Volume 6, Issue 9
SOLAR ECLIPSE NEWSLETTER

September 2001

SOLAR ECLIPSE NEWSLETTER

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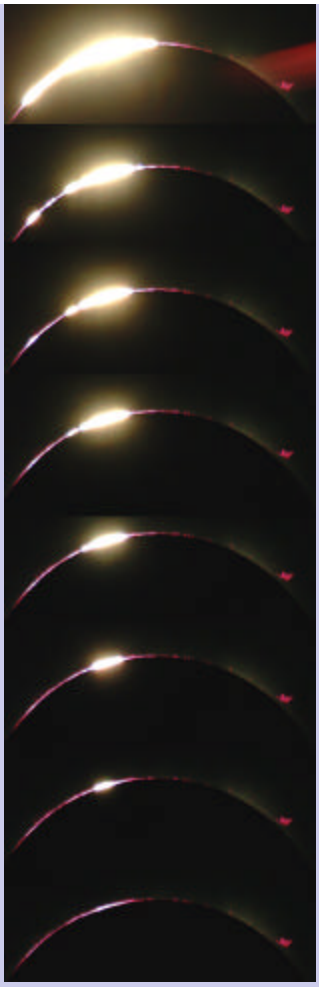
The Solar Eclipse Mailing List

The Solar Eclipse Mailing List (SEML) is an electronic newsgroup dedicated to Solar Eclipses. Published by eclipse chaser Patrick Poitevin (patrick_poitevin@hotmail.com), it is a forum for discussing anything and everything about eclipses.

Thanks to the voluntary efforts of Jan Van Gestel of Geel, Belgium, the Solar Eclipse Mailing List (listserver) has been in operation since 10 December 1997. This is the first mailing list devoted solely to topic of solar eclipses on the internet.

You can send an e-mail message to the list server solareclipses@Aula.com, which will then forward your e-mail to all the subscribers on the list. Likewise, you'll receive e-mail messages that other subscribers send to the listserver. Only subscribers can send messages.

Solar Eclipse Mailing List



Dear Eclipse Chases

This newsletter brings up completely up to date. We hope that you enjoyed the special edition celebrating the successful African adventure, we tried to show as many of your wonderful pictures as we could.

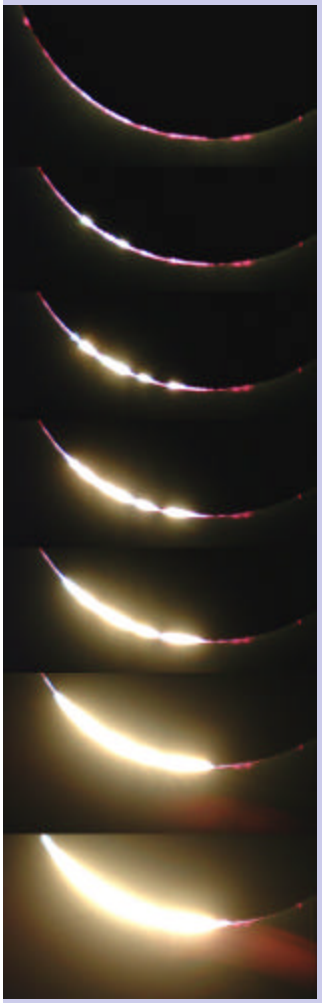
We know that Fred is busy preparing the next Nasa bulletin for December 2002, so we can all start making the next difficult choice between Africa and Australia.

Patrick and myself would like to take this opportunity to express our deep sorrow and regrets for the act of terrorism in New York last week. Our hearts go out to the innocent people who were just on their way to work as you and I do every day, but never came home to complain about the boss, or the crowds on the subway. We would like to thank Eric Brown who described his own experience on Tuesday, and shared it with us.

We would stress that we have tried to keep the solar eclipse newsletter neutral over the last week, please keep your messages strictly solar eclipse related. This is purely a professional approach and in no way reflects our own personnel views on the subject.

Best regards

Patrick and Joanne



2nd and 3rd contact by Derek Hatch, Madagascar

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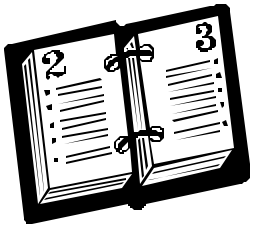
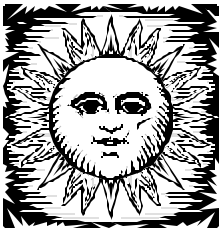


September 2001



Dear All,

Please find herewith the solar eclipse calendar for September. If you have any additional information, queries or remarks, please drop me a mail.

September 01, 1859 In 1859, the first solar flare ever to be recorded by humankind. An intense aurora followed the next day. Two independent observers, Richard C. Carrington and R. Hodson (UK), described their experiences in volume twenty of the Monthly Notices of the Royal Astronomical Society. They are the first to observe a flare on the Sun and they both note that a magnetic storm in progress on earth intensifies soon afterwards, but they refrain from connecting the two events.

September 02, 2817 Next total solar eclipse in Amsterdam at sun altitude of 14 degrees. Annular eclipses in Amsterdam will be on October 2, 2350, March 26, 2639 and May 23, 2878 (the same century as the total solar eclipse).

September 03, 0118 ". . . about this time while he was pursuing his studies in Greece, such an omen was observable in the heavens. A crown resembling Iris surrounded the disc of the Sun and darkened its rays." Refers to solar eclipse of 3 September AD 118, or possibly AD 96. From: Philostratus, Greek (died between AD 224 and 229). Quoted in UK Solar Eclipses from Year 1 by Sheridan Williams.

September 03, 1885 Bettina 250: Minor planet discovered 1885 September 3 by Jojann Palisa at Vienna. Named for Baroness Bettina von Rothschild of the Austrian plutocratic family. In Observator, Vol 8 p 63 (1885) the following info was published: "Herr Palisa, being desirous to raise funds for his intended expedition to observe the Total Solar Eclipse of August 29, 1886 will sell the right naming the minor planet N°244 for 50 £"..(Ref. VK)

September 03, 1998 SOHO recharged his batteries after months of inactivity. (Ref DD 09/99)

September 03, 2081 Next large partial solar eclipse in the Netherlands. It is not that large as the one of 1999. Magnitude in Utrecht is 0.902 and 0.939 in Maastricht.

