

## The Ford Amateur Astronomy Club Newsletter

Volume 5, Number 8

August 1996

# SOHO STARTS A REVOLUTION IN THE SCIENCE OF THE SUN

European Space Agency, Press Information Note No. 16-96

Human perceptions of the star that gives us life are changing rapidly as a thousand images a day stream from the sun-gazing SOHO spacecraft 1,500,000 km out in space. Since its launch on 2 December 1995, the Solar and Heliospheric Observatory has vastly improved the ability of scientists to probe the Sun's interior by detecting sound waves at its surface. SOHO also gives the best maps of the ever-changing patterns of magnetism at the Sun's visible surface. And the spacecraft has revealed and anatomized knots of hot activity that can occur in the solar atmosphere even when the visible surface of the Sun appears completely calm.

In addition, SOHO has found clues to the forces that accelerate the solar wind of atomic particles blowing unceasingly through the Solar System. By relating the huge outbursts called coronal mass ejections to preceding magnetic changes in the Sun, SOHO scientists hope to predict such events which, in the Earth's vicinity, endanger power supplies and satellites. SOHO sees differences in the strength of the solar wind in various directions, by mapping a cavity in the cloud of interstellar hydrogen surrounding the Sun. As a bonus, SOHO secured remarkable images of Comet Hyakutake, by ultraviolet and visible light.

The revolution in solar science will seem more complete when all the pieces and actions of the Sun, detected by twelve different instruments, are brought together in observations and concepts. Fundamental questions will then be open to re-examination, about the origin of the Sun's magnetism, the cause of its variations in the 11-year cycle of sunspot activity, and the consequences for the Solar System at large. SOHO is greater than the sum of its parts.

"SOHO takes solar science by storm," says Roger Bonnet, the European Space Agency's Director of Science, "thanks to its combination of instruments. Unprecedented results from individual telescopes and spectrometers are impressive, of course, but what is breathtaking is SOHO's ability to explore the Sun all the way from its nuclear core to the Earth's vicinity and beyond. We can expect a completely new picture of how agitation inside the Sun, transmitted through the solar atmosphere, directly affects us on the Earth."

SOHO is a project of international cooperation between the European Space Agency and NASA. The spacecraft was built in Europe and instrumented by scientists on both sides of the Atlantic. NASA launched SOHO and provides the ground stations and an operations centre at the Goddard Space Flight Center near Washington. SOHO has an uninterrupted view of the Sun from a halo orbit around Lagrangian Point No. 1 where the gravity of the Sun and the Earth are in balance. The spacecraft's engineering has proved to be excellent and no difficulty is anticipated in keeping it operational for at least six years.

Early SOHO results were summarized in ESA's Information Note Nr 07-96, 2 May 1996. Here follow notes and comments on some further conclusions by SOHO's scientists.

### Fast action in the Sun's atmosphere

The ultraviolet spectrometers aboard SOHO, called SUMER and CDS, were designed to analyse events in the solar atmosphere and discover temperatures, densities and speeds of motion in the gas. Their detailed results come in the spectra, which analyse the intensities at different wavelengths with high sensitivity, but the spectrometers also generate images by scanning selected regions of the Sun.

When the SUMER instrument scans the whole Sun by the ultraviolet light of strongly ionized sulphur atoms (S VI at 933 angstroms) it picks out gas at 200,000 C and reveals a vast number of bright regions created by magnetic field lines looping through the atmosphere. The brightness can change by a factor of ten in a distance of a few thousand kilometres or in a few seconds of time. SUMER has also shown that thick streaks called polar plumes, which climb far into space from the Sun's polar regions, are anchored in bright regions near the Sun's visible surface.

The spectrometer CDS has observed fast action in the Sun's atmosphere. It can measure velocities along the line of sight by shifts in the wavelength of emissions from selected atoms, and contrary motions (turbulence) appear in a spreading of the wavelengths. In one high-velocity event, corresponding with a small streak of brightness in the scanned image, CDS detected vertical motions differing by 450 km per second, and an overall motion of 65 km per second downwards.

"By taking the Sun's atmosphere to pieces we begin to understand how it influences our lives," says Richard Harrison of the UK's Rutherford Appleton Laboratory, principal investigator for the CDS spectrometer. "Surprises here on Earth don't come from the steady light and heat, which we take for granted, but from atmospheric storms that send shock waves through the Solar System. By making temperature and density maps of the Sun's atmosphere we expect to find out how these storms develop."

### Accelerator of the solar wind

All of the common chemical elements are present in the Sun's atmosphere, though they are not always detectable. They are represented more plainly in the solar wind. SOHO's solar-wind analyser CELIAS has demonstrated an unprecedented ability to recognize and quantify many different elements and isotopes.

There is a puzzle about how the heavy atoms are accelerated, so that they can keep up with the commonplace lightweight hydrogen of the solar wind. If the speeds of atomic particles were due only to heat, heavy atoms would travel much more slowly than the hydrogen atoms. That is not the case. Instead, a natural electromagnetic accelerator, akin to man-made particle accelerators, operates in the Sun's atmosphere and treats all elements similarly.

Measurements of the speeds of oxygen atoms leaving the Sun's atmosphere to join the solar wind catch them in the process of acceleration. As the stop light changes to green, the oxygen atoms go from less than 100 km per second at 250,000 km above the solar surface, to about 225 km per second a million km farther out. This result comes from SOHO's ultraviolet coronagraph UVCS, observing conditions above a polar coronal hole, where the atmosphere is relatively cool and magnetic lines run freely into space. Here originates a fast solar wind at around 700 km per second, with about twice the speed of the solar wind coming from magnetically constrained regions near the Sun's equator. One of SOHO's main tasks is to explain the solar wind, and further investigations by UVCS may settle arguments about how the natural accelerator works.

"Some of the big rewards from SOHO will come from better and more continuous observation" comments Vicente Domingo, ESA's project scientist for SOHO. "In other cases wholly new results will help to decide between conflicting theories. UVCS's high-speed oxygen atoms at the source of the fast solar wind are one case in point. Sub-surface motions revealed by MDI are another."

(continued on page 2)

(continued from page 1)

### Sub-surface flows show pancake-like features

MDI is SOHO's oscillations imager and it is the most elaborate of the instruments that probe inside the Sun by helioseismology, using oscillations at the visible surface due to sound waves reverberating through the interior. MDI divides the Sun's surface into a million points and measures vertical motions once a minute by small changes of the wavelength of light. Deducing flows just below the visible surface requires prolonged calculations with a supercomputer. These detect small changes in the travel-time of sound waves according to whether they are heading into, or travelling with, the flow of material inside the Sun.

