

## ART AND ECLIPSES

established in history with customs and norms. These Andean Indians also had established a great deal of accuracy in solar observations and calculations.

But the question still remains, did isolated indians have a way to know what time this eclipse would start? Did they, instead keep a fire burning all day? (unlikely at this altitude to keep gasoline burning all day) If they did know when... then how? Jen Winter

From: Michel-André Levy

Do you really think that a logical behaviour, when an eclipse is announced, is to light fires ? I don't think any of the list members ever did so during an eclipse. There are various reasons for keeping a fire burning during the day. In the alti-plano, I suppose it can be cold. Or may be they wanted to cook something.... So, I would not say that the fires were "obviously" lit because of the eclipse. Michel-Andre LEVY

From: Vic & Jen Winter, ICSTARS Inc.

> I don't think any of the list members ever did so during an eclipse.

...by the Indians.

From: Glenn Schneider <gschneider@mac.com>

In 1981 I observed the TSE from a site near Bratsk, Siberia, along with hundreds of other non-Soviets (this was back in the days of the USSR), selected by a local/governmental coordinating and organizing committee). They thoughtfully were going to provide a post-eclipse lunch at the site. To do so they erected some rather large open-fire grills, and during ingress partial phase began to cook mounds of shaslaks (pardon my transliterative spelling), [large greasy sausages]. The leaping flames flared and the fires smoldered with billowing smoke as they were fed by dripping fat. The greasy billowing smoke would blow toward where we had set up our equipment for the eclipse, with increasing optical density as more food was prepared, and as totality approached. I was REALLY getting concerned. Fortunately, moments before totality, with multi-lingual shouts of beckoning, the fires were finally quenched and did not affect our view (or breathing). So, I agree, it most certainly is NOT "logical behavior" to light fires for an eclipse. But because it is not logical, does not mean it would not be done! Cheers, Glenn Schneider

The Aymara Indians also traditionally told not to look at the eclipse. It is said to "alter a person's soul forever".

From: Evan Zucker <ez@MrTotality.com>

Great story! (Especially because I wasn't there!). I had a similar experience for an ordinary star party. I arranged to bring my telescope to the house of a friend who was blessed with a dark back yard with clear views to the horizon. And what does he do to prepare for our evening of star gazing but start a roaring fire in a fire ring right next to where the telescope is? I told him I'd never let him live it down.

Both in the case of eclipses and my star party, it's simply a matter of ignorance on the part of the locals. It's actually quite logical from their point of view because they think the fire will be warm and inviting on a dark day or night. -- EVAN

From: barr deryl

Upon our arrival at the train depot in Sevaruyo for the Bolivian eclipse of 1994 we were greeted with large bonfires set by the local Indians. According to Ernie Piini in his "Eclipse Over the Altiplano," such a ritual has taken place during solar eclipses for hundreds of years to warm and brighten the earth.

From: Vic & Jen Winter, ICSTARS Inc. <icstars@icstars.com>

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The Aymara indians of the altiplano have a number of traditional behaviors which may not seem logical, but are still tradition. The Aymara Indians also traditionally told not to look at the eclipse. It is said to "alter a person's soul forever".

I went back to the piece of artwork to look at the details again. I noticed that there were two indians; a woman seated by her fire looking away from the eclipse and a man in a hat holding a fire also looking away from the eclipse. In all of our collective 10 trips to the Altiplano, we have only seen one instance where an individual holds fire in his hands. This is part of the ritual and blessing process of the Kallawailla Witch Doctor. The Kallawailla holds a bowl of fire in his hands and repeats incantations to the fire as an act of blessing or inauguration. I would have to look up the special term for this blessing of the Kalawailla. Perhaps the Witch Doctor was performing these blessings in tradition with thier eclipse customs?

The Aymara also set fires on the winter equinox. They believe that their mother earth, PachiMama, is cold and must be warmed by the fires. At one of our star parties at Lake Titicaca, we were present on the 21st of June and fires were lit everywhere. This wasn't great for our seeing, but at least there was no threat of fires out-of-control. The lack of oxygen puts them out almost as soon as they are started.

These indians have set their calendars, agricultural schedules, holidays and rituals based on the calculated movement of the Sun and still practice the ways set thousands of years ago. Their logic may be flawed in thinking that a fire will warm the earth, but the calculations have been accurate for over 6000 years. If their own legends have names, stories and traditions for eclipses, you know they have encountered them. It would be curious to know just how MUCH they know.

We will be talking with a prominent archaeo-astronomer from the region at SSSP in May who has done a lot of research in the area. We will try to query him about any understanding the ancient culture knows about timing of eclipses. This could prove interesting. jen

From: Dale Ireland

I was on one of those trains. Everyone in Sevaruyo was celebrating the Day of the Dead (a three day drunken binge) and to a lesser extent the arrival of money laden tourists, they didn't seem to have a clue about eclipses other than the recent info they were given. I roamed around the town for a couple hours and found that most of the locals didn't care much about the event and the ones who did stayed indoors throughout. I didn't see the bonfires but we were greeting on the way out by a band of rather tipsy musicians and a poorly trained horde of 8 year-old pickpockets.

From: <Jay.M.Pasachoff@williams.edu>

My favorite eclipse fire story took place at the Putre eclipse in 1994, high in the mountains of northern Chile. The night before the eclipse, people started camping on a mountain overlooking this village. They even burned the Coca-Cola sign that people were upset about, recent erected. The newspaper reported on eclipse day that someone burned his feet very seriously by attempting firewalking during the eclipse. It was a headline in a local paper that, unfortunately, I did not get a copy of to keep.

So now I warn people to be careful of their feet catching fire during eclipses--and to stay out of campfires. It is perhaps as important a warning as those about eye protection and ear protection. (The latter has been very serious recently--with loud music playing that would be of more risk of hurting people's ears than the eclipse is of hurting their eyes.) Jay Pasachoff

From: Glenn Schneider <gschneider@mac.com>

I'm 99% sure I have the same eclipse poster! And, I have a a matching tee shirt. I liked it so much, I wore it (the tee shirt, not the poster) for "luck" when I navigated our DC-10 flight in 1992 the year after the Baja eclipse. I happen to have a photo of that in which you can just see a piece of the lizard's tail and the eclipsed sun on my web site: [http://nicmosis.as.arizona.edu:8000/ECLIPSE\\_WEB/ECLIPSE\\_92/NAVIGATE.jpg](http://nicmosis.as.arizona.edu:8000/ECLIPSE_WEB/ECLIPSE_92/NAVIGATE.jpg) Can you tell from the piece of it you can see if it is indeed the same one that you have? Mine is hanging in my bedroom (the poster, not the tee shirt). I have to admit that the bathrooms in my house are the only ones without some sort of eclipse decor. I guess I'll have to remedy that. Glenn Schneider

From: Dale Ireland <direland@drdale.com>

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That Iguana looking at the eclipse was a big hit! I have the poster too, in our bedroom, also the t-shirt and a tank-top which have "Iguana bar" in big letters. The "logo" in Bolivia was a Jaguar with the Sun in its mouth. Dale

From: Mark Friedman <MarkFriedman1@usa.net>

Here is a partial scan of the back of an eclipse t-shirt that I bought in Aruba during the 1998 TSE. Both the diamond ring and the mylar in the lizard's eclipse glasses glow in the dark. Mark Friedman

From: Olivier Staiger <olivier.staiger@span.ch>

Yo ! In Aruba, with Fred's and Ken's (God bless him) group , I saw a lizard (Iguana?) right there , at the beach , an hour before totality. Took a photo of him. See <http://eclipse.span.ch/feb26.htm> , scroll down, and you'll see the Iguana. :-) He did not like the eclipse. Iguanas love to be lazy in the sun, and eclipse means there's no sun :-) Klipsi

From: <Jay.M.Pasachoff@williams.edu>

I took the original request for "art" to mean good art, such as that shown at high quality from the last hundreds of years by real artists in the book of Brunier and Luminet, "Glorious Eclipses." I hope that the discussion of who has what eclipse souvenirs tails off soon. Jay Pasachoff

From: Michael Gill <eclipsechaser@yahoo.com>

<<Are there artists, especially of the 19° / 20° centuy, who have painted eclipses?>>

Hi Nello, An artist of the 20th (and 21st) century who paints eclipses is David Hardy of Birmingham in the UK. His work has been featured in many publications including Sky & Telescope.

He is an eclipse-chaser and he has painted some lovely eclipse scenes. I have his picture "Eclipse over Halemau-mau" (Hawaii, July 1991 eclipse) set as the wallpaper on my PC.

One work, showing what the 1999 eclipse should have looked like at St. Michael's Mount in Cornwall (in reality it was cloudy) can be seen at: <http://www.hardyart.demon.co.uk/images2.html> (Scroll down the page to the third image)

Another Hardy picture, "Eclipse Watchers" shows the Easter Island moai under an eclipsed Moon: <http://www.novaspace.com/DIGI/PIX/Eclipse.f.jpeg> Michael Gill.

From: Mike Murphy <evmurph@zetnet.co.uk>

> Is there a link between eclipses and art?

There sure is.

Yes; Whilst in Cornwall for the 1999 TSE we went to the Tate gallery in St Ives and virtually the whole place was devoted to art that was inspired by eclipses. It was excellent.

I can't remember any particular artists right now, but I expect the gallery will be able to help. They have a web site that can be reached via: <http://www.tate.org.uk/> Regards - Mike

From: Dale Ireland <direland@drdale.com>

This is different thread, obviously. Everyone's view of "art" is different and eclipse memorabilia seems pretty on topic to me. You don't have to read the thread. Most of the readers here are hobbyists and memorabilia is part of the hobby. Dale Ireland

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### ART AND ECLIPSES

From: Sylvain Rivaud <pithecland@chez.com>

> Is there a link between eclipses and art? Are there artists, especially of the 19° / 20° century, who have painted eclipses ? Thank you very much.

Very interesting question... Some other members has already answer, but I can give another names of artists (french artists in particular) who worked about eclipses : Marcel Duchamp for example, with a work entitled "éclipse totale" in his serie "Rotoreliefs" (you can see it at : <http://www.chez.com/lepithec/eclipse/eclipse.gif> - and an animation at : [http://www.chez.com/lepithec/eclipse/eclipse\\_ani.gif](http://www.chez.com/lepithec/eclipse/eclipse_ani.gif)).

A french painter called Muriel Bordes has also painted about eclipses in her serie entitled "Astronomie Populaire" (popular astronomy). One of her painting can be seen in Christophe Lanier's book "Eclipses, mythes & symboles" (1999)... Other references ?? Sylvain, french eclipse chaser, art student, and very bad in english (sorry...)

From: Valentin Kinet

On the occasion of the eclipse of 1999 there was an artist who made two big crossbows. The intention was to let the crossbows follow the sun's path throughout the day and to shoot during the eclipse a n arrow to freighthen the moon. one installatio was put on the berges of the Semois in Bouillon, near the famous castle. The other was placed in Arlon. I don't think all went well because the weather wasn't the best as you know. The installation in Bouillon was now moved to a crosspoint, known as Menuchenet. I think it was better on an other place because now youy have really to seek to find it. But politics and art doesn't go together I think. Valentin Kinet

## GENERAL TOPICS—GREEN FLASH

From: Harvey Wasserman <onsite@gate.net> To: <SOLARECLIPSES@AULA.COM> Sent: Friday, March 30, 2001 12:25 AM  
Subject: [SE] Green Flashes revisited

I just got back from the Florida Keys where I took the kids for spring break. I lived in California for the first 38 years of my life, but never saw a green flash, and thought they were made up. Then the picture sighted previously in the group...

While in the keys, I saw the green flash twice, on consecutive days! It was really a beautiful sight! Without the previous discussion, I don't think I would have bothered to look. Thanks! Harvey Wasserman

From: <Rayabrooks2@cs.com>

As a previous non-believer of the green flash I understand.

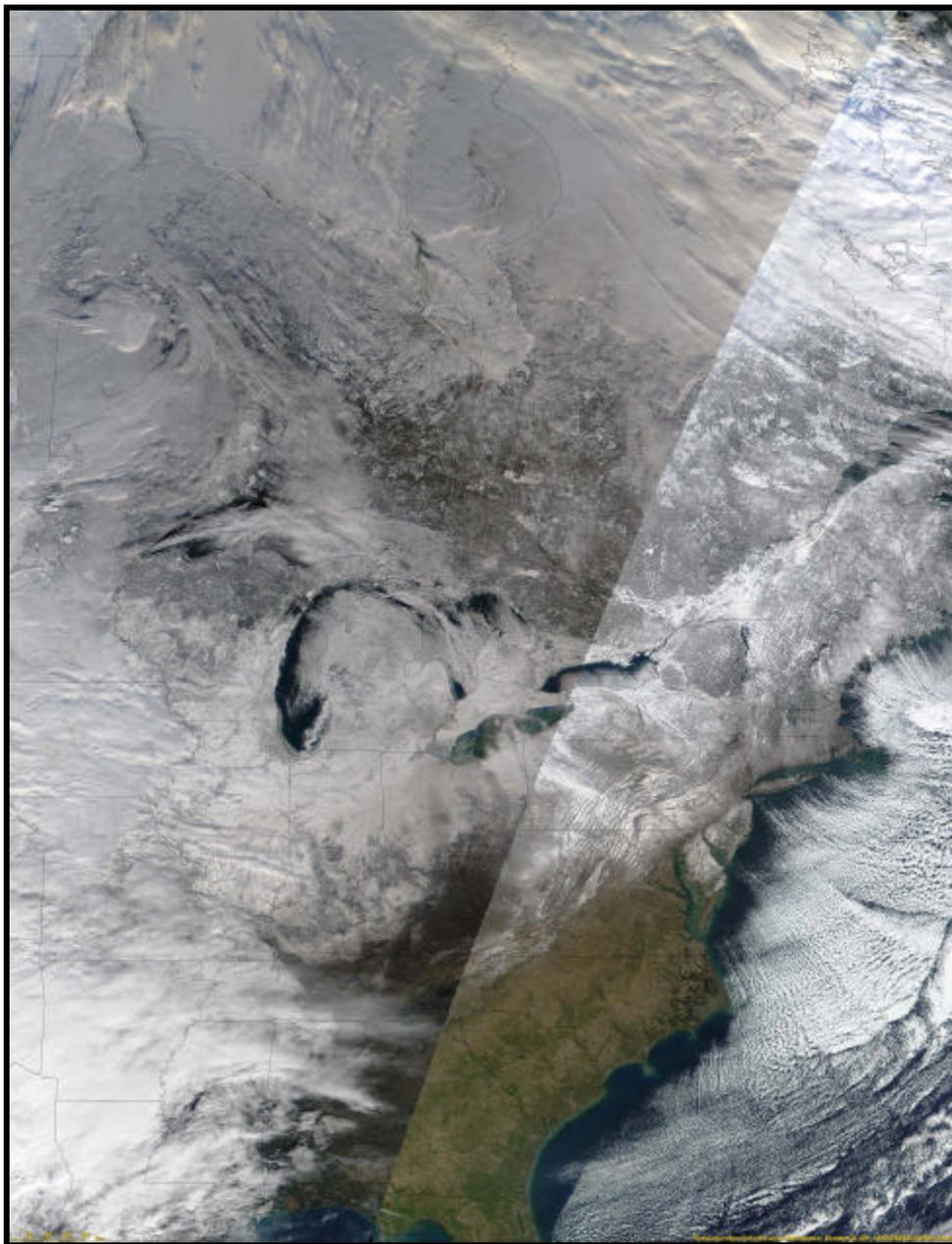
I've seen about 20 so far. July 11 1991 the entire ship saw a beauty green flash sunset about 6 hours following the eclipse.

According to a Navy expert who's name escapes me right now (he has a technical book on optical effects) a blue flash can occur...he is right because I saw 2 spectacular blue flashes in Hawaii on consecutive sunsets in 1987. But he also says that on very rare circumstances it can be violet!!

The blue flashes my wife & I saw were quite long, 2 to 3 seconds, and wide, 6 to 8 sun diameters (3 or 4 degrees). then changed to green lasting longer and even wider. I would love to see a violet flash. Ray Brooks



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**THE CHRISTMAS ECLIPSE—25TH DECEMBER 2001**

From: Bryan Brewer <bryanb@earthview.com> To: <SOLARECLIPSES@AULA.COM>; <eclipse@hydra.carleton.ca>  
Sent: Monday, March 05, 2001 10:36 PM Subject: [SE] **interesting eclipse photo**

NASA's "Visible Earth" project features a composite photo of the surface of the Earth taken from a satellite on Dec 25, 2000. The image "image shows a composite of two adjacent viewing swaths acquired on December 25, 2000 in two consecutive overpasses ... The swath on the left side of the image [acquired at 17:30 UTC (12:30 EST)] is considerably darker than the swath on the right [acquired at 15:50 UTC (10:50 EST)\_eclips] due to the Moon's shadow."

<http://visibleearth.nasa.gov/cgi-bin/viewrecord?7350>

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**DIGITAL LUNAR ORBITER PHOTOGRAPHIC ATLAS OF THE MOON**

The Lunar Orbiter Database can be accessed in the following ways:

- 🌕 List of Feature Names
- 🌕 Search by Feature Name
- 🌕 Search by Photo Number
- 🌕 Search by Coordinate Range
- 🌕 List of Features by Descending N Latitude
- 🌕 List of Features by Descending S Latitude
- 🌕 List of Features by Descending E Longitude
- 🌕 List of Features by Descending W Longitude

**Lunar Orbiter Photographic Atlas of the Moon**

The Lunar Orbiter Photographic Atlas of the Moon by Bowker and Hughes (NASA SP-206) is considered the definitive reference manual to the global photographic coverage of the Moon. The images contained within the atlas are excellent for studying lunar morphology because they were obtained at low to moderate Sun angles. This digital archive consists of the complete set of 675 plates contained in Bowker and Hughes. Images in the archive have been enhanced to display the best photo quality possible. For accuracy and usability surface feature information has been improved and updated, and multiple search capabilities added to the database. More detailed information about the digital archive process can be read in abstracts presented at the 30th and 31st Lunar and Planetary Science Conference.

For questions or comments about this dataset please contact Jeff Gillis at [gillis@levee.wustl.edu](mailto:gillis@levee.wustl.edu).

**FOREWORD CREDITS HISTORICAL INFORMATION**

Consolidated Lunar Atlas

## GENERAL TOPICS

From: <Rayabrooks2@cs.com> To: <solareclipses@aula.com> Sent: Saturday, March 17, 2001 12:25 PM Subject: [SE]  
**Longest Total**

Here is a copy of what I just sent Fred Espenak and Jean Meeus.

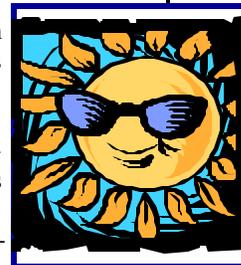
It is an academic point but has me by the throat. If you wouldn't mind reading through the rest of this and let me know your thoughts. It is the question of the longest theoretical total eclipse.

In quite a few authoritative eclipse books/articles, including Fred's & Guy's, it is stated that the longest is 7 minutes 31 seconds, with such and such eclipse only 2 or 3 seconds short of the theoretical max. After seeing that, I simulated it in my program and it is clearly over 7:44. My duration errors are less than 0.6 seconds versus both the NASA TP accounts and Eclipse Complete by Zephyr Services (algorithms very similar to NASA.)

To maximize duration, obviously we bring the moon in and the sun out and tilt local noon to the lunar inclination angle so that the site velocity and shadow velocity vectors are essentially co-linear (greatest eclipse occurring at local noon). The vectors would be more closely aligned over duration time if lunar inclination angle (5.15 degrees) equaled obliquity of the ecliptic (23.4 deg). That would result in a shadow path closely following the Earth's equator (the four hours of Earth moving along its orbit during U1 to U4 would preclude staying precisely on the equator.....the vectors are never exactly co-linear longer than an instant).

JPL Pasadena website has published the minimum geocentric perigee based on ranging data as 356,375 km (221,441.16 miles) which is 25 km less than the typical value of 356,400 but that 25 km difference effects only 0.34 seconds duration. Let's use 356,400 km (221,456.7 mi) for a lower maximum duration value.

There are four days in the present annual orbit of Earth when the planet axis is tilted 5.15 degrees clockwise (CW) or counterclockwise (CCW); 12.54 days before and (roughly) after the June solstice (for this epoch) and 11.78 days before and (roughly) after the Dec solstice. These plus/minus values change over time as orbit eccentricity varies (orbit speed near the solstices). We discard December (for this epoch) because the sun is closer and larger; the larger 'holidays' sun stealing about 2 and a half minutes of duration and concomitant faster solar angular speed replenishing only about 3 seconds of it.



Aphelion for our present epoch around July 4 is extremely close to 12.54 days after the June solstice; it is more favorable than June 8 but a June 8 eclipse would still be excellent. Obviously the difference between the tropical and anomalistic years will spread the dates of aphelion and solstice apart over time; e.g. year 5500 solstice June 20 & aphelion late August, year 9000 aphelion in October.

From a holistic viewpoint, the solstice stays near late June as June precesses clockwise toward Leo and aphelion 'generally' stays in the direction of Sagittarius as eccentricity wavers over a very long period of about 3 precession years (a precession year being about 26,000 years). In half a precession the optimal tilt periods (when aphelion is near the 5.15 deg tilt date) will be about 12 days before December solstice (12,000 years from now) and 12 days after December solstice (14,000 years from now). 24,000 years from now aphelion will be about 12.5 days before June solstice, 26,000 it's back to our present circumstances. What eccentricity value to use? It has a huge effect. I am using today's value; more below.

