura/forum). An open forum has been set up with this posting, as well as directions for sending comments or addressing questions to the AURA Observatories Council. A copy of the posted materials will be automatically sent to you if you send email to: [auraforum-info@noao.edu](mailto:auraforum-info@noao.edu). In the www posting, we present the basis for the conclusions sketched above and go on to invite a community-wide effort to improve the funding situation for all of astronomy. ☆



# HUBBLE MEASURES UNIVERSE

Two international teams of astronomers, using NASA's Hubble Space Telescope, are reporting major progress in converging on an accurate measurement of the universe's rate of expansion — a value which has been debated for over half a century.

The Hubble Space Telescope Key Project team, an international group of over 20 astronomers, is led by Wendy Freedman of Carnegie Observatories, Pasadena, Robert Kennicutt, University of Arizona, and Jeremy Mould, Mount Stromlo and Siding Springs Observatory, Australia. The group's interim results, announced at a meeting held at the Space Telescope Science Institute, are consistent with their preliminary result, announced in 1994, of 80 kilometers per second per megaparsec (km/sec/Mpc), based on observations of a galaxy in the Virgo cluster. These new results yield ranges for the age of the Universe from 9-12 billion years, and 11-14 billion years, respectively. The goal of the project is to measure the Hubble Constant to 10% accuracy.

"We have five different ways of measuring the Hubble Constant with HST," said Dr. Freedman. "The results are coming in between 68 and 78 km/sec/Mpc". (For example, at an expansion rate of 75 km/sec/Mpc, galaxies appear to be receding from us at a rate of 162,000 miles per hour for every 3.26 million miles farther out we look).

Two months ago, a second team, led by Allan Sandage, also of the Carnegie Observatories, Abhijit Saha (Space Telescope Science Institute), Gustav Tammann and Lukas Labhardt (Astronomical Institute, University of Basel), Duccio Macchetto and Nino Panagia (Space Telescope Science Institute/European Space Agency) reported a slower expansion rate of 57 km/sec/Mpc.

The value of the Hubble Constant allows astronomers to calculate the expansion age of the Universe, the time elapsed since the Big Bang. Astronomers have been arguing recently whether the time since the Big Bang is consistent with the ages of the oldest stars. The ages are calculated from combining the expansion rate with an estimate of how much matter is in space. The younger age values from each team assume the Universe is at a critical density where it contains just enough matter to expand indefinitely. The higher age estimates are calculated based on a low density of matter in space.

"A point of great interest is whether the age of the Universe arrived at this way is really older than the independently derived ages of the oldest stars," said Saha, an investigator on both Hubble teams. "The numbers lean on the side that the stellar ages are a little lower, or that the hypothesis that we live in a critical density universe needs to be questioned. As further results accumulate over the next few years, we hope to tighten the constraints on these issues."

## THE OBSERVATIONS

The Key Project team is midway along in their three-year program to derive the expansion rate of the Universe based on precise distance measurements to galaxies. They have now measured Cepheid distances to a dozen galaxies, and are about halfway through their overall program. The Key Project team also presented a preliminary estimate of the distance to the Fornax cluster of galaxies. The estimate was obtained through the detection and measurement with the Hubble Space Telescope of Cepheid variables found in the Fornax cluster. The Fornax cluster is measured to be approximately as far away as the Virgo cluster of galaxies — about 60 million light-years.

The Key Project team member who led this effort, Caltech astronomer Barry Madore said, "This cluster allows us to make independent estimates of the expansion rate of the Universe using a number of different techniques. All of these methods are now in excellent agreement. With Fornax we are now at turning point in this field." The team is measuring Cepheid distances to the Virgo and Fornax clusters of galaxies as a complementary test. Their strategy is to compare and contrast expansion numbers from a variety of distance indicators.

The Key Project team is systematically looking into a variety of methods for measuring distances. They are using Cepheids in a large sample to tie into five or six "secondary methods". One such secondary method relates the total luminosity of a galaxy to the rate at which the galaxy is spinning, the Tully-Fisher relation. Another secondary method makes use of a special class of exploding star known as a type Ia supernova. This phase of the Hubble Constant research will be completed within another two years.