September 03, 2081 Next Total Solar Eclipse in France, Germany, etc. Next Total Solar Eclipses in Europe: August 12, 2026 total in North of Spain shortly after sunset. The year after, August 2, 2027 total in extreme South of Spain and September 12, 2053 total in extreme South of Spain, September 3, 2081 total in France, South in Germany, Switzerland, Austria, etc., September 23, 2090 total in northern France and the southwestern Belgium at sunset.

September 05, 1984 Landing of STS-41D Discovery: 6 astronauts, of whom 1 paid passenger. 3 satellites launched. Big solar panel folded open and shots made with IMAX-camera. 1rst flight for Discovery, 12 for all shuttles together (Ref DD 9/99)

September 06, 1892 Birth of E. V. Appleton, British physicist. Studied relation between solar and earth atmosphere. Got Nobel price in 1947 for physics. (ref. DD 9/98)

September 07, -0246 (247 BC) "[D]iary for year 65 (SE), king Antiochus . . . [month V]. The 28th, 74 deg after sunrise, solar eclipse (at) 5 months' distance; when I watched I did not see it." Refers to a solar eclipse of 7 September 247 BC, predicted to take place in Babylon, but which was actually far north of Babylon. Babylonian tablet in the British Museum. Quoted in Historical Eclipses and Earth's Rotation, by F Richard Stephenson, Cambridge University Press, 1997, page 122.

September 07, 1820 Partial eclipse in England but annular over the Isles of Shetland. The trial of Queen Caroline was going on in the House of Lords, and the House suspended its sitting for a short time for the sake of the eclipse. (ref. Chambers, The Story of Eclipses, 1899)

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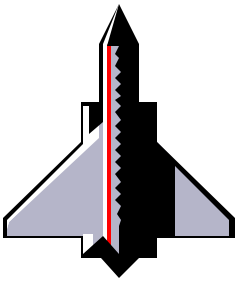
September 07, 1858 Neither at Olmos nor Piura, did any enceinte woman leave her room during the eclipse, whilst some from curiosity, but more through fear, were in the streets, yet not daring to look upon the sun, lest malady befall them. The somber green light gave them the appearance of corpses, and they apprehended that a plague might be visited upon them. Afterwards, the muleteers told us that their animals stopped eating, and huddled together in evident alarm." Lieut. J M Gillis An Account of the Total Eclipse of the Sun on September 7, 1858, as Observed Near Olmos, Peru in Smithsonian Contributions to Knowledge, vol. 11, April 1859, Smithsonian Institution.

September 07, 1962 Samitchell 2624 (1962 RE): Minor planet discovered September 7, 1962 at the Goethe Link Observatory at Brooklyn. Named in memory of Samuel Alfred Mitchell (1874-1960), a faculty member of Columbia University from 1899 to 1913 and then director of the Leander McCormick Obs until 1945, known for his work on Eclipses in 1900, 1901 and 1905 referred to nearly 3000 lines. ...Ref VK 6/97

September 09, 1934 1670 Minnaert 1934 RZ. Minor Planet discovered 1934 September 9 by H. van Gent at Johannesburg. Named in honor of the late Prof. Marcel G. J. Minnaert (1893-1970). He made major contributions to solar research ... and attended eclipse expeditions.

September 09, 1994 Launch of STS-64 Discovery with 6 astronauts for nearly 11 days. Experiments with Spartan (solar wind and corona) and atmosphere research with Lite. (ref. DD 9/98)



September 10, 1919 Robert B. Leighton, was born on 10 Sep 1919. OK, during the only total eclipse he tried to observe (Hawaii 1991), he was clouded out. But, using the 60-ft. solar tower at Mt. Wilson (California) more than 30 years earlier, he had discovered the 5-min. and 15-min. oscillations of the Sun, thereby creating the field of helioseismology, which occupies several dozen scientists around the world today. (GONG, etc.) His son, Alan Leighton is subscribed to the Solar Eclipse Mailing List. (Ref. AL 9/99)

September 10, 1923 Hildago 944:Minor planet discovered October 31, 1920 by W. Baade at Bergedorf. German astronomers observed the Total Solar Eclipse 1923 September 10 in Mexico. After the Eclipse they had an audience with the president of Mexico and asked permission to call this planet after Miguel Hidalgo y Costilla (1753-1811) who proclaimed the Mexican independence in 1810. AN 221, 159 (1924). Ref VK 6/97

September 10, 1967 Surveyor 5 (US) makes a soft landing on the moon. Made more then 19.000 pictures and landed 25 km from the later landing place of Apollo 11. (ref. DD 9/98)

September 12, 1838 Birth of Arthur J. G. F. von Auwers, German astronomer. He reviewed the distance of the sun several times, using transits of Venus and a close encounter of a minor planet. Ref DD 9/99.

September 12, 1851 Birth of Sir Arthur Schuster (1851-1934). A comet is discovered and photographed by Sir Arthur Schuster (1851-1934), Germany/UK, during an eclipse in Egypt: first time a comet discovered in this way has been photographed. The Total Solar Eclipse had been observed by Sir Joseph Norman Lockyer (1836-1920), Ranard and Schuster from England, Tacchini from Italy, Trépied, Thollon and Puiseux from France. Observation from Sohag at the Nile. (Ref. Rc 1999)

September 13, 1178 Vigeois, France .., on a clear day, about the 5th hour, the Sun suffered an eclipse,... (Ex Chronico Gaufredi Vosiensis, Bouquet, 1781, p447) Ref PG 9/99.