The closest perigee moon has a fixed angular velocity (in ecliptic longitude) of 0.64 arc-seconds/second (this is one of my program weak spots, Meeus indicates angular velocity accuracy is about .005 degrees per day or about a tenth second duration). This is a geocentric angular velocity relative to a moving aphelion sun of close to 0.60 arc-seconds/second or geocentric lunar velocity of 2317 MPH.

Is there some kind of solar system harmonic that would preclude close perigees (as opposed to the more common mediocre perigees) from occurring during or near aphelion? Seems not to be. I counted at least 30 very close perigees on aphelion day that will be under 221,500 miles over the next 66,000 years.

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So far we have a close moon, a far sun and a day that is tilted correctly. Now where is the optimal site? It is about latitude 4.8 degrees (north now, south in 13,000 years). The Earth is tilted 22.9 degrees away/toward the sun when tilted 5.15 CW or CCW. So the closest site to the moon (sub-lunar pt., the largest shadow) is at that latitude of +/- 22.9 degrees. But 22.9 deg has a lower tangential velocity than those sites nearer the equator. The best point is a balance of speed and size. Thus the best timing is not exactly during node passage but about 5 hours before/after node passage (present epoch: before passage) to allow the umbra to cross lower latitude parallels. So, curiously, the optimal eclipse is not with the sub-solar point coincident with the sub-lunar point). But it is precisely at local noon. Usually greatest eclipse is not at local noon.

Put all optimums together:

Moon distance geocentric 221,456.7 miles,

Moon angular speed 0.597"per second relative

Shadow speed, 2322.8 MPH vs. fundamental plane at 5.29 deg inclination

Sun distance 94,507,322 miles

Best tilt is 5.2924, (5.15 plus 0.1424, moves optimal site at bit closer to equator)

Latitude 4.83 degrees (north or south)

Longitude Local noon

Site velocity 1036.8 MPH vs fundamental plane at same 5.3 deg inclination Relative velocity 1286 MPH, 0.35723 miles per sec Shadow minor diameter 166.21 miles Duration 465.3 secs or 7m 45.3s

The 173 day period for lunar inclination variation of 5.15 deg, +/- 0.15 deg is not much of a factor in terms of duration (0.04 secs). It has more of an effect on time difference between aphelion date and inclination matchup date (+/- 9 hours of Earth orbit)

A better illustration of all this is by taking the July 16, 2186 eclipse with a duration of 7:29, touted as only 2 seconds short of maximum, and tuning it up.

The moon at greatest eclipse is at a geocentric distance of 222,039.88 miles (my number, please verify, possibly a 12 mile error); quite close but not optimal.

1) Bring it closer to 222,456.7 miles and shadow size grows from 161.2 miles minor diameter to 166.5; net effect 13.11 additional seconds 17.16 secs increase with shadow growth, 4.05 sec loss from faster lunar angular velocity Duration up to 7:42.1

2) Bring sun from 94,488,581 mi to 94,507,214 miles (Aphelion was July 7, 2186 07:00 UT at 94,502,526) Enlarges shadow from 166.5 to 166.9 miles Duration now 7:43.2 (smaller sun, +1.1 secs, slower sun -0.01 sec Using eccentricity in year 2186, 94,502,526 mi. duration would be 7:42.9

3) Match Earth axis tilt with lunar inclination. Change tilt value from 10.16 deg for July 16 2186 to 5.29 deg (12.1 days sooner in orbit) Site velocity vector (relative to fund planes) Changes From: 172 mph up, 1016.9 horizontal To: 84.3 mph up, 1027.9 horizontal Relative velocity (shadow to site) reduces From 1,297.4 mph to 1,292.3 mph Duration now up to 7:44.3

4) Now move site from 7.44 north latitude to 4.81 north Although the shadow diameter shrinks from 166.7 to 166.2 (0.301%) The relative speed lowers from 1292.3 mph to 1287.2 mph (0.396%) Duration up to 7:44.8

5) The last tweak is to adjust longitude (hour angle) because now greatest eclipse is local noon. Goes from a morning greatest eclipse to noon. Angle hour goes from 0.1 hours (1.55 degrees) to zero. Duration 7:45

If we had used the lower perigee value from JPL it would be 7:45.3 So I think 7:31 duration is way off.

One could argue that aphelion simply does not occur the day of tilt matchup in year 2186, but had the same eclipse occurred at aphelion July 7 2186 even without tilt matchup, (i.e. same lunar distance) duration would have been 7:31.3. If

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in addition the moon had been the minimum perigee (583 miles closer), duration would be over 7:44.

A clunky way to look at things but it should be valid. So what are the opportunities down the road?

JPL says the moon is moving away about 2 inches per year. For a given epoch the lunar angular velocity is a simple function of  $1/(r \text{ squared})$  but as it recedes the velocity of the higher average distance follows  $(T \text{ squared}) / (r \text{ cubed})$ .

In round numbers it will take the moon 3.2 million years to recede 100 miles; reducing the theoretical duration by 2.7 seconds each 100 miles ( -2.9 due to distance, +0.2 slower moon). To shave off 14.3 seconds (7:45.3 to 7:31) would take roughly 17 million years, that is about 650 full precessions of Earth, each half precession presenting many chances to match aphelion, tilt, gamma, perigee.

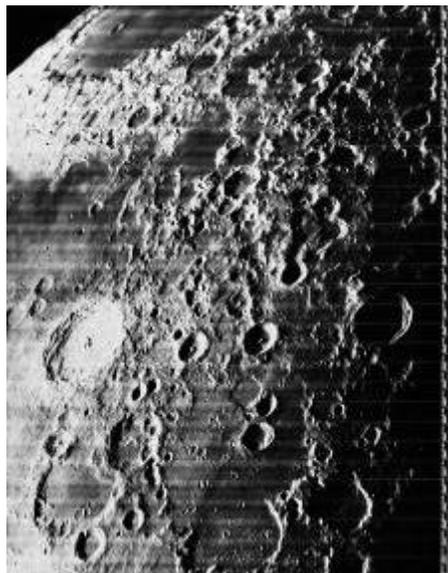
The tilt matchup we enjoy now will exist four times for each precession year, before and after each solstice; that is 2600 (650 x 4) tilt matchup seasons. If the moon orbit precessed at a fixed value of 5.15 degrees there would be only an instant of time in the 26,000 year 'precession-year' where tilt matchup and aphelion coincided. Due to the wobble (173 day nutation period) each matchup season lasts about 58 years when matched tilts can exist precisely at aphelion. But that is not critical. There are many opportunities for close tilt matching in the years before and after these 58 years when sun distance is not at aphelion but darn near it; i.e. sun distance over a given Earth orbit arc changes the least near aphelion.

In fact, that is exactly what is happening now. In 2001 we are within, but leaving, this 58 year window. Right now we can attain the tilt after July 4 but we don't get a super long eclipse in 2001 because the rest of the eclipse recipe is not tuned up. In 2186 although Earth has precessed away from the window the sun is still quite distant. So it is important to be near the window but you do not need to be in it.

With the oscillation of Earth orbit eccentricity reaching as high as 1.06 in 64,000 years, the sun could be 98.6 million miles away increasing duration to 11 mins 35 secs. The 64,000 years of time would only shave off 0.05 seconds of potential max duration based on the moon receding. But I always felt that by theoretical limit everyone meant with present perigee, present eccentricity, etc. Aphelion at present epoch is 94,507,322 miles, in 2186 it is 94,502,526.

And bigger is not always better. If the lunar orbit was so eccentric it could six-fold the moon's size it would certainly be dark for long (about 20 minutes) but it would not seem like an eclipse, more like standing behind a building.

Please let me know your evaluation, whether I am way off base or essentially correct. It is very important to me. Eclipses are a source of comfort for me in a wacky world!



Lunar Orbiter Database: Vendelinus Photo Number IV-184-H1

Feature Name: Vendelinus  
 Feature Latitude: 16.4°S  
 Feature Longitude: 61.6°E  
 Size: 131 km  
 Sun Angle: 83.1°  
 Spacecraft Altitude: 5790.16 km  
 Medium Photo Center Latitude: 35.18°S  
 Medium Photo Center Longitude: 69.32°E

\*Listed feature names are IAU approved and listed coordinates are IAU assigned.

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We are going with TravelQuest who has managed to secure the help of Jay Anderson for meteorology. Although he will be in Madagascar, we will be in contact. The day before the eclipse a number of TravelQuest groups (approx 400 people) will conjoin in camp near Lusaka and overnight 7.37 miles off centerline. I worked fairly hard on TravelQuest to get us there the day before. Clear skies. Raymond Brooks

From: Jean Meeus <JMeeus@compuserve.com>

This is a short reply to the message of Raymond Brooks. I could not examine in detail all what he writes, but I think I have found the error in his reasoning.

Brooks considers the total solar eclipse of 2186 July 16. The maximum of this eclipse will occur at 15:15 Dynamical Time, and at that instant the distance between the centers of Earth and Moon will be 357346 kilometers. I made the calculation using Chapront's lunar theory. Taking 1 mile = 1.6093 kilometers, we get a distance of 222051 miles.

Now, Brooks writes : "Bring the Moon closer to 222456.7 miles. Clearly there is a typing error here, as 222456.7 is \*larger\* than 222051. Maybe he meant 221456.7 instead?"

In Chapter 3 of my 'Mathematical Astronomy Morsels' (Willmann-Bell, ed.) I mention the least distance between the centers of Earth and Moon during the period A.D. 1500-2500. This record distance is 356371 kilometers, on 2257 January 1.

Now you could say : "Bring the Moon closer to the Earth, from 357346 km (the distance at maximum eclipse on 2186 July 16) to 356371 km (the least possible distance). That would increase further the diameter of the Moon's shadow at the Earth's surface."

However, this is just impossible. In said Chapter 3 the extreme perigees of the Moon (< 356425 km) during the period 1500-2500 are mentioned. It appears that all these extra short perigee distances occur during the period of the year from December 6 to February 9, that is, during the period when the Earth is near the perihelion of its orbit.

You never can have simultaneously the Moon at an extreme perigee and the Earth near aphelion. This is, as far as I can see, the error in Brooks' reasoning. A good example of how a 'correct' arithmetical reasoning is in contradiction to the physical reality...! Jean Meeus

From: <Rayabrooks2@cs.com>

Thank you Jean Meeus. Yes, that was the error I made. I had performed a search of perigee moons for July 4 which is

not always or even usually when aphelion occurs over the eons. I had even noted that fact in the presentation...once again not seeing the forest for the trees. And I am even aware that the closer perigees cluster around perihelion...so I have absolutely no excuses for my ignorance.

The funny part is after I sent the email, I had continued re-searching and Encyclopedia Britannica states in their macropedia that circumstances can allow for duration as high as 7:40 so then I really thought I was onto something. Not the first time victim of wishful thinking.

Thanks again. And now all seems right with the cosmos. Sincerely Raymond Brooks

From: <JohnLX200@aol.com>

Raymond, First, let me say that you've obviously put a lot of thought into this, and I personally appreciated hearing every word of it. It might give me something to think about on the airplanes between here and the eclipse.

Second, let me say that I have great respect for Jean's accomplishments. He's literally the guy who wrote the book on this sort of thing, and I own some of them. I personally appreciate that, as well.

Now, let's get down to business: If I were you, I'd not give up so easily.

Jean's argument stated certain data for only a 1000 year timespan, rather than any underlying analysis of the physics, or the data over a timespan of the same order of magnitude you were speaking of. I'm sure he has a good understanding of the physics and math behind it all, but I didn't see any of it given in his explanation. And if I had, I would be curious as to whether it was derived from analysis of the equations of motion, or from the empirical results over a given timespan.

You were talking about input variables varying over timespans such as 1 cycle = 3 x 26,000 years; millions of years giving us many of those cycles for different things to happen; and other long-term possibilities for favorable and unfavorable variations and trends to all have their day in the sunlight...or better yet the shade.

Perhaps the closest perigee over millions of years is little different from the period 1500-2500 AD. Perhaps not. The crux of the matter was perhaps best addressed by your comment:

\*\*\* Is there some kind of solar system harmonic that would preclude close perigees (as opposed to the more common

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## GENERAL TOPICS

mediocre perigees) from occurring during or near aphelion? Seems not to be. I counted at least 30 very close perigees on aphelion day that will be under 221,500 miles over the next 66,000 years. \*\*\*

I wouldn't limit the above question just to (resonances and) harmonics, but to all dependencies between the variables under examination. If they are independent, then you are correct that it is possible, and it boils down to possibilities vs. probabilities vs. reality. If they are dependent, the possibilities are reduced...or perhaps (albeit less likely) increased!!

It seems to me that Jean's close examination of the (essentially random) 1000 year timespan centered on the current day does nothing to disprove your range of results over 66,000 years, much less the much longer time periods into the millions of years you were examining before the moon's receding distance becomes significant.

More work obviously needs to be done before declaring your result impossible.

Perhaps it only requires documenting the dependencies of the various variables to show that you're wrong. Certainly it would be worthwhile to develop a model for the physically possible maximum and minimum values for lunar perigee, each as a function of the distance of the Earth/Moon system's center of mass from the sun. Then expand it to include the other variables as inputs.

On the other hand, perhaps it only requires finding an example somewhere between 7:31 and 7:44 to show that you were on the right track but that the most optimistic of circumstances might be impossible due to dependencies. These could reduce the magnitude of the gains which you so eloquently showed are possible if all the examined parameters were independent, and forced to the most optimistic values simultaneously....and the question remains as to what value they are reduced to.

I'd also consider working the problem backward in time rather than forward, to gain the added advantage of a slightly closer moon. Or would that be cheating? Perhaps a reasonable compromise is to assume both bodies are perfectly rigid with no tidal energy losses. This would keep the Earth's rotational rate and Moon's distance much more constant while the other variables get a very long time to try out their permutations.

If a 7 minute 36 second TSE happened 1.8 million years ago and no humans were there to see it, nor to give us Delta T to show where it happened, nor to verify where the poles were pointed, would it still count as a real eclipse? As we go farther back in time, should we examine the range of possible

effects of impacts, different tidal effects due to continental drift, land formation, rise and fall of sea levels, etc.? How sure are we of the solar radius in the distant past and future? And so on.

But first, if we want to talk about the results of using simple assumptions over long periods of time, we need to "run the numbers" over that period of time and see what they are. Then we can debate whether it is fair to say "if by coincidence at the time of the great eclipse of 6.789012 million years BC, the North Pole had happened to be at current coordinates of 88.2N and a specific longitude relative to local noon at maximum eclipse, it could have lasted 7 minutes 40 seconds" John Hopper

From: Jean Meeus <JMeeus@compuserve.com>

As a response to the message of John Hopper, I can tell that I indeed derived the least distance between the centers of Earth and Moon, during the period 1500-2500, from "empirical results", using the "brute force" of the computer.

I did \*not\* analyse the equations of motion. I must confess that such an analysis would be beyond my capacities... :-)

On the other hand, it should be noted that an analysis over millions of years, as proposed by John Hopper, would not make sense. Indeed, even during a much shorter time span does the eccentricity of the Earth's orbit vary significantly.

That eccentricity, which is now equal to 0.0167, in presently decreasing. It will reach a minimum of 0.0023 about A.D. 29500. There will be another, still deeper minimum, 0.0006, about the year 465,000. Then the Earth's orbit will be almost exactly circular. But at other times, the eccentricity can be as large as 0.06.

Therefore, the statement that the longest possible duration of a total solar eclipse is 7 minutes 31 seconds, is valid only for the present time. That maximum possible will change over time, as the eccentricity of the Earth's orbit vary between almost zero and about 0.06. However, I did not calculate how much the variation will be. Jean Meeus

From: Harvey Wasserman <onsite@gate.net>

> If a 7 minute 36 second TSE happened 1.8 million years ago and no humans were there to see it, nor to give us Delta T to show where it happened, nor to verify where the poles were pointed, would it still count as a real eclipse?

and if a man said something while alone in the forest with no one to hear him, would he still be wrong? sorry, couldn't resist. flames accepted. Harvey

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## GENERAL TOPICS



From: <Rayabrooks2@cs.com>  
That is one of my favorite lines but I heard it this way.....

If a husband said something while alone in the forest with no wife to hear, would he still be wrong?

Absolutely! She would find out somehow.

The line from "My Fair Lady"....with a little bit o' luck, the bloodhound

won't find out. Thanks, Ray Brooks

From: FRED ESPENAK

"Totality: Eclipses of the Sun" (Littmann, Willcox and Espenak) quotes the theoretical maximum for the duration of totality as 7 minutes 31 seconds (page 22). This figure comes from a oral paper by Isabel M. Lewis (U. S. Naval Observatory) which she delivered at the forty-second meeting of the American Astronomical Society (1929). Unfortunately, the paper was never published but I do have the abstract for it. Lewis says (in part):

"Calculations were made to test out various combinations of circumstances with a view to obtaining the maximum duration. It appears that the most favorable combination of circumstances possible at least for some centuries to come, will occur early in the month of July; when the sun is at or near apogee; when the moon is at perigee and at its ascending node and its latitude is 24 minutes South; and when the observer is on the equator. A computation for such a combination gave a value of 7m31.1s with the formulae and constants employed in calculating the duration of total eclipses given in the American Ephemeris."

I want to point out the web page I have devoted to the longest total and annular eclipses during the 7000 year period from 3000 BC to AD 4000. The web page address is: <http://sunearth.gsfc.nasa.gov/eclipse/SEcatmax/SEcatmax.html>

The longest central solar eclipses of this period are:

Longest Total Solar Eclipse: 2186 Jul 16 Duration = 07m29s  
Longest Annular Solar Eclipse: 0150 Dec 07 Duration = 12m24s

We are "fortunate" that the longest total eclipse during this seven millennium period occurs only 185 years from now! - Fred Espenak

From: Francis Graham <francisgraham@rocketmail.com>

Dear Fred and List, As you state the longest eclipse in 7

millennia will happen in 185 years, it is interesting to note what 185 years means in human terms. I was fortunate to have been reared by my great-grandparents and grandparents, fine 19th and early 20th century people. Some very older people they knew when they were very young told them stories about older people those people knew when they were very young. Thus, if you have a good family reputation as an eclipse chaser, it is just possible that someone in your direct or collinear descent in 2186 will mention your name as someone they, when young, heard about from older people who learned about you when they were very young from their great-grandparents. Likely the remembrance will come as the eclipse is being discussed as the news of the day, of course by what medium we have no clue. Speaking of which, alas, in 185 years much in NASA will be so deeply archived or lost, Fred, even your legacy may be just a rare book here and there. Electronic correspondence like this will be total entropy. Makes me depressed, but such is the passage of time. Francis Graham

From: Carton, WHC <Wil.Carton@corusgroup.com>

Fred, Is this difference caused by deep valleys near the lunar south pole, that have no counterparts near the lunar north pole? If yes, that is astonishing, because near the lunar south pole are the Doerffel and Leibnitz Mountains. High peaks indeed, but also very deep valleys? Or am I wrong? Regards. Wil Carton.

From: FRED ESPENAK <u32fe@lepvox.gsfc.nasa.gov>

The 'maximum duration' shift north of the center line is due to two factors.

First, the south polar region is indeed much more rugged than the north limb with both high mountains and deep valleys. Take a look at the limb profile on page 40 of the NASA 2001 eclipse bulletin. Now remember that the path limit is due to the valleys, NOT the mountains.

The second cause of the shift is due to the fact that my center line path is calculated with respect to Center of Mass, rather than Center of Figure. So I do not add a somewhat arbitrary shift to the Moon's declination to account for the Center of Figure. I much prefer to do a rigorous limb profile analysis to determine the limits and maximum duration wrt the Center of Mass center line. - Fred

From: Harvey Wasserman <onsite@gate.net>

Fred, perhaps you would say a bit more about Figure 8, page 40 of the bulletin. I have tried to puzzle it out several times. There is apparently a wealth of data there.

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## GENERAL TOPICS

It appears that the "True Limb" is the true profile of the moon at maximum eclipse, but at an exaggerated scale, right?

Do the N S E W refer to lunar N S E W? Are the valleys being referred to below the same as those seen in the ESE and SE of the True Limb? If so, what part does the valley in the NNW play? Are these the areas that we may expect to see Baily's Beads?

The "center of Mass" is offset from the "Center of Figure" to the NW. Is this what you are referring to as the second reason below? If so, would both the actual duration and the actual time of max eclipse for any given location actually shift not only N, as discussed, but also slightly to the East?

What is the significance of the "Zenith"?

The Sun and Moon at Maximum Eclipse have slightly different R.A and Dec. Is this also a factor in the theoretical maximum eclipse? IE., in a "perfect" eclipse, these values would be identical?

How are the "Time Correction Curves" used?

A great chart, Fred! I would just like to be able to use it, or at least understand it better. Thanks, Harvey Wasserman

From: FRED ESPENAK <u32fe@lepvox.gsfc.nasa.gov>

>Fred, perhaps you would say a bit more about Figure 8, page 40 of the bulletin. I have tried to puzzle it out several times. There is apparently a wealth of data there.