In contrast, the Sandage team focused on a single secondary distance indicator, one of the same indicators also used by the Key Project team, the type

Ia supernova. Sandage maintains that these stars are "standard bombs" according to theory. He suggests that when they explode they all reach exactly the same intrinsic brightness. This would make them extremely reliable "standard candles," (objects with a well-known intrinsic brightness) visible 1,000 times farther away than Cepheids. Since they are intrinsically brighter than any other standard candle, they offer the opportunity for an accurate measurement of the Universe's overall expansion by looking out the farthest.

Although both teams still disagree over the precise rate at which the Universe is expanding and on how old it is, they are optimistic that their estimates will continue to converge with further observations and analysis. ☆

## PHYSICS NEWS UPDATES

The American Institute of Physics Bulletin of Physics News  
by Phillip F. Schewe and Ben Stein (physnews@aip.org)

THE FIRST BINARY-STAR SYSTEMS BEAMING X RAYS AT SUB-MILLI-SECOND rates have been observed by the Rossi X-Ray Timing Experiment, an orbiting telescope launched in December 1995. Speaking at a meeting of the American Astronomical Society in San Diego, RXTE scientists reported that a binary system (Sco X-1) in the constellation Scorpius was emitting x rays on and off 1130 times per second. Another binary system (4U 1728-34) in the constellation Sagittarius was emitting x ray bursts at a rate of up to 1100 per second. In each case the x rays are believed to arise when material from a normal star falls onto a companion neutron star. For Sco X-1, x rays beamed at a slower rate are also seen. The researchers are puzzled as to why the slower pulses and the faster 1130 pulses/sec emissions are modulating over time in the same way. (AAS press release.)

THE OLDEST STARS IN THE MILKY WAY ARE 15 BILLION YEARS OLD. An important adjunct to the debate over the Hubble constant is the notion that the universe cannot be older than its oldest stars, which appear to be those in globular clusters, spherical clumps of hundreds of thousands or millions of stars found near and around our galaxy. Don Vandenberg of the University of Victoria (davb@uvvm.uvic.ca) uses the Canada-France-Hawaii telescope to view the ancient, metal-poor stars (they largely lack the elements heavier than helium which many younger stars inherit from earlier supernova explosions) in globular clusters. By plotting the stars' luminosities versus their colors, and by employing the standard model for stellar evolution, the age of the stars can be calculated. Vandenberg, speaking at a meeting of the American Physical Society in Indianapolis, said the oldest reliably dated stars, in globular cluster M92, were most likely 15 billion years old. Uncertainties in the determination of the distances to the clusters (effecting calculations of the stars' luminosities) might permit an age of 13 or even 12 billion years. But Vandenberg asserted that the ages could not be much younger than that. New observations of his in globular cluster M13 did not alter this assessment. ☆

(continued from page 1)

coronal temperatures." Gurman added. Such jets have been observed in the X-ray portion of the spectrum by a telescope on Japan's Yohkoh spacecraft, "but this is the first time that small-scale jets have been observed outside large active regions on the Sun," he said. "In fact, we are seeing them in a coronal hole at the south pole, along with the plumes."

Much of the new information on polar plumes and on the unexpected disturbances on the "quiet Sun" comes from the SOHO Extreme-ultraviolet Imaging Telescope (EIT). Dr. Jean-Pierre Delaboudiniere, of the Institut d'Astrophysique Spatiale, Orsay, France, is principal investigator for EIT. The EIT images show the portion of the plumes from their bases in the solar surface layer out to heights of about 93,000 miles. At its base, a plume is about 1.5 times as wide as the diameter of the Earth—which is 7,928 miles.

Other important information comes from SOHO's Michelson Doppler Imager (MDI), which measures underlying magnetic fields and gas flow patterns on the solar surface, and from the Large-Angle Spectroscopic Coronagraph (LASCO), which images the plumes as far as 30 solar radii from the surface of the Sun. (The radius of the Sun is about 440,000 miles.) Professor Philip Scherrer of Stanford University is the principal investigator for MDI and Dr. Guenther Brueckner of the Naval Research Laboratory, Washington, DC, is the principal investigator for LASCO.