After mapping sub-surface flows across a wide area, the MDI team has analysed a vertical slice. Along a 300,000-km line at the Sun's equator, the computation cuts 8000 km deep into the turbulent convection zone, where the outer part of the Sun boils like a kettle. The main convection cells that link ascending and descending flows turn out to be surprisingly shallow and pancake-like. They reach down about 1500 km, compared with about 4000 km expected by some theorists. Further results from an intensive observing campaign will enable the MDI scientists to confirm that their first results are typical, and to make a movie to see how structures change with time.

### Stormy weather ahead

The oscillation imager MDI also charts magnetic fields running in and out of the Sun's surface. The speckled pattern that it sees will change dramatically in the years ahead, when the Sun is due to swap its north and south magnetic poles around and sunspots will become much more numerous.

Among SOHO's earliest results, the daily observations by the extreme ultraviolet imager EIT revealed many bright and active spots. They tell of remarkable activity in many parts of the Sun's atmosphere, even at a time when the surface observed by visible light looks very calm. The extent of atmospheric storms becomes more apparent in a new processing of EIT images which compares the intensities at different wavelengths.

In one case a huge and complex magnetic disturbance in the Sun's equatorial atmosphere was almost half as wide as the visible disk of the Sun. The extent and violence of such events can only tend to increase as the Sun becomes more active.

"EIT is beginning a career similar to the meteorological satellites that monitor the weather on the Earth every day," says its principal investigator, Jean-Pierre Delaboudini the Institut d'Astrophysique Spatiale at Orsay in France. "Just as those have revolutionized meteorology, so our observations give us vivid new impressions of the Sun's weather. SOHO is due to operate for at least six years, into the next maximum of sunspot activity, so we shall see more precisely than ever before the changes in solar weather with the magnetic seasons, which also affect conditions at the Earth."

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## PHYSICS NEWS UPDATES

The American Institute of Physics Bulletin of Physics News (physnews@aip.org)

### EXTREMELY HIGH ENERGY COSMIC RAYS

Number 278 July 8, 1996 by Phillip F. Schewe and Ben Stein

Extremely high energy cosmic rays show a slight preference as to their directionality. With no accelerators to boost particles above the trillion-electron-volt (TeV) range, scientists look to cosmic rays for supplying not only the highest particle energies but also hints about what must be a tremendous energy machine at work in our galaxy or beyond. This is especially true of cosmic rays with EeV ( $10^{21}$  eV) energies. A new study of 36 cosmic-ray events recorded with the Akeno Giant Air Shower Array (AGASA) in Japan shows that mostly they are distributed uniformly across the sky. A notable departure from this general pattern consists of three pairs of events whose directions of arrival are quite close, less than 2.5 degrees. And of these, two pairs are located within 2 degrees of the supagalactic plane, defined roughly by the agglomeration of bright nearby galaxies in the northern hemisphere. The Akeno scientists (Motohiko Nagano, mnagano@icrr.u-tokyo.ac.jp) suggest that most likely some kind of celestial accelerator lies in the direction of the collimated pairs and that the original cosmic ray (eventually detected on Earth where it spawns an air shower in the atmosphere) was a neutral particle. (N. Hayashida et al., upcoming article in Physical Review Letters.)

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### 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:	Bob MacFarland	33-79750
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.

### WWW PAGE

Computers inside the Ford network or on the Internet can access the F.A.A.C. web page at one of the following addresses:

Ford Intranet:	<a href="http://av3168.pd8.ford.com:8080/faac/faac.html">http://av3168.pd8.ford.com:8080/faac/faac.html</a>
Internet:	<a href="http://www.id.net/~erik/faac.html">http://www.id.net/~erik/faac.html</a>

### 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. Subscriptions are free to 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.

## AUGUST 1996

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6 	7	8	9	10
11	12	13	14 	15	16	17
18	19	20	21 	22 FAAC Meeting	23	24
25	26	27	28 	29	30	31

- Aug 02 Asteroid Toro Near-Earth Flyby (0.2208 AU)
- Aug 06 Last Quarter Moon (12:56 am)
- Aug 06 Asteroid 3103 Eger Near-Earth Flyby (0.1158 AU)
- Aug 08 Asteroid Nausikaa at Opposition
- Aug 12 Perseids Meteor Shower (Potential Meteor Storm)**
- Aug 14 New Moon (3:05 am)
- Aug 16 Moon Occults Mercury
- Aug 17 Asteroid Lutetia at Opposition
- Aug 17 Asteroid Dembowska at Opposition
- Aug 18 Comet 1996 A1 Jedicke Perihelion (4.06 AU)
- Aug 19 Asteroid Urania at Opposition
- Aug 19 Venus Reaches Greatest Elongation (46 Degrees)
- Aug 20 Comet Shoemaker-Holt 2 Perihelion (2.663 AU)
- Aug 20 Asteroid Laetitia at Opposition
- Aug 21 First Quarter Moon (11:08 pm)
- Aug 21 Mercury At Its Greatest Elongation (27 Degrees)
- Aug 28 Full Moon (1:23 pm)
- Aug 28 Asteroid 1991 CS Near-Earth Flyby (0.0508 AU)
- Aug 31 Comet Wild 4 Perihelion (1.989 AU)

## 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, August 22, 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 7/25/96

by Harry Kindt, Sec'y FAAC

The general membership meeting was called to order at 5:07 PM by president Bob MacFarland. There were 27 members and guests present. (The FAAC welcomes Mike Kruskie, Dave Boll, and Eldon Abraham who visited us at the 7/25 general membership meeting. We hope they will join us in our future activities)

The Treasurers report was read and accepted.

Don Klaser and Greg Burnett reported on the progress of the plans for our star party on September 7th. Registration forms are completed, flyers have been prepared and are ready for mailing and distribution. Bob MacFarland has been in contact with City Camera and is negotiating with Howard and his suppliers to provide us with door prizes. Patti Forton has the "Tour of the Universe Certificates" ready. Plans are to offer a prize to any and all who complete the

tour. We are still seeking an outside vendor who would be willing to provide the food and other refreshments for the evening.

Paul Mrozek and Erik Przekop reported on the development of a WEB site for the Ford Club. The site is now up and running as a "mirror" of the Intranet site that has been available to Ford employees only. Look for the Internet address in this issue of Star Stuff. Access is also available through Doug Bock's Home Page. (I've had a chance to browse around our new Web site and was quite impressed by the layout and it's content, Paul and Erik are to be congratulated on the fine job they've done. ed.).

As a member of the Ford Employees Recreation Association, we are obligated to take part in any promotion or ticket sales sponsored by that organization. Patti Forton is asking for your help in selling tickets for The Renaissance Festival. The tickets cost \$10.50, a substantial savings over what others are asking, and the prices charged at the gate. Contact Patti if you would like to take part in the sale of these tickets.