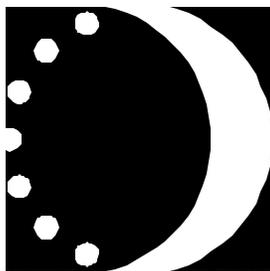
>It appears that the "True Limb" is the true profile of the moon at maximum eclipse, but at an exaggerated scale, right?

Yes, that is right.

>Do the N S E W refer to lunar N S E W?

No. The labels N S E and W refer to directions on the celestial sphere. That is, they correspond to the motions/directions of an equatorially mounted telescope.

The large arrow (near the top) labeled 'North' is actually the Moon's north pole. It lies only 1.6 degrees east of celestial north during this particular eclipse for the given place and time. However, the Moon's north pole can vary up to ap-



proximately 28.5 degrees (plus or minus) with respect to celestial north depending on the time of year and whether the Moon is at its ascending or descending node.

The reason why the Moon's axis lies almost due north on the celestial sphere during the June 21 eclipse, is because it is the Summer Solstice!

>Are the valleys being referred to below the same as those seen in the ESE and SE of the True Limb? If so, what part does the valley in the NNW play? Are these the areas that we may expect to see Baily's Beads?

The appearance of Baily's Beads depends primarily on three factors:

- 1) the lunar limb profile
- 2) the relative sizes of the Sun and Moon
- 3) the observer's position with respect to the center line

Relatively speaking, the lunar limb profile does not change very much during the several hours it takes the umbra to sweep across the Earth.

A larger variation is the relative size of the Sun with respect to the Moon. Just consider a hybrid (annular/total) eclipse to convince yourself of this fact.

However, the largest and (by far) most important factor in the appearance of Baily's Beads is your position in the path with respect to the center line. When you are on the center line, the position angles of second and third contact occur 180 degrees apart on the lunar limb. But as you move south wrt the center line, the position angle of second contact rotates counter clockwise while the position angle of third contact rotates clockwise.

Since the contacts now occur along a different sections of the lunar limb (as your geographic position shifts wrt center line), a different set of lunar features will then determine the appearance of Baily's Beads.

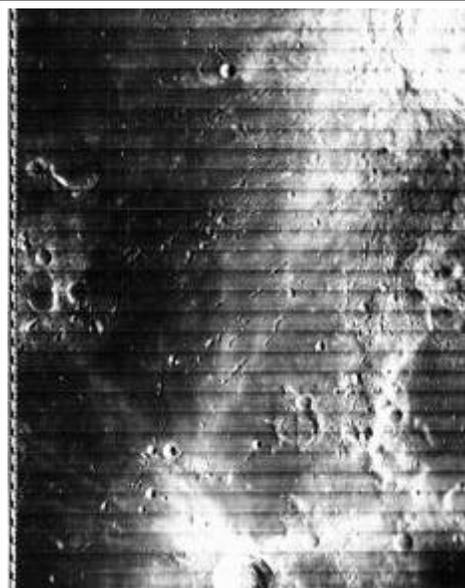
The second and third contact angles gradually get closer and closer together as your position changes from center line to southern limit. When you actually reach the southern limit, then second and third contacts are theoretically identical and totality begins and ends at the same instant.

The second and third contact points move in the opposite direction (in the above example) when you travel north of the center line.

I think that with this explanation, you can now see why the

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## GENERAL TOPICS



Lunar Orbiter Database: Vendelinus  
Photo Number IV-053-H2

Feature Name: Vendelinus  
Feature Latitude: 16.4°S  
Feature Longitude: 61.6°E  
Size: 131 km  
Sun Angle: 65°  
Spacecraft Altitude: 2740.23 km  
Medium Photo Center Latitude: 14.82°S  
Medium Photo Center Longitude: 56.82°E

\*Listed feature names are IAU approved and listed coordinates are IAU assigned.

NASA eclipse bulletins do not give specific predictions for the appearance of Baily's Beads. Such predictions would be highly dependent on the observer's actual position in the path (both in time and geographic position).

>The "center of Mass" is offset from the "Center of Figure" to the NW. Is this what you are referring to as the second reason below? If so, would both the actual duration and the actual time of max eclipse for any given location actually shift not only N, as discussed, but also slightly to the East?

The difference between "Center of Figure" and "Center of Mass" does shift the central position of the Moon as you note. However, at this level the over-riding factor in the timing and duration of totality is the lunar limb profile.

>What is the significance of the "Zenith"?

Figure 8 is calculated for the center line position at 13:00 UT. The arrow marked "Zenith" is then the direction of the zenith at that instant and geographic position. In other words, if you hold Figure 8 in front of you and rotate it so that "Zenith" is up, it will match the orientation of the Sun and Moon at that time.

>How are the "Time Correction Curves" used?

There's a pretty thorough discussion of this in the bulletin. First, you need the position angles of second and third contact ('P2' and 'P3', respectively). These are listed for hundreds of geographic positions in tables 9 through 15. If your geographic location is not listed in these tables, you can estimate the position angles using the explanation on pages 6-7.

Once you have the position angles of second and third contact, you can use the "Time Correction Curves" in figure 8. An example of how to do this is given for Lusaka on page 9 (middle of page). Hope this helps. - Fred Espenak

From: Glenn Schneider <gschneider@mac.com <mailto:gschneider@mac.com>>

To: <SOLARECLIPSES@AULA.COM <mailto:SOLARECLIPSES@AULA.COM>>

Sent: Tuesday, March 20, 2001 9:03 PM

Subject: Re: [SE] Maximum Duration NOT on the Center line

> Apropos of my earlier comments on this thread, and Fred's recent

> posting on this subject, it has come to my attention that the 21st

> century is indeed upon us and the Lunar Orbiter Photographic Atlas

> of the Moon has been digitized and on the Web.

>

> <[http://www.lpi.usra.edu/research/lunar\\_orbiter/](http://www.lpi.usra.edu/research/lunar_orbiter/)>

>

I have been browsing through the on-line version while comparing a number of digitized images to the hard copy productions of the plates in my Atlas. The fidelity of the digital reproductions is very good. If you want to see what selenographic features give rise to the topology of the limb as tabulated in the Watt's data you should take a look at the above. While we are used to seeing limb-features edge-on, Lunar Orbiter gave us a unique prospective. My copy of the big blue Lunar Orbiter Atlas is one of my prize possessions. It is wonderful to see that these images are now readily available at the click of a mouse! Thanks to Jeffery Gillis for compiling this, and to NASA for a spectacularly useful mission which produced a wealth of data beyond the primary scope of the selection of the Apollo landing sites. When you are enjoying the few extra seconds of totality (or a prolonged diamond ring, or Baily's beads, if that is your preference) by the application of the data routed in these images, remember your tax money (or those of your parents and grandparents for the younger ones on list list), was well spent (well, for those of us in the U.S., anyway, others got it for free!) Cheers, Glenn Schneider

## GENERAL TOPICS

### ECLIPSE RELATED TOPICS ONLY PLEASE.....

From: Patrick Poitevin <patrick\_poitevin@hotmail.com> To: SE Mailing List <SOLARECLIPSES@AULA.COM> Sent: Thursday, March 29, 2001 6:59 PM Subject: [SE]

#### Off topic messages on the SEML

Dear All, Although the attempt is there to send non solar eclipse related messages to the entire list, before sending them to the SEML, including excuses to me or to others, please send the message first to me so we can discuss. Messages appearing on the SEML, and non solar eclipse related will put off professional observers who are subscribed for solar eclipse related messages only. It is too often that you excuse on the list (which is to be honest a bit cheeky isn't it?).

I hope you understand and thank you very much for your understanding.

PS: I used to be on astro lists, though I do not have the commands anymore. Please check via the archive lists where you will find all kind of mailing lists, including how to subscribe and all archived messages: [www.astroarchive.com](http://www.astroarchive.com)

PS2: In regard of political situations in eclipse countries, please refer to WebPages, mailing list or ask people to send you a private mail, so you can brief them about your findings. Long and continuous mails end most of the time about non solar eclipse countries and all their grieves.

PS3: No, I repeat NO attachments to the SEML please.

If any comments, please send them off list. If you want to spread your griever anyway, ask me to put your message in the Solar Eclipse Newsletter.

and.... keep those solar eclipse related messages coming... Best regards, Patrick



From: Victor Reijs <victor.reijs@MYSELF.COM> To: <HASTRO-L@WVNVM.WVNET.EDU> Sent: Wednesday, March 07, 2001 10:58 PM

#### Subject: orbital parameters of sun/earth and moon

Hello all of you, This is a little of topic, but I hope that someone can provide me a link to this information (off-line). I have the orbital information of sun/earth and moon for epoch 2000 CE. But I am also looking for this information lets say for epoch 3500 BCE (see: <http://geniet.mypage.org/moonfluct.htm>). Or are the orbital parameters still the same (can't imagine).

Who can help me with a lead? All the best, Victor

From: Larry Ely <ldely@CROCKER.COM>

Victor, I would recommend that you read Robert R. Newton's The Moon's Acceleration and Its Physical Origins, Volume 2, The Johns Hopkins University Press, Baltimore, 1984. Therein you will find expressions for the mean longitudes of the Sun and Moon, plus an expression for delta-T based on observations back to c. 1000 BCE. You could use Newcomb's and Brown's expressions for the other elements of the Sun and Moon respectively. Larry Ely

From: Joachim Draeger <draeger@informatik.tu-muenchen.de> To: <SOLARECLIPSES@AULA.COM> Sent: Wednesday, March 07, 2001 9:38 PM Subject: [SE]

#### Polarized E-Lines

Hello together, I have a question concerning polarized emission lines of the solar corona. Which are the most important ones? I know the 530.3 nm line, are there other examples?

Background of this question is my intention to make some corresponding measurements during the total SE in June of this year. What is a good source for narrowband interference filters? Joachim

From: <Jay.M.Pasachoff@williams.edu>

The two major lines in the visible are 530.3 nm (coronal green line) and 6374 (coronal green line).

See, for example, <http://www.stecf.org/~rfosbury/home/photography/Eclipse99/csp.html> and [http://www.stecf.org/~rfosbury/home/photography/Eclipse99/csp\\_description.html](http://www.stecf.org/~rfosbury/home/photography/Eclipse99/csp_description.html)

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## GENERAL TOPICS

Leon Golub and I describe coronal emission lines in our advanced book "The Solar Corona" (Cambridge University Press). I hope you will all read a popular treatment in our new book for general readers, "Nearest Star: The Exciting Science of our Sun" (Harvard University Press, 2001), to be published in early May. Jay Pasachoff

From: Joachim Draeger <draeger@informatik.tu-muenchen.de>

Hello again, a supplementing question concerning the observation of coronal emission lines (polarized and unpolarized). Does it make sense to observe these lines (ok, the stronger ones) with interference filters having a bandwidth of, say, 10nm or even 30nm? Or is a filter with a bandwidth lower than, say, 3nm, required for making useful observations? I am asking, because an interference filter with a bandwidth of only 3nm is expensive for me. Joachim

From: Patrick Poitevin <patrick\_poitevin@hotmail.com> To: SE Mailing List <SOLARECLIPSES@AULA.COM> Sent: Thursday, March 01, 2001 10:31 PM Subject: [SE] **Roger Fry and the solar eclipse**

Does anyone know more about Roger Fry? In 1631, Oxford professor of astronomy John Bainbridge hired sea captain Roger Fry to carry out an astronomical expedition to South America. Attacked by Portugues, Fry was held prisoner in Brazil, where he was able to perform a number of astronomical observations including a solar eclipse, presumably unaided by instruments, which were sent back to Oxford. (Nicholas Tyacke, Science and religion at Oxford before the Civil War. pp 73-93: D. Pennington & K. Thomas (eds.). Puritans and Revolutionaries, Oxford, 1980. Cited by North, below.) Best regards, Patrick

From: Carton, WHC <Wil.Carton@corusgroup.com>

Patrick, I do not know something about Roger Fry. But I became curious to know when that eclipse could have been observed there. The first eclipse that deserves consideration, was the annular solar eclipse of 8 april 1633. Its belt of annularity ran from Bolivia in northeastern direction across the Amazone delta. Its degree of obscuration on the Amazone mouth was 98,0%, altitude 67 degrees, the maximum duration was 1 minute 34 seconds. Wil Carton.

From: Julio Bueno <juliofb@yahoo.com> To: <eclipse@hydra.carleton.ca> Sent: Wednesday, March 28, 2001 10:52 AM Subject: [eclipse] **Software**

I'd like to know when occurred the last total eclipse viewed in my city and also the next one. Is there a software which could be able to give this information, by typing the coordinates of a given location? Thanks. Julio Cesar Bueno

From: <bdenton2@csc.com.au>

Julio, which is your city and are you interested in a solar or lunar eclipse Regards, Bob Denton

From: Julio Bueno <juliofb@yahoo.com> To: <eclipse@hydra.carleton.ca> Sent: Thursday, March 29, 2001 11:17 AM Subject: Re: [eclipse] Software

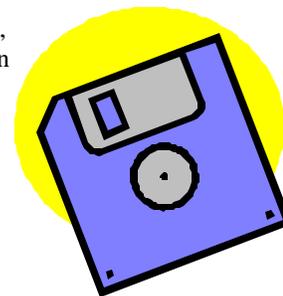
I'm interested in solar eclipses. I live in S.Paulo, Brazil. I have been testing several softwares, but I didn't find out a program that could just tell past and future eclipses observed in a location yet.

From: Michael Gill <eclipsechaser@yahoo.com>

Julio, EclipseComplete will provide this information for you...

<http://www.zephyrs.com/eclcomp.htm>

Some other software packages that have varying eclipse capabilities are listed on Fred Espenak's website: <http://www.>



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## GENERAL TOPICS

mreclipse.com/Totality/TotalityApD.html Best regards, Michael Gill.

From: <KCStarguy@aol.com>

I really like how starry night show the eclipses from the ground up, from the moon or space. You can program your own or access the databases.

If anyone wants my review of the versions pro, deluxe and backyard, contact me directly and i will send you it. Dr. Eric Flescher (KCStarguy@aol.com)

From: Olivier Staiger <olivier.staiger@span.ch>

Yo ! Whassssssaaaaaaa !

For all those who cannot make it to Africa for June 21, here's good news: I will have a LIVE report with daily updates on

<http://eclipse.span.ch/2001tse.htm> , (no www.)

live from Lusaka Zambia June 15 - 22 , with LOTS of pictures . And we'll do a live webcast at

[www.solareclipseafrica.com](http://www.solareclipseafrica.com)

from several locations (Zambia, Zimbabwe, maybe more) on June 21 starting around 11 UT. ( 7 am EDT).

This is my 14th solar eclipse, my 6th total. Yes, I know, I know, I was clouded out in '99. Darn.... Don't you EVER dare remind me ! ☺) Enjoy the show ! Olivier "Klipsi" Staiger , Geneva Switzerland

From: Patrick Poitevin <patrick\_poitevin@hotmail.com>  
To: SE Mailing List <SOLARECLIPSES@AULA.COM>  
Sent: Monday, March 19, 2001 8:08 PM Subject: [SE]  
**Solar Observations during the night?**

> Dear All, For those who want to observe the Sun between 23h00 UT and 09h00 UT from Solar News, The Electronic Newsletter of the Solar Physics Division, American Astronomical Society, Volume 2001 Number 8, Stephen R. Walton, editor, March 16, 2001:

Huairou magnetogram data on line

>From Gaanghua Lin <lgh@sun10.bao.ac.cn> 15 Mar 2001

Data from the Video Vector Magnetograph at Huairou Solar Observing Station of Beijing Astronomical Observatory at Beijing, China are now available in line at:

<http://sun.bao.ac.cn/observation/datadir.html>

The Huairou's solar observations normally cover the period between 23:00UT and 09:00UT. The data are processed and made available before 00:00UT of next day. The observational lists and the daily magnetograms at Huairou Station are provided after 1989.

The brief description of the data can be found at

<http://sun.bao.ac.cn/observation/README>

and the reading subroutine of the Huairou data at

<http://sun.bao.ac.cn/observation/Software> .

If one has some problems on the Huairou data, please contact with Dr. Ganhua LI of Huairou Solar Observing Station (the e-mail address: [lgh@sun10.bao.ac.cn](mailto:lgh@sun10.bao.ac.cn) ).

From: Anthony Kinder <anthony.kinder@LINEONE.NET> To: <HASTRO-L@WVNVM.WVNET.EDU> Sent: Friday, **March 16, 2001 11:52 PM** Subject: **Maunder, The BAA, Kinau**

Dear All, The Maunder's, Just to say that I am still looking for any correspondence etc. concerning the Maunder's (Annie Scott Dill, Edward Walter and Thomas Frid). I am still in the process of research, and although I have been able to obtain copies of many letters to or from the Maunder's, there must still be a lot out there - especially Europe, Australasia and the America's. I hope to compile a calendar of correspondence of the Maunder's, so copies in particular would be greatly appreciated. (My home address is below.)

The British Astronomical Association

I am also starting work on the history of the BAA since its foundation. Therefore if anyone has any access to information about the BAA in the archives of universities, observatories and societies I would greatly appreciate being informed. Al-

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## GENERAL TOPICS

though most of the membership was UK based, a small but significant number (about 10 per-cent) came from overseas. Including names of many well known astronomers - e.g. the Pickering, Antoniadi, De Roy, Reid, Tebbutt, Dorothy Klumpke Roberts. C. A. Kinau

>Some time ago I requested information on the above person, who lived in the 1840's-1850's, in what is now Bohemia and undertook research on the Moon (discovering many rilles). The only information I have on him is that given in the BAA Memoir "Who's Who in the Moon" (1938). I am still looking for information on him, in particular full names and dates. Does any one have ideas? All the standard biographical works (Poggendorff, German language dictionaries of biography) do not mention him at all. He is supposed to have written two works (books?, monographs?, articles?) on fungi, none of which is also mentioned in standard bibliographical directories of the time. Many thanks, Anthony Kinder

From: Wilds <Wilds@NETWORKSPUS.NET>

Greetings Anthony: I am publishing an historical account of the work done on the Marginal Zone of the Moon. In it I have included a discussion of some of the work done on this topic by the BAA as follows:

Amateur astronomers continued to be seriously involved in observing the marginal zone during the 1930s. The BAA's Lunar Section, under the directorship of Walter Goodacre, began a program of careful observation of the lunar limb. A number of capable observers -- i.e. Dr. Hugh Percy Wilkins and Patrick Moore -- were a part of this team. Interest in the lunar limb and occultations was so high in 1933 that the BAA decided to attempt an observation of an astronomical event of a rare and exotic type -- a grazing occultation. J. T. Foxell, of the BAA's Computing Section, had predicted a graze of the star Regulus along the northern limb of the moon. Dr. R. L. Waterfield and Dr. R. M. Fry acted as the graze leaders for a team of 12 BAA members. The graze team met at the White Horse Inn in Bridge and then traveled to the predicted graze path near Barham and Elham along the Canterbury-Dover Road on 6 April 1933. Even though the star could be seen before and after the graze, the event was clouded out for all stations. That is except for one event timed by a single separated observer using a 3" refractor behind the Crewe Railway Station. There is, however, no clear mention in the historical report that this observation was made in the graze area. This observation along with the many total occultation timings of the event was reduced by J. D. McNeile. (Foxell, 1933) In fact, the BAA reports that the weather was particularly bad that entire decade. After this the political weather became the problem as World War II came over the limb of time. The deaths of a number of astronomers were noted by the BAA as well as by other

groups caught in the conflict. (Kelly, 1948)

After the war the surviving members of the BAA continued toward a better understanding of the marginal zone by making accurate drawings of the region. It was a difficult task due to the perception problems caused by foreshortening on the limb. Their work slowed in the 1960s when it was thought that the Lunar Orbiters (especially Orbiters IV and V) would put them out of business. (Hill, 1991) However, it was found that the Orbiters could not image the polar regions due to poor lighting. (Bowker, 1971) The biggest problem has been the area known as the Cassini Region (which is never totally illuminated as seen from earth). It has also been called Luna Incognita. Interesting drawings have been made of this area by E.A. Whitaker (1954 and 1956) and Harold Hill (1991) as well as many others of the BAA. The mapping efforts of the BAA and many other fine observers, and scientific organizations finally led to the latest maps of the limb area -- Antonin Rukl's Atlas of the Moon (1990) and Dr. John E. Westfall's "Mapping Luna Incognita" (1990).

I am also listing some of the sources I used to construct my work:

Foxell, J.T., "Occultation of Regulus, 1933 April 6." Journal, B.A.A., Vol. 43, No. 5, 1933. Pages 196-198. "Notes: The Occultation of Regulus, 1933 April 6." Journal, B.A.A., Vol. 43, No. 9, 1933. Pages 303 and 397. Other notes on pages 278-279 and 397. Foxell, J.T., et al., "An Expedition to Observe The Occultation of Regulus, 1933 April 6." Journal, B.A.A., Vol. 43, No. 7, 1933. Pages 281-283. Hill, Harold. A Portfolio of Lunar Drawings. Cambridge, New York, 1991. Kelly, Howard L., "The History of the British Astronomical Association." Memoirs, B.A.A., Dec 1948. Pages 1-132. Rukl, Antonin. Atlas of the Moon. Hamlyn, London, 1990. Westfall, John E., "Mapping Luna Incognita." The Strolling Astronomer: J.A.L.P.O., Vol. 34, No. 4, Nov. 1990. Pages 149-159. Plus updated chart graciously supplied by Dr. Westfall. "A Lunar Polar Peek." Sky and Telescope, April, 1997. Pages 112-113. Whitaker, E.A., "The Lunar South Polar Regions." Journal, B.A.A., Vol. 64, No. 6. May 1954. Pages 234-243. Wilkins, H. Percy, ed. "Tenth Report of the Lunar Section." Memoirs, B.A.A., Oct 1947. Pages 1-20. "Eleventh Report of the Lunar Section." Memoirs, B.A.A., July 1950. Pages 18-20. Wilkins, H. Percy & Moore, Patrick. The Moon. Macmillan, New York, 1955.