SOHO is on location in space near the L-1 Lagrangian point, where the Earth's and Sun's gravitational forces balance, some one million miles sunward from the Earth. This vantage point enables solar astronomers to observe the Sun continuously, with no intervening "night." ☆

# STATISTICALLY SPEAKING

Location (Dearborn, MI): 42°19'12" N, 83°10'48" W, 180 meters elevation  
Local Time = Universal Time - 4.5 hours (Eastern Daylight Time)

Abbreviations used in reports:

FM Full Moon FQ First Qtr Moon LQ Last Qtr Moon NM New Moon  
MR Moon Rise MS Moon Set SR Sun Rise SS Sun Set

## Calendar Report for June 1996

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30 SR: 5:29 SS: 20:43 MR: 20:08 MS: 5:07		Lunar Events FM: 16:19 June 01 LQ: 6:37 June 08 NM: 21:08 June 15 FQ: 0:55 June 24 FM: 23:30 June 30				1 SR: 5:28 SS: 20:33 MR: 20:24 MS: 5:30
2 SR: 5:28 SS: 20:34 MR: 21:26 MS: 6:26	3 SR: 5:28 SS: 20:35 MR: 22:23 MS: 7:28	4 SR: 5:27 SS: 20:35 MR: 23:13 MS: 8:35	5 SR: 5:27 SS: 20:36 MR: 23:56 MS: 9:46	6 SR: 5:27 SS: 20:37 MR: None MS: 10:56	7 SR: 5:26 SS: 20:37 MR: 0:34 MS: 12:06	8 SR: 5:26 SS: 20:38 MR: 1:09 MS: 13:14
9 SR: 5:26 SS: 20:38 MR: 1:42 MS: 14:20	10 SR: 5:26 SS: 20:39 MR: 2:14 MS: 15:24	11 SR: 5:26 SS: 20:40 MR: 2:47 MS: 16:27	12 SR: 5:25 SS: 20:40 MR: 3:22 MS: 17:28	13 SR: 5:25 SS: 20:41 MR: 3:59 MS: 18:27	14 SR: 5:25 SS: 20:43 MR: 4:39 MS: 19:22	15 SR: 5:25 SS: 20:41 MR: 5:23 MS: 20:13
16 SR: 5:25 SS: 20:42 MR: 6:11 MS: 21:00	17 SR: 5:26 SS: 20:42 MR: 7:02 MS: 21:42	18 SR: 5:26 SS: 20:42 MR: 7:56 MS: 22:20	19 SR: 5:26 SS: 20:43 MR: 8:51 MS: 22:55	20 SR: 5:26 SS: 20:43 MR: 9:47 MS: 23:26	21 SR: 5:26 SS: 20:43 MR: 10:44 MS: 23:56	22 SR: 5:26 SS: 20:43 MR: 11:42 MS: None
23 SR: 5:27 SS: 20:43 MR: 12:41 MS: 0:25	24 SR: 5:27 SS: 20:43 MR: 13:41 MS: 0:54	25 SR: 5:27 SS: 20:43 MR: 14:43 MS: 1:24	26 SR: 5:28 SS: 20:44 MR: 15:48 MS: 1:57	27 SR: 5:28 SS: 20:44 MR: 16:55 MS: 2:35	28 SR: 5:29 SS: 20:43 MR: 18:02 MS: 3:18	29 SR: 5:29 SS: 20:43 MR: 19:07 MS: 4:09

