

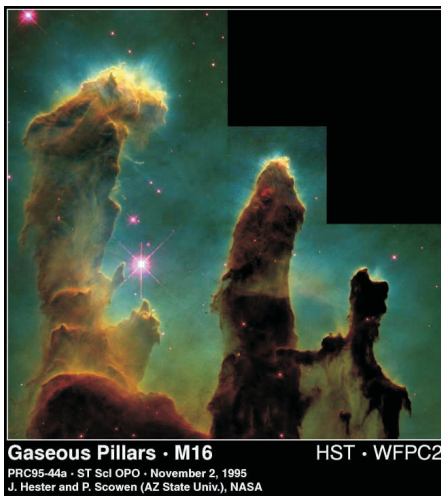


Regulus

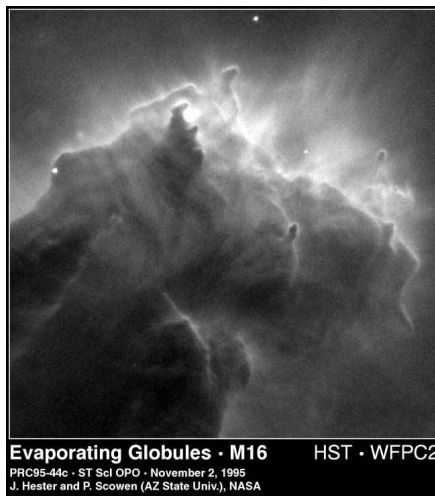
November - December 1995

Newsletter of the Kingston Centre
of The Royal Astronomical Society of Canada

Interstellar Eggs ?



Gaseous Pillars · M16 HST · WFPC2
PRC95-44a · ST ScI OPO · November 2, 1995
J. Hester and P. Scowen (AZ State Univ.), NASA



Evaporating Globules · M16 HST · WFPC2
PRC95-44c · ST ScI OPO · November 2, 1995
J. Hester and P. Scowen (AZ State Univ.), NASA



Star-Birth Clouds · M16 HST · WFPC2
PRC95-44b · ST ScI OPO · November 2, 1995
J. Hester and P. Scowen (AZ State Univ.), NASA

Recent Hubble photos of the region around the Eagle Nebula showing rather dense, compact pockets of interstellar gas called evaporating gaseous globules (EGGs)

See article on page 8

"It's a bit like a wind storm in the desert"

- Comment by Jeff Hester, Arizona State University, Tempe AZ
on the process occurring within the pillars in M16

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Astronomy Day	Cathy Hall	(000) 000-0000
Education	Denise Sabatini	(000) 000-0000
Publicity	Bill Broderick	(000) 000-0000
Observing	Steven Manders	(000) 000-0000
Light Pollution	Bill Broderick	(000) 000-0000
GA Bid	Peggy Torney	(000) 000-0000

Executive E-Mail Addresses

David Levy
Walter MacDonald
Leo Enright
Ruth Hicks
Kim Hay *(addresses removed)*
Kevin Kell
Cathy Hall
Peter Kirk

Centre Address

RASC - Kingston Centre
P.O. Box 1793
Kingston, Ontario
K7L 5J6

Meetings and Events

November 10

Speaker: Denise Sabatini
Topic: "Mithraic Origins"

December 9, 1995

Speaker: Steve Manders
Topic: "Solar Collisions: Their Effect on Earth"

January 12, 1996

Speaker: Christine Kulyk
Topic: "Cinemascope Astronomy"

Meetings

Regular Meetings of the Kingston Centre, RASC are held on the **second Friday** of each month (unless noted otherwise) at 8 p.m., in Room B-201, *Mackintosh-Corry Hall, Queen's University*. Non-members are welcome. Executive meetings are at 7:30 p.m.

Regulus is published six times per year. Views and opinions expressed herein do not necessarily represent the official position of The Royal Astronomical Society of Canada or its officers and members unless so indicated.

SUBSCRIPTIONS: Members of the Centre receive REGULUS as a benefit of membership. Non-members may subscribe for \$10 per year.