More discussion was held on the possibility of the club moving our viewing site to a less light polluted area. George Korody has been in contact with several clubs and individuals who have access to the Lake Hudson State Park and who are sponsoring an informal star party at this site on August 9th. Our club has been invited to attend. If you are interested contact George or Bob MacFarland for directions and more information.

Our usual round table discussion, over pizza and pop, was the next item on the agenda. This is the time that those present introduce themselves and have a few moments to discuss their viewing activities since our last meeting

Our guest speaker for the evening was Dave Kropp, Solar System Educational Consultant. Dave's topic of discussion was the planet Jupiter with emphasis on the 2 year mission of the space probe Galileo. He presented the latest findings resulting from the probe that was sent from Galileo through the atmosphere of the giant planet. In addition, he described the remainder of the mission which will take Galileo around Jupiter for 11 orbits while it obtains data on 10 of Jupiter's moons. Thanks once again to Dave for his informative presentation.

The meeting adjourned around 7:00 pm. ☆

## AUGUST SPACE EVENTS

The following July events come from the 6/29/96 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov).

- Aug 06 35th Anniversary (1961), Vostok 2 Launch
- Aug 09 20th Anniversary (1976), Luna 24 Launch (Soviet Moon Sample)
- Aug 10 30th Anniversary (1966), Lunar Orbiter 1 Launch
- Aug 17 30th Anniversary (1966), Pioneer 7 Launch (Solar Orbiter)
- Aug 24 30th Anniversary (1966), Luna 11 Launch (Soviet Lunar Orbiter)
- Aug 25 15th Anniversary (1981), Voyager 2 Saturn Flyby ☆

## AUGUST 1996 SPACE EVENTS

The following July 1996 events come from the 6/29/96 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.

- Aug ?? Telecom-2D/Insat-2D Ariane 4 Launch
- Aug 05 Galileo, Orbital Trim Maneuver #8 (OTM-8)
- Aug 14 Soyuz TM-24 Launch (Russia)
- Aug 15 FAST Pegasus XL Launch
- Aug 17 ADEOS/NSCAT Launch
- Aug 20 GE-1 Atlas IIA Launch
- Aug 27 Galileo, Orbital Trim Maneuver #9 (OTM-9)
- Aug 28 GPS II R-1 Delta Launch
- Aug 29 Interball-2 Launch (Russia) ☆

## FAAC WWW PAGE

by Paul Mrozek (pmrozek, pmrozek@ford.com)

The F.A.A.C. web page is finally on the Internet! Thanks to Erik Przekop, a mirror of the internal Ford site can be accessed at the following address:

<http://www.id.net/~erik/faac.html>

The address to both www sites will be kept in the newsletter for reference in the shaded area on page 2. ☆

# FAAC STAR TRAILS

by Bob MacFarland (F.A.A.C. President)

## 4th Annual Island Lake Star Party

I'm getting excited as I see the FAAC Public Relations committee putting together plans for the 4th Annual Island Lake Star Party on September 7th. (You will find a flyer in this newsletter with the specifics). After all, this is how I personally became hooked into the hobby. After finding the 2nd Annual Island Lake Star Party flyer posted in one of the offices at work, I took my 12 year old son. I was truly overwhelmed. I never realized how many amazing things that could be seen in the night sky and that this could be done with equipment that is priced within the reach of the patient hobbyist. I was also taken aback by the "Please come and look through my scope!" attitude of the people there.

Two years later, having spent many hours at reading and researching, and an unmentionable amount of money, I've been trying to put my finger on exactly what reason why I've kept up my interest in a hobby that forces me to drive great distances to go out in the Michigan extreme elements way past my bedtime.

Is it the vast mysteries of what can be seen in the night skies? Is it the technical diversity of the knowledge involved and the equipment being used to find and capture these objects? Could it be that warm feeling one gets when he/she hears the excited comments from a newcomer being introduced to the night sky objects for the first time? Or is it the sincere, friendliness of the people involved who will always take the time to help each other out no matter what experience level you may be at? Maybe its because there is no hidden agenda to deal with. I think the bottom line answer is a resounding "Yes!" to some of all of the above.

## 1996

This year, the Island Lake event will bring many surprises including some new interactive activities for our visitors. Food and drink will again be given out as well as door prizes. You can bring your used equipment out to trade in the Swap Meet area and look for that super bargain amongst all the treasures others will offering up.

Since we have had the benefit of being posted in the upcoming events sections of the hobby magazines, we are getting inquiries from a broad range of locations in the midwest region. So, with all of the long distance folks and the local area amateur clubs being in attendance, you'll be able to see some of the latest commercially available and home built equipment first hand. You'll be able to reacquaint yourselves with some old friends and make some new ones. Bring your family and friends out for free food and drink along with chances on those door prizes.

Bring out your binoculars or a scope and help us introduce folks to our hobby and hob-knob for an evening. If you don't have either, come on out and share ours. Mother Nature will put on her fantastic display and you'll hear lots of "Oous & Ahs" as the night goes on.

You now have time to tell your family members, friends, neighbors and coworkers about the event and to get it on their calendars. Post the flyer at work or wherever you can to give the star party some exposure. For those involved in scouting or science classes, this is a great opportunity for the kids to learn about what's in the heavens. Take the time to make a phone call or two.

## Time to Take a Shower

Don't forget to take in the Perseid meteor showers on August 12th. The meteor shower will be at its best around midnight and after. At 60 to 100 meteorites per hour, it should be a super time to get out to watch and/or photograph the show (no telescope needed).

## Future Activities and Credits:

This fall, the club will continue its active calendar with some interesting projects and events. Suggestions have been made by many on things to do that will enhance our club activities. And several folks have set out to make them happen. Please forgive me if I have missed anyone (let me know and I'll make an addition in the next issue). Here are a few:

**George Korody** has researched the possible use of Lake Hudson State Recreational Area (near Clayton, MI) as a potential "dark sky" observing site (I think David Lee suggested this earlier this year). By law it is a 'Dark Sky Preserve' and with camping facilities sounds like a pretty good spot to go. George plans to check it out in August.

**Paul Mrozek** (of the FAAC Newsletter fame) and **Chuck Boren** would like to explore the potential of the membership putting on some beginning astronomy classes. Sign me up! It seems that the more I learn about this topic, the more I've come to realize that I know very little about it.

**Paul Mrozek** continues to turn out this most professional newsletter and Ford intranet web page. He is also now joining forces with **Erik Przekop**, **Larry Vassallo**, **Doug Bock**, **Tim Klepaczyk** and **Jack Kennedy** who have all volunteered to explore the possibility of having a Ford Amateur Astronomy Club internet web page. This would greatly enhance our communications abilities. By the way, thanks to **Doug Bock** for listing the FAAC activities on the NCO web page. I'm looking forward to seeing our pages being linked together.