"...indeed the business of the universe is to make such a fool of you that you will know yourself for one, and so begin to be wise!" Quote of Mr. Raven (The Librarian, The Sexton or Adam) from Lilith, by George MacDonald. Richard and Tat-

*(Continued on page 41)*

## GENERAL TOPICS

yana Wilds

From: Lenny Abbey <labbey@MINDSPRING.COM>

The BAA published its history in two volumes. One in about 1950, and another about 1980. Check with them.

The greatest concentration of "overseas" members is in the US, including yours truly. I joined in '56, and am working my way towards the 50-year point, at which I will no longer have to pay dues! Lenny

From: Lenny Abbey <labbey@MINDSPRING.COM>

Wilkins' map includes some interesting drawings of features on or near the limb. He even drew some of them as seen from the other side! Lenny

From: Jean Meeus <JMeeus@compuserve.com> To: Solar Eclipses <solareclipses@aula.com> Sent: Friday, March 23, 2001 3:40 PM Subject: [SE] **Wednesday eclipses**

Already I knew that recent important solar eclipses in Belgium often took place on a Wednesday. For instance, the eclipses of 1954 June 30 (total in Sweden), 1961 February 15 (total in France and Italy) and 1999 August 11 (total in southern Belgium) all occurred on a Wednesday. In the German journal 'Sterne und Weltraum' of April-May 2001, page 312, Prof. Matthias Dopleb again draws our attention on this Wednesday-mystery. If made some calculations and found a preponderance of Wednesday eclipses not only for important (nearly total) eclipses, but for *\*all\** solar eclipses visible from a given place. If we use the codes 0 = Sunday, 1 = Monday, etc. till 6 = Saturday; then here is the number of solar eclipses visible at Berlin, Germany, from 1583 to 3000. An eclipse is 'visible' when at least one of the following occurs above the horizon : first contact (beginning of partial phase), maximum, last contact.

day 0 72 eclipses

day 1 97

day 2 55

day 3 106

day 4 63

day 5 106

day 6 73

I made the same calculation for Washington, D.C., and for the same period, and found the following distribution among the weekdays :

day 0 43

day 1 97

day 2 57

day 3 101

day 4 70

day 5 68

day 6 88

So, here too Wednesday has the largest frequency of solar eclipses. I got the same conclusion for Madrid (Spain) and for Moscow (Russia).

Going to the southern hemisphere, I got a surprise for Johannesburg, where not a trace of the "Wednesday-effect" appeared. I again made the calculation for Berlin, but now for the years 1 to 1500, and there it was also, that Wednesday-effect.

I have no idea what can be the reason for that strange distribution of solar eclipses over the days of the week. Any suggestion? Jean Meeus

From: Bob Morris <morris@sce.carleton.ca>

It's pretty easy, actually: "wed" : to blend together or unite inseparably. (Random House)

Actually, I lied: Wednesday comes from "Woden's day" or day of Mercury.

So, Wednesday is the day you are most apt to see the planet Mercury during daylight hours.

So, both definitions confirm that Wednesday is *\*the\** day for total eclipses. Bob Morris

From: Odille Esmonde-Morgan & Warwick Lawson <analog6@ozemail.com.au>

I remember this 'debate' from some time ago. It has absolutely no meaning as Wednesday in one part of the world is Tues-



*(Continued on page 42)*

## GENERAL TOPICS

day in another - so you could just as easily argue for Tuesday eclipses. Stick to the main event, guys!

Odille Esmonde-Morgan Canberra, Australia

From: Olivier Staiger <olivier.staiger@span.ch>

I endorse Odille. Take the de-orbiting of Mir (as a fresh example :-): Mir was de-orbited Friday 23rd but crashed (at 160°W longitude) Thursday 22nd local time. Now I am sure that Jean Meeus made his calculations based on Wednesday in UT. But if an eclipse occurs on a Wednesday evening UT in Australia and the Pacific Ocean, well it is Thursday morning in Australia and Wednesday afternoon in the Pacific. Can we then really say the eclipse occurred on a Wednesday? Depends on where you were in the path. My opinion is, this is just coincidence. Wednesday is the winner, could have been any other day. Someone has to win the game! Maybe also, since eclipses are so rare, a much longer time span should be used. Wednesday may be the winner over 2000 years, but will it be the same over 2 million years?

P.S. 3 months to totality .... YEEEE-HAAAAAAAAAAAA !!!!!!

Olivier "Klipisi" Staiger, Geneva Switzerland

From: Jean Meeus <JMeeus@compuserve.com>

Yes, of course, when it is Wednesday somewhere, it can be Thursday at some other place. It is for this reason that I restricted my calculations to places not too far from the meridian of Greenwich, and that I choose Johannesburg and not a place in Australia, or Washington D.C. and not Hawaii.

In his letter in 'Sterne und Weltraum', Prof. Dopleb writes that in the present Germany there will be 10 total solar eclipses from A.D. 3202 to 3768, and that of these 10 eclipses NINE take place on a Wednesday. Maybe I will check this when I have time.

So what...? Concerning the message of Michael Gill: yes, that period of 300 years is interesting, but it could explain only a (very small) part of the 'mystery'.

Michael cites the large eclipses of 1715 May 3 and 2015 March 20, visible in the U.K. And, yes, 300 years before the eclipse of 1715 there was another one, on 1415 June 7, whose magnitude was 0.86 in London. But 300 earlier, the eclipse of 1115 July 23 was \*not\* visible in the British Isles, nor will be that of 2315 February 5. Secondly, the 300-year period doesn't explain the 'Wednesday-effect' \*within\* such a time lapse of 300 years. During the period 1912-2081, France is crossed by the central lines of five solar eclipses, namely

1912 April 17

1961 Febr. 15

1999 Aug. 11

2059 Nov. 5

2081 Sept. 3

and \*all five\* occur on a Wednesday!

Jean Meeus

From: Michael Gill <eclipsechaser@yahoo.com>

Jean, I realised that the three hundred year periodicity could only offer a partial solution to the Wednesday-effect, but I thought that by quoting periods like 109529 and 90629 days maybe other (even longer) periodicities that were wholly divisible by 7 could be looked at and resonances searched for.

For the French eclipses you mentioned I looked into the intervals. Obviously, the periods are all wholly divisible by 7. Some of the more promising intervals might be:

44030 days = 1618 Draconic months = 1491 Synodic months = 127 eclipse years

36057 days = 1325 Draconic months = 1221 Synodic months = 104 eclipse years

7973 days = 293 Draconic months = 270 Synodic months = 23 eclipse years

If this Wednesday-effect is present for large numbers of locations and long time-spans then surely this subject is worthy of a chapter in any 'Mathematical Astronomy Morsels 2' :-) Best regards, Michael Gill.

From: Jean Meeus <JMeeus@compuserve.com>

In 'Sterne und Weltraum' of April-May 2001, page 312, Prof. Matthias Dopleb writes that between A.D. 3202 and 3768 there will be 10 total solar eclipses in present-day Germany, 9 of them occurring on a Wednesday. However, my own calculations give a different picture. I find the following total eclipses in Germany from 3202 to 3567.

12 June 3202 Wednesday

2 July 3211 Saturday

15 April 3354 Monday

6 April 3439 Saturday

29 June 3453 Wednesday

20 Sept. 3486 Monday

8 May 3493 Monday

No longer is there a 'Wednesday effect' seen here! My calculations were made with the lunar theory of Chapront and the solar theory of Bretagnon. For the famous quantity Delta T, I used the formula recently given by Chapront (1998). Prof. Dopleb made his calculations with the software Guide. I suspect that Guide makes use of another formula for calculating Delta T, whence the difference between our results.

However, the 'Wednesday mystery' remains for other places and other periods. For instance, all five central eclipses in France in the period 1912-2081 occur on a Wednesday:

17 April 1912 (annular-total)

15 Februari 1961 (total)

11 August 1999 (total)

5 November 2059 (annular)

3 September 2081 (total)

Jean Meeus, Kortenberg (Belgium)

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From: Olivier Staiger <olivier.staiger@span.ch>  
To: <SOLARECLIPSES@AULA.COM> Sent:  
Wednesday, March 14, 2001 8:03 PM Subject:  
[SE] **African eclipse live webcast**

There will be various live webcasts of the solar eclipse June 21.

I have teamed up with guys from Zimbabwe. We are a team of professionals. We have a professional reporter (works for CNN and others), a video specialist, a computer specialist, and an eclipse specialist (me :-). We will do a multi-location webcast, me from Lusaka and they from 3 locations in Zim. More locations are expected. see [www.solareclipseafrica.com](http://www.solareclipseafrica.com). We will also produce a video and CD. Klipsi



From: Cliff Turk To: Solar Eclipses List Sent: Monday, March 05, 2001 8:24 AM Subject: [SE]  
**Archaeological remains**

A short time ago someone mentioned having read an article by a Dr Hromnik about astronomically (solar) aligned remains in northern South Africa and said they were hoping to visit and/or contact Dr Hromnik during their trip to see the June 21 eclipse. However they did not know how to contact Dr Hromnik. By sheer chance I have run into a member of his family and can pass on his email address and telephone number in Cape Town if the enquirer will contact me direct on [cliffturk@yebo.co.za](mailto:cliffturk@yebo.co.za). Incidentally, there is a paper by Dr C.A. Hromnik in Mon Notes Ast Soc of Sth Africa Vol 55 (1997) page 69, entitled: Ancient Indian religious astronomy in the stone ruins of Komatiland, South Africa. Cliff

From: F.Podmore <podmore@science.uz.ac.zw> To: <solareclipses@aula.com> Cc: <cliffturk@yebo.co.za>  
Sent: Saturday, March 24, 2001 11:56 AM Subject: [SE]

#### **Cliff TURK's Eclipse book**

The 64 page book by Cliff TURK, called UNDERSTANDING ECLIPSES, published by Struik Publishers (Pty) Ltd [address: Cornelius Struk House, 80 McKenzie Street, Cape Town, South Africa 8001] has now been published and is available in South African bookshops for R29.95 (that's in South African Rand) The ISBN is 1 86872 580 4

Chapter titles are : Introduction; Eclipses through history; How eclipses occur; Eclipse observing; Eclipse of 21 June 2001; Eclipse of 4 December 2002; Photographing eclipses; Glossary; Eclipses 2001 to 2010; Contacts and Addresses.

It contains useful diagrams, maps and tables, a good number of black&white photographs and a most attractive colour cover.

It may be available to order online (Michael Gill - please check) but our weblink has just gone down :((). Hey ho.... Francis Podmore

From: <Jay.M.Pasachoff@williams.edu> To:  
<SOLARECLIPSES@AULA.COM> Sent:  
Wednesday, March 21, 2001 10:15 PM Sub-  
ject: [SE] **eclipse slots available**

Lusaka, March 21 I am in Lusaka this week with my travel agent, Mark Sood. Because we have changed our tour-group itinerary to avoid entering Zimbabwe, we have a modified post-eclipse itinerary and have four spaces available. See [www.solareclipsetours.com](http://www.solareclipsetours.com) for information. The land arrangements for the luxury tour June 17-July 1 are approx. \$4000. Mr. Sood also has a tour for 11 days, not involving me, for eclipse observing in Lusaka plus some touring for only \$1500. Jay Pasachoff



From: Joachim Lorenz To: solareclipses@Aula.com Sent: Wednesday, March 21, 2001 9:34 PM Subject: [SE]

#### **SE in Lusaka**

Dear All, I'm looking for a contact to an observers group near Lusaka for total solar eclipse on 21st June. I want to stay for 2 days in Lusaka. (20.-22.06.). Who have any informations about accommodations (for 2 days)? Best regards,

Joachim from Germany

From: Stuart Holdstock To: solareclipses Sent: Thursday, March 22, 2001 1:33 AM Subject: [SE] Assistance?

Dear all, I am an Astronomy student in the UK travelling with another Astronomy student to Lusaka to see the eclipse. I was wondering if there were any experiments that any of you in the area may be requiring assistance with.

For the 1999 eclipse I formed part of the UCL eclipse team with which I prepared to perform a number of experiments. From this, I have experienced the preparations involved with photographing the eclipse. Regards, Stuart Holdstock University College London

From: Massimiliano Lattanzi

Hi, I shall be travelling alone (from Paris) and have a hi-res digital video camera, a telescope and a tele-lens to look after. If you do not find more attractive proposals we may play the game together.... Keep in touch, Max

From: Eric Pauer <pauer@bit-net.com> To: Solar Eclipse Mailing List <solareclipses@aula.com> Sent: Thursday, March 22, 2001 8:39 PM Subject: [SE]

#### Madagascar - Eclipse Expert for Tour needed

Remote Rivers Expeditions (<http://www.remoterivers.com>) is looking for a professional or amateur astronomer knowledgeable and experienced with solar eclipses to help with their 2-25 June trip to Madagascar. This person would be the "eclipse expert" on the trip. They are willing to offer a substantial discount (under \$2000 USD ground cost) as an incentive. The group plans on viewing the eclipse from near the centerline. If interested, contact Gary at phone (800) 558-1083 or [gary@remoterivers.com](mailto:gary@remoterivers.com).

Regards, Eric

From: Stig Linander <linander@worldonline.dk> To: <solareclipses@aula.com> Sent: Tuesday, March 13, 2001 10:11 PM Subject: [SE]

#### Web site: "Solar eclipse 2001 in Madagascar"

Found a beautiful web site, "Solar eclipse 2001 in Madagascar": <http://www.madagascar-eclipse2001.com/welcome.htm>

In French: <http://www.madagascar-eclipse2001.com/> Clear skies! Stig.

From: Odille Esmonde-Morgan To: SOLARECLIPSES@AULA.COM Sent: Saturday, March 17, 2001 4:37 AM Subject: [SE]

#### HEALTH WARNINGS FOR ZAMBIA

Dear Eclipsers, An AP snippet in today's (16 March 2001) Sydney Morning Herald newspaper reports an outbreak of bubonic plague in eastern Zambia - 11 dead and 30 ill. It may pay to check with your country's health authorities before leaving, or one of the web sites such as the US one (it's been mentioned on this site before) for warnings for countries in the eclipse path. Odille Esmonde-Morgan, Canberra, Australia

From: B Yen <byen00@earthlink.net>

MARCH 14, 10:03 SET Plague Kills 11 in Eastern Zambia

LUSAKA, Zambia (AP) ó Bubonic plague spread by flea infested rats has killed at least 11 people and sickened 30 others in eastern Zambia in the past week, authorities said Wednesday. Emergency medical teams have been sent to Zambia's Partake district, the state Central Board of Health said. The disease is usually fatal within days if not treated immediately, board spokesman Ben Chirp said. Victims suffer swollen glands and fever. The illness is transmitted by fleas on plague infected rats and other bush animals, Chirp said. After the animal dies, the fleas seek a new host, human or animal. The bacteria also can be inhaled, causing pneumonia and rapid death if left untreated. Plague was first recorded in the southern African nation in 1936. The most serious outbreak in 1997 claimed 25 lives.

From <http://ponderosa-pine.uoregon.edu/students/Janis/prevention.html> "Bubonic plague has a vaccine. It lasts for about 6 months. Currently [ what year?? ], plague vaccine is not available in the United States. A new vaccine is being worked on and could be licensed later this year. Travellers to plague infested areas should take prophylactic antibiotics. The preferred antibiotic for prophylactics is tetracycline or doxycycline, and for children 8 or less, sulfonamides. Bubonic plague is easily treated if caught early. Streptomycin is the preferred drug, but gentamicin, teracyclines, and chloramphenicol also are effective. Penicillin is useless on plague. Treatment shortly after exposure can reduce overall plague mortality from 60% -100% to 10% -15%. The most effective way to prevent plague is better sanitary conditions and precautions. These conditions and precautions include:  
-rat populations should be controlled using rodenticide

(Continued on page 45)

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-effective insecticides should be used to control the flea population that transmits plague to humans and rodents ...."

I would like some medical opinions on safeguards against Bubonic Plague, for travel to Zambia. Is it really true there is no vaccine available in USA? I have used tetracycline before, so maybe I should get my doctor to prescribe some. (I have yet to go to him, for anti-malaria treatment).

I already know I will probably be out in the wild for a LONG time (2 weeks), so that is probably increasing the risk. I get attacked by mosquitoes all the time, so that means fleas will eat me alive.

I would like some \*realistic\* commentary on how I should "do" Zambia for the eclipse. Should I:

- stay near clean, non-rodent areas (say, within a hotel in Lusaka)
- stay at an outback camp, with bathing facilities (keep body odors down, to prevent from being "flea bait")
- ignore the threat (overhyped by media), & run around carefree

Probably bring some insecticide, & bug repellent applied to the skin.

There was this Hanta virus (spread by mouse feces, via airborne contamination) in Western US a few yrs back. There were some local cases, & some deaths. So, the above should be kept in perspective.

In SouthEast Turkey for the '99 eclipse, I slept on a wheatfield out in the open. I was awoken by scurrying noises, which I assume was mice. (there was a 6 ft snake spotted, so I assume it was preying on mice).

From: Harvey Wasserman <onsite@gate.net>

I have been unable to find this article in the Sydney Morning Herald, and GOOGLE doesn't find anything, either. Do you have a link to the story?

Here is what the CDC says about plague: <http://www.cdc.gov/travel/diseases/plague.htm> Hope this helps, Harvey Wasserman

From: Joel M. Moskowitz, M.D.  
<moskowi@attglobal.net>

The first question is: Where in Eastern Zambia? Is it anywhere near the path of totality?. I think the

first thing to do is to see if the area involved is the area where you will be.

That stated, the idea of a good insect repellent is excellent. It is also part of prevention for malaria, and any insect-borne disease. Tetracycline is an antibiotic that I routinely take with me whenever I visit ANY undeveloped area. It is a good broad spectrum antibiotic useful for a variety of ailments one might encounter. Certainly, if you should find yourself in the area involved, AND you get symptoms of bubonic plague or pneumonic plague, IMMEDIATE usage of this antibiotic should be started and seek immediate medical care. Getting immediate, or any decent medical care in these countries could be very difficult. So, taking along tetracycline is wise.

Joel M. Moskowitz, M.D. 7 (total) eclipses and counting

From: Odille Esmonde-Morgan <analog6@ozemail.com.au>

Harvey, No link - it was a little one paragraph piece in the printed version and they don't put those tiny ones on the Internet version. If you like I can scan it for you and email it to you direct - let me know. Odille

From: Bryan Brewer <bryanb@earthview.com>

Here's a link to the Associated Press story (March 14, 2001):

[http://wire.ap.org/APnews/center\\_story.html?FRONTID=AFRICA&STORYID=APIS7ANOG B00](http://wire.ap.org/APnews/center_story.html?FRONTID=AFRICA&STORYID=APIS7ANOG B00)

From: Harvey Wasserman <onsite@gate.net>

I did a search on the "Partake region". Seems to be about 250 clicks north of Lusaka. I found an article from back in November (?) about relocating ex UNITA soldiers from the war with the Congo there. I wonder if it is related.

The CDC makes it sound pretty unlikely to get. Just keeps getting more interesting, doesn't it. Harvey

From: <Jay.M.Pasachoff@williams.edu>

The plague region (which is described as the big headline today in the LUsaka paper) is northeast of the eclipse path, and you do not encounter that region if you just go to Lusaka and the eclipse path. Jay Pasachoff

From: Mike Murphy <evmurph@zetnet.co.uk>

(Continued on page 46)

I found this, at: Latest News from IRIN Southern Africa  
<http://www.reliefweb.int/IRIN/sa/safp.phtml>

ZAMBIA: Seven more killed as plague spreads. JOHANNESBURG, 15 March (IRIN) - Seven more people have died from bubonic plague in Petauke in Zambia's Eastern province, bringing the total death toll to 18, 'The Times of Zambia' reported on Thursday. The number of admissions at the local hospital has swelled to 44. Hospital administrator Jack Phiri said patients at the hospital were responding to treatment and that some would be discharged soon. Central Board of Health Director-General Gavin Silwamba said that of those admitted, many were young children. He appealed to people in the affected areas to not touch dead rats with their bare hands, to block holes in their houses, to kill as many rats as possible, and then bury or burn them and seek medical attention quickly.



Regards - Mike in the UK

From: F.Podmore <podmore@science.uz.ac.zw> To: <solareclipses@aula.com> Sent: Saturday, March 24, 2001 12:16 PM Subject: [SE]

#### Obtaining eclipse viewers in UK/Europe

For people planning to come south for 21 June eclipse, where can they buy eclipse viewers, in UK, and in continental Europe? I know several suppliers advertize in Sky&Telescope (and are listed of Fred Espenak's website) but they are in USA. Thanks. Francis

PS Incidentally all the viewers which were sent in after my appeal have already been distributed to all Zimbabwe schools (about 6000) with some eclipse leaflets. All this thanks to Southampton Assurance company. MNAY THANKS TO THEM.