ADVERTISING: Classified advertisements re items to sell, buy or trade are free to members of the centre. Commercial advertising is \$25 per half page \$50 for full page. Commercial advertisers must supply clean camera-ready copy.

CONTRIBUTIONS INVITED articles, notes on observation, humour, poetry artwork, anything on astronomy or related topics are invited. Submitted material may be edited for brevity or clarity.

Deadline for receipt of material is the 15th of the month prior to Publication.

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New Moon Visibility

By David Stokes

The Lunar Calendar has been prepared for many thousands of years primarily for religious use. The production of such a calendar requires prediction based on accumulated knowledge and patient observation over long periods of time. Yet, even today there is still no true and tested criterion to assist the calendar maker, though a more scientific approach has been attempted in recent years, for example, by Muhammad Ilyas (1).

Ilyas has summarized (1) the observations of Fotheringham, Maunder and the Indian Astronomical Ephemeris in a graph relating the Moon's altitude at sunset with the difference in azimuth of sun and moon at that instant. This is recalculated and presented in Figure 1. The thin crescent of the new moon will be seen sometime between sunset and moonset if the moon's altitude, at sunset, falls above the chosen curve shown in

greatest separation while the Indian criterion allows for the last separation.

A second criterion, said to be independent of observer's latitude, is the altitude separation between sun and moon, again at sunset, and their separation in the sky (elongation). This is summarized in Figure 2 and is based on very extensive data given by Ilyas (1).

It is pertinent to ask whether the data of Fig.2 is consistent with one of the curves shown in Fig 1, and whether predictions based on such criteria are borne out by observation.

The observations of the very young lunar crescent reported by Denise and Leo Enright (4) for 1995 March 31 provides a critical check because experienced amateurs observed from a relatively high latitude. A detailed analysis using Meeus

also the Bruin-Ilyas criterion for attitude separation vs elongation in Fig.2.

Figure 1 Earliest Visibility

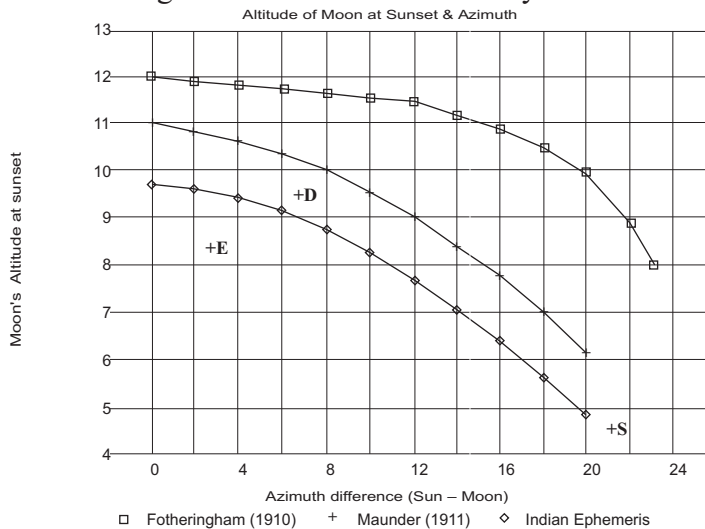
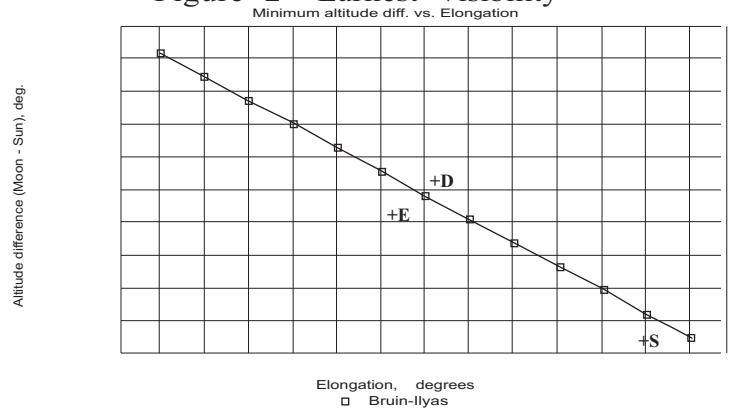