## Planet View Info Report for June 1996

Mercury	Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
	6/ 1/1996	4:42	18:33	3h15m41s	14°06'50"	20°49'18"	0.194	0.66847
	6/ 8/1996	4:26	18:28	3h31m17s	15°11'13"	23°32'09"	0.324	0.77864
	6/15/1996	4:18	18:40	3h59m15s	17°27'12"	23°04'23"	0.470	0.91046
	6/22/1996	4:18	19:07	4h39m14s	20°15'21"	19°50'56"	0.637	1.05430
	6/29/1996	4:32	19:44	5h31m25s	22°46'35"	14°07'54"	0.820	1.19278
Venus	6/ 1/1996	6:17	21:41	5h40m21s	25°02'43"	14°51'20"	0.033	0.30314
	6/ 8/1996	5:42	20:48	5h23m52s	23°18'03"	4°13'39"	0.003	0.29009
	6/15/1996	5:05	19:53	5h05m48s	21°20'16"	6°57'07"	0.007	0.29204
	6/22/1996	4:32	19:05	4h51m26s	19°33'51"	17°14'43"	0.045	0.30859
	6/29/1996	4:02	18:26	4h44m08s	18°19'38"	25°49'53"	0.103	0.33749
Mars	6/ 1/1996	4:28	18:53	3h17m05s	17°57'26"	19°09'17"	0.987	2.36688
	6/ 8/1996	4:15	18:51	3h37m43s	19°16'30"	20°47'29"	0.984	2.35962
	6/15/1996	4:04	18:50	3h58m29s	20°26'14"	22°27'54"	0.982	2.35083
	6/22/1996	3:52	18:47	4h19m20s	21°26'10"	24°10'39"	0.980	2.34033
	6/29/1996	3:42	18:44	4h40m15s	22°15'57"	25°55'48"	0.977	2.32808
Jupiter	6/ 1/1996	22:55	8:08	19h11m41s	-22°24'04"	144°16'10"	0.997	4.35246
	6/ 8/1996	22:25	7:38	19h09m00s	-22°39'31"	151°35'44"	0.998	4.29157
	6/15/1996	21:55	7:07	19h05m51s	-22°35'33"	159°01'12"	0.999	4.24308
	6/22/1996	21:24	6:35	19h02m21s	-22°41'55"	166°31'11"	0.999	4.20798
	6/29/1996	20:54	6:03	18h58m36s	-22°48'19"	174°03'55"	1.000	4.18694
Saturn	6/ 1/1996	2:42	14:47	0h22m28s	0°02'49"	65°37'57"	0.998	9.92802
	6/ 8/1996	2:15	14:21	0h24m17s	0°12'45"	71°50'43"	0.997	9.81967
	6/15/1996	1:49	13:56	0h25m15s	0°20'55"	78°07'03"	0.997	9.70733
	6/22/1996	1:22	13:30	0h27m09s	0°27'25"	84°27'17"	0.997	9.59235
	6/29/1996	0:56	13:04	0h28m11s	0°32'00"	90°51'33"	0.997	9.47618
Uranus	6/ 1/1996	0:03	9:36	20h27m25s	-19°44'20"	126°25'07"	1.000	19.15026
	6/ 8/1996	23:31	9:08	20h26m50s	-19°46'36"	133°15'46"	1.000	19.06064
	6/15/1996	23:03	8:39	20h26m06s	-19°49'19"	140°07'51"	1.000	18.98071
	6/22/1996	22:35	8:11	20h25m15s	-19°52'24"	147°01'11"	1.000	18.91176
	6/29/1996	22:07	7:42	20h24m18s	-19°55'48"	153°55'26"	1.000	18.85487
Neptune	6/ 1/1996	23:32	9:04	19h57m48s	-20°10'47"	133°18'26"	1.000	29.45677
	6/ 8/1996	23:04	8:36	19h57m18s	-20°12'13"	140°07'48"	1.000	29.37510
	6/22/1996	22:08	7:40	19h56m03s	-20°15'43"	153°48'11"	1.000	29.24551
	6/29/1996	21:39	7:11	19h55m20s	-20°17'43"	160°38'49"	1.000	29.19957
Pluto	6/ 1/1996	18:52	6:07	16h08m21s	-7°16'13"	163°41'38"	1.000	28.93005
	6/15/1996	17:55	5:10	16h06m55s	-7°14'56"	153°30'32"	1.000	28.99479
	6/29/1996	16:59	4:14	16h05m38s	-7°15'32"	141°14'10"	1.000	29.11068

## Moon Apides Report for June 1996

6/ 3/1996	Moon @ Perigee	Hour: 11	Distance: 361502 (km)	Dia.: 0.5509°
6/19/1996	Moon @ Apogee	Hour: 2	Distance: 406046 (km)	Dia.: 0.4905°

## Planet Conjunction/Opposition Report for June 1996

6/10/1996	Venus @ Inferior Conjunction	Hour: 19
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Date	Meteor Shower	ZHR	RA	DEC	Illu. Frac.	Longitude
6/ 9/1996	Ophiuchids	5	17h56m	-23°	0.35	79°
6/19/1996	Ophiuchids	5	17h20m	-20°	0.13	89°