From: Marc Weihrauch <marc.weihrauch@student.uni-halle.de>

Dear Francis, You might try [http://www.baader-planetarium.de/index\\_e.htm](http://www.baader-planetarium.de/index_e.htm) , at least that's where I'm going to buy. This link leads you straight to the English version of the website of this German manufacturer. If the link doesn't work, try <http://www.baader-planetarium.de> and click "English". Best regards Marc

From: Stuart Holdstock <s.holdstock@ucl.ac.uk>

The company that supplied eclipse viewers for the 1999 Cornwall eclipse still sells them. They are based in the UK but they also sell to Europe. Their website is: <http://ds.dial.pipex.com/eclipse99page/prices.htm> Stuart

From: <Jay.M.Pasachoff@williams.edu>

Francis and others: I was just in Zambia and tested cutting up one of those pairs of viewer glasses into many bits. Each bit only 5 mm x 5 mm is perfectly adequate for a solar filter for the eclipse, when mounted to cover a hole cut in a piece of paper. (If you fold the paper in both directions, you can snip off a corner of the folded paper and then open it up to find a diamond that can be covered with the Mylar.)

From the single piece of Baader planetarium Mylar for \$70, one can make  $40 \times 80 = 3,200$  filters. From each pair of "glasses," one can make at least 12 filters. So the price per individual comes way down. Also, since these filters are only for glancing at the partial eclipse, each group of 4 or 6 students can have one filter and pass it around. So we really have 10,000 filters (!) for \$70, plus some work of students in cutting up and pasting the filters over holes in paper.

I think that pieces of paper or cardboard that you hold up with one hand are better and safer than goggles that people will tend to wear for long periods. Further, pinhole cameras work just fine, and are even cheaper than any filters. A major point to stress is that the filters or pinhole cameras are just for the pre-total and post-total phases. Jay Pasachoff

From: <JohnLX200@aol.com>

Jay, Thank you for taking the lead on this. I'd been thinking along similar lines but had not yet taken action. I figured I would have my own children make 5000 viewers from a roll of Baader material, to give out in Africa.

I was thinking of using a 10mm square of material covering a 5mm diameter hole in a 54x56mm piece of paper. If the material is sandwiched between 2 sheets of paper, then it uses exactly one 500 sheet pack of 8.5x11 inch printer paper, one roll of Baader filter material, and an undetermined amount of glue, labor, razor blades, and bandaids. Of course, it would wind up being 8.5x11 x somewhat taller than the original pack of printer paper.

I already purchase the Baader material in moderate wholesale quantities of rolls. At least for dealers in the USA, the cost savings is not as significant as one would guess, especially after a very significant wholesale price increase with no corresponding retail price increase for the rolls. Essentially it was a way for the importer to reduce competition on their own retail sales of rolls, while not being enough to discourage value-added resellers like myself who make finished filters.

I've heard that prices in Europe may be lower.

Regardless of the prices, I'm personally willing to donate to the cause somewhat, beyond making and taking a quantity myself. I'll make up to 10 rolls of visual material available at the subsidized price of \$45/roll plus the postage to send it directly to whatever nonprofit organization is making them. If there is interest in this, I may also ask the importer to also donate by cutting the price for this purpose. I'd probably cut the rolls into sheets both to save postage and to save the volunteer assemblers from working with the somewhat unwieldy rolls.

In addition, I have a significant quantity of scraps of the 5.0 density Baader material which I would donate to the cause. They probably add up to approximately a full roll worth, albeit mostly in the shape of what is left after cutting circles out of a roll.

I almost hate to bring this up, as it's not the preferred solution, but in case the need turns out to be greater than the supply, I will mention another avenue. I also have several full 0.5m x 1.0m rolls of 3.8 density "photo-only" material which I would make available at even more attractive prices. I would only do this if Dr. Chou or some other eye-safety expert can provide guidelines for its safe visual use. Perhaps something such as a smaller diameter of hole punch to use in the paper for this less dense material would make it safe for naked-eye visual use. Or perhaps a conservative specification of how long a look through it is safe, although that would require labeling/training issues I suppose. Or to use it in combination with the old bucket of water reflection. It's so far superior to smoked glass, for instance, that it's frustrating to not be able to outright say it is safe, as doing so might lead to careless use and therefore liability. Perhaps a look at its transmission curve vs. the Questar "visual filter" which is arguably less safe can resolve this issue of whether it is ethical to distribute a safe product with a slimmer safety margin than other products available, when the alternative might be that nothing is distributed.

Hopefully we can come up with enough donors, subsidies, matching funds, price reductions, and free labour to get more than enough 1-eye 5.0 density viewers made. I agree with you and Dr. Chou that these are preferable to the eyeglass-style viewers. I recall him recommending that they be cut in half and used with one eye, in order to discourage unnecessary continuous use which can even lead to tripping over things. ;-)

For the 1999 eclipse, I had my own children make by hand the viewers we used. I think it would be wonderful for the children and teachers in the eclipse path in 2001 and 2002 to be able to make their own viewers as well.

Oh, and I'd also advise making a rubber stamp to print instructions on each viewer to LOOK STRAIGHT AT IT without the viewer when it's total! John Hopper

From: Mark <rainbowsymphony@rainbowsymphony.com>

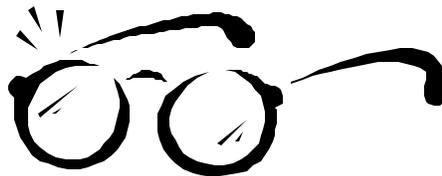
If anyone wants to cut up material and make their own viewers we all kinds of different solar viewing materials this can be done with. The materials unmounted are relatively inexpensive. For example, we have spools of silver/black polymer 2" X 3500' for very good prices...ya'll need to contact us!!!

(Continued on page 48)

Best Regards, Mar S. Margolis Rainbow Symphony, Inc. <http://www.rainbowsymphony.com> Ph# 818-708-8400  
Fax# 818-708-8470 Quality Paper Eyewear and Specialty Optics

From: <Jay.M.Pasachoff@williams.edu>

I should elaborate on my brief message of yesterday about cutting up filters, which was written while still jetlagged from my trip back from Zambia.



What I wrote about cutting up filters was correct. I should add that Rainbow Symphony was generous in donating 300 pairs of glasses for me to take to distribute there. I was glad to do so, but I saw that any semi-finite number of glasses wasn't enough for the huge need they have. For example, I lectured at a local high school to an attentive class with 200 teenagers in the room. The school is so crowded it is on double session, with 2500 people in the morning and 1800 people in the afternoon. They just don't have \$4300 for 4300 filters at \$1 each (3500 kwacha at the current rate). Similarly, the university doesn't have thousands of dollars in its budget for filters. So cutting up filters or filter material will help distribute filters more widely.

I can add that the University of Zambia last upgraded its physics lab equipment in the 1960s, so if anybody has more recent college lab equipment to donate or wants to contribute to a fund to buy some recent experiments, that would be great. They would love to have a telescope. Meade just wrote me back that they would be glad to consider such a request, though they get at least 3 a day.

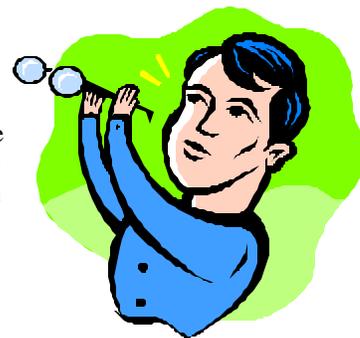
So I found very nice and well meaning and competent people in Zambia, but they can use a lot of help. Best wishes,  
Jay Pasachoff

From: Olivier Staiger <olivier.staiger@span.ch>

In the spirit of Jay, here is an idea I'd like to share: I'm sure that many of us have several cameras which we don't use much. I mean, I myself get a new camera every now and then (time to update :-), but what do I do with my old camera? In other words: if you have a camera that still works fine but you just don't use it anymore because you got the newer model, then why not donate it? If you bought a new Digital8 video camera and you realize you don't use your older Hi8 video camera anymore, bring it along to Zambia and make a gift. If you just bought the latest Canon D30 digital photo camera and you don't use your old EOS A2 no more, bring it to Africa and make a donation. If you don't use your Celestron C5 anymore because you bought the latest C8 Nexstar, leave your C8 at home and bring your C5 to Zim or Zam and make a gift. If you have an old SLR camera which you realized you used only once in the past 5 years, take it with you and offer it to a local school in Africa. If you have a lens that you don't use anymore (e.g. your first 35-80mm zoom replaced now by a 28-105mm), bring it to Africa. If you replaced your 200mm telelens by a 400mm telelens and you don't use the 200mm anymore, bring both to Africa and offer the 200mm to a local school or university. You can still use your camera or lens for your safari and the eclipse. But shortly after 3rd contact, take out the film, keep the film, and give the camera. Olivier "Klipsi" Staiger, Geneva Switzerland

From: <Kidinvs@aol.com>

Mark Margolis from Rainbow sent me some eclipse glasses for the Xmas eclipse at a very reasonable price. I intend on distributing approx 500 pair as we travel from Lusaka to the tented village that we will be at to see the eclipse. Eric Brown



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From: F.Podmore <podmore@science.uz.ac.zw> To: <solareclipses@aula.com> Sent: Friday, March 02, 2001 5:02 PM  
Subject: [SE]

### Partial solar eclipse visibility

Another request for help - Is there an easy = quick way of getting a list of all the partial eclipses visible from the centre of Zimbabwe (e.g. 20 degrees south, 30 degrees east) for the past 100 years? With the time of start/max/end, and % maximum obscuration?

Can anyone generate that and send it to me?

And for clarification, Does max obscuration (e.g. 97.8% for TSE 21o601 in Harare) mean % of solar disc AREA covered OR % solar DIAMETER covered? Thanks again folks. Francis

From: FRED ESPENAK <u32fe@lepvox.gsfc.nasa.gov>

>...for clarification, Does max obscuration (e.g. 97.8% for TSE 21o601 in Harare) mean % of solar disc AREA covered OR % solar DIAMETER covered?

Eclipse Obscuration measures the Sun's AREA eclipsed.

Eclipse Magnitude measures the Sun's DIAMETER eclipsed.

>Is there an easy = quick way of getting a list of all the partial eclipses visible from the centre of Zimbabwe (e.g. 20 degrees south, 30 degrees east) for the past 100 years? With the time of start/max/end, and % maximum obscuration?

The table below gives local circumstances for every solar eclipse (with a magnitude greater than several percent) visible from Harare from 1900 through 2050. All times are in UT. Most of the columns are pretty self explanatory. However, the second column 'Eclipse Type' requires a short description. The first letter (T, A, or P) gives the eclipse type (Total, Annular or Partial) from the point of greatest eclipse. The second letter (t, a or p) tells what type of eclipse was seen from Harare (total, annular or partial). For example, everyone is familiar with the famous 'Einstein' eclipse of 1919. Although this was a total eclipse it was only visible as a partial eclipse from Harare. Thus the Eclipse Type is 'T:p'.

Note the two annular eclipses visible from Harare in 1900 and 1923, and two near miss annulars in 1934 and 1951. Aside from these, the two eclipses with the greatest magnitude and obscuration are the 2001 and 2002 events. It's interesting how eclipses sometimes 'bunch up.'- Fred Espenak

From: Brian Garrett <mgy1912@home.com>

Maximum obscuration is the fraction of the solar disk actually covered by the Moon. The fraction of the solar diameter obscured would be the magnitude. Brian

From: Olivier Staiger <olivier.staiger@span.ch>

>And for clarification, Does max obscuration (e.g. 97.8% for TSE 21o601 in Harare) mean % of solar disc AREA covered OR % solar DIAMETER covered?

Obscuration : % of solar disc area (surface)

Magnitude : % of solar disc diameter

when you have a 0.50 magnitude, the obscuration is less than 50%. Klipsi

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From: Patrick Poitevin <patrick\_poitevin@hotmail.com> To: SE Mailing List <SOLARECLIPSES@AULA.COM>  
Sent: Thursday, March 01, 2001 9:45 PM Subject: [SE]

**Planispheres for the solar eclipse trips**

From: Rob Walrecht Subject: Planispheres!

Dear astro-friends, I would like to draw your attention to our website: [www.walrecht.nl](http://www.walrecht.nl), which has four extra pages of information about our new planispheres for the southern hemisphere and a summary of our program and prices. We have one particular planisphere, for 20° South, which is interesting for people who are going to see the 21 June Eclipse!

NEW: three completely new planispheres for 20°, 30° and 40° South latitude!

STANDARD: our standard program now contains seven English planispheres, for seven different latitudes, with two more being planned for 2001/2002: for 20° North and for the Equator area. When these last two are ready, we will have a planisphere available for every region between 65° North and 45° South: that is almost every land region in the world!

For STUDENTS: our planispheres are perfect for use with students of all ages, particularly since they can be personalised (see below). Besides, we can offer you a 'build-it-yourself' version that is very cheap and great fun for younger students!

LANGUAGES: there are also planispheres in our standard program in German, French, Dutch, Norwegian and Danish, with plans for Spanish, Italian and other languages. This must certainly be the most extensive planisphere program available!

PERSONALISED: the new computer-designed planispheres are even more accurate and offers you even more possibilities to obtain a really unique planisphere for your planetarium, museum, school, company or other organisation: for any latitude and in any language, with your logo and information! And with your own text!

PERFECT COMBINATIONS: the perfect combination would be to have your own, personalised planisphere, for your latitude and in the native language, supplemented with some planispheres in other languages, to accomodate tourists or foreign students.

I hope you will take the time to visit our website to discover the possibilities. We can provide you with (almost) anything you like/need/want! I wish you the very best! Rob Walrecht director

From: Jeff Batten <jeff.batten@csun.edu> To: <SolaRECLIPSES@AULA.COM> Sent: Thursday, March 29, 2001 8:27 PM  
Subject: [SE]

**Prominaces for Africa TSE?**

In the 91 Baja eclipse I was blown away by the beautiful red prominences.

With the sun hopefully becoming active again, could we have a similar performance in Africa?

Also, Does any recent total eclipse stand out for the most impressive prominences? Did I see the best show in 91? Has a major (giant) flare at the limb happened just before a TSE? Thanks, Jeff

Two for two at Sea (Jubilee 91 & Rynndam 98). : )

O for 1 on land - Austria 99 : (

From: Eric Pauer <pauer@bit-net.com>

The consensus from the group I was with for the 1999 solar eclipse was that this event was the best prominence eclipse. For one fellow on our trip, this was his tenth total, and according to him, by far had the most prominences. BTW, we viewed from the eclipse centerline near Lake Balaton, Hungary. I easily counted eight prominences through my 10x50 binoculars, even a

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large one detached from the sun.

There are many subscribers on this list which many more than 10 total eclipses under their belt who might comment.

I think it is safe to say that given the recent increase in solar activity, the 2001 total solar eclipse could likely provide even more prominences than the 1999 TSE.

Clear skies, Eric, 1998 (Aruba) and 1999 (Hungary) TSEs - "rookie"

From: Bill Kramer <bill@autocode.com>

Most prominences or best prominence display?

Although more were visible in 1999 due to the short duration (smaller moon relative to sun), they were not as spectacular (nor as large) as those during the 1991 eclipse.

If we are lucky, there will be lots of activity for this upcoming eclipse. 1991 was after solar maximum as this upcoming one will be. 1991 had a lot of sun spot activity while I felt that 1999 did not have near as many. With the condition of the sun this week I'd say we could get a great display - but we have several months to wait and see what happens.

Luck has a lot to do with it - during the 1980 and 1981 eclipses, the prominences were not as fantastic and I missed the 1979 eclipse due to exams (I had my priorities wrong obviously!). -Bill Kramer, <http://www.eclipse-chasers.com> -- Eclipses of the Sun and Moon

From: Daniel Fischer <dfischer@astro.uni-bonn.de>

I have to disagree: The two prominences of 1991, first the "flying S" and then (before 3rd contact) the "giant sea-horse" have yet to be matched in both size and weirdness/beauty of shape. 1988 was a fine year as well as there was just one medium-size prominence, but it had a textbook-perfect loop shape. Another eclipse trivia question emerges: What was the largest prominence ever photographed/ever seen during a total eclipse? I've seen bigger specimen than even the 1991 seahorse on photographs from the beginning of the century but don't have the details ready. Daniel



From: Brian Garrett <mgy1912@home.com>

I didn't see the eclipse itself (except on television), but I did go to Griffith Observatory in Los Angeles to look through their H-alpha telescopes to get an idea of what would be visible in a few hours to those who would be in the zone of totality. There was a good sized prominence just starting to erupt on (IIRC) the western limb, and I seem to recall reports from others saying that they had seen the decaying stages of this prominence during the eclipse itself. Brian Garrett

From: Anton van der Salm <ajsalm@hotmail.com>

I think we saw the best show in 1991. I have seen all the TSE's since that one, but never saw a prominence as big and beautiful as the 1991-one. The shape of a horse-head. Regards, Anton, Netherlands

From: Anton van der Salm <ajsalm@hotmail.com>

Well, TSE 1999 had a lot of prominences. I have seen all of the TSE's of the 90's. But, the biggest and most beautiful prom.(on my slides approx. 60 k miles above photosphere, horseheadshaped) was TSE 1991 in Mexico.

The sun will be very active in June next. One of the joys of eclipsechasing is: It is always a surprise! Kind regards, Anton van der Salm

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From: Mike Murphy <evmurph@zetnet.co.uk> To: <SOLARECLIPSES@AULA.COM> Sent: Tuesday, March 13, 2001 11:49 AM Subject: [SE]

### Use of GPS

Hi all, I wonder if some of you might be able to advise me on the use of a hand held GPS (at the eclipse in Zambia). I've used a GPS when sailing a couple of times and have been trying to decide what the best method is for making sure one is on the centre line.

This would then hopefully, inform my GPS purchasing decision; With the great myriad of GPS models to choose from and the technology seemingly advancing quite rapidly (moving maps, WAAS etc) I need all the help I can get. Regards - Mike in the UK

From: Peter Tiedt <Peter.Tiedt@npc-eagle.co.za>

Mike A GPS will be useful!! Also a freeware utility for the PC, such as Waypoint+ - (available from the website of the same name) I use a Garmin GPS12 and am exceptionally happy with it.

Waypoints for 2001, (in various formats) are available from my website - see <http://www.eclipse.za.net>. The specific page is [www.eclipse.za.net/html/2001.html](http://www.eclipse.za.net/html/2001.html) and the link is more or less near the bottom of the page. Regards ... Peter

From: Marc Bernstein

If all you want to do is check that you are on the centerline a low end unit is all you need. The Garmin eTrex is a good unit and I believe currently the lowest price GPS available (\$119). You can also get a serial cable with it to connect it to your PC/laptop if you want to upload waypoints. I wouldn't bother with anything fancier than that. The database units with mapping capability won't do anything for you in southern africa. Most of the uploadable maps cover North America and Europe. I also wouldn't bother with WAAS/DGPS. None of these cover the area and the current GPS accuracy of 10-20 m is good enough.

From: Gerard M Foley <gfoley@columbus.rr.com>

I have used four "handheld GPS". They all worked well. I like Garmin e-Map. Stripped, for around \$150 or so, it contains a very crude world map. You have to know where the center line is, from Fred Espenak's pages at

<http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html>

Otherwise, just turn it on a few minutes ahead of time. Hit "Enter" to mark the position you are in when you have settled before eclipse time.

If you want a little more detail you can buy a memory chip (grossly overpriced) to slip into the e-Map, and Garmin's MapSource WorldMap CDROM, also pretty pricey for the few hundred megabytes it contains.

Lowrance and Galileo may have comparable units which may or may not have more detail for central Africa built in them.

Happy eclipse! Wish I could see this one too! Gerry K8EF

From: Gerard M Foley

I agree about Africa. The maps are fun in other places, though. Gerry K8EF

From: Vic & Jen Winter, ICSTARS Inc. <icstars@icstars.com>

I would disagree about the GPS map / lack of map issue in Africa. The mapping feature of a GPS is not just for discerning where known, frequently traveled highways are. For starters, we have found many dusty international roads quite accurately represented in our Garmin's memory.

However, the greatest benefit of the mapping feature is in displaying relativity and scale of your own travel where there are no roads. As your own paths and waypoints are entered in your GPS, a new map is generated that can help you reference your relative location and distance to other locations. It has certainly helped us navigate and keep from getting lost in our last trip to a 10,000 sq mile desert plain where there were no roads or any kind. I wouldn't dare try to navigate in this instance WITHOUT a mapping GPS. Jen Winter

From: Gerard M Foley <gfoley@columbus.rr.com>

I think almost all GPS receivers have tracking, which will let you retrace your steps, even without mapping. Anyway, check that

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whatever you buy does have tracking if not mapping. Gerry K8EF

From: Marc Bernstein

What did people do before mapping GPS was available, stay home? These units are very nice and are great in areas with good map CD-ROM coverage. The bottom line is how much do you want to spend on a GPS to make sure you are on the eclipse centerline? An eMap unit with cables and CD-ROM maps will cost 3 times what an eTrex costs. Not to mention the laptop you will need to upload maps.