Figure 2 Earliest Visibility



algorithms (2) and programs by Sax (3) shows sunset occurred 18h32m, moonset 19h26m and moon's altitude at sunset was 8°22' and separated 9°12' from the sun. The azimuth difference was 2°38' and elongation 10°23'. These coordinates are entered at E on Figs.1 & 2 where

Fig.1 It is apparent that Fotheringham's criterion, based on his own and Schmidt's data from Athens (Greece), requires the

it is apparent the Enright observations far exceed the Indian Ephemeris criterion and

**GRAZING OCCULTATION
BY JUPITER ON SUNDAY
SEPTEMBER 24, 1995**

By Bill Broderick

The sky had turned clear on the evening of Sunday, September 24th, so I tore myself away from the boob tube to go up the hill to my observatory and have a look at Jupiter through my C-11. I find the early evening before darkness sets in the optimum time for observing the King of Planets and this evening, about 7:40 p.m. EDT, was no disappointment.

As I slipped in my 40mm eyepiece (70X) my first impression was that Jupiter had acquired an "extra" moon—three on one side, one on the other, and a fifth one just off Jupiter's southeast limb. The time, as noted, was about 7:40 p.m. (23h40m UT).

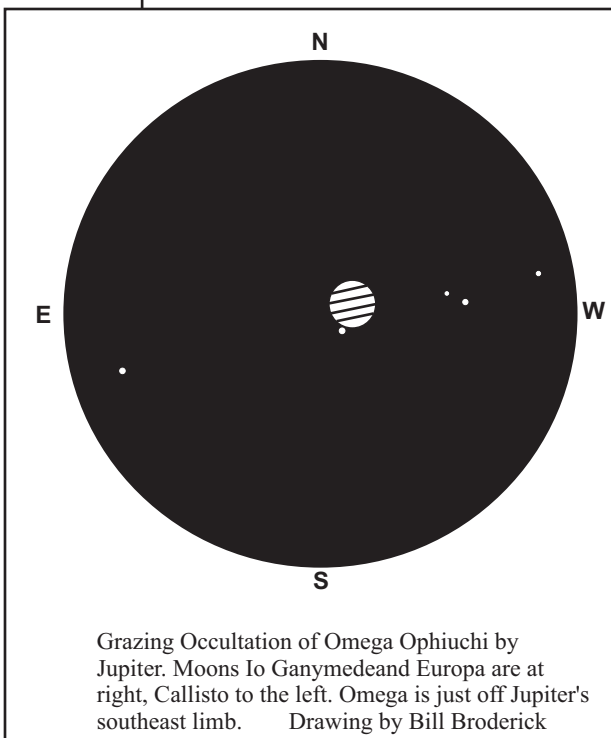
Reaching for my trusty Observer's Handbook, I opened it to the "Planetary Occultations" section and found that on this evening Jupiter would occult the 4.45 magnitude star SAO184450 — a perusal of Sky & Telescope later on gave the identification as Omega Ophiuchi. Unfortunately, I did not have the presence of mind to try and time the exact moment when the star was just under Jupiter's central meridian — but it was pretty close to 7:53 p.m. (23h53m UT), the time predicted. From my location Omega was not occulted — I don't think it was even dimmed. However, from around 7:50 to about 7:58 or so, I could not see any space between planet and star, not even at 140X or 225X.

I found it a real experience to see

Jupiter passing by the star at such a "rapid" clip. We are accustomed to thinking of events in the sky or in space as happening very slowly, over the course of days, weeks, months, even years. But here we could observe a major Solar System object moving a distance equal to its own diameter (142,980km) in the span of about two hours. My observation started at about 7:40 and ended at 8:30, a duration of only 50 minutes, so of course I did not see that. But when I left off Jupiter at 8:30 p.m. the star's position was well off Jupiter's southwest limb.

All in all, this event was well worth observing. My catching it was sheer luck.