September 13, 1912 Birth of H. W. Babcock, American astronomer. Studied magnetic fields of the sun. (ref. DD 9/98)

September 14, 1923 Gellivara 1073: Minor planet discovered September 14, 1923 by Johann at Vienna. Named for the small town Gällivare in Swedish Lapland where in the year 1927 astronomers from several countries observed the Total Solar Eclipse of 1927 June 29. Named by the astronomer J. Rheden and endorsed by Anna Palisa. Ref. VK 6/97

September 14, 1994 Ulysses (ESA) reached the south pole of the sun (-80,22 degrees). (ref. DD 9/98)

September 17, 1354 Perugia, Italy In this year on 17 september that novelty appeared. The Sun became dark on a Wednesday at

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about the third hour and it lasted for the space of two hours... (Memorie di Perugia dall'anno 1351 al 1438) Ref PG 9/99

September 17, 1354 "In this year on 17 September that novelty appeared. The Sun became dark on a Wednesday at about the third hour and it lasted for the space of two hours. Above the Sun and Moon, which were joined together - that is, the Moon was covering the Sun - there appeared a very large star with fiery rays like a torch . . . Many people viewed the rays of the small Sun by reflection in a mirror or in clear water. And the rays of the Sun were so small and so dark, on account of the Moon covering the Sun, that there did not remain un-obscured as much as 3 fingers of the Sun. . . Everyone appeared deathly pale." Refers to a total solar eclipse in Perugia, Italy, of 17 September 1354. From: Memorie di Perugia dall'anno 1351 al 1438 Quoted in Historical Eclipses and Earth's Rotation, by F Richard Stephenson, Cambridge University Press, 1997, page 421.

September 18, 1783 Death of Leonhard Euler (1707-1783), Swiss mathematician and astronomer. Observed transit of Venus in 1769 and determent herewith the distance to the sun being 151.225.000 km. (ref. DD 9/98, Rc 1999)

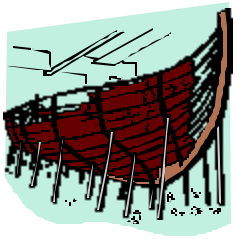
September 18, 1819 Birth of Jean Bernard Leon Foucault (1819-1868), French physicist. Photographed the sun and measured the speed of light together with (Armand) Hippolyte Louis Fizeau (1819-1896). The Royal Society gives 18 or 19 September 1819. (ref. DD 9/98, Rc 1999)

September 18, 1896 Death of (Armand) Hippolyte Louis Fizeau (1819-1896), French physicist. Known for his measurements of the speed of light and he made a daguerreotype (picture) of the sun together with Jean Bernard Leon Foucault (1819-1868). (ref. DD 9/98, Rc 1999)

September 18, 1919 Schlutia 922: Minor planet discovered September 18, 1919 by Karl Reinmuth at Heidelberg. Named in honor of the important businessmen Edgar Schlubag (Hamburg) and Mr. Tiarks (London) who together supported the Dutch-German Solar Eclipse expedition to Christmas Island in 1922. Named by Schlubach and Tiarks AN 218, 253 (1923). Ref VK 6/97

September 18, 1959 Launch of Vanguard 3 (US). Studied the sun in roentgen. Weight only 50 kg and is still in orbit around the earth. (ref. DD 9/98)

September 18, 2620 Next total solar eclipse on the Portuguese island Madeira. It is since 4 May 292 (23 centuries) that there was a total solar eclipse on that island. Though, in 292 the sun's altitude at maximum was only 1 degree. But before that, on 15 May 291, only 12 months from the previous, there is another total solar eclipse. There was a near-miss in 540 with a magnitude of more than 99%, and in 1781 a total solar eclipse just before sunrise. (ref. JM 7/99)



September 19, 1710 Death of Ole Romer, Danish astronomer, in Copenhagen. From his observations of the moons of Jupiter in 1676, he determined the speed of light.

September 19, 1950 2513 Baetsle 1950SH. Minor planet discovered September 19, 1950 by S. Arend at Uccle. Named in memory of Paul-Louis Baetsle (1909-1983). See Ciel et Terre Vol 100, No 1, p11-12 (1984). Baetslé was a professional eclipse chaser.

September 20, -0600 (0601 BC) "Duke Hsuan, 8th year, 7th month, day chia-tzu. The Sun was eclipsed and it was total." Refers to a total solar eclipse of 20 September 601 BC. From: Ch'un-ch'iu, book VII (Chinese). Quoted in Historical Eclipses and Earth's Rotation, by F Richard Stephenson, Cambridge University Press, 1997, page 226.

September 21, 1922 Chant 3315 (1984 CZ): Minor planet discovered February 08, 1984 by E. Bowell at Anderson Mesa. Named in memory of Clarence Augustus Chant (1865-1956), generally referred to as the "father of Canadian astronomy". He participated in five Solar Eclipse expedition, the most important being the one he led to Australia in 1922 to test Einstein's prediction of the deflection of starlight by a massive body. MPC 12210.

September 21, 1922 Malabar 754 : Minor planet discovered 1906 August 22 by A. Kopff at Heidelberg. Named in remembrance of the Dutch-German Solar Eclipse expedition to Christmas Island in 1922. Malabar is a city on Java. (I. van Houten-

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Groeneveld) AN 218, 253 (1923) - Ref VK 6/97

September 21, 1922 Schlutia 922: Minor planet discovered September 18, 1919 by Karl Reinmuth at Heidelberg. Named in honor of the important businessmen Edgar Schlubag (Hamburg) and Mr. Tiarks (London) who together supported the Dutch-German Solar Eclipse expedition to Christmas Island in 1922. Named by Schlubach and Tiarks AN 218, 253 (1923). - Ref. VK 6/97

September 21, 1922 William Wallace Campbell (1862-1938) and Robert J. Trumler (US) reconfirm Einstein's relativistic bending of starlight during an eclipse in Wallal, Australia.

September 22, 1968 This Eclipse has been successfully observed in Western Siberia. A number of outstanding Eclipse observers have attended the site of observation (Yurgamysh, Siberia): M.Waldmeier, J.Houtgast, M.Laffineur, G.M.Nikolsky, M.N.Gnevyshev, S.K.Vsekhsvjatsky. Younger scientists also made observations there in; among those Serge Koutchmy and Rudolf Gulyaev. (ref. personal mail RG-9/97)

September 22, 1977 Launch Prognoz 6 (USSR), for study the effect of sunshine on magnetosphere. (ref. DD 9/98)

September 22, 1982 2816 Pien 1982 SO. Minor Planet discovered 1982, September 22 by E. Bowell at Anderson Mesa. Named in honor of Armand Pien, of the Royal Meteorological Institute, Uccle. Well known for his popularization of meteorology and astronomy. He has presented the livised weather forecast in Belgium for more than 30 years. He also popularized solar eclipse pictures on TV.