**Greg Burnett** continues to provide the ever growing mailing distribution of these newsletters.

**Ken Anderson** and **Ray Fowler** have investigated some of the commercial sources for getting informational and educational materials to the club. **Ray** has procured a VHS tape of the JMI Catalog for members use. We are now writing to Tuthill for some of their tapes.

**Chuck Boren** has been working on a special project we will all enjoy. Rather than spoil the surprise, I'll just say it will be quite a production. He will release it soon.

**George Korody** plans on another telescope making class this winter.

A special "Thank You!" goes out to **Patti Forton**, **Kevan Granat**, **Harry Kindt**, **Chuck Boren** and **Greg Burnett** who as our current or past officers who have worked tirelessly to keep the club alive and active. Thanks for keeping us on the straight and narrow in the areas of the Ford Employees Recreation Association, all the treasury services, minute taking, correspondences, communications, administrative and organizational details. It is a pleasure to serve with you.

Thanks also goes to **all of you** who have supported our activities throughout the year. Everyone's contribution has helped.

As I mentioned above, the Public Relations Committee headed by **Don Klaser** has some fantastic ideas under development for the September 7th Star Party. I'll keep these as surprises for now as we need to get some of the details worked out. So far, **Greg Burnett**, **Jack Kennedy**, **George Korody**, **Harry & Ada Kindt**, **Patti Forton**, **Kevan Granat**, **Larry Vassallo**, **Gery Kissel**, **Barry Craig**, **Chuck Boren** and myself have joined **Don** in this planning effort. A few others have offered to help out during the party and we will need several more to pitch in on that night. Please consider giving some of your time as we identify what tasks need to be done. This will be a fun event for everyone if we all pitch in. Clear Skies, Bob MacFarland. ☆

## 1996 FAAC CALENDAR OF EVENTS

August 10-12	Perseid Showers (midnight or later)
August 15-18	S.M.U.R.F.S. Star Party, Hillman, Michigan Observing, Swap, Golf, Camping Genesee Astro. Soc.- Kurt Kemp, 2034 Noble Ave, Flint, MI 48532
August 22	F.A.A.C. General Membership Meeting
September 7	4th Annual F.A.A.C. Star Party Island Lake Recreation Area, Brighton, Michigan
September 13-15	Bad Axe Campout & Star Party
September 13-15	Fall Campout at the NCO wilderness location west of Cadillac BYO everything. Rustic Camping. Contact Doug Bock @ 810-750-0273
September 26	Lunar Eclipse (enters penumbra 8:12pm, mid eclipse - 10:54pm edt)
September 26	F.A.A.C. General Membership Meeting
October 19	F.A.A.C. Mini-Star Party Island Lake Recreation Area, Brighton, Michigan
October 24	F.A.A.C. General Membership Meeting
December 5	F.A.A.C. General Membership Meeting ☆

# EQUIPMENT TALK: TELEVUE PANOPTICS

by Todd Gross (Toddg@shore.net)

*The following article was reprinted from AstroNet, Issue 42, July 15, 1996. For more information, please contact resource@resource-intl.com.*

I have been playing "catch-up" after a hiatus in astronomy for many years. As many of you know, I have furiously tried out an unusual number of visual astronomy products, mainly eyepieces in the past 2-3 years..... so much so that I have been encouraged to share my experiences about equipment on the net. I have tried all Naglers, Panoptics and Superwides. I have also tried out numerous scopes, binoculars, and 3+ bino-viewers. In this edition of "Equipment Talk" I will go over all the Televue Panoptic Eyepieces from 15 mm focal length on up. All information offered here is from personal experience only, there may be some unintentional errors or omission of facts.

The Televue Panoptic eyepieces are the natural extension of the Nagler line. The Naglers run up to 20mm in focal length, and offer an 82 degree apparent field, while the Panoptics start at 15mm f.l., and run up through 35mm, offering 68 degrees. The Panoptics feature very sharp images across almost the entire field. I have tested them in an 8" SCT, 4" refractor, 3" refractor, and 10" SCT. I will discuss their pros and cons as we run down each eyepiece below:

## The 15mm Panoptic:

A truly sharp-to-the-edge eyepiece, yet the 15mm is sometimes considered the least impressive of the Panoptic line. This is perhaps unfair. The 10mm eye relief is shorter than it's big brothers, so some observers complain about it. In reality, it is very hard to find ANY eyepiece at 15mm which offers much more than 10mm eye relief anyway. (with the exception of specialty eye-relief eyepieces such as the Vixen Lanthanum, which has 20mm eye relief at 15mm focal length) Also, the 1.25" eyepiece is so small and convenient, that many folks will think they simply look less expensive...or less like a "Panoptic". In truth, this is a great eyepiece, with eye relief that is a too short for those who wear or need glasses at 15mm (you tend to need to correct astigmatism as you use lower powers, not higher ones, so you may be able to get away with this one w/o glasses, just correcting for your diopter with focus) The only problem I perceived with this eyepiece, is that the many elements may have soaked up a bit too much light for my taste. I was, however, comparing it to a 17mm plossl..but never-the-less adjusting for the diminished exit pupil, it still seemed just a bit dimmer than it could have been. I did not test this eyepiece for the so-called "pin-cushion" distortion (see below) but I don't think offhand it showed much, if any. This eyepiece works well with all bino-viewers, by the way. The eyepiece does have an easy to use fold down eyeguard.

## The 22mm Panoptic:

Billed as the alternative to the 20mm Nagler, indeed this eyepiece may be even more desirable. It is a 1.25" eyepiece with a 2" skirt, and is larger than a 9mm Nagler, but smaller than a 12, or 16mm Nagler, to give you an idea of size. It is MUCH lighter than a 20mm Nagler. Still it's pretty hefty for a bino-viewer, and can only be used in those with wide clear aperture such as the Televue bino-viewer. (More on bino-viewers in a subsequent article..do not buy them without thorough research!) The eyepiece affords a generous eye relief, approximately 18mm (personal estimate), just enough for most (but not all) eyeglass wearers.

Now, about the view! Wow! A wide field, that approaches the actual field of view of the 20mm Nagler in actual use. (If you bury your head in the 20 Nagler, and really look around, you can make out significantly more field..but in practical use, the 22mm Panoptic has about the same "easy-to-see" field size) Correction towards the edges on all scopes was excellent. In fact, the eyepiece was color free, and distortion free towards the edge, especially when compared with a Meade 24.5 superwide, one of it's closest (but less expensive) competitors. However, note that the Meade eyepiece is pure 1.25", not a hybrid, and works better in binoviewers, than the Panoptic.