I'm glad I did. And in future, I for



one will try to pay more attention to upcoming events.

Notice

In the January - February issue the centre membership will be published. The information to be displayed will include Names, Addresses, Phone Numbers, E-Mail addresses and other hobbies. If you do not want any of this to be printed contact any Executive member listed on page two.

continued from page 3...

Fig. 1 coordinate 'D'). This situation also meets the criterion of Fig.2 for earliest visibility. Go for it! Then celebrate Christmas early. The next real challenge here will not occur until 1996 April .

REFERENCES

1. A modern guide to astronomical calculations of Islamic calendar, etc. etc., by Muhammad Ilyas. Berita Publishing, Kuala Lumpur. 1984
2. Astronomical Algorithms. Jean Meeus. Willmann-Bell, Inc. Richmond, Va. USA. 1991.
3. QuickBasic algorithms by Sax based on Meeus algorithms. Available on disk from Willmann-Bell.
4. The Quest for the young moon: success on the last day of March. Leo Enright. Regulus Newsletter of the Kingston

Telescope Mounts

By Doug Angle

Many people build their own telescopes, and the largest percentage of them use the Dobson style mount. This allows stability, portability, and maintains the relative position of the eyepiece. Unfortunately, many are also over built, resulting in a mount that is less portable, and therefore less usable, than it could be.

In this article, I will outline some engineering principles that apply, and show how to use them to optimize the

mount design. I have built two mounts this way; one for a 6 inch f/8 that weighs about 15 lbs, and one for a full thickness 12 inch that weighs about 9 lbs. Both mounts have been in service for several years, and perform as well as their heavy-weight cousins.

The key to light weight construction is to understand the difference between strength and stiffness. Strength is how much load the material can take before it breaks. It can be found by multiplying the tensile strength of the material by the area under load. Stiffness refers to how much it will bend under much lower loads. To predict how much bending will take place is more complex, and involves calculating the moment of inertia. This basically means that the thicker shapes are stiffer than thinner ones, and that the outside layers of a material take more of the load than the inside layers. If you take a straight bar of wood or some other material, and try to bend it, the one side will be stretched - in tension, and the other in compression. The center of the piece, called the neutral axis, will take no load at all.

So what good is this? Well, since the center does not contribute to the stiffness, it can be built lighter than the outside areas, provided that there is still enough left to hold it all together. In the first mount I built using this principle, I used two layers of 1/8" plywood, separated by strips of 3/4" pine. Because it was largely hollow, the mount is much lighter than solid 3/4 " plywood. However, because it was thicker overall, it has the same stiffness as solid wood. As for strength, a one foot cross section of 3/4" plywood can support a dead load of about 28,000 lbs. before failure, so losing 75% of its strength doesn't really hurt.

There are two drawbacks to this method. One is that you must use more care in construction. The strength of the finished system depends on good glue joints, which in turn means accurate cuts, and clean mating surfaces. Special

allowances must be made for the bearing blocks. For the azimuth bearing, I made sure that there were cross braces under the bearings. The altitude bearing required gluing in extra blocks inside the frame.

The second problem is wear. Solid plywood can take a lot of abuse without affecting the performance, but hitting the side of a 1/8" plywood can do serious damage quickly. Again, this can be controlled somewhat by careful design.

There is another way, however, and it results in even lighter, stronger construction. We can reduce weight from the center of the system by using materials other than wood. My favorite is that marvel of materials science -Styrofoam. The second mount I made used the same basic principle, but I used 1/4" plywood for the bracing instead of 3/4" pine. Then I carefully cut Styrofoam to fill all the gaps, and glued the skins in place. This method calls for even more care in construction: The bolt used to center the azimuth bearing has its own wooden block, which in turn is supported by the ribs. Still, the Styrofoam fits tight to all of it.

There are a few things that can be done to ensure a successful project. The altitude bearing blocks will tend to damage the frame unless they are properly supported. One way is to drill a hole in the styrofoam, insert a piece of dowelling, and put the bearing block on the end of the dowel. You can expect that the load will be spread at a 45o angle from the dowel, so use this as a guide. Six inches of 3/4 inch dowel should be sufficient.