September 23, 1791 Birth of Johann Franz Encke (1791-1865), German astronomer. Studied comet which has the same name (predicted return in 1822). Determined an accurate value of the sun parallax. (ref. DD 9/98, Rc 1999)

September 23, 1819 Birth of (Armand) Hippolyte Louis Fizeau (1819-1896)., French physicist. Known for his measurements on light velocity and made daguerreotype (photo) of the sun both together with Jean Bernard Leon Foucault (1819-1868). The Royal Society mentioned 23 or 24 September 1819. (ref. DD 9/98, Rc 1999)

September 23, 1877 Death of Urbain Jean Joseph Le Verrier (1811-1877), French astronomer. Believer of the existence of planet Vulcan. (ref. Rc 1999)

September 23, 1981 Brian Marsden did send an IAU circular of the discovery with the coronograph Solwind (Satellite P78-1). A comet collision on the sun was detected. The comet was already photographed in August 1979 but due to the change of the magnet band pictures, it was discovered one year later. The comet is called Howard-Koomen-Michiels. Many other sungrazers have been detected and reported later (also SOHO)

September 23, 2090 Next total solar eclipse in Paris, France.

September 24, 1898 Birth of Charlotte E.M. Sitterly, American astronomer. End 20s she worked at Mount Wilson Observatory with Charles E. St. John and Harold Babcock on a study of the solar spectrum. They analyzed lines in the spectra of sunspots. She published books about solar spectra and multiple spectra lines. Ref DD 9/99.

September 24, 1935 2213 Meeus 1935 SO. Minor Planet discovered 1935 September 24 by Eugène J. Delporte at Uccle. Named in honor of the Belgian amateur astronomer and professional meteorologist Jean Meeus. ... and improved and updated versions op Oppolzer's canon of eclipses. Meeus also attended eclipse expeditions.

September 25, 1644 Birth of Ole Romer in Aarhus. From his observations of the moons of Jupiter in 1676, he determined the speed of light.

September 26, 0702 Ch'ang-an reign period, 2nd year, 9th month, day i-ch'ou. The sun was eclipsed, it was almost com-

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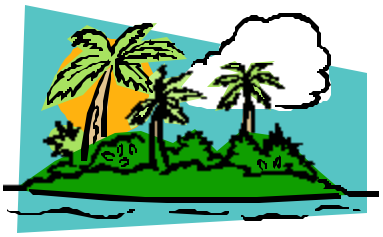
pletes. It was in Chueh (Hsin-t'ang-shu, chap 32) Ref PG 9/99.



September 28, 1791 Captain George Vancouver observed this Wednesday morning a partial solar eclipse. He went on the name the barren rocky cluster of isles, by the name of Eclipse Islands. The actual date was September 27, 1791 at 22h39m (local time Sep. 28, 6h39m) with a mag. of 0.936. Patrick Poitevin observed at about the same place the partial eclipse of September 2, 1997 (mag. 0.551) between the clouds.

September 28, 1971 Launch of Luna 19 (USSR). Studied magnetic field of the moon and prominences. (ref. DD 9/98)

September 29, 1971 Launch of Orbiting Solar Observatory 7 (VS). Got in a wrong orbit. Observed sun in UV, XUV and roentgen. (ref. DD 9/98)

September 30, 1995 Ulysses (ESA) finished its first phase of Solar research. (ref. DD 9/98)

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

From : "Gerard M Foley" <gfoley@columbus.rr.com> To : <SOLARECLIPSES@AULA.COM> Subject : Re: [SE] **Solar Eclipse Calendar for August** Date : Mon, 30 Jul 2001 17:57:46 -0400

<snip> August 01, 1818 Birth of Maria O. Mitchell (1818-?), American astronomer. Observer of sunspots, discovered a comet in 1947 and was calculator at the American Nautical Almanac. (ref. DD 7/98) <snip> Her comet discovery was 1847. First woman fellow of the American Academy of Arts and Sciences.

http://maria1.mmo.org/

She died June 28, 1889 in Lynn, Massachusetts.

http://www.netsrq.com/~dbois/mitchell.html

Thanks, Patrick Gerry K8EF http://home.columbus.rr.com/gfoley/ http://www.geocities.com/gerryf.geo/eclipselist.html http://www.fortunecity.com/ victorian/pollock/263/egypt/egypt.html

From : Bob Morris <morris@sce.carleton.ca> To : SOLARECLIPSES@AULA.COM Subject : Re: [SE] **SECalendar for September** Date : Wed, 29 Aug 2001 18:00:30 -0400 (EDT)

September 17, 1354 "In this year on 17 September that novelty appeared. The Sun became dark on a Wednesday at about the third hour and it lasted for the space of two hours. Above the Sun and Moon, which were joined together - that is, the Moon was covering the Sun - there appeared a very large star with fiery rays like a torch . . . Many people viewed the rays of the small Sun by reflection in a mirror or in clear water. And the rays of the Sun were so small and so dark, on account of the Moon covering the Sun, that there did not remain un-obscured as much as 3 fingers of the Sun. . . Everyone appeared deathly pale." Refers to a total solar eclipse in Perugia, Italy, of 17 September 1354. From: Memorie di Perugia dall'anno 1351 al 1438 Quoted in Historical Eclipses and Earth's Rotation, by F Richard Stephenson, Cambridge University Press, 1997, page 421.

It is reports worded like the above (and there are numerous ones in the eclipse "quotes" file referenced on Fred's site) that make the biblical accounts of a total solar eclipse lasting for hours when Christ was crucified believable. In the quote above, they must mean that the sun was obscured to some extent, for two hours.

Thus, the modern terms of reference about the duration of a total solar eclipse being the duration of totality (i.e., 7.5 mins or less) were not the ones used in ancient times.