The only problem with the 22mm, and the 27, and 35mm Panoptic, is something called "pin-cushion" distortion. If you have a Dob, for instance, and love to pan around the sky, the starfield is magnified slightly more towards the edges. In fact, in looking at a ruler, even while stationary through the eyepiece, the ruler looks bent.. sharp, but the trade-off is a distortion that bends straight lines. When panning this can literally get you sea-sick. The distortion is very minor to some folks, and bothers other's more. Most people have not noticed it that I have spoken to..but those than Pan around a lot certainly do. There is some evidence as reported on the Internet newsgroup sci.astro.amateur that the 27mm Panoptic may suffer this effect the most, and that it may vary from eyepiece to eyepiece, but this is still being "tested" by our trusty group.

## The 27mm Panoptic:

The single sharpest eyepiece I have ever used, the 27mm is a true 2" eyepiece, and needs a 2" diagonal, or focuser to hold it. However, it is not much bigger, or heavier than the 22mm Panoptic. Like the 22, I have noticed some pin-cushion distortion only when panning the scope. Otherwise, pinpoint images over a huge field of view for this focal length make this a winner. Everything views sharp and bright to the edge...more-so than the 35mm Panoptic. This one really "wows" compared to the very nice, but not quite as fantastic 24.5 Superwide.(Meade) The field of view on this eyepiece is wider than 1.25" 40mm eyepieces, and yet the magnification is much greater.

I will talk a bit about barlowing the Panoptics at this point. On all telescopes I have tested on, I have been able to barlow the 22, and the 15mm Panoptics without any problem using a 1.25" or a 2" barlow lens of good quality. The 27, and 35mm Panoptics need a 2" barlow, such as Televue's Big Barlow. I have not really noticed the necessity on the scopes I have tried, for the Televue Panoptic-Barlow interface. This is in addition to a barlow, to make the image better with Panoptics. I have heard that on the 27mm, and the 35mm Panoptic, it helps a lot in very fast scopes, such as f/4. I believe this corrects some distortion towards the edge of field, but I have also heard it helps make the view more comfortable as well. I did indeed notice some "black-out" areas on the 35mm in an F/10 8" scope when it was barlowed, with a Televue Big Barlow, similar to the Kidney Bean Effect (see Nagler article). I am not positive exactly what the interface does, or who exactly needs it, and would welcome comment on it. I will say that I tested the 35mm Panoptic with a Vernonscope 2X barlow on the day I am writing this (but the Vernonscope barlow goes between the focuser and the diagonal, which only some scopes can accommodate.. It actually ran at 2.2X) and I found the eyepiece delivered perfect views with it, better in fact than un-barlowed.

## The 35mm Panoptic:

The single most useful eyepiece I own because of it's wide true field, a combination of low focal length, and wide 68 degree apparent field. In some scopes, star images are not quite pinpoint, but close to pinpoint in the 35mm Panoptic. However, unlike other eps it is very sharp towards the edge of field. Scopes that suffer from curvature of field such as Schmidt Cassegrains, usually have trouble with low power, wide field eyepieces, such as the Meade 40mm Superwide. I hate seeing sea-gulls towards the edge. Honestly, on brightest stars, I CANNOT get a fantastic image with this eyepiece with a f/6.3 10" Schmidt.. but on all other objects I can, and with all other scopes I can...even on bright stars. Another qualifier though: On fast refractors, I do see poor edge correction compared to the 27mm Panoptic. So as you can see, if you are very fussy about images, despite it's great reputation, you might do better with the 27. One other caution: When evaluating this or any other low power eyepieces, make sure to have your astigmatism, no matter how slight, corrected first with glasses. I made the mistake of thinking several eyepieces were not very good initially, when it was really my eyes.

Like all the eyepieces above, the 35mm can be sent in for repair to Televue after you use it a lot..and believe me you will use this eyepiece a lot.. giving you the widest possible field (almost) that can be had in a 2" eyepiece. In fact, the true field of view, is just short of the 2" 55mm Televue Plossl, and 2" 56mm Meade Super Plossl in terms of size. Eye relief is comfortable, for this focal length, it isn't "too much" as you often see in 32mm and up plossls of 1.25" design. I can use this and the 27mm eyepiece with glasses, with just slight crowding.

In summary, the Televue Panoptics offer some of the best, sharpest views available, at medium to low power, along with a wide field of view. Stars and planetary images are very sharp. Eye relief is for the most part comfortable, and light throughput is acceptable. Some scopes will do better with the 35mm than others, and also the view barlowed reportedly varies with scope. If you had to choose only one, I would pick the 27mm Panoptic. In fact, if you get crafty with a barlow and place it at different distances from the eyepiece, you can theoretically use just this ONE eyepiece, and get away with it.. but now I am starting to drift onto another topic altogether.

My next Article, which I expect to write in August, 1996 will deal with the enigmatic world of binocular viewers. They are really, really fantastic, delivering true binocular-like views at higher power than hand-held binoculars, but they do have some serious limitations. (By the way, it is TOTALLY UNTRUE that you cannot use them well on deep sky objects, this only applies to certain units, gets me mad when I read that) There are very few available of high quality, and they run a pretty penny. Nevertheless, I believe I can untangle the confusion, and offer some suggestions on which one you should buy, and which eyepieces can be used in them, in my next Equipment Talk.

## LIGHT POLLUTION FILTERS

by David Knisely (dk84538@ltec.net) via sci.astro.amateur  
Prairie Astronomy Club  
<http://www.infoanalytic.com/pac/>

There are a number of different filters available on the market today, with most coming in one of three classes: 1. Broad-Band "light pollution" filters, 2. Narrow-Band "nebular" filters, and 3. Line filters.

In the Broad band range are the Lumicon Deep-Sky, and the Orion SkyGlow. They enhance many deep-sky objects by blocking out the common Mercury vapor and some other emission lines which contribute to light pollution, while letting through a broad range of wavelengths. While they do help increase the contrast of some objects somewhat, their overall effect is not terribly striking. A similar effect can sometimes be achieved by increasing the magnification slightly, since the light pollution effect is then diluted. The Lumicon Deep-Sky does help enhance the visibility of things like the Merope Nebula, the Trifid, and M42, but not much of an effect is noted with galaxies and star clusters. I have noted that using the filter on M33 and NGC 253 in my 10" when skyglow is higher than usual will help boost the visibility of the detail, but the effect is only moderate. Since some light is blocked by the Deep-Sky filter, there will actually be a light loss, and some objects may even be harder to see with the filter than without. The Deep-Sky also works as a passable blue filter for observing Jupiter. Thus, the broad band filter, while somewhat useful, is not the most effective filter intended for deep-sky use.