The Stryfoam should be cut on a tablesaw to ensure accurate, square cuts. Be careful when you cut it this way. It doesn't handle as well as wood, and if you let the blade drift, it will chew up your sheet pretty quickly. Practice without power on a couple of times, then cut joints seal. Use a brush or roller to spread the glue. Use only water based finishes, as most solvents will dissolve Styrofoam. Test your finish on scraps first.

With this method, there is a lot of added stiffness and strength. and it is much less succceptable to damage. Overall, the mount I made weighs in under 9 lbs., and supports a full thickness 12" f/6 Newtonian, and has operated successfully for several years. Compared with it's solid wood relatives, the mount is less than 1/4 the weight. Since it' less of a chore to move, it spends more time under the stars - where it belongs.

CENTRE ELECTIONS

The October meeting of the Centre saw the elections of the executive for the 96-97 membership year. The new Executive will be as follows:

- | | |
|---------------------|--------------|
| Honorary President: | David Levy |
| President: | Peggy Torney |
| Vice President: | David Stokes |
| Treasurer: | Kim Hay |
| Secretary: | John Baker |
| Librarian: | Kevin Kell |
| Newsletter: | Kevin Kell |
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Leo Enright |
| Light Pollution
Chair
Chair
Member | John Baker
Joanne Burns
Bill Broderick |
| G.A. | No change |

Observing Winter Meteor Showers

By Cathy Hall

Have you ever tried meteor observing in the wintertime? If you haven't, you are missing some spectacular astronomical events, events that don't require a lot of equipment or expertise to enjoy or record. This winter, we have 4 main showers, as follows, as taken from the 1995 Handbook of the British Astronomical Association:

Shower Late(U.T.) ZHR R.A. Dec.

Leonids Nov.18d 04h 10? 10h 08m +22

'Enhanced activity a distinct possibility. Fast meteors, often with trains. Observations essential this year, despite moonlight.'

Geminids Dec.14d 10h 90 07h 28m +32

'Excellent in 1990 and 1991. Rich shower of medium speed meteors. Many bright events.'

Ursids Dec.23 5 14h 28m +78

'Usually rather weak, but good in 1945 and in 1982 and 1986. Needs observing. Very favourable.'

Quadrantids Jan.4d 05h 100? 15h 28m +50

'Blue and yellow meteors. Diffuse radiant except at peak. Good activity in 1992.'

Note several things. You can see meteors for a handful of days before and probably be the best nights but you never know for sure until you go out and observed ZHR refers to the Zenithal Hourly Rate, the number of meteors you would expect to see per hour per person with the naked eye, if the radiant (where the meteors

'radiate' from in the sky) was right overhead. The R.A. and Dec. positions are for the radiant.

Basically, how do you observe meteors? The most common method is visual. Take a reclining chair outside, with a sleeping bag and several blankets, preferably with a foam, insulating mat underneath your sleeping bag. You'll need paper and clipboard, a watch, a red flashlight, and the proper attire for the winter weather wherever you live.

You see a meteor! You should record the time period you saw it in, its brightness, whether it is a 'shower' meteor (one of the ones listed above), or a 'non-shower' meteor (random meteor), and any comments such as colour, trail left behind, etc.

Most people write up a log sheet ahead of time, marked in 10 minute periods for every hour they are observing. For brightness, we usually try to estimate to the nearest .5 magnitude, based on 'standard' stars. For the winter sky, some of these are:

- 1.5 Sirius
- 0 Capella, Arcturus
- 0.5 Procyon
- 1 Aldebaran
- 1.5 Castor, Regulus
- 2 Alpheratz, Alhena, Benetnasch, Polaris
- 2.5 Zosma, Markab, Phecda
- 3 Cor Caroli, Ras Elased Australis
- 3.5 Metallah, Tania Borealis
- 4 Mu Leo, Chi Ursa Major
- 4.5 Lambda Leo, Delta Ursa Minor
- 5 Eta Ursa Minor

You can write some of these magnitudes on a star chart ahead of time. How do you tell if it is a 'shower' meteor? Trace the meteor's path backwards in the sky to see where it came from. If, for instance, it came from the Leonid 'radiant' as listed above, then the meteor is a Leonid.