I believe I pointed this out earlier but no-one was interested. You should be. :-) Bob Morris

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From Marc Weirauch

Hi Bob, Does the bible explicitely speak of a "total solar eclipse" at the crucifixion? The German translation by Luther speaks of "eine Finsternis... und die Sonne verlor ihren Schein" ("a darkness... and the sun lost its shine"). That has been interpreted as a heavy thunderstorm also; especially since a solar eclipse is not consistent with a crucifixion around passah. Best regards, Marc

From Brian Garett

The crucifixion took place at Passover, according to the Gospel accounts. Passover is the fourteenth day of the Jewish month of Nisan. The Jewish calendar is a lunar calendar, with months nominally beginning at the sighting of the new lunar crescent, a day or so after astronomical new moon. Thus, the age of the moon at the time of the Crucifixion would have been approximately 15 days. This renders a total eclipse of the sun by the moon an impossibility at that moment in time. Brian

From Jim Huddle

I WAS interested in Bob's point (see end of the appended note below), but didn't think it needed a reply. What interests me about the case at hand is that "there did not remain un-obscured as much as 3 fingers of the Sun." I wonder what "three fingers" means? When I hold my hand toward the Sun with my arm fully stretched, even ONE finger completely obscurs the Sun. Clearly, their use of "three fingers" as a measure is different from mine, too. Jim Huddle

From Brian Garett

My inkling is that "finger" is a slightly inaccurate rendering of the Latin "digitus". The source document is apparently in Italian, but I suspect the word comes from the same Latin root. I *think* the author was trying to say that three "digits", or tenths, of the Sun was covered. Brian

GENERAL TOPICS

From : "Tiny Kouters" <tkouters@wxs.nl> To : <SOLARECLIPSES@AULA.COM> Subject : [SE] **2 year ago** Date : Sun, 12 Aug 2001 Yesterday (11-8-2001) it didn't work but I try it again.

L.S. It's two years ago that I have seen my first sun-eclips. (Pourlanville a small town near Amiens in France) I hope that I can see more of them but I work at a school as mathematics- and physics teacher and I can't get free at all time to go to a sun-eclips. The eclips in Africa this year cames 2 weeks to early. I hadn't holiday at that time.

I hope that I can see the eclips of : 1 August 2008; 22 Juli 2009; and maybe 11 Juli 2010.

Greetings from the Netherlands, Tiny Kouters

From : B Yen <byen00@earthlink.net> I too, recalled the 2 yr anniversary of Aug. 11, 1999 eclipse from Turkey. Great eclipse & cultural experience, Turkey is a fantastic tourism country: friendly people, lots of scenery.

I was on Mt. Wilson, observing the 2001 Perseid meteor shower (which I observed on Aug. 11 from Turkey, in 1999). I ran meteor-patrol photography, & I should have recorded some intersting fireballs. B Yen

From : Kidinvs@aol.com As this is the anniversary of the 199 eclipse, I will remind everyone that Turkey is, in fact, a wonderful country... it's people, it's history, and it's hospitality. If you visited in 1999, you will find the country even a better bargain now to visit. And in 2002, the country of Zimbabwe will be blessed with another eclipse, one that I plan to take 65 people to see from a lodge located only 50 km fromthe centerline. I hope everyone enjoyed the weekend in England. The fare was very expensive, and I therefore could not attend, but I am sure that Patrick put together an excellent program, one that I hope to read about on the SEML. Eric Brown

From : Jean Meeus <JMeeus@compuserve.com> To : "INTERNET : SOLARECLIPSES@AULA.COM" <SOLARECLIPSES@AULA.COM> Subject : [SE] **Digits** Date : Fri, 31 Aug 2001 02:25:29 -0400

I think the correct English word is "digits".

Earlier astronomers expressed the magnitude of a solar or lunar eclipse in digits, one digit being 1/12 (not 1/10) of the diameter of the Sun's disk (or of the lunar disk in the case of a lunar eclipse). Even Oppolzer, in his famous Canon (1887), expressed the eclipse magnitudes in twelfths (in German : Zoll).

So, for instance a magnitude of exactly 6 Zoll (digits) means a magnitude of 0.500. Jean Meeus

From: Patrick Poitevin <patrick_poitevin@hotmail.com> To: SE Mailing List <SOLARECLIPSES@AULA.COM> Sent: Wednesday, August 01, 2001 9:51 PM Subject: [SE] **CD-ROM SEC2000 Proceedings**

Dear All, For those whom attended the Solar Eclipse Conference on 14 - 15 October in Antwerp, Belgium, at last, the CD-ROM Proceedings should be in your position. To respect copyrights, the pictures and files are mainly in pdf. Of course we have to give in in resolution. Still, I hope you enjoy.

Please give me your comments. Although there will be no CD-ROM proceedings of Totality Day 2001, it is still the aim having an international Solar Eclipse Conference in the central eclipse free year 2004. Your feedback is appreciated.

For those whom did not attend and want to obtain a CD-ROM: I am doing my best getting extra copies. I will keep you posted. Best regards, Patrick

GENERAL TOPICS

Eclipse Predictions and Stonehenge

From : Bill Kramer <bill@autocode.com> To : Solar Eclipse Group <SOLARECLIPSES@AULA.COM> Subject : [SE] Eclipse predictions Date : Fri, 10 Aug 2001 15:12:30 -0400

If you've seen an eclipse, you know they are staggering and amazing events to behold. Imagine the impact on ancient man, not knowing what was going on.

It is often quoted in literature that sites like Stonehenge can be used to predict eclipses. Numerous texts make reference to the 56 holes surrounding the site as a simplified way to "track" the nodes, Sun, and Moon. This method would alert to eclipse danger zones and operates in a fashion very similar to the Mayan system of eclipse danger zone predictions.

The Stonehenge site seems to have been "tuned" to the rising of the Sun and Moon during the Summer and Winter solstices. There are a series of almost 100 post holes indicating the possible location of the moon rise around the time of the Winter solstice. This may have been done during an "investigative" period in an attempt to isolate a repeating number for eclipse prediction purposes. Or an attempt to refine the prediction process (add more circles, a primitive decimal point?).

Does anyone know if there have been any studies or publications demonstrating how neolithic sites could have been used to predict eclipse events by precise measurements (predictions) of the nodal crossings? Or using the counting system ascribed to Stonehenge?

Thanks for any direction or ideas! -Bill Kramer

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

Hi Bill, in a German astronomy journal I've read an essay on this topic. It suggested that Stonehenge could indeed be an ancient eclipse calculator and describes how it could have been used. Even a layout of Stonehenge with instructions is included. However, the article is in German and therefore probably not much use for you.