In the narrow-band "nebular" filter range, the best filters seem to be the Orion Ultrablock, and the Lumicon UHC. These filters allow only the emission lines of Hydrogen (h-alpha and h-beta) plus the bright Oxygen III lines (plus everything in between), to get through. Their effect can be quite striking, with many faint nebular objects becoming easy to see (without the filter, they may not be visible at all!) Even the more prominent nebulae which are visible without filters gain considerable detail and contrast with the narrow band filters. Both the UHC and Ultrablock will, for example, often show the Rosette Nebula TO THE NAKED EYE when you look through them. Even under a really dark sky, the contrast and detail improvement are impressive, and most observers continue to use their nebular filters at such dark-sky sites. One neat trick for finding tiny

planetary nebulae is to "blink" the objects by holding the filter between the eyepiece and the eye. The stars will dim somewhat, but the planetary nebula will remain bright, thus standing out from the background stars. As for performance, both the UHC and Ultrablock have very similar characteristics, but some people have reported a slight edge in performance with the Ultrablock. At times the Ultrablock has also been somewhat less expensive than the UHC. Both will perform very well, and should be used at moderate to low powers for best results. However, these "nebular" filters do not work well on star clusters, reflection nebulae, or galaxies.

With the "line" filters, the Lumicon Oxygen III (OIII) filter is the real standout. It allows only the narrow pair of emission lines of Oxygen to get to the eye, and for many planetary and diffuse emission nebulae, the boost in visibility has to be seen to be believed! The Veil and North American Nebulae look like photographs in a 10" with the OIII filter, and many of the "green box" emission nebulae in SKY ATLAS 2000.0 jump out at you. You may even see some nebulae which are not shown on many atlases. Planetary nebulae become easy, and the "blinking" technique becomes vastly more effective, as the stars nearly vanish, leaving the planetary nebula standing out like a sore thumb. However, since the bandwidth of the OIII filter is so narrow, it may hurt some objects slightly, like M42 or the Trifid. This filter also hurts the view of clusters and galaxies even more than the narrow band filters do.

One line filter of note is Lumicon's H-Beta filter. As the name indicates, the filter only lets through the H-Beta emission line of Hydrogen, and is only useful on a VERY limited number of objects: The Horsehead Nebula, the California Nebula, the Cocoon Nebula, and M43. On an 8" to 10" scope, the Horsehead Nebula goes from invisibility to visibility, as does the California Nebula. However, these objects remain fairly faint (especially the Horsehead), and unless you REALLY like looking at them, you can probably forget about buying the H-Beta!

For recommendations, I like the Orion Ultrablock and the Lumicon OIII, but remember to use them with an eye that is properly dark adapted. Have fun!

[For more information about light pollution filters, check out the "Gadget, Accessory, and Thingy FAQ" in the "FAQs & Other Info" section of the FAAC web page.] ☆

## FERA News - FERA News - FERA News - FERA News



### *Relive the Days of Knights!*



The Ford Amateur Astronomy Club is selling Michigan Renaissance Festival tickets in association with FERA. The Renaissance Festival is a very popular event and there shouldn't be any trouble in selling the 80 tickets we took. As a club within the Ford Employees Recreation Association, we are required to participate in one FERA sales event each year. It is because of FERA that we can use Ford facilities, i.e.. meeting rooms, profs, copy machines, etc..... Let's show our support by doing our best to sell these tickets!! Contact Patti Forton (313-845-1740 PFORTON) if you would like to sell or purchase tickets.

ADULTS \$10.50  
(\$12.95 at the gate)

CHILDREN \$4.50  
(\$5.95 at the gate)

August 17-18, 24-25, 31  
September 1-2, 7-8, 14-15, 21-22, 28-29, 1996  
10:00 am to 7:00 pm -- Rain or Shine





# 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

Planet/Moon Apisides Report for August 1996  
8/12/1996 Moon @ Apogee Hour: 11 Distance: 406486 km Diameter: 0.4899°  
8/19/1996 Mercury @ Aphelion Distance from Sun: 0.47 AU  
8/27/1996 Moon @ Perigee Hour: 13 Distance: 358791 km Diameter: 0.5551°

Twilight Report for August 1996

Date	Sun Rise	Set	Astronomical Begin	End	Nautical Begin	End	Civil Begin	End
8/3/1996	5:58	20:19	3:59	22:18	4:42	21:35	5:21	20:56
8/10/1996	6:05	20:10	4:11	22:05	4:52	21:23	5:30	20:46
8/17/1996	6:12	20:00	4:22	21:51	5:01	21:11	5:38	20:35
8/24/1996	6:20	19:49	4:33	21:36	5:10	20:59	5:46	20:23
8/31/1996	6:27	19:38	4:43	21:22	5:19	20:46	5:54	20:11

## SKY & TELESCOPE NEWS BULLETINS

from the editors of SKY & TELESCOPE magazine

### THE FIRST STARS?

Last December, the Hubble Space Telescope stared at a patch of "empty" sky in Ursa Major for over 100 hours, building up the deepest visible-light image ever taken. The remarkable result revealed roughly 1,600 galaxies, some of which are as dim as 30th magnitude — a billion times fainter than the dimmest naked-eye stars. In the June 27th issue of Nature, Ken Lanzetta and Amos Yahil (SUNY/Stony Brook) and Alberto Fernandez-Soto (Cantabria University, Spain) describe how they used the colors of the Deep Field's galaxies to estimate how much the light from these galaxies has been redshifted and thus how far we have peered into the universe's past.

It's pretty far indeed. About 20 percent of the galaxies seem to have redshifts above 2, implying light that has traveled for roughly 7 billion years. Six objects appear to have redshifts greater than 5. This means that their constituent stars may well have shone less than a billion years after the Big Bang. In some of the galaxies, other light-reddening effects, such as obscuration by dust, may well be conspiring to mimic the redshift due to the universe's expansion. But, by and large, the ambitious project seems to have achieved its goal of glimpsing the earliest galaxies and thus some of the first stars to form.

### A CLOSER MOON, A FASTER EARTH

Geologists have long depended on sediments to explore the Earth's past, and now delicate layerings have revealed something about the Moon. Based on cyclic deposits of silt left by long-ago tides, Charles P. Sonett (U of Arizona) and others have concluded that the Moon used to be quite a bit closer and the Earth's day much shorter. The oldest sediments, found near Salt Lake City, are 900 million years old. Back then, Sonett's team calculates, the Moon was 7.5 percent closer than it is now and took just 23.4 days to complete an orbit. Meanwhile, Earth itself was probably turning in a little more than 18 hours. The team's analysis appears in the July 5th issue of Science. We've known for some time that the Moon's orbit is expanding, and thus gaining energy, at the expense of Earth's rotation. For example, by firing lasers at reflectors left on the Moon by Apollo astronauts, researchers learned that the Moon is moving outward at 3.8 cm per year. And ancient, tide-induced deposits have been studied before. But the estimates by Sonett's team for how much the Moon's orbit has expanded and the length of our day grown are larger than previously thought.