From: Dale Ireland

The EMap uses cartridges you can program and take along more than one on a trip. You can also program the unit prior to leaving, 16 megs is a lot of maps. I use the Garmin Navtalk, it is a mapping GPS and a cell phone in one. You can even call another Navtalk and view its map to see its exact location. Dale

From: Marc Bernstein

Perhaps this needs some clarification. There are 2 sources of map data. The unit comes with a built-in database. There are 2 versions available, one of which includes coverage of Africa. You can also upload map data from a Garmin supplied CD-ROM into data cartridges. They have a World CD-ROM covering Africa. I haven't seen either coverage so can't comment on the level of detail available from each. Has anyone compared these?

From: Joel M. Moskowitz, M.D. <moskowi@attglobal.net>

Absolutely. I first used one in 1994 and at every eclipse since. They are very easy to use, and are very inexpensive. The fact that I had one in 1994 got me on a different eclipse bus, when the leader decided it would be an asset. Remember, if you get a map enabled one, there will not be any maps for Africa! :) Joel M. Moskowitz, M.D. 7 (total eclipses and counting

From: Gerard M Foley

I have looked at the Garmin MapSource WorldMap CDROM for a random spot on the centerline of the 2001 eclipse. (My readings are approximate, and may be in error by as much as a mile.) The path in Zambia appears to pass about 2 miles (3 km) south of a town called Lunkunyi. On the scale spanning about 30 miles, the map shows a river with eight tributaries. It shows about 4 roads as heavy lines and two others as lighter lines. Besides Lunkunyi, two other towns are marked in this 25 x 30 mile area, Mukandakundu and Chinyingi Mission. Greater zooms do not show any more detail. The region I describe is about 25 miles north of the western end of Highway M8, at a town called Zambezi, which is marked as having an airport. I thus assume that the river is the Zambesi. Aside from the river and some tributaries, there is no topographic detail on the WorldMap CDROM.

I don't have my e-Map with me to look at the detail in this region on the built in map, but from experience with other regions I would guess that there is essentially no detail on the built in map.

I hope this gives some idea of the detail. This CDROM can be used to download to the Garmin eMap. I can't find in the MapSource manual what other Garmin GPS units can be downloaded from this CDROM.

If anyone feels it worthwhile I could post a copy of this part of the map on Photopoint or on a webpage somewhere. I don't think I should attach a jpeg to pots to this group Gerry K8EF

From: <JohnLX200@aol.com>

I have the WorldMap CDROM, and I'm eagerly awaiting delivery of a Garmin eTrex Vista. The Vista is due to be released in a couple of weeks, has 24MB (not expandable) memory, a GPS-calibrated barometric altimeter, electronic compass for when you aren't moving, and keeps time-stamped tracklog points in 3 dimensions.

It can take maps from CDs including the WorldMap and also MetroGuides just like the eMap. It comes loaded with a basemap of the Americas plus world cities (and points of interest?) plus some marine navigation aids already preloaded.

I'm not as sure of which maps can be loaded into the eTrex Legend, which is similar but with only 8MB, less stuff loaded, and no altimeter or compass. Last but not least the eTrex Venture only gets map info from the new, lesser Points of Interest CD for its 1.44MB memory.

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I hope this helps. I plan to load eclipse path coordinates into mine, in addition to the countries of interest. I would be happy to share whatever data and methods I come up with for doing so after I get mine and figure it out, bearing in mind that I'll be concentrating on the Kafue Park area the most. I hope to plot information gathered from various maps, plus information about expedition camps and viewing locations. John Hopper

From: <Jay.M.Pasachoff@williams.edu>

I've been reading the track about the GPS, and I wonder whether a major point has been overlooked: The duration of totality varies very little, only a few seconds, for many miles on either side of the center of totality. Even Lusaka, which is way off to the side of totality, has 3 minutes of totality instead of the 3.5 on the center line. So, while it is fun to have a GPS, it isn't necessary or even particularly useful. Accuracy on a map is quite good enough. Further, in Zambia, you shouldn't be off by yourself.

I am going to Lusaka tomorrow for a week, so if there are any special requests for things for me to look at, please let me know. Jay Pasachoff

From: Glenn Schneider <gschneider@mac.com>

Hi Mike, GPS certainly makes life easy, but depending upon what you are doing, it is also certainly less important to locate yourself "exactly" on centerline then to know WHERE you are, and hence WHEN you are in the dynamical timeframe of the shadow motion. The path through Zambia (which is what you specifically asked for) is actually quite wide, averaging about 175 km (+/- ~ 5km) depending upon where you are long the path within Zambia). Remember that the DURATION of totality declines VERY slowly as you move off centerline, approximately as:  $T * \text{SQRT}[1 - (X/W)^2]$ , where X is your distance from centerline (perpendicular), W is the width of the path at that centerline location, and T is the centerline duration of Totality. So, for example, in Eastern Zambia at 13:10 UT mid-eclipse the duration of totality as a function of your distance in 10 KM increments from centerline is approximately:

km	secs
0	217.8
10	216.3
20	211.6
30	203.7
40	192.0
50	175.9
60	153.8
70	122.8
80	71.9



So, even if you are 10 km off centerline, you would lose only a second and a half. Certainly that should be well within the ability to locate yourself with navigation tools as crude as a road map and odometer. Not that I am advocating this. Before the days of GPS I would haul tubes of path-overlaid topo maps around to an eclipse path, and by line-of-site triangulation to hills, towers, other landmarks, etc., could usually get my location to about 100 meters too much effort. If you want to know WHEN the times of contact will occur to a precision of a second or better, particularly if you intend to be off of the centerline (i.e., if you are going after limb/grazing phenomena) you would need that. Again, GPS makes it a snap. Also, if you are doing any sort of automated photographic sequence, or observations/experiments (here, of course I can't help plugging UMBRAPHILE; <http://balder.prohosting.com/stouch/UMBGRAPHILE.html> ).

Of course, there is the esthetic consideration of being concentrically located within the umbra at mid-eclipse, from the perspective of the view of the interaction of the umbral "edge" with the atmosphere. As you move off center, of course, the asymmetry of the shadow lightens the sky as more photospheric light from outside the umbra scatters in. And, you get a very different mid-eclipse visualization of horizon colors and brightness. Again, though, a few km for this eclipse should not make much of a difference.

I bought a small hand-held GPS unit in 1996 from Garmin to use for the 1997 in Siberia eclipse. It is pretty crude by today's standards. Indeed, through it can do tracking, PC downloads, etc. all I ever use it for is to read off my lat/long/altitude. I paid about \$100 for it then, and I have found it well worth the investment.

My prompting to purchase it then (aside from the fact that GPS was becoming pretty mature as consumer products) was based

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upon an experience I had on my 1981 eclipse trip to Siberia. When flying to Bratsk on a Soviet Yak-42 aircraft, John Beattie (another die-hard eclipse chaser) and I had sprawled out in front of a mid-cabin window (where there were no seats across from a galley) and were intently studying the terrain while consulting unfurled annotated topo maps I had brought along. After about 20 minutes one of the flight crew on a break happened to walk by, looked at us for a moment or two and returned to the cockpit. A couple of minutes later the co-pilot came back and asked fairly sternly in somewhat hesitant English "Where did you get those maps?" I said "I brought them with me from the U.S.". He repeated, more slowly and distinctly, as if I did not understand what he had said: "No, WHERE did you get those maps?" I then had horrible visions of them being confiscated - before the eclipse! Did I bring in unknowing contraband to the USSR during the height of the cold war? But then, as he unfolded one of the maps HE had been using for navigating the aircraft I understood. HIS maps were quite detailed around major cities and populated areas. Between them, for stretches of literally hundreds of miles the terrain and topography was whited-out, with only black lines drawn to indicate against a lat/long grid where aircraft were permitted to fly. He then said "This is MY map, where can I get YOURS?" So, I very cordially gave him the address of the Hammond map store in New York City where I had purchased them. It was a bit unsettling to think that if the plane went down prematurely he might have had no reference to know apriori where would might set down! Glenn Schneider

From: Assoc Prof J R Huddle <huddle@usna.edu>

Mike (in the UK) wanted to know HOW to use a GPS to place himself on the centerline.

Perhaps the most straightforward method, and one that will work with any model of GPS, is to plot the centerline on a paper map, then use the GPS to determine your position and plot that on the paper map. If you're not close enough to the CL, you can see which way you have to go. If you surf Fred Espenak's web site ([www.mreclipse.com](http://www.mreclipse.com)), you can find plotting coordinates for the CL. Jim Huddle

From: Dale Ireland <direland@drdale.com>

If you want to be exactly on the center line you must correct the table values for elevation above sea level and enter them into the GPS ahead of time, especially if the Sun's altitude is low. Dale

From: Jean-Paul GODARD <jean-paul.godard@noos.fr>

Use of the GPS to find the center line: I used the following method for 2 total eclipses and enjoyed it (in situations where it was not possible to have a good relation between landscape and map)

I have a quite old GPS (bought in 1993) KX-G5500 from Panasonic. I can define Way points and i have a navigation mode to be used between way-points: assuming that i am going from wp 23 to wp 24, the GPS give me: - current position (Obvious) - Distance to wp23, wp24, \*\*\*Distance to the line joining wp23 to WP24\*\*\* (route error) - position (left or right) relative to the line, Time to destination,...

If I enter the coordinates of the centerline over the concerned territory, i can monitor my distance to the centerline during my "approach" on road or by air (see below).

The first time I used this, was in Thailand in '95. I hired a cab from Bangkok with no precise idea of my destination. I was able to monitor the "final approach" and to avoid the "reserved location for tourist" observing very close from the center line.

The second time I used it, was in '99 during a flight over France. The GPS was used to improve position of the plane which was under Military control (they have a good precision, but don't plot center lines on their scope) Have a look to : <http://mapage.noos.fr/eclipses>

From: Harvey Wasserman <onsite@gate.net>

A bit off the topic, but seems to me a while back there was a discussion regarding where it is best to view total eclipses. There were those that wanted to be directly on center-line, while others sought the edges, trying to catch more baily's beads.

It remember that someone was saying that in Zambia, due I think to the lunar limb profile, the eclipse would actually be of slightly longer duration if you were somewhat north of central.

Am I making this up, or is this indeed true? Could someone please explain this? How far off center are we talking about? How

(Continued on page 56)

much longer? - or was it some other phenomenon that was being discussed? (uh, if this is actually true at all!) Thanks, Harvey Wasserman

From: Bob Morris <morris@sce.carleton.ca>

As I've noted before, my version of GPS in 1966 turned out to be a guy called Donald Menzel.

On May 20 1966, travelling the road to Sounion south from Athens on a bus, and not having any precise map, and knowing that the path of the annular-total eclipse was 0 miles in width at the point (according to the Naval Observatory Bulletin), we saw a hillside with about 100 observers, many with telescopes. Since it was near where we guessed we should get off, we got off.

As per my photos published in the Aug 66 Sky & Tel, the diamond necklace phase was perfectly symmetrical and lasted about 1 second!

When we found out that Donald Menzel was on site (via Sky & Tel) we knew that in all probability we had been within a fraction of a mile of the center line of the eclipse -- the one and only time that will ever be the case for me.

BTW, May 20 '66 and March 7 '70 (Cape Charles) are the only two times that I've had perfect, cloudless skies! Bob Morris

From: Marc Weihrauch <marc.weihrauch@student.uni-halle.de>

Dear shadow-chasers, there's another aspect not mentioned before in the discussion about finding the center line. If you look at Fred's pages about the TSE01 you'll find a figure 9 which shows the duration of totality against distance to center line for several places along the shadow path. Duration is shown once theoretically, considering a mean lunar limb profile, and once considering the true profile. The true profile seems to make difference of up to six or eight seconds (I haven't printed the figure out; I'm only estimating it on the screen). From Eastern Angola eastwards you get maximum duration OFF the center line! In Madascar that's as much as 10 km to the North.

So obviously you can gain a few seconds by leaving the center line. Best regards Marc

From: FRED ESPENAK <u32fe@lepvax.gsfc.nasa.gov>

>I remember that someone was saying that in Zambia, due I think to the lunar limb profile, the eclipse would actually be of slightly longer duration if you were somewhat north of central. Am I making this up, or is this indeed true? Could someone please explain this? How far off center are we talking about? How much longer? - or was it some other phenomenon that was being discussed?

*(Continued on page 57)*

From: Mike Simmons To: solareclipses@Aula.com Sent: Saturday, March 24, 2001 8:59 AM Subject: [SE]

**Reports from Zimbabwe (long)**

The following reports have been forwarded to me by Stephen Tonkin, a former Zimbabwe resident now living in the UK. He has received these from Dereck Wetherall, a friend in Zimbabwe. I thought they might be of interest to those on the SEML because of the changing conditions in that country. Stephen will be sending me more of these reports and I will gladly pass them on if there is interest and they are considered appropriate for the list. Mike Simmons

From Dereck Wetherall Sent Monday, March 19, 2001 9:50 AM Subject Some pretty good Zim items

From The Financial Gazette, 15 March

.../...

From: Mike Simmons <msimm@ucla.edu>

I've received another message about the situation in Zimbabwe. I won't be posting it to the list but anyone interested can contact me and I will forward it to you. Mike Simmons, msimm@ucla.edu

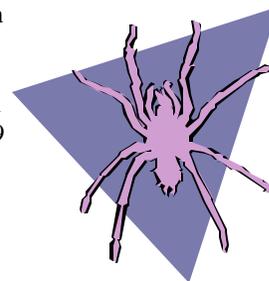
Yes Harvey, it's true.

Take a look at Figure 9 (page 41) of the NASA 2001 eclipse bulletin ([http://umbra.nascom.nasa.gov/eclipse/010621/figures/figure\\_9.gif](http://umbra.nascom.nasa.gov/eclipse/010621/figures/figure_9.gif)).

Figure 9 shows a series of calculations for the duration of totality within 60 kilometers of the center line and spaced at ten minute intervals along the path through Africa and Madagascar. For a given time, the duration of totality is calculated at 1 kilometer intervals perpendicular to the path within a 120 kilometer zone centered on the center line. Predictions using the Moon's center of mass and mean limb are represented by the dotted curves. Predictions using the actual limb profile to calculate corrected contact times and the resulting duration of totality are plotted as solid curves. What becomes immediately apparent upon inspection of Figure 9, is the asymmetry of the true limb duration curves and is a consequence of the complex Sun/Moon limb geometry which changes quickly with path position.

Observers wishing to witness the maximum possible duration of totality from a given section of the path can use Figure 9 to optimize their location with respect to the center line.

For the case of central Zambia (13:10 UT), Figure 9 shows that the center line duration (including limb profile effects) is about 185 seconds. However, the maximum duration of 189 seconds actually occurs about 9 kilometers north of the center line. - Fred Espenak



From: Glenn Schneider <[gschneider@mac.com](mailto:gschneider@mac.com)>

This is true, but depends in part as to HOW you define centerline.

Classically (i.e., until not too very many years ago) the centerline of eclipse tracks were computed dynamically based upon the center of mass of the moon only. The problem is that the center of mass of the moon is not coincident with the topocentrically viewed center of Figure, and the later depends in detail upon the lunar libration. There are two effects which contribute to this.

First, the moon to first order may be described as a tri-axial ellipsoid, so even if its surface were perfectly smooth and defined only by an Earth/Solar perturbed gravitational potential, it's profile as seen from some location on the Earth (or elsewhere) would not be perfectly circular, by very slightly that of a projected ellipse (far too small to be noted visually). But, a cord across the major axis would be a very slightly different length than the diameter of a true circle. Actually, the center of mass is also slightly displaced from the tri-axial approximation to the center-of-figure because of "mass concentrations" or mascons, which were discovered as part of the Apollo program.

That said, this is a SECONDARY effect. The primary one is due to the lunar topography (or more correctly selenography) itself. The mountains and valley's of the moon, seen in profile, modify what the "smooth moon" approximation to the appearance of the limb looks like from the Earth. If a particularly deep valley intrudes into the "smooth moon" profile, the photosphere will be extinguished later at second contact, or earlier at third, thereby shortening the duration of totality - if one defines it by the complete extinction of the photosphere (rather than some subjective mean value of "k"). For example take a look at: [http://nicmosis.as.arizona.edu:8000/ECLIPSE\\_WEB/ECLIPSE\\_86/limbprof.gif](http://nicmosis.as.arizona.edu:8000/ECLIPSE_WEB/ECLIPSE_86/limbprof.gif) which is explained, in context in: [http://nicmosis.as.arizona.edu:8000/ECLIPSE\\_WEB/ECLIPSE\\_86/ECLIPSE\\_86.html](http://nicmosis.as.arizona.edu:8000/ECLIPSE_WEB/ECLIPSE_86/ECLIPSE_86.html)

Today, the duration of totality is usually "corrected" for the modifying effects of the limb profile. The compilation of the libration dependent limb profiles was first compiled in charts by Watt's and later digitized for use on computers. The source for the profiles, which has been modified over the years, was from Lunar Orbiter photographs (still one of the best, or I should say THE best source of information on global lunar topography) and tweaked by analyses of occultation observations.

Fred Espenak very nicely shows the magnitude of this, for the upcoming eclipse for several locations along the path of totality at: [http://umbra.nascom.nasa.gov/eclipse/010621/figures/figure\\_9.gif](http://umbra.nascom.nasa.gov/eclipse/010621/figures/figure_9.gif)

Once again, thank you, Fred. So, for example, in Zambia at 13:00 UT the actual duration on centerline is shorter by about two seconds than if you moved about 5 km to the North of centerline. Glenn Schneider

From: Joel M. Moskowitz, M.D. <[moskowi@attglobal.net](mailto:moskowi@attglobal.net)>

(Continued on page 58)

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There is one use for the GPS no matter where you are in the area of totality. If you want accurate timings, you need accurate lat and long. If you use Glenn Schneider's Umbraphile program for automatic camera control, you need to have accurate location numbers. The GPS is most useful here. Joel M. Moskowitz, M.D.

From: Glenn Schneider <gschneider@mac.com>

Jim, Mea Culpa! And thank you for a careful reading. Sigh! Typos will get you (well, me) every time. Of course, W is the half-width, which I meant to write.

If you check the 10 km table I posted you will see it is correct, and indeed I used the half-width to print this out. The word "half" unfortunately evaporated from my fingers when I wrote my last posting. Apologies.

FYI - along these lines, never trust word processors. Whenever I write the word "coronagraphic" in a MS Word document, Bill Gates wants to change it to "pornographic". I found that out the hard way a couple of years back when, in an instant I did not check carefully enough, when I had an abstract of a paper for a meeting go out that way. -GS-

> Assoc Prof J R Huddle wrote: You wrote, " $T * \text{SQRT}[1 - (X/W)^2]$ ", where X is your distance from centerline (perpendicular), W is the width of the path at that centerline location, and T is the centerline duration of Totality." Should not W be the HALF-width? Jim Huddle

From: Mike Murphy <evmurph@zetnet.co.uk>

Hi all, many thanks to everone who replied to my query about this.

In particular I would thank Glenn Schneider for his amusing tale about maps aboard the Soviet Yak-42 aircraft and to Jean-Paul Godard, who said:

> I have a quite old GPS (bought in 1993) KX-G5500 from Panasonic. I can define Way points and i have a navigation mode to be used between way-points: assuming that i am going from wp 23 to wp 24, the GPS give me: - current position (Obvious) - Distance to wp23, wp24, \*\*\*Distance to the line joining wp23 to WP24\*\*\* (route error) - position (left or right) relative to the line...

This was the sort of thing I was trying to work out. Like many things, it's obvious when you know how, but this is particularly useful because this ability to tell you how far you are from a line joining two waypoints is absent from, for example, the Garmin eTrex; it just tells you which direction to go.

Other conclusions that I have drawn are: - a mapping GPS is not necessary. (Although I have found some electronic maps of Southern Africa, available from Germany and originating from Russia). - WAAS accuracy is not necessary, now that SA is turned off. (Although many of the new models just coming onto the market are WAAS-ready). - if I want to be dead centre in the actual shadow I have to take the limb profile into account. (I hadn't previously realised this).

So, off I go to find a nice shiny new GPS unit that will provide off-track data (route error). Thanks again, all, this list is such a useful resource. Cheers - Mike Southsea, UK.

From: John Leppert <johnleppert@peoplepc.com> To: <SOLARECLIPSES@AULA.COM> Sent: Saturday, March 17, 2001 3:22 PM Subject: [SE]

#### **Obtaining Zambia/Zimbabwe visas for US citizens...vaccination info...**

Dear eclipse travelers, For those of you with US passports who are traveling to Zambia and/or Zimbabwe, I am writing and offering some advice. Americans are required to hold visas, unlike some other nationals, and the manner and process for obtaining them is a bit involved. If you have not yet begun the process, perhaps you might contact me directly and I'll pass on the details as I know them. I have Zambia visa forms their Washington Embassy emailed me (Word format) which I'd be pleased to forward to anyone as an attachment. The Zimbabwe visa forms must be obtained from their Embassy as hard copies. I've also got vaccination advice and recommendations that I can email. John Leppert Bismarck ND

From: Harvey Wasserman <onsite@gate.net>

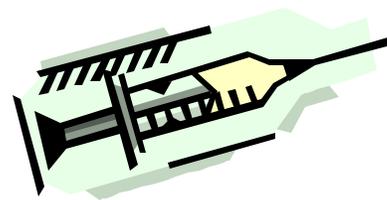
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My understanding is that both visas may be obtained at point of entry. Harvey

From: <Kidinvs@aol.com>

I pass along this info sent to me last week from the Zambian Embassy...Eric Brown.