The exact source is "Stonehenge - eine steinerne Finsternisuhr?" (Stonehenge - an eclipse clock of stone?) by Klaus Meisenheimer in SuW Special 4 "Sonne - der Stern in unserer Naehe" (Sun - the star in our vicinity), ISBN 1434-2057.

The principle is that the courses of sun and moon are simulated in three circles. There are two inner circles for the moon (Stonehenge II), one of 29 and of 30 holes which are used alternately (to describe the number of days in a synodic month using integers). An outer circle of 56 holes (Stonehenge I) is for the sun. Even the course of the nodes is simulated on the outer ring. This system allows to recognize full and new moons and the position of the sun relative to the nodes, so you can predict lunar eclipses with good certainty and at least tell dates with the "danger" of a solar eclipse. Eclipse observations have to be used to calibrate the counting.

However, the author emphasizes that this is his interpretation only.

I hope this short abstract helps a bit. If you have further questions, please ask. Marc

From : Archer Sully <archer@meer.net>

Not exactly. A book that may still be in my possession is "The Stonehenge People" by Aubrey Burl. Amazon lists it as out of print, but the author does a very good job of tracing the history and use of Stonehenge. In a nutshell: it was a funery temple, and earlier versions of it stood on the site for over a thousand years prior to the erection of Stonehenge itself. The alignments were probably used to determine lunar alignments that were important for religious rites. Burl's conclusion its use as an eclipse calculator was extremely unlikely. Archer Sully

From : Shivapuja@aol.com

marc, as a lover of both stonehenge and eclipses, thank you so very much for the overview of the article! michael, ohio, usa

From : Evan Zucker <ez@AbacusTotality.com>

"Stongehenge Decoded" by Gerald Hawkins is my favorite book on this subject.

http://www.amazon.com/exec/obidos/ASIN/0385041276/qid=997563368/sr=1-1/ref=sc_b_1/107-6287270-4787720

http://shop.barnesandnoble.com/booksearch/isbnInquiry.asp?userid=66MHAHWABH&mscssid=88R2VK1SFEKE9KCTBTXGV224WC2R9736&isbn=0880291478 Evan H. Zucker

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From : jmp@williams.edu

The standard book about Stonehenge as an eclipse predictor was by Fred Hoyle, "On Stonehenge," a few decades ago. It followed "Stonehenge Decoded," in 1965, by Gerard Hawkins. But though a very complicated scheme can be invoked to predict eclipses, more recently it has been thought unlikely to be the actual use of Stonehenge.

The Proceedings of a conference on "Science and Stonehenge" held in 1996 at the Royal Society, London, have been published as Barry Cunliffe and Colin Renfrew, eds., "Science and Stonehenge," published for the British Academy by Oxford University Press, ISBN 0-19-726174-4.

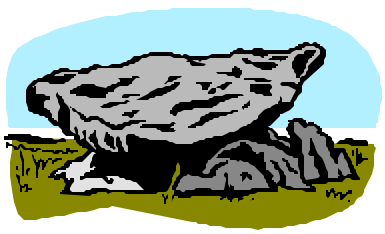
A nice Stonehenge URL is at http://witcombe.sbc.edu/earthmysteries/EMStonehenge.html

I discuss Stonehenge and archaeoastronomy in my text "Astronomy: From the Earth to the Universe." The sixth edition will be released on Friday (August 17, 2001). See www.williams.edu/astronomy/jay. Jay Pasachoff

From : "Barrie W. Jones" <b.w.jones@open.ac.uk>

Prof Clive Ruggles of the University of Leicester in the UK is an authority on neolithic monuments in the British Isles (= UK plus Ireland). He came to archaeology through astronomy and is a highly respected achaeo-astronomer. He is one of a rare breed that understands both the astronomy and the archaeology! There is an article by him and Derek McNally in the UK Royal Astronomical Society publication "Astronomy and Geophysics" Vol 38 Issue 1, Feb/March 1997, pages 30-31 (this article includes a photograph I took of the half-Moon bisected by the horizon, seen through the inner circle of stones). The article gives several references, including books. Try C L N Ruggles in "Science and Stonehenge" (London 1997, edited by B W Cunliffe and Lord Renfrew of Kaimsthorn). Try also "Astronomy in Prehistoric Britain", Yale University Press, about 1997).

Ruggles's view on Stonehenge is summarised as "Apart from the solstitial alignment of the main axis, direct evidence of astronomical alignments in the architecture of the monument is weak." Please note that this view is based on a lot of careful work. Barrie W Jones



From : "Patrick Poitevin" <patrick_poitevin@hotmail.com> To : SOLARECLIPSES@AULA.COM Subject : [SE] **Final Program Totality Day 2001** Date : Thu, 09 Aug 2001 05:26:04 +0000

Dear All, Totality Day 2001 is nearby. For the late deciders, place to be on Saturday 11 August is the Open University of Milton Keynes. Entrance is free. Eclipse addicts from over the world are attending or will give a presentation. Trade and Posters as well. The final program being:

TOTALITY DAY 2001 – PROGRAM

08h00 Doors open. Entrance Main Reception of Berrill Building

10h00 Opening TD2001 by Dr. Barrie W. Jones (England)

10h10 Low altitude Central Eclipses and the 2003 Scottish Annular Eclipse by Sheridan Williams (England)

10h30 The eclipse from Madagascar including 4th contact at sunset by Derek Hatch (England)

10h35 The best from our Zambian Expedition by Daniel Fischer (Germany)

10h50 Break

11h15 Historical Eclipses and Changes in the Earth's Spin Rate by Prof. F. Richard Stephenson (England)

12h00 Lunch (Berrill Café is open for sandwiches, drinks or pack-lunch)

14h00 The Solar Eclipse in Zimbabwe by Dr. Francis Podmore (Zimbabwe)

14h15 Project Eclipse Glasses by Dr. Francis Podmore (Zimbabwe)

14h30 Experiments for Students during a Total Solar Eclipse by Assoc. Prof. Jim Huddle (USA)

14h50 Solar Eclipse Weather Effects by Dr. Edward Hanna (England)

15h10 Eclipse video by Joanne Edmonds (England)

15h20 Video: Eclipse from the Southern Edge by Richard Bareford (USA)

15h25 Video: Shadow Bands and the 2001Eclipse by Dr.