You should also record general

observing information your geographical location, local weather conditions, and faintest magnitude star visible to the naked eye.

How about observing with a telescope? Well, you won't see as many meteors generally, as with the naked eye, but telescopic meteor observation is an area that warrants further study. In order to be able to judge magnitudes, you would have to consult an atlas such as the A.A.V.S.O. star atlas, to get some fainter standard stars for the part of the sky you're observing. For major showers - such as the above ones - it would be interesting to point your scope at the 'radiant' point, put in a low power eyepiece, and see what the rates are like!

How can you take photos of meteors? A general rule is to try during a major shower. With higher numbers of meteors in the sky, your chances of getting one on film are better. Set up your camera with a standard lens, on a tripod. Set the lens wide open, set the focus at infinity, put the camera on time exposure setting, and open the lens, preferably using a cable release. High speed film, as least ASA 200 or 400, should be used. If you're in a darker sky, with less sky fog due to urban lighting, use even faster film. Exposures could be anywhere from 5 minutes to 20 minutes or more, again, depending on your sky conditions.

If you know that a bright meteor (0 magnitude or brighter) has gone through your picture, cut that exposure short and advance the film to the next frame. If you capture a really incredibly bright meteor, make notes on the exact time, and any colour or trail or other details. If by any chance, another observer a number of miles away got a photo of the same very bright meteor, characteristics of the meteor, such as height in the atmosphere, can be determined!

What should you do with your observations? If you have extensive detailed observations, consider sending them to the International Meteor Organization, attention Mr. Peter Brown

(XXXX@XXXXXXXXXXXXX) If you're doing observations on a casual basis, please send in a written description to our newsletter, Regulus, so we can all compare notes! The Leonids, especially, are worth keeping an eye on this year. They are noted for incredible storms every 33 years. We are still several years away from the predicted 1999 spectacle, but meteor showers can be unpredictable!

If you have any questions on meteor observing, drop me a note by computer at 9999999@xxxxxxxxxxxxxxxx. I'd be glad to offer suggestions, and help you out!

(C. Hall originally got into astronomy through meteor observing with the R.A.S.C. Ottawa Centre's Quiet Site meteor observing team. She holds the endurance record there, jointly with Dr. Douglas Welch, for the longest non-stop meteor session - 9 hours 30 minutes at 5 degrees F. for the Geminids in 1974.)

December 3 to December 7, and on December 9 the area of this region decreased to .00001 hemisphere, which is at the limit of my observing power. The NOAA USAF coordinates for the region are very close so the average value of my own readings.