ZAMBIAN VISA REQUIREMENTS (INFORMATION CORRECT ON 07 MAR 01)

PASSPORT HOLDERS FROM THE FOLLOWING COUNTRIES DO NOT REQUIRE A VISA:

ANTIGUA & BARBUDA; AUSTRALIA; THE BAHAMAS; BARBADOS; BELIZE; BOTSWANA; BRUNEI; CANADA; CYPRUS; DOMINICA; FIJI ISLANDS; GRENADA; IRELAND; JAMAICA; KENYA; KIRIBATI; LESOTHO; MALAWI; MALAYSIA; MALDIVES; MALTA; MAURITIUS; NAMIBIA; NAURU; ROMANIA; ST KITTIS & NEVIS; ST LUCIA; ST VINCENT & GRENADINES; SAMOA; SEYCHELLES; SINGAPORE; SOLOMON ISLANDS; SOUTH AFRICA; SWAZILAND; TANZANIA; TONGA; TRINIDAD & TOBAGO; TUVALU; UGANDA; VANUATU; YUGOSLAVIA; ZIMBABWE.

PASSPORT HOLDERS FROM THE FOLLOWING COUNTRIES REQUIRE VISAS ON A RECIPROCAL BASIS:

BRITAIN; BANGLADESH; GAMBIA; GHANA; INDIA; NEW ZEALAND; NIGERIA; MOZAMBIQUE; SRI LANKA; SIERRA LEONE; PAKISTAN; PAPA NEW GUINEA.

PASSPORT HOLDERS FROM THE FOLLOWING COUNTRIES DO REQUIRE A VISA & MAY OBTAIN THEM AT PORT OF ENTRY OR MISSIONS ABROAD:

ANGOLA; BURUNDI; COMOROS; CONGO DEMOCRATIC REPUBLIC; DJIBOUTI; EGYPT; ERITREA; ETHIOPIA; MADAGASCAR; MOZAMBIQUE; RWANDA; SOMALIA; SUDAN.

AMERICAN TOURISTS AND BUSINESS TRAVELLERS SHALL BE ISSUED WITH MULTIPLE ENTRY VISAS VALID FOR THREE YEARS AT A FEE OF US\$40 PER PERSON AT MISSIONS ABROAD OR PORTS OF ENTRY.

ANY PRIVATE AND/OR BUSINESS VISITORS WISHING TO VISIT NEIGHBOURING COUNTRIES SHALL BE ISSUED WITH RE-ENTRY VISAS VALID FOR 7 DAYS AT INTERNAL IMMIGRATION OFFICES OR AT BORDER POSTS BEFORE DEPARTURE FROM ZAMBIA.

THE HOLDERS OF THE FOLLOWING PASSPORTS DO REQUIRE A VISA AND NEED TO OBTAIN THE VISA FROM A ZAMBIAN EMBASSY BEFORE ENTERING AND CANNOT OBTAIN ONE FROM THE BORDER POST LIKE OTHER TRAVELLERS:

DANNISH; SWEDISH; FINNISH

DAY-TRIPPER – Just coming in from Zimbabwe to view the Falls, buy curios or raft:

US\$10.00

	SINGLE ENTRY	TRANSIT ENTRY	DOUBLE ENTRY	MULTIPLE ENTRY
BRITISH NATIONALS	GBP35	GBP35	GBP45	GBP45
AMERICAN NATIONAL			US\$40.00	
ALL OTHER NATIONALS	SUS\$25.00	US\$25.00	US\$40.00	US\$80.00

BRITISH NATIONALS CAN GET SINGLE ENTRY VISAS CHEAPER AT ZAMBIAN MISSIONS ABROAD (GBP33).

PLEASE ENSURE THAT YOU CHECK WITH ALL TRAVEL AGENTS THE NATIONALITY OF THEIR CLIENTS AT CONFIRMATION!

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From: Assoc Prof J R Huddle <huddle@usna.edu>

Last year (both in March 2000 and in June 2000) I had absolutely zero trouble getting a Zimbabwe visa at Harare International Airport. I just paid the money and they stamped my passport and waved me through. Has this changed? As of December, 2000, the Embassy of Zimbabwe was saying Americans could still get their visas at the airport in Harare.

The Zambia visa was different: The Zambian Embassy in Washington, DC told me that it was necessary to get a visa before I left the USA. I took my passport to the Zambian Embassy, filled out an application, and left my passport and application there. They mailed my passport back to me about a week later, with the visa. It was no problem, just something that had to be done and took some time. Since I'm not going to Zambia, I have not checked recently to see if the procedure has changed. Jim Huddle

From: John Leppert <johnleppert@peoplepc.com>

Dear Jim, I thought getting visas for one or both countries in advance was wise because that's what the US State Dept advised. I have no idea as to whether Zimbabwe has changed their requirement or not. Guess, I'd be curious to hear what the Zimbabwe visa cost you in-country. According to DC-Embassy instructions, a single entry visa is \$50, a double entry visa is \$65, and multiple entry visas have to be gotten in-country. No fee cost was in the instructions I was sent for the latter. I personally don't want to face any hassles getting a visa in mid-June with a solar eclipse a few days away. As well, I offered to give some advice since I virtually got next to nothing from the tour group I'm traveling with to Africa, and I'm not too certain that other US citizens may be in the same boat, so to speak. John Leppert Bismarck ND

From: Harvey Wasserman <onsite@gate.net>

I thank you, John, for sending me the Zambian visa application. The more I think about it, the more I am inclined to get this one ahead of time. It is true, I just do not need any hassles getting into Zambia. The rest I am not too worried about. I am sure that getting the visa at the point of entry would be fine, but then again... Harvey

From: Harvey Wasserman <onsite@gate.net>

I thank you, John, for sending me the Zambian visa application. The more I think about it, the more I am inclined to get this one ahead of time. It is true, I just do not need any hassles getting into Zambia. The rest I am not too worried about. I am sure that getting the visa at the point of entry would be fine, but then again... Harvey

From: <Rayabrooks2@cs.com>

There is a visa service in Washington DC that will walk all the papers through for multi -country visits. Reduces chance of losing passport in mail. "Generations Visa Service" 1-800-845-8968

From: <Jay.M.Pasachoff@williams.edu>

I read the official information just sent. The actual situation, as of my entry at Lusaka yesterday, is that American citizens can get a visa on the spot at the airport for \$25, but only a single-entry visa. Jay Pasachoff

From: Harvey Wasserman <onsite@gate.net>

As far as I can tell, the Zambian Embassy in DC is no longer open, However, I found the following link that promises to be the link to the "Permanent Mission of the Republic of Zambia to the United Nations". It also has an email address for correspondence.

<http://www.undp.org/missions/zambia/>

I have asked them for an address to apply for a visa, and will post it if I get an answer.

Can anybody confirm that the embassy is closed, and what address to send the application to? Thanks, Harvey Wasserman

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From: Harvey Wasserman <onsite@gate.net>

I got the following message back...

"No storage space available in mailbox for zambia@un.int

The following recipients haven't received this message: zambia@un.int "

So, back to square one. Anybody know what's up? Harvey

From: barr deryl <dbarr@nque.com>

One may download visa applications for any nation currently open to travel by US citizens at the Zierer Visa Service home-page: [www.zvs.com](http://www.zvs.com) For an additional fee they will process the application for you, and have your visa (visas) to you in usually less than 2 weeks.

From: Jean-Paul GODARD <jean-paul.godard@noos.fr>

Mailbox might be full and unvisited for a long time. Cordialement / Regards Jean-paul.godard@noos.fr

From: Paul & Leni <pauleni@rcn.com>

Just a little bit of information. We have already received our passports back with the appropriate visa stamps. Following is the necessary information for US citizens.

They required passports, 2 copies of the application form, 2 photos of each person (signed on the reverse) and a money order or cashiers check for \$40 per person sent to:

Embassy of the Republic of Zambia  
2419 Massachusetts Avenue, NW  
Washington, DC 20008

I would suggest a call, to the embassy, in advance for the name of a contact person at the to whom you will send the above materials by certified mail. This, hopefully, will allow you to track down your passport, in case of and unforeseen problems.

From: Assoc Prof J R Huddle <huddle@usna.edu>

Recall Jay's recent message - a few days ago, he got a single-entry visa at the airport in Lusaka for \$25.... Jim Huddle

From: Paul & Leni <pauleni@rcn.com>

The visa application form clearly indicates the following: "N.B. All U.S. Nationals are issued multiple entry visas only for a \$40.00 fee."

If in doubt I suggest that you call the emb assy at (202) 265-9717. I would hate to be delayed entering Zambia prior to the TSE.

From: Madden.G <iluveix@netacc.net>

We too have already recieved our processed visa's by return mail (we included SASE).

Our passports were out of our possession for about 14 days. We used the address below. madden/rochester

From: Vic & Jen Winter, ICSTARS Inc. <icstars@icstars.com>

It is likely that the confusion in fees here is caused due to the use of Visa Services. The link that Paul and Leni cited is a Visa Service. Their service is to acquire visas for clients conveniently. This service can come at a fee over and above what one may pay

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to apply for the visa at the port of entry, or directly from the honorable consulate.

Many thousands of travelers use a visa service to assist in procuring documents. They are useful exactly in this instance where there is some question about the accessibility of the DC embassy. It is a personal choice on where to acquire your visa from.

This would explain the cost differences that are showing up. Clear Skies, Jen

From: Paul & Leni <pauleni@rcn.com>

As far as George Madden and I are concerned we sent our paperwork directly to the Embassy of Zambia in Washington D. C. not an intermediary service. (Looking forward to seeing you in Zambia, George and Roseanne)

The following is an excerpt from the Zambian National Tourist Board at:

<http://www.africa-insites.com/zambia/travel/Default.htm>

"6 AMERICAN VISA REQUIREMENTS Diplomatic personnel and Government officials, from United States of America shall be issued with multiple entry visas valid for three (3) years at Zambian Missions Abroad or ports of entry. American tourists and business travellers shall be issued with multiple entry visas valid for three (3) years at a fee of US \$ 40.00 at Missions abroad or ports of entry. American Students shall be issued with multiple entry visas for the whole period of their studies in Zambia on production of letter of acceptance from the institution of learning in Zambia. Americans travelling to Zambia to take up employment shall be issued with multiple entry visas valid for three (3) years at Zambian Missions Abroad or ports of entry. The spouse and children of the employee shall pay US \$ 20.00 fee each valid for three (3) years. American nationals working for Non Governmental or Non-Profit making Organisations shall pay entry visa fees of US \$ 30.00. Their spouses and children shall pay US \$ 10.00 each."



For your own peace of mind I would urge you to call the Embassy and obtain the correct information directly from them. We all have enough to think about without being concerned about our paperwork when we land in Lusaka.

Clear skies and looking forward to comparing notes with everyone in Zambia. "Vic & Jen Winter, ICSTARS Inc." wrote:

From: Harvey Wasserman <onsite@gate.net>

I am sorry for whatever confusion/hysteria I may have contributed. A Call to the Zambian Embassy in Washington, DC, confirms that the address on the Visa Application is correct. I was told that it takes 3 days to get a visa, once the passport is received at the embassy.

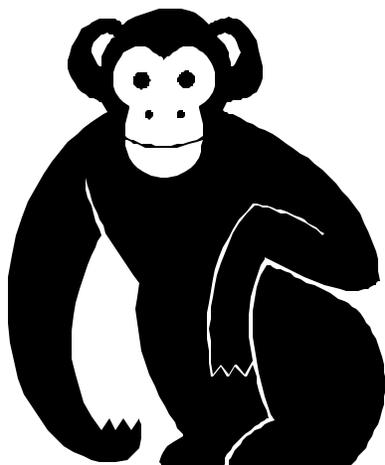
To those not in the US - Apologies for the bandwidth use. Sincerely, Harvey Wasserman

From: B Yen <byen00@earthlink.net> To: <SOLARECLIPSES@AULA.COM> Sent: Sunday, March 25, 2001 10:29 AM Subject: [SE]

### **Zambia expedition**

I am going to Zambia for the eclipse (in country: June 14 - June 28), & am looking for a group to attach myself to:

1. scientific expedition
2. group of technical amateurs
3. group of local Zambia amateurs
4. friendly local (e.g., farmer in the outback)

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I need to get in touch with the appropriate people, to setup my "in country" plans. I need suggestions & advice.

I like Option 1, since there will be "numbers" & infrastructure (in case of health, or other emergencies). I mind my own business, won't interfere, do my own technical eclipse program. (For '99 eclipse in SE Turkey, I did this because of security concerns. ironically, I split off the group because of weather concerns. See <http://www.comet-track.com/eclipse/sec199/sec1991.html>)

Option 2? I've seen many technical amateurs make "motions" toward an informal eclipse group. A guy from Russia (on sci.astro.amateur), some recent posts here on SE mailing list (UK, others). The potential problem, is people might change their mind, the group is small in number..which implies a security problem (i.e. getting robbed).

Option 3? This was recommended to me a long time ago by Donald Trombino (experienced eclipse expedition leader). Local amateurs know the country, know good sites (for eclipse observation)..this probably implies good security.

Option 4? I like the idea of hooking up with a friendly local, like a resident in the outback. I did this in '95 India, where a local farmhouse was nearby (they gave me food, I entertained them. <http://www.comet-track.com/eclipse/sec195/sec195.html>). It also happened in '98, where a helpful Curacao contact set me up with a friend (who let me stay in his house, got me a rental car, gave me a tour of potential sites in his 4x4). I found my own eclipse site, did the eclipse, then returned to "home base" (his home)

Notes: - I don't require luxury accomadations or fancy safari tours. - Since I am in country for almost 2 weeks, this gives me a chance to do Southern Sky night astrophotography. So, I would plan to do this 1 week before E-day, 1 week after E-day. I.e., I would be setup at a dark site (out in the bush) for a long time. This means I need a secure site. Like an official tourist camp, \$11/night in a tent. (I might spend a bit more for an enclosed hut) - I need to avoid crowds, which are potentially problematic. This came up during '99 eclipse, where the local security couldn't control the crowds (NASA group in Dyarkbakir, group in Harput)..I talked to amateurs who were really upset about being promised security & having their equipment knocked around. I need a controlled environment (as in Option 1), to do my work

From: Alan Leighton <[leighton@gmx.net](mailto:leighton@gmx.net)>

I believe the correct URL is <http://www.comet-track.com/eclipse/sec199/sec199.html>

Fantastic pictures Bob! I look forward to seeing your Zambia pictures. I wish you, and all other eclipse chasers, CLEAR SKIES!!!! and the best of luck. Alan Leighton

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## ~ AFRICA 2001 ~

by Raymond Brooks

Africa.... 'sunny' in Latin, 'without cold' in Greek; spanning 5,195 miles from tip to tip, as far as San Francisco Bay to the fresh waters of Oslo, Sweden; the dark continent indeed on June 21, 2001: an earthbound space odyssey to the pinnacle of the moon's pleasing pall that taps on Earth's shoulder just as Earth bows its solstice-head directly to the sun in homage for the very first time in the new millennium; humanity's homeland; what a time, what a place, what fortune we have to be alive and enjoy our consciousness amidst provocative timing!

As the moon starts its trace across the blue globe, Africa is poised dead center, Cape Town pointing straight down. The sun is directly overhead in the Sahara, blazing; the full and partial shadow of the Moon offering no cooling relief whatsoever over the next 5 hours; not a nick of sun getting blocked. As the moon accelerates toward its perigee 2 and a quarter days away, its umbra dancing across Earth will keep almost 3 pounds of sunlight from its intended target over the three hour trip. The umbra has picked a careful path avoiding land, crossing only the thinner part of the continent of Africa and Madagascar, running south of the Atlantic islands Trindade and Ascension and north of the island St. Helena.

Even if the Earth were a crystal clear globe, the shadow axis out the back of Earth would avoid land the entire journey except for a thin transit across the narrow south end of Chile and Argentina a minute and a half after landing on Earth; taking only 2 minutes to cross beneath the 400 mile wide strip; offering 90 seconds of totality if viewable 15 degrees below the horizon by the Chilean residents.

Our site, Landless Corner enters the (92.7 x 171.3 mile) shadow at 2,462 MPH and leaves the (91.3 x 182.4 mile) shadow at 2,753 MPH making a gentle arc that deviates 302 feet from being perfectly straight over the 156 mile length. During the nearly 4 minutes of totality the shadow ellipse rotates 1.6 degrees CCW. When Landless Corner is mid-totality the shadow axis exits back of Earth 1200 miles SW of Australia with a ground (water) speed of 4100 MPH which would allow only 1 minute 17 seconds of totality in a 54 x 104 mile shadow.

The 4,190 feet of elevation at Landless Corner adds only about .03 seconds duration to totality.  
The Subsolar point for our mid-eclipse is just off coast of Africa due south of the Canary Islands.

There are 7 perigee moons in 2001 that are closer than the perigee associated with this eclipse.  
The perigee moon of February would have added almost 80 seconds of totality at our site of Landless Corner Farms assuming it too was over 2 days away.

The month leading up to eclipse sees a lot of traffic; Saturn passing 3 solar diameters beneath the Sun May 25, Mars reaching opposition June 13 (but closest to Earth 8 days later, eleven hours after the eclipse due to its very eccentric orbit), Venus reaching aphelion June 14 only six hours before Jupiter passes ¼ solar radius below the Sun, Mercury passing beneath the sun June 16.

Enjoy the sights. Look around. Look for the shadow coming just before totality. Personally I take very few photos during eclipses. The eye is best and there is no time at all. Do not get hung up with your camera if there is a glitch. No photo can match the sensitivity and range of the human eye for eclipses. But if you do want to get a photo, get everything set (battery, film, focus) far in advance so you can spend 99% of the 3 mins 34 seconds looking, not shooting. There will be numerous shots of this eclipse in the astronomy magazines later.

### LANDLESS CORNER FARMS

#### TIMELINE JUNE 21 2001

Times are Landless Corner Farms, Zambia local (UT plus 2 hours) Latitude: -14.8744 South Longitude: 28.0658 East (+/- 19 feet)

<u>TIME</u>	<u>Local Events</u>
<u>H : M : S</u>	
00:09:23.49	Precisely local midnight at Landless Corner (at given coordinates) Sun due north, altitude -81.4
03:14:30	Venus rises Azimuth 76 degrees. Slightly over ¼ phase
04:19	Pleiades rise Azimuth 65 degrees.

04:55	Saturn rises Azimuth 70 degrees
05:45	Jupiter occulted by Moon in eastern Australia
05:59	Mars sets Azimuth 243 degrees
05:59	Mercury rises, near the sun but potentially visible
06:11	Jupiter rises
06:16:20	Moonrise (not visible) Azimuth 67 degrees
06:20:40	Solar viewpoint: Moon center aligned with bottom of Earth climbing 5 degree slope
06:31:58	Sunrise, Azim 66 degrees, Moon altitude 3.2 deg, 6.1 sun diameters up

(Early rise times due to refraction of a standard atmosphere are included only for rising of Venus, Moon and Sun)

### Approach Phase

With the length of the umbra cone elongating about 1 mile every hour, the penumbra and umbra approach their contact points, P1 and U1, on the leading limb of Earth.

07:06:10	Penumbra edge 10,000 miles from limb of Earth (point P1)
07:59:40	Penumbra edge 8,000 miles from limb of Earth (P1) ~1 Earth diameter away
09:01:00	Venus transits local meridian, due north, 62 degrees altitude, magnitude -4.2, 45 deg west of sun hopefully no clouds thus visible naked eye
09:02:36	Umbra edge 8,000 miles from limb of Earth ( point U1)
09:38	Solstice occurs, Earth axis vertical from sun's perspective
09:56:00	Umbra edge 6,000 miles from limb of Earth ( point U1)
10:49:04	Umbra edge 4,000 miles from limb of Earth (U1), 1 Earth radius
11:19:40	Penumbra edge 500 miles from limb of Earth (P1), half moon radius

P1 11:33:01 240 miles southeast of Rio de Janeiro. First opportunity on Earth to see partially eclipsed sun - moon bites top of sun at local sunrise. This can actually be seen almost a degree west (about 61 miles west-southwest) of the site indicated in the NASA TP (for a standard atmosphere) due to refraction. For the site indicated, the sun would simply be about 1.8 diameters above the horizon. If we included non-forecastable atmospheric conditions that can create the green flash effect then the very farthest location to the west that could witness initial first contact would be as much as another 4 miles west and a bit sooner. But basically everyone along a line from the TP site to that max west point would see contact at nearly the same time - the farthest point west perhaps witnessing contact up to 4 seconds sooner, depending on specific refraction effects.

11:33:22	First contact, Rio de Janeiro, 1 o'clock position.
11:42:32	Umbra edge 2,000 miles from limb of Earth contact point
11:44:12	Center of sun viewpoint: Inner limbs of moon and Earth vertically aligned
11:54:06	Ascension Island, first contact top of sun, 35 deg alt in NE sky About 660 miles north of umbra path in east mid-Atlantic
12:03:33	First contact, St. Helena Island, 11 o'clock spot on sun, 38 deg alt About 175 miles south of umbra path in east mid-Atlantic
12:09:15	Umbra edge 1,000 miles from limb of Earth contact point
12:09:30.0004	Precisely local noon at Landless Corner (at given coordinates) Sun due north, altitude 51.7
12:13:05	Solar viewpoint: Center of moon/umbra in vertical alignment with leading limb of Earth
12:15	At Landless, the Sun and Moon same altitude, Moon to left of Sun, less than a diameter between limbs

N1p 12:18:37 Top of moon starts grazing bottom of sun, 0% magnitude.  
There is no southern penumbra limit on Earth for this eclipse.  
Minimum southern penumbral magnitude is 20.6% on Antarctic Circle  
Penumbra southern limit extends 438 miles "below" bottom limb of Earth

12:22:36	Umbra edge 500 miles from limb of Earth contact point
12:29:16	Umbra edge 250 miles from limb of Earth contact point
12:33:49.7	Umbra edge is one umbra diameter from limb of Earth contact point shadow cone extending 7,975 miles (~ 2 Earth radii beyond Earth's center into outer space).