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Wolfgang Strickling (Germany)

15h30 Break

16h00 Total Solar Eclipses and Modern Culture by Dr. Francisco Diego (England)

16h45 Eclipses; The Artist's Perspective by David A. Hardy (England)

17h05 Looking for the Coronal Heating Mechanism with the SECIS instrument by Prof. Ken Phillips (England)

17h50 Africa 2001 Eclipse Images of SENL contributors by Patrick Poitevin (England)

17h55 Closing TD2001 by Joanne Edmonds (England)

20h00 Doors closed

See you on Saturday in the Open University or in the bar on Friday night in the Hilton hotel across the road of the University.

Best regards, Patrick and Joanne

Dr. Francisco Diego and Prof. Ken Phillips during lunch

From : Henrik Glintborg <Henrik@tycho.dk> To : solareclipses@aula.com Subject : [SE] Great Eclipse Day 2001! Date : Mon, 13 Aug 2001 09:58:59 +0200

Just returned from London from another wonderful solar eclipse conference organised by Patrick and Joanne - and Barrie (W. Jones). Antwerp last year was great and so was this Totality Day at the Open University in Milton Keynes. The mixture of the different speaches were great - from Daniel Fischers very entertaining "The best from our Zambian Expedition" over Francis Podmores report from the eclipse in Zimbabwe (where I was with my group of 80 people) to David A. Hardys artistic perspective on eclipses - just to mention a few!

It was truly a pleasure to meet all these eclipse-addicted people again and to hear - and see - about their experiences in Africa this June. I am looking forward seeing you again next time we meet which must be in January/February 2003... ;-)

Great job Patrick and Joanne! Henrik Glintborg, Copenhagen, Denmark

Assoc. Prof. Jim Huddle (US) at David A. Hardy's stand

From : Daniel Fischer <dfischer@astro.uni-bonn.de> Subject : [SE] Link collection / Mugabe & the eclipse / Who was ...?

As promised on Totality Day 2001, here is the URL of the German website that has the largest collection of links to the 2001 event I've encountered so far: http://www.sofi01.de (SoFi being a popular German acronym for Sonnenfinsternis = solar eclipse, until 1999 used only by amateurs, but then it became popular in the general media as well). Other websites related to talks at the conference are http://www.astro.uni-bonn.de/~dfischer/skyreports/zam2001 (my own), http://www.astroart.org (David Hardy) and http://ast.star.rl.ac.uk/secis/exp01/exp01.html (Ken Phillips).

On the way back to Germany, I found 'our' 2001 eclipse mentioned twice in The Sunday Times of August 12, both on the front page and on page 23. Apparently the approaching natural event has played a role in the increasingly bi-

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zarre mental state of Zim's Robert Mugabe (who is being haunted by ghost, for example). We read that "Mugabe's distress deepened before an eclipse in June - a portent of evil in traditional tribal culture" and that "his anxiety increased in the weeks approaching last June's eclipse, a foretelling of evil in Shona belief. [...] Although he ordained a media campaign insisting that the eclipse was not a harbinger of evil, 'it was the president who most needed convincing', one source said."

And finally, who were these British astronomers I talked to during one of the breaks who were putting together a chartered plane flight out of Australia to observe the 2003 eclipse, for just 200 to 300 pounds? I forgot to look at their name tags and only remember that they were just creating a society for extreme eclipse chasing called T.I.T. ... Daniel

From : "Patrick Poitevin" <patrick_poitevin@hotmail.com>
Date : Thu, 16 Aug 2001 19:24:35 +0000

Dear All, For those whom attended Totality Day 2001. We hope you enjoyed as much as we did. It was a beautiful day, complete with most interesting speakers and a very nice and committed audience.

It is for sure, we are organizing a next Totality Day. The next Totality Day will be on Saturday 8 February 2003. And do not tell us we informed you well upfront... The main topics will be the past December 04, 2002 total solar eclipse and the preparations for the 31 May 2003 and the 23 November 2003 solar eclipses.

Due to the wonderful venue and the perfect help of Dr. Barrie Jones and his colleagues, we will have TD2003 again in the Open University of Milton Keynes in England.

If you want to contribute, trade, posters, or want to spread the word, please send me a private mail.

PS: The International Solar Eclipse Conference is due August 2004. The two day conference will be as well in the Open University and it will be again a crossroad of eclipses and solar physics. More details of SEC2004 later about the exact weekend.

PPS: There have been errors in the SEC2000 CDROM Proceedings. Our apologize for this. Some wonderful presentations came out as a mess and some wonderful pictures lost their high resolution. Next time better: We will control better.

PPPS: The CDROM of Totality Day 2001 will be for sale in the next coming months. Contributions are welcome, as long as it is solar eclipse related.

Keep those solar eclipse related messages coming... Best regards, Patrick

Dr. Francis Podmore (Zimbabwe) and Prof. Richard Stepehenson (UK) at a break

From : "Glenn Schneider @ Home" <gschneider@mac.com>

All, I had sent a contributed poster to the Totality Day meeting, which was returned by UK customs for I had not put a customs declaration form on the mailing tube (live and learn). It was re-posted, with the appropriate form attached, but apparently did not arrive in time for the conference. For any who are interested, I have made it available over the Web as a downloadable/viewable .jpg file. It is quite large, ~ 10 Mbytes, so be patient. I have put it on two servers, in the event you have difficulty with one, try the other:

http://nicmosis.as.arizona.edu:8000/POSTERS/UMBRAPHILE_POSTER.jpg
or
http://balder.prohosting.com/stouch/UMBRAPHILE_POSTER.jpg

Cheers, Glenn Schneider

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

May I suggest a somewhat modified timeline for both the 2003 Totality Day and the 2004 Eclipse Conference (which I've already discussed with some TD participants)? With the same number of (hotel) nights or even fewer nights, one could have a more relaxed program, plus more free time inbetween the formal presentations:

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Totality Day: Let it run from Saturday @ 2 p.m. to Sunday @ 2 p.m.