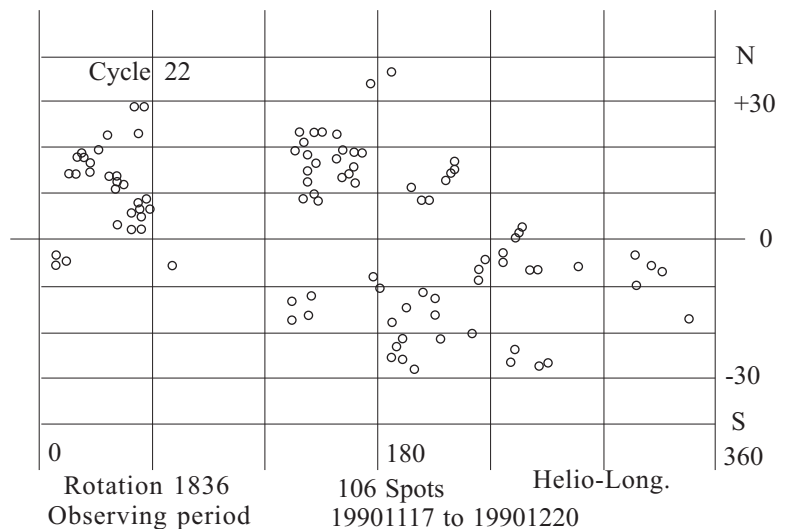
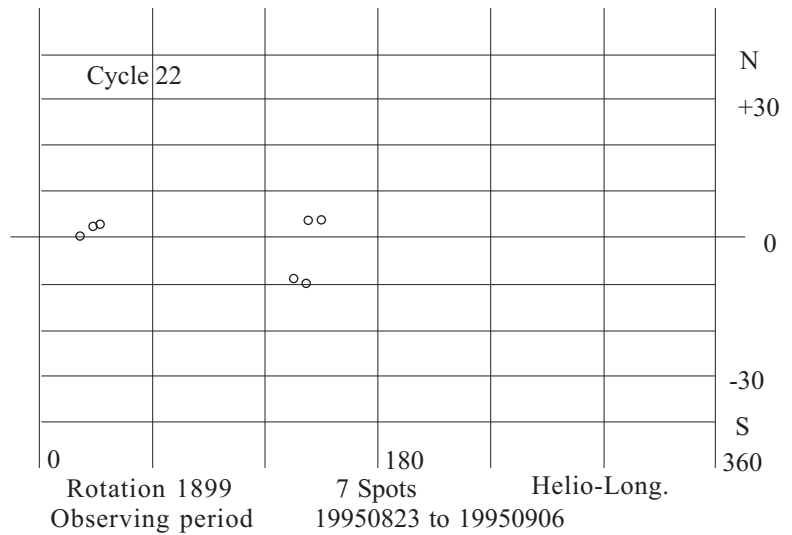
The recent Rotation 1899 had very few spots but the NOAA USAF report noted that region 7899 (latitude +17, helio-longitude 215) had a magnetic polarity reversal and this may represent the first region in the next cycle (Cycle 23). This

region was very small (between 0 and .00001 Hemisphere) and I did not see it. The previous minimum was around the end of 1985 and the beginning of 1986. This means that Cycle 22 is maybe shorter than the average solar cycle. A recent broadcast by the BBC WorldNews gave a news item about the coincidence of a shorter sunspot cycle and a higher Earth temperature. This is perhaps one of the reasons that we had warmer summers during the last years.

SUNSPOTS
By Hein VanAsperen

There are still some sunspots but we are coming close to the minimum of solar cycle 22. When we compare the sunspot map of rotation 1836 (round the sunspot maximum) with a recent map, the difference is very obvious. The number of spots is greatly reduced and the spots are also more centered around the solar equator. The map for rotation 1836 contains Region 6390, about 35 degrees north of the equator. This region has clearly two distinct sunspots. It is interesting to compare my own observations with the information supplied by the joint NOAA-USAF Space Environment Services Center. The center gives the coordinates for the region while I record the coordinates for the individual spots. I have no observations in the period from

Date 1990	NOAA-USAF		HvA OBSERVATIONS				AVERAGE	
	LAT	H-LONG	LAT	H-LONG	LAT	H-LONG	LAT	H-LONG
Nov 29	35	184	36.9	185.9			36.9	185.9
Nov 30	35	181	36.6	185.1	34.3	178.9	35.5	182.0
Dec 01	35	180	36.4	182.1	35.1	176.4	35.8	179.3
Dec 03	35	179	35.0	183.0	33.9	175.0	34.5	179.0
Dec 08	36	179	35.5	176.3			35.5	176.3