## Twilight Report for June 1996

Date	Sun Rise	Set	Astronomical Begin	End	Nautical Begin	End	Civil Begin	End
6/ 1/1996	5:28	20:33	3:15	22:47	4:06	21:55	4:49	21:12
6/ 8/1996	5:26	20:38	3:09	22:55	4:02	22:02	4:46	21:18
6/15/1996	5:25	20:41	3:06	23:00	4:01	22:06	4:45	21:21
6/22/1996	5:26	20:43	3:07	23:03	4:02	22:08	4:46	21:23
6/29/1996	5:29	20:43	3:11	23:02	4:05	22:08	4:49	21:23

# SKY & TELESCOPE NEWS BULLETINS

from the editors of SKY & TELESCOPE magazine

## THE EROS WATCH

The asteroid 433 Eros currently has an orbit that brings it close to — but not across — the Earth's orbit. However, according to new computer simulations by dynamists in France and Italy, Eros's orbit is likely to evolve over the next two million years. Don't worry: the immediate threat of a catastrophic collision is extremely small, and we appear to be safe for at least the next 100,000 years. However, a collision is likely in the far future: the team gives Eros a 50/50 chance of becoming an Earth-crossing asteroid within the next million years, and one simulation actually yielded a collision 1.14 million years from now. Such an event would have dire consequences. Measuring 40 km long and 14 across, cigar-shaped Eros would hit with roughly 10 times the destructive energy of the object that devastated Earth 65 million years ago. The NEAR spacecraft, launched in February, should reach Eros for a close look in 1999.

## SUN OF SOHO

Astronomers have high hopes for a spacecraft called the Solar and Heliospheric Observatory, or SOHO, which was launched December 2nd to begin a long-term study of the Sun. And it's already paying dividends, as the first results were announced on May 2nd. SOHO is supposed to monitor the "quiet Sun" during the minimum in its 11-year activity cycle. But movies made from SOHO ultraviolet data show that the Sun's outer atmosphere, or corona, is surprisingly active. "There is continuous motion and action everywhere," notes NASA investigator Joseph Gurman. Disturbances are even occurring within what are termed coronal holes, regions of relative calm and uncomplicated magnetic fields. Moreover, SOHO's data shows that the corona's long, feathery plumes are rooted in chaotic regions of knotted magnetic fields and turbulent gases. SOHO was built by the European Space Agency in partnership with NASA. It is situated at the L1 Lagrangian point, 1.5 million km from Earth.

## X-RAY FLASHERS

Yet another orbiting observatory is making its mark. Astronomers say the Rossi X-ray Timing Explorer has discovered a trio of objects whose X-ray emissions flicker very rapidly. The fastest of the three is Scorpius X-1, whose oscillations have been clocked at up to 1,130 per second. Each of the sources is a binary system containing a neutron star, and all are located in the southern sky. Astrophysicists think the periodic oscillations probably come from gas orbiting very near the neutron star. More controversial is the idea that the spacecraft has detected wave motion on the neutron stars' surfaces or within their solid crust.