### NEW COMET BREWINGTON

Amateur observer Howard Brewington has discovered a faint comet along the border of Virgo and Leo, halfway between the bright stars Spica and Regulus. His find, which is a diffuse 10th-magnitude glow, came on the night of July 3rd. For now it has been designated 1996 N1, but if no one else reports an earlier sighting Brewington will soon claim this as his fifth comet discovery. He notes that in finding the first four he spent 725 hours at the eyepiece. But it took another 702 hours to bag this one.

### GANYMEDE SPIED BY GALILEO

Planetary scientists had counted on getting crisp images of Ganymede when Galileo flew past the big Jovian moon in June. But even they underestimated the wealth of detail contained in the first frames radioed to Earth. One of the images presented on July 10th reveals regions overrun with dozens of long, side-by-side ridges and valleys formed long ago when the moon's water-ice crust expanded and cracked. Another shows a vast dark "sea" some 2,800 kilometers across and hints of water-driven volcanism.

Perhaps more surprising than the tortured surface is the realization that Ganymede has its own magnetosphere and, almost certainly, an intrinsic magnetic field. The field strength measured by the spacecraft rose fivefold in Ganymede's immediate vicinity, and the field's orientation shifted to point toward the Jovian moon. The field is roughly a thousandth the strength of Earth's. Such a field would most likely result from electric currents coursing through a shell of salt water circulating deep below the frozen crust, though a molten metal core can't yet be ruled out.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	Lunar Events LM: 0:56 Aug 06 NQ: 3:05 Aug 14 FQ: 23:08 Aug 21 FM: 13:23 Aug 28		1 SR: 5:56 SS: 20:22 MR: 21:42 MS: 8:40	2 SR: 5:57 SS: 20:20 MR: 22:17 MS: 9:52	3 SR: 5:58 SS: 20:19 MR: 22:52 MS: 11:02	
4 SR: 5:59 SS: 20:18 MR: 23:26 MS: 12:09	5 SR: 6:00 SS: 20:17 MR: None MS: 13:13	6 SR: 6:01 SS: 20:16 MR: 0:02 MS: 14:14	7 SR: 6:02 SS: 20:14 MR: 0:41 MS: 15:12	8 SR: 6:03 SS: 20:13 MR: 1:22 MS: 16:05	9 SR: 6:04 SS: 20:12 MR: 2:07 MS: 16:55	10 SR: 6:05 SS: 20:10 MR: 2:55 MS: 17:40
11 SR: 6:06 SS: 20:09 MR: 3:46 MS: 18:21	12 SR: 6:07 SS: 20:07 MR: 4:40 MS: 18:58	13 SR: 6:08 SS: 20:06 MR: 5:35 MS: 19:32	14 SR: 6:09 SS: 20:05 MR: 6:31 MS: 20:03	15 SR: 6:10 SS: 20:03 MR: 7:29 MS: 20:33	16 SR: 6:11 SS: 20:02 MR: 8:26 MS: 21:02	17 SR: 6:12 SS: 20:00 MR: 9:25 MS: 21:31
18 SR: 6:13 SS: 19:59 MR: 10:24 MS: 22:01	19 SR: 6:15 SS: 19:57 MR: 11:25 MS: 22:34	20 SR: 6:16 SS: 19:56 MR: 12:27 MS: 23:10	21 SR: 6:17 SS: 19:54 MR: 13:30 MS: 23:52	22 SR: 6:18 SS: 19:52 MR: 14:32 MS: None	23 SR: 6:19 SS: 19:51 MR: 15:33 MS: 0:40	24 SR: 6:20 SS: 19:49 MR: 16:31 MS: 1:35
25 SR: 6:21 SS: 19:48 MR: 17:25 MS: 2:37	26 SR: 6:22 SS: 19:46 MR: 18:13 MS: 3:46	27 SR: 6:23 SS: 19:44 MR: 18:56 MS: 4:59	28 SR: 6:24 SS: 19:43 MR: 19:35 MS: 6:13	29 SR: 6:25 SS: 19:41 MR: 20:12 MS: 7:27	30 SR: 6:26 SS: 19:39 MR: 20:48 MS: 8:39	31 SR: 6:27 SS: 19:38 MR: 21:23 MS: 9:49