**EMBRYONIC STARS
EMERGE FROM
INTERSTELLAR "EGGS"**

Erie, dramatic new pictures from NASA's Hubble Space Telescope show new born stars emerging from "eggs" - not the barnyard variety but rather dense, compact pockets of interstellar gas called evaporating gaseous globules (EGGs). Hubble found the "EGGs," appropriately enough, in the Eagle nebula, a nearby star-forming region 7,000 light-years away in the constellation Serpens."For a long time astronomers have speculated about what processes control the sizes of stars —about why stars are the sizes that they are," said Jeff Hester of Arizona State University, Tempe, AZ. "Now in M16 we seem to be watching at least one such process at work right in front of our eyes."Striking pictures taken by Hester and co-investigators with Hubble's Wide Field and Planetary Camera 2 (WFPC2) resolve the EGGs at the tip of finger-like features protruding from monstrous columns of cold gas and dust in the Eagle nebula (also called M16 —16th object in the Messier catalog). The columns — dubbed "elephant trunks" — protrude from the wall of a vast cloud of molecular hydrogen, like stalagmites rising above the floor of a cavern. Inside the gaseous towers, which are light-years long, the interstellar gas is dense enough to collapse under its own weight, forming young stars that continue to grow as they accumulate more and more mass from their surroundings.Hubble gives a clear look at what happens as a torrent of ultraviolet light from nearby young, hot stars heats the gas along the surface of the pillars, "boiling it away" into interstellar space a process called "photo evaporation. "The Hubble pictures show photo evaporating gas as ghostly streamers flowing away from the columns. But not all of the gas boils off at the same rate. The EGGs, which are denser than their

surroundings, are left behind after the gas around them is gone."It's a bit like a wind storm in the desert," said Hester. "As the wind blows away the lighter sand, heavier rocks buried in the sand are uncovered. But in M16, instead of rocks, the ultraviolet light is uncovering the denser egg-like globules of gas that surround stars that were forming inside the gigantic gas columns."Some EGGs appear as nothing but tiny bumps on the surface of the columns. Others have been uncovered more completely, and now resemble "fingers" of gas protruding from the larger cloud. (The fingers are gas that has been protected from photo evaporation by the shadows of the EGGs). Some EGGs have been pinched off completely from the larger column from which they emerged, and now look like teardrops in space.By stringing together these pictures of EGGs caught at different stages of being uncovered, Hester and his colleagues from the Wide Field and Planetary Camera Investigation Definition Team are getting an unprecedented look at what stars and their surroundings look like before they are truly stars."This is the first time that we have actually seen the process of forming stars being uncovered by photo evaporation,"Hester emphasized."In some ways it seems more like archaeology than astronomy. The ultraviolet light from nearby stars does the digging for us, and we study what is unearthed.""In a few cases we can see the stars in the EGGs directly in the WFPC2 images," says Hester. "As soon as the scar in an EGG is exposed, the object looks something like an ice cream cone, with a newly uncovered star playing the role of the cherry on top."Ultimately, photo evaporation inhibits the further growth of the embryonic stars by dispersing the cloud of gas they were "feeding"from. "We believe that the stars in M16 were continuing to grow as more and more gas fell onto them, right up until the moment that they were cut off from that surrounding material by photoevaporation," said Hester. This

process is markedly different from the process that governs the sizes of stars forming in isolation. Some astronomers believe that, left to its own devices, a star will continue to grow until it nears the point where nuclear fusion begins in its interior. When this happens, the star begins to blow a strong "wind" that clears away the residual material. Hubble has imaged this process in detail in so-called Herbig-Haro objects.Hester also speculated that photo evaporation might actually inhibit the formation of planets around such stars. It is not at all clear from the new data that the stars in M16 have reached the point where they have formed the disks that go on to become solar systems," said Hester,"and if these disks haven't formed yet, they never will,"Hester plans to use Hubble's high resolution to probe other nearby star-forming regions to look for similar structures. "Discoveries about the nature of the M16 EGGs might lead astronomers to rethink some of their ideas about the environments of stars forming in other regions, such as the Orion Nebula," he predicted.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), for NASA, undercontract with the Goddard Space Flight Center, Greenbelt, MD. TheHubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).Image files in GIF and JPEG format and captions may be accessed on Internet via anonymous ftp from ftp.stsci.edu in / pubinfo: GIF JPEGPRC95-44a M16 3 Pillars gif/M16Full.gif jpeg/M16Full.jpgPRC9S-44b M16 1 Pillar gif/M16WF2.gif jpeg/M16WP2.jpgPRC95-44c M16 B&W Detail gif/M16HaBW.gif jpeg/M16HaBW.jpg