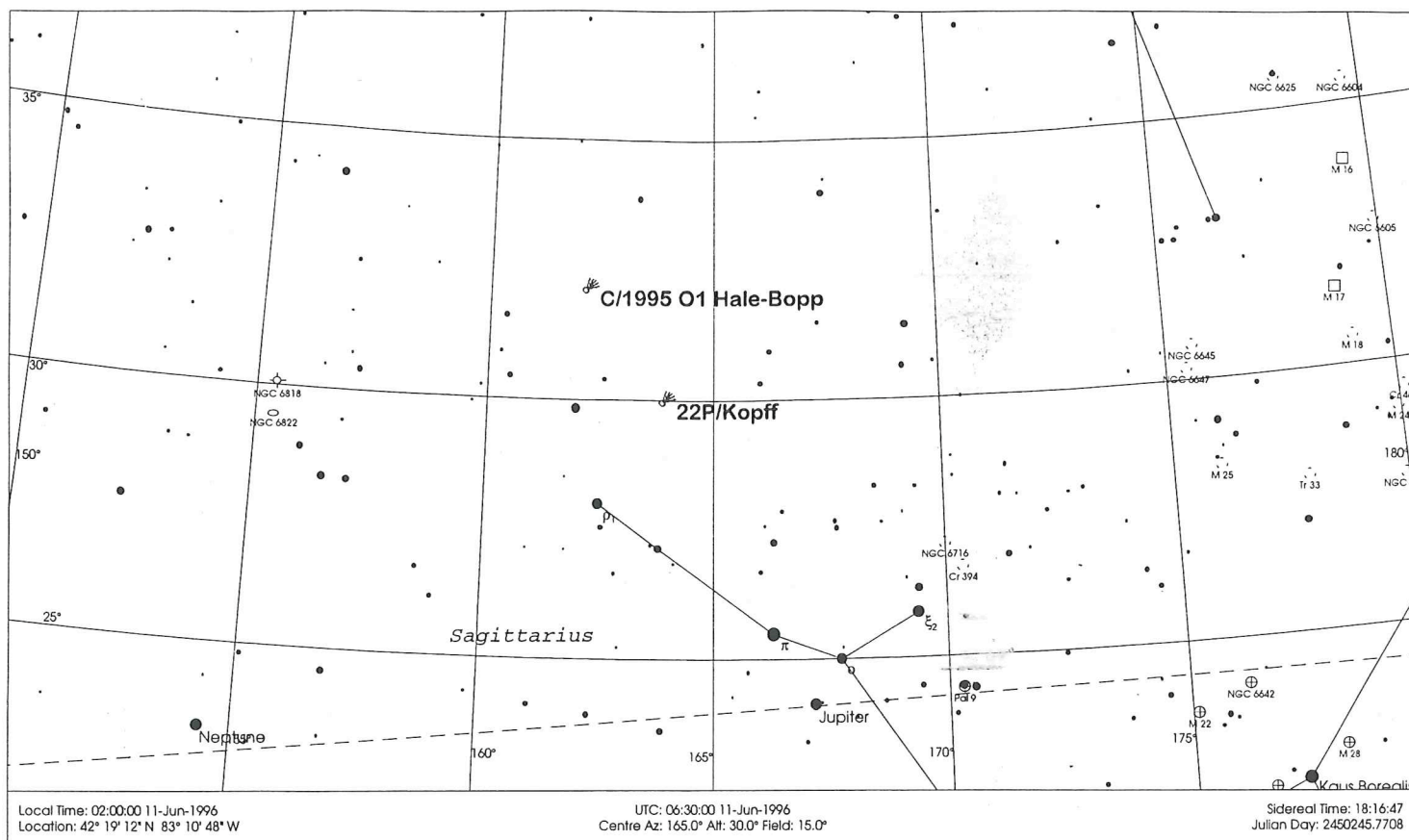
## FIRST LIGHT FOR KECK II

The second 10-meter Keck telescope was dedicated at a May 8th ceremony atop Mauna Kea in Hawaii. Its twin already ranks as the world's largest optical telescope, but plans call for Keck I and II to be used together as an optical interferometer. The distance between them is 85 meters, a baseline that should provide unprecedented resolution at visual and near-infrared wavelengths. To that end NASA will provide \$44 million toward the development of an adaptive-optics system. And now that both telescopes are completed, Keck's long-time project manager Gerald Smith is stepping down. On July 1st Frederic H. Chaffee, current director of the Multiple Mirror Telescope in Arizona, will become the director of Keck. Also, the newly named asteroid 5811 Keck honors not just the observatory but also Howard B. Keck, who managed the foundation that provided more than \$150 million for the observatory.

## VESTA REIGNS

The asteroid 4 Vesta reached opposition on May 11th and now shines at magnitude 5.6, making it visible with the unaided eye if your sky is very dark. Observers at mid-northern latitudes can look for Vesta in the constellation Libra beginning in early evening low in the southeast. Find the three bright stars that form the upper part of the Scales of Libra. Third-magnitude Beta Librae is at the top, and Vesta is about 4 degrees northwest of Beta. A finder chart appears on page 71 of SKY & TELESCOPE's May issue.

# FINDING COMET HALE-BOPP AND COMET KOPFF



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