Landing Phase

U1*	12:35:55	First part of shadow contacts Earth 250 miles southeast of Cabo Santa Maria Uruguay. First opportunity to see totally eclipsed sun. Refractive effects of P1 apply.
N1u*	12:36:36	Northerly grazing of totally eclipsed sun begins, 100% magnitude. (Top of shadow path lands on Earth)
C1*	12:37:05	Center of shadow contacts Earth 21.8 miles south of U1. 4,954 miles west-southwest of Landless Corner. Topocentrically* shadow is 0.9 deg wide, -36 alt, 114 deg left of sun
S1u*	12:37:36	Southerly grazing of totally eclipsed sun begins, 100% magnitude. (Bottom of shadow path lands on Earth)
U2*	12:38:15	Last part of umbra finally contacts Earth. All of the shadow is on Earth. No part of shadow cone extends past Earth.
	12:42:27	Sunrise Santa Cruz Bolivia, 43 seconds later nick in sun rises
	12:57:25	First contact coast of Angola, 9 o'clock position
	13:00:00	At Landless topocentrically* shadow is 1.7 deg wide, -23 alt, 87 deg left of sun 3,187 miles away
	13:00:50	Sunrises in Buenos Aires, 68 seconds later top of nick in sun clears the horizon revealing an eclipsed sun, bite is at 5 o'clock position
	13:06:42	Farthest western point (0% atmosphere) on Earth to experience C4 (occurs at sunrise) 18.3 deg S, 68.00 W. This is the western limb of Earth aligned so as to split the touching but departing limbs of moon and sun. The refractive effects of P1 apply here also, so Sun would appear almost 2 diameters above horizon with slight but noticeable bite at 4 o'clock. Due to eclipsed portion of sun being on the lower part, the farther point to the west to see the bite would only lie about 30 miles farther west.
	13:10:20	Last contact Santa Cruz Bolivia.
	13:17:46	First contact Cape Town, S. Africa, 8 o'clock position
	13:34:39	First contact Victoria Falls
	13:35:03	Last contact Buenos Aires, Argentina 3 o'clock spot. Sun altitude 5 deg.
	13:35:15	Maximum eclipse St.. Helena Island, 96.4% magnitude
	13:39:35	First contact, Johannesburg, 7 o'clock position

Local Approach

C1 (local)	13:41:09	First contact occurs at Landless Corner. Bite starts at V 122.6 degrees CCW (about the 8 o'clock spot on sun) Altitude 45.6, Azim -30.7 in NW sky. Note air temperature.
	13:41:36	Last contact Rio de Janeiro, 4:30 o'clock position
	13:46:48	Last contact with South America. 60 miles south of eastern-most point of S. America
	13:47:15	First contact, west Mozambique
	13:57:45.3	New moon. Sun and moon same ecliptic longitude, occurs 5.2 seconds before conjunction in R.A. for this eclipse

The following 4 underlined events occur in Atlantic Ocean 750 miles west of Angola coast. Time is Landless Corner local, UT+2

<u>noon</u>	13:57:50.5	Mid eclipse at local noon off Angola shore 1,834 miles from Landless Latitude 11.6 South, Longitude 0.98 East, 123 miles west of G0 (some eclipses have no such point, others can be at local midnight in the land of the midnight sun)
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Shadow too small to encompass this site and G0 simultaneously

<u>G0</u> *	14:03:41	Latitude 11.25 South, Longitude 2.75 East Instant of greatest eclipse, shadow footprint is least elliptical, closest to Earth's center. Shadow can encompass this site and next two sites, D and M, simultaneously for 2 minutes 20 seconds and 1 minute 45 seconds, respectively.
<u>D</u>	14:06:16.5	Greatest duration ignoring rough limb Latitude 11.14 South, Longitude 3.52 East, 52 miles east of G0 0.07 seconds longer than G0 due to a closer moon and the site is closer to equator providing greater vertical speed to help match shadow speed.
<u>M</u>	14:06:48.9	Greatest magnitude, moon assumes largest size ratio relative to sun Latitude 11.12 South, Longitude 3.68 East, 10.8 miles east of D Duration 0.05 seconds more than at G0

Note:

D - Although the shadow is not quite maximum size, duration is greatest here because the site is closer to the equator with concomitant higher speed thus lower relative velocity to shadow speed.

M - Does not occur at G0 (closest site on path center to sun) because the moon is approaching Earth and the sun slightly decreases in size over the life of the path because we are receding from it. The moon is increasing in size because it is approaching Earth's center but that is eventually offset by the ground path's departure away from the moon in its latter stages.

14:15:00	Topocentrically* shadow is 3.9 deg wide, -11 alt, 43 deg left of sun 1,499 miles away
14:12:02	First contact, west coast of Madagascar
14:15:22	First contact, Nairobi, 7 o'clock position
14:26:57	Northernmost pass of penumbra, Lat 22.01 N, Long 7.57 E
14:36:22	Totality starts, coast of Angola, 981 miles from Landless Corner Farms
14:40:28	Totality ends, coast of Angola
14:41:00	Eclipse magnitude 65%, Venus eight minutes from setting, azim 285

Half hour to go. Put on eye patches. I strongly suggest placing a patch over your good distance-seeing eye (eye patches are sold at local drugstores). It grossly enhances sensitivity to the corona – credit Glenn Schneider for this good idea. Start looking for shadow bands & small crescents against a bright background. Sharp shadows, cooling, animal behavior. Pinhole effect.

14:48:01	First contact, Seychelles, 500 miles NE of Madagascar, 7 o'clock spot
14:50:17	Last contact Ascension Island, 3 o'clock position

About 20 minutes to go

Start looking for Jupiter 5 degrees lower left of sun

Start videos, tape recorders, UTC timers, etc.

14:57:15	Farthest eastern point of Earth to experience eclipse (occurs at sunset). 9.97 S, 71.76 E Appears on lower left of sun. This is the eastern limb of Earth aligned so as to split the touching and approaching limbs of moon and sun.
14:59:14	Shadow enters Zambia, 317 miles from Landless Corner Farms
15:00:00	Topocentrically* shadow is 14 deg wide, -3 alt, 25 deg left of sun 399 miles away

About ten minutes to go

Start looking for lower left edge of moon silhouetted against the corona.

Remove mylars from binocs etc.

15:05:12	30,000 ft altitude level of umbra appears on horizon, 23 degrees left of sun. Shadow center 217 miles away.
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15:07:00	Shadow leading edge only 136 miles away. Shadow 24 degrees wide. 30,000 ft altitude level of umbra up 21 degrees, 24 degrees left of sun. Shadow center 151 miles away. Shadow leading edge only 68 miles away. Shadow 36 degrees wide.
C2 (local) 15:08:53.9	Totality starts. Eye patches off. Look for lunar features (maria).
C3 (local) 15:12:27.8	Totality ends
15:15:21	Last contact St. Helena Island, 48 deg altitude, 4 o'clock spot
N2 15:30:51	Last part of shadow departs Earth, 1927 miles SE of Landless
C4(local) 16:27:03	Last contact at the 1 o'clock spot on sun. Elevation at Landless (+4190) results in delay of 3 seconds. Sun alt 16 deg, azimuth 300.
P4 16:34:21	Very last contact on Earth, in Mozambique Channel 72 miles offshore from west coast of Madagascar. P1 minus P4 = 5hrs 01min 21sec: life span of eclipse
June 22 00:08	Moon at ascending node 7½ hrs after P4 , same ecliptic latitude as Earth. About one minute before local midnight.
June 22 00:56	Mars nearest to Earth (Opposition was June 13)

\* Topocentrically refers to size and shape of shadow as seen from Landless Corner Farms site if the Earth were a clear globe and shadow could be seen through the ground.

All times calculated by Raymond Brooks, StarEngineering  
Contact times marked \* converted from TDT in NASA TP 209484 (Espenak/Anderson).  
Rounded to nearest full second.

### LUNAR VIEWPOINT

None of the esoterica below needs to be dedicated to memory - just read what suits your fancy and revel in being alive at a time when the moon can completely cover the sun even though it is 400 times smaller. In about 900 million years the moon will have receded back so far from Earth due to tidal friction that it will not appear large enough, even during perigees, to cover the sun.

This has the potential of being another wonderful eclipse. Three of the five brightest planets visible to the naked eye will be above our horizon during totality to the lower left of the Sun. Seeing all five happens just slightly less often than 1 eclipse out of 4 because the outer planets spend varying degrees of their own year 'behind the dark half of Earth'.

A great way to understand the details of a solar eclipse is to imagine yourself as the moon, looking at the Earth with the sun on your back. You are facing a full Earth a quarter of a million miles away and you now measure over 2000 miles in height (a bit pudgy since you are as wide as you are tall). The Earth would look huge; almost 14 times more image area on your eyes than the moon. Stand back 28 feet from a 12 inch globe with someone holding it up against the sky and imagine it rising over the horizon, it seems very big. That is what an Earthrise looks like from the moon. If it were cloudy over most of the Earth's surface, the very white bright clouds of a full Earth would reflect back about 125 times more light than a full moon (only about 64 times as much if no clouds). People on Earth could actually see your rather dark 2000 mile-wide rocky face once you block the sun from their eyes; just as we can see the dark side of the moon when it is a thin crescent. A full white Earth is equivalent to a 75 watt light bulb burning only 5 feet 8 inches away! So, as the moon you could easily read a book at night (so too an astronaut on your surface) just from the Earthlight.

Hopefully it is not cloudy where your shadow is cast so people can actually see you block the sun, with its white corona and gorgeous pink prominences lining the edge of your silhouette. As the moon, you begin eclipse day with the Earth a little off to your right, with Gemini, Orion and the Seven Sisters in the background. If there were motes of dust in space you could see the cone of your shadow neck down to a vanishing point in space reaching only 4000 miles beyond Earth's back end (Earth is 8000 miles diameter). You would slowly advance to your right taking an hour to move your own body width. It seems slow but being 2000 miles wide that means your moving about 2000 MPH! Initial first contact (P1) would be when your right hip first starts to block the sun,

lining up with the left side of Earth. This is the first chance anyone on Earth has of seeing any part of you start to block the sun. They would be located a little below the horizontal centerline of Earth since for this eclipse you are floating a little below the plane of the ecliptic yourself. At this initial stage the center of your shadow is one moon diameter to the left of Earth, invisible in empty space.

An hour later your right hip reaches the other edge of the sun and now you completely eclipse the sun for people on the left limb of Earth - the cone tip of your shadow which was out in space suddenly is cut off, losing 8000 miles off its tip as it contacts the very edge of Earth. As the moon you would see your 2000 mile wide shadow narrow down from you toward Earth and end in a 60 mile wide dot growing to 100 mile dot that would barely have some apparent thickness to your eyes even from a quarter million miles away. Seemingly 3 times the size of the period at the end of this sentence.

When the leading edge of the shadow contacts Earth its ground speed is extremely high because the ground is tilted edge-on to the shadow. Theoretically, it is infinitely fast at the instant of contact; after 0.1 seconds it has slowed to about 400,000 MPH. A minute and a half later the trailing edge lands on Earth just as fast - and the leading edge (now having resided for 90 seconds) has slowed to just under 14,000 MPH. So in the very early stages the front of the shadow ellipse is going much slower than the back - so the shadow must be shrinking. It is shrinking. It is very stretched out arriving on Earth and quickly shrinks to more of a circle as it approaches the middle of the globe. Then for the second half of the path it is the converse; becoming more elliptical as the front goes faster and faster.

As your small fully dark shadow approaches the center bulge of the Earth it comes almost 4000 miles nearer to you (and thus bigger, growing from about 60 miles minor diameter to 100). A bigger shadow means longer time in the shadow. When it is near to the bulge of Earth the people there are moving almost 1000 MPH to your right along with you (the Earth is spinning) so that also keeps them in your shadow longer. Their speed has reduced your relative speed in half.

### **NIGHTTIME STUFF**

#### **SOUTHERN NIGHT SKY**

On this trip you will be able to see all 5 naked eye galaxies simultaneously at about 5:30 in the morning. Andromeda M31 and the Pinwheel M33 in Triangulum to the northeast, the Large and Small Clouds of Magellan wonderfully positioned to the south and southeast and the fifth galaxy is ours, the Milky Way, with the center in Sagittarius 2 hours from setting.

But let's start at sunset (order of brightness). From west to east will be heavy hitters; Betelgeuse (10) very low, Sirius (1), Canopus (2), Procyon (8), Regulus (21), the Twins (18 & 22), Alpha Centauri (3), Arcturus (4), Spica (16), A Crux (12), Antares (15). Later in the east come Altair (12), Fomalhaut (17), Vega (5), Acernar (9), Deneb (19). All the 20 brightest stars except Capella (6).

Eta Carina (the "bursting star" you may have seen from the Hubble photos), the southern cross, Omega Centauri second brightest globular cluster, the Jewel Box and Coal Sack are nice and high after sunset.

The Large & Small Clouds of Magellan are circumpolar at Krueger National Park and never set. 47 Tucanae is a beautiful globular cluster (the brightest) near the Small Cloud.

The southern sky is spectacular.

There will be many Hubble Telescope and ISS Space Station passes over the 2 to 3 weeks at dawn and dusk along with some Iridium satellite flashes. There will also be some Iridium flashes in mid-day. I will provide those later, at the beginning of the trip to allow better accuracy due to drag effects.

### **SAROS SERIES 127**

This is a fun Saros series. There are 25 total eclipses of the series in the upper half (positive gamma) and 17 in the lower (negative gamma). No annulars. The first (see lower left of diagram) in May sweeps above the Arctic Circle and "behind and above" the North Pole (a reverse eclipse) but not quite a midnight sun eclipse because the ascending node path favors the upper left of Earth while the North Pole in late May is on the upper right of Earth. Reverse eclipses start in the morning but advance to earlier times of the day and travel to the north and west. The next eclipse in June,

the path has moved “in front and below” the North Pole and sweeps through noon as a “normal” eclipse. Duration increases with each eclipse as the Moon approaches perigee and the path moves closer to the sub-solar point and closer to the equator, all making the shadow larger and slower. But by September these three effects are beaten by the fast approaching Sun, growing so quickly in size that duration declines. The September/October sun peaks at 1,135 mph approach speed to Earth. This effect is so powerful that full moons at that time of year are almost as close to the Sun as the new moon was 2 weeks earlier. (e.g. Oct 7 2006 full moon is only 87,000 miles farther than the new moon Sept 22)

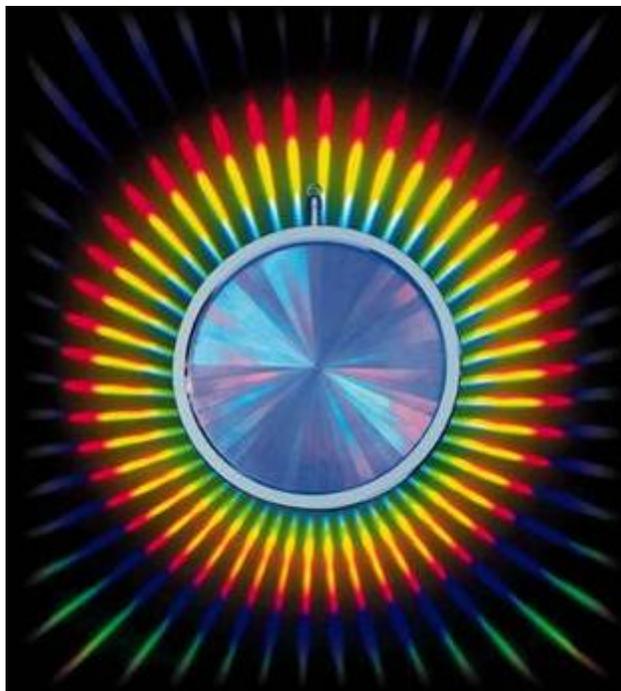
In late November the Moon passes and recedes from perigee contributing to duration reduction. This continues to the end of January when the then shrinking sun allows duration to increase until May. By May, gamma is decreasing so quickly that the path has significantly moved away from the sub-solar point making the shadow smaller. Gamma changes very slowly in winter and very quickly in summer.

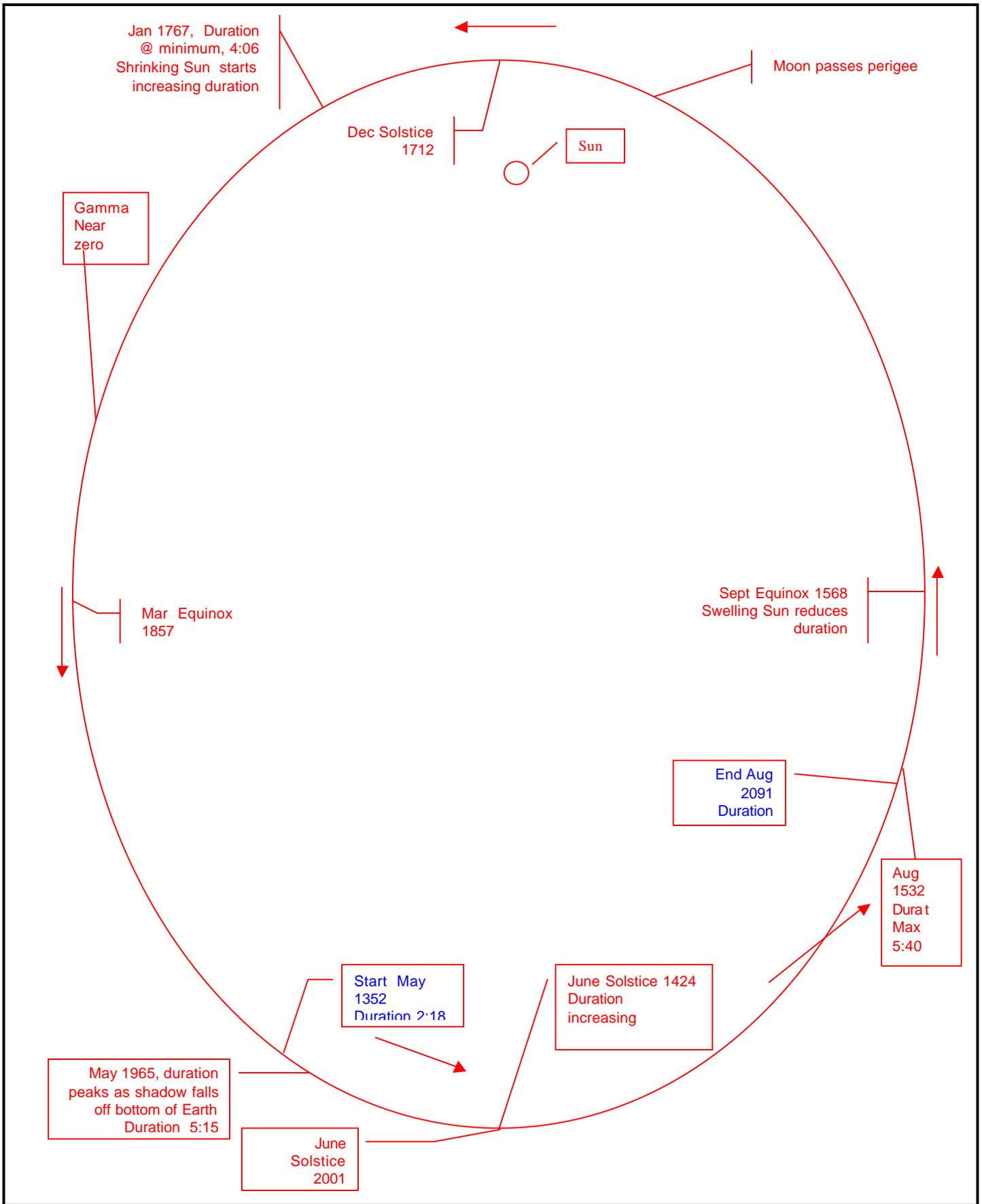
From eclipse to eclipse the average shift between the node and new moon is 51.3 minutes. But a January to January eclipse within a saros has a differential of less than 3 minutes. That is a 3 minute difference over 18 years 11 days! So they have different periods but the cycles are almost exactly in phase over a saros increment.

If anyone would like contact times for their home site or special calculations and questions, please contact me by phone or by e-mail.

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Have a great eclipse trip and “remember to remember” in the middle of it all. It will make your memories much more vivid. Clear skies to all. Raymond Brooks, StarEngineering







Joanne & Patrick

Solar Eclipse Mailing List



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THE WIZARD OF ID



Patrick and Dr. Eric Flescher (KCStarguy@aol.com) found this cartoon clip whilst on business in Ireland. So the challenge is for you all to keep on the look-out for any eclipse related topics for the newsletter. Joanne