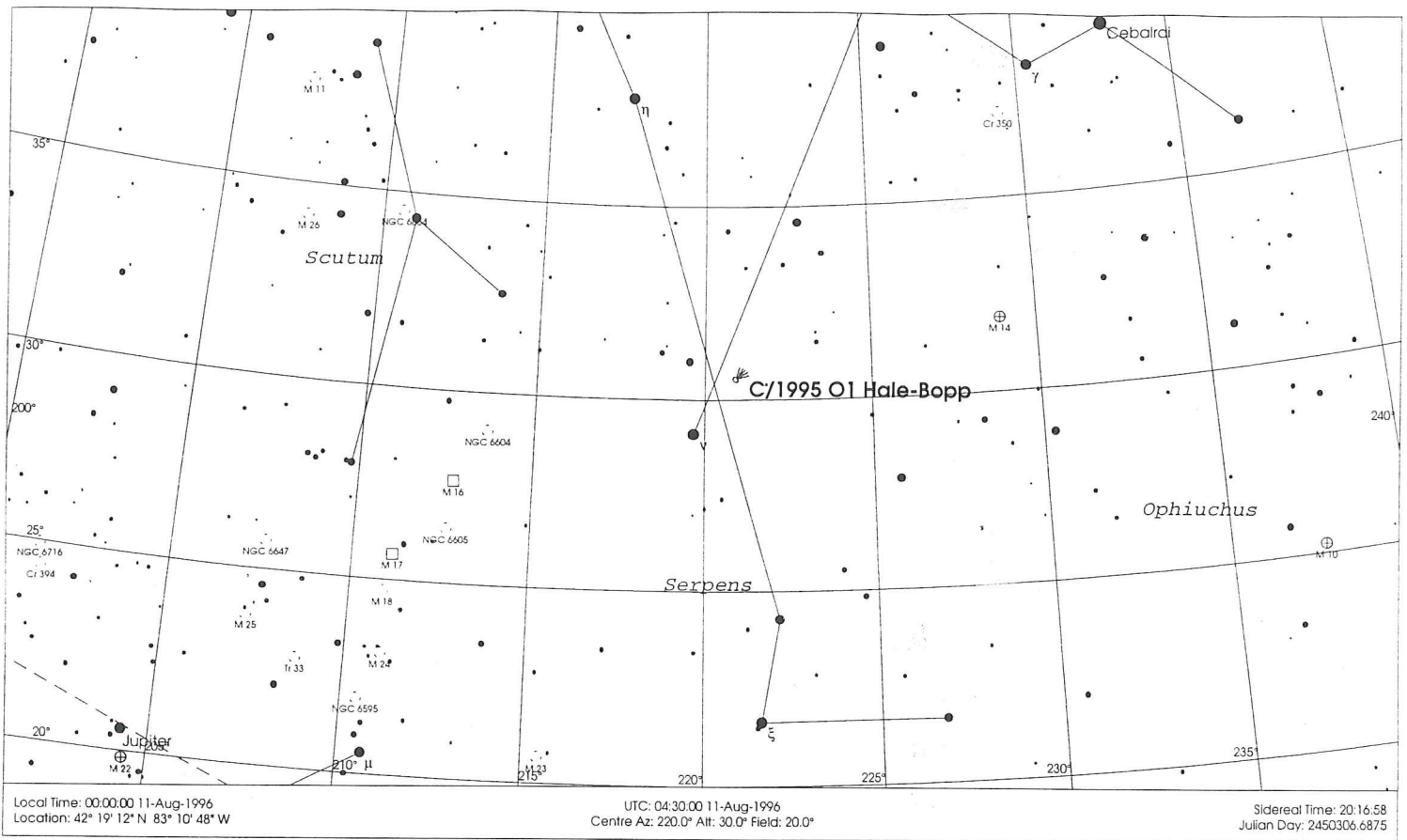
Planet View Info Report for August 1996

Mercury	Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
	8/3/1996	7:49	21:18	10h17m34s	11°27'41"	21°11'18"	0.763	1.17259
	8/10/1996	8:17	21:09	10h54m59s	6°43'57"	24°47'56"	0.678	1.08215
	8/17/1996	8:36	20:55	11h25m56s	2°15'54"	26°56'34"	0.588	0.98470
	8/24/1996	8:45	20:36	11h49m44s	-1°35'10"	27°16'16"	0.483	0.88257
	8/31/1996	8:41	20:12	12h04m03s	-4°19'07"	25°01'13"	0.350	0.78033
Venus	8/3/1996	2:43	17:17	5h45m20s	19°05'36"	44°34'41"	0.398	0.57443
	8/10/1996	2:39	17:16	6h09m56s	19°32'13"	45°25'56"	0.443	0.62873
	8/17/1996	2:37	17:17	6h36m49s	19°46'09"	45°47'50"	0.484	0.68331
	8/24/1996	2:38	17:18	7h05m27s	19°42'35"	45°46'58"	0.523	0.73782
	8/31/1996	2:43	17:18	7h35m23s	19°18'05"	45°27'51"	0.558	0.79199
Mars	8/3/1996	3:01	18:17	6h24m08s	23°49'12"	35°25'28"	0.961	2.23658
	8/10/1996	2:54	18:08	6h44m24s	23°37'37"	37°29'31"	0.958	2.21152
	8/17/1996	2:48	17:59	7h04m22s	23°16'48"	39°37'32"	0.954	2.18394
	8/24/1996	2:43	17:49	7h23m59s	22°47'15"	41°49'33"	0.951	2.15380
	8/31/1996	2:37	17:37	7h43m14s	22°09'38"	44°05'41"	0.947	2.12112
Jupiter	8/3/1996	18:20	3:26	18h40m45s	-23°14'11"	148°24'22"	0.997	4.29477
	8/10/1996	17:51	2:56	18h38m14s	-23°17'24"	141°06'59"	0.996	4.35554
	8/17/1996	17:21	2:26	18h36m16s	-23°19'56"	133°56'24"	0.995	4.42717
	8/24/1996	16:53	1:57	18h34m56s	-23°21'49"	126°53'30"	0.994	4.50828
	8/31/1996	16:25	1:29	18h34m15s	-23°23'04"	119°58'42"	0.993	4.59738
Saturn	8/3/1996	22:35	10:46	0h28m52s	0°25'57"	124°06'51"	0.998	8.92870
	8/10/1996	22:07	10:17	0h28m06s	0°19'08"	131°01'46"	0.998	8.83654
	8/17/1996	21:39	9:48	0h27m04s	0°10'41"	138°02'01"	0.999	8.75365
	8/24/1996	21:11	9:19	0h25m47s	0°00'46"	145°06'59"	0.999	8.68146
	8/31/1996	20:42	8:49	0h24m16s	-0°10'23"	152°15'59"	0.999	8.62115
Uranus	8/3/1996	19:45	5:17	20h18m43s	-20°14'49"	171°17'43"	1.000	18.77435
	8/10/1996	19:17	4:48	20h17m35s	-20°18'29"	164°19'37"	1.000	18.80103
	8/17/1996	18:48	4:20	20h16m31s	-20°21'56"	157°20'51"	1.000	18.84169
	8/24/1996	18:20	3:51	20h15m30s	-20°25'06"	150°22'06"	1.000	18.89576
	8/31/1996	17:52	3:22	20h14m36s	-20°27'55"	143°23'38"	1.000	18.96235
Neptune	8/3/1996	19:19	4:49	19h51m27s	-20°28'35"	165°00'30"	1.000	29.17844
	8/10/1996	18:51	4:21	19h50m42s	-20°30'40"	158°07'38"	1.000	29.21648
	8/17/1996	18:23	3:52	19h50m00s	-20°32'38"	151°14'17"	1.000	29.26790
	8/24/1996	17:55	3:24	19h49m22s	-20°34'27"	144°20'46"	1.000	29.33194
	8/31/1996	17:27	2:56	19h48m48s	-20°36'05"	137°27'14"	1.000	29.40762
Pluto	8/3/1996	14:40	1:54	16h03m42s	-7°25'23"	108°52'57"	1.000	29.57328
	8/10/1996	14:13	1:26	16h03m36s	-7°28'40"	102°21'07"	1.000	29.68523
	8/17/1996	13:45	0:58	16h03m35s	-7°32'19"	95°49'05"	1.000	29.80027
	8/24/1996	13:18	0:31	16h03m42s	-7°36'18"	89°17'18"	1.000	29.91673
	8/31/1996	12:51	0:03	16h03m54s	-7°40'34"	82°45'57"	1.000	30.03301

Meteor Showers Report for August 1996

Date	Meteor Shower	ZHR	RA	DEC	Illum	Frac.	Longitude
8/1/1996	alpha-Capricornids	5	20h36m	-10°	0.92		130°
8/5/1996	iota-Aquarids	8	22h10m	-15°	0.54		134°
8/11/1996	Perseids	75	3h04m	58°	0.06		140°
8/20/1996	alpha-Cygnids	5	21h00m	48°	0.36		148°

# FINDING COMET HALE-BOPP



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