Advantages: a) This will be much more inviting for people from outside a few hours driving time from Milton Keynes, because they can, in principle, fly in on Saturday and fly out on Sunday (getting a cheap fare this way) and spend only one night in a hotel. This year two nights were unavoidable for visitors from abroad.

b) During the night Saturday to Sunday all participants will have to stay in MK, which offers much more time for private discussions and lengthier video shows (like we had in Antwerp).

Disadvantages: People from the area will have to stay overnight or commute - but since Totality Day is supposed to be an international event, I think that's a reasonable sacrifice.

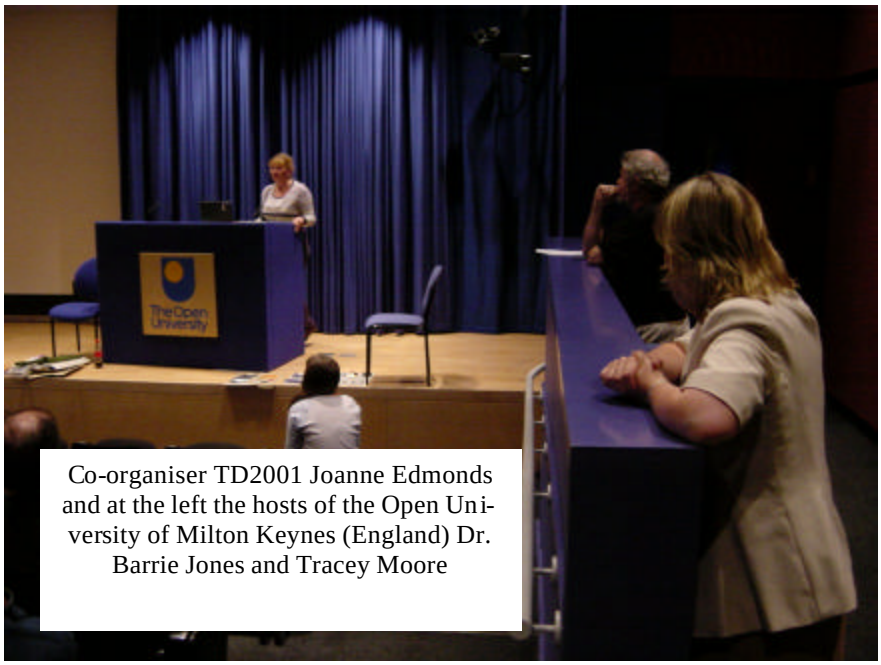
Eclipse Conference: Let if run from Friday Evening @ 6 p.m. to Sunday @ noon, with a (sponsored?) reception for all on Friday and a big (pay for yourself) dinner on Saturday evening.

Advantages: a) a much more relaxed conference with two evenings free for longer presentations and video shows and b) one night in a hotel less than was necessary in Antwerp (where one needed to stay from Friday to Monday, unless one hurried away quickly on Sunday evening) - now one only needs to book from Friday to Sunday.

Disadvantages: None I can see whatsoever - the scenario outlined above is actually the standard procedure for each and every weekend astronomy conference in Germany, and everyone seems to like it.

And finally I would like to propose a venue for the next Eclipse Conference *after* 2004 (in 2007?): Why not hold it in ... Violau? Some in the community already know this wonderful conference center in the middle of nowhere in Bavaria, Germany, as three international planet and comet conferences were held there. The main advantage is the price: For just 125 Euros or so you get accomodation for a full weekend (three nights), full catering (which is excellent) and all the conference facilities.

See http://www.astro.uni-bonn.de/~dfischer/mepco97inv.html for a typical invitation (most links are dead, sorry), http://www.bruder-klaus-heim.de, and http://home.t-online.de/home/082951097/bkhe.htm for an introduction to the venue - many exterior and interior views of which can be seen in http://www.bndlg.de/%7ekcmayer/fotoalbum/Fotos.htm - and finally http://www.schwebel.de/astro/violau_de.html (in German only) for some of the atmosphere of the place. Violau is close to Augsburg and reasonably close to Munich; transportation to the site would be by chartered busses or a van (owned by the facility), and once everyone's there, a successful conference is all but guaranteed. I've been there more than 20 times now since 1985 ... Regards, Daniel



Co-organiser TD2001 Joanne Edmonds and at the left the hosts of the Open University of Milton Keynes (England) Dr. Barrie Jones and Tracey Moore

From: Jean Meeus <JMeeus@compuserve.com> Sent: Monday, August 06, 2001 9:57 AM Subject: **DeltaT**

On 2001 July 1, Delta T (the difference between the uniform Dynamical Time and the Universal Time) was 64.21 seconds,

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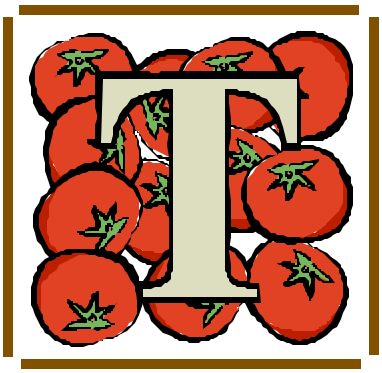
the same value as on June 1.

Here are the values of Delta T, in seconds, since 1991.

First column : the year. Next columns : value of Delta T on January 1, April 1, July 1, and October 1.

1991	57.57	57.77	57.96	58.11
1992	58.31	58.54	58.74	58.90
1993	59.12	59.36	59.58	59.76
1994	59.99	60.20	60.40	60.56
1995	60.79	61.03	61.25	61.40
1996	61.63	61.81	62.00	62.12
1997	62.30	62.48	62.66	62.79
1998	62.97	63.14	63.28	63.34
1999	63.47	63.57	63.67	63.71
2000	63.83	63.91	63.98	64.01
2001	64.09	64.16	64.21	



Jean Meeus

From: Mick Wolf <mickwolf@picknowl.com.au> **Duration of TSE**

Hello Fred, I was wondering if you could provide me with eclipse duration of 2 eclipse observed on

1) 20-6-74, at Hamelin Bay, W.A.
Lat. 34deg.14' and Long.115 deg.2'
2)23-10-76, at Robe,S.A.
Lat.37deg.12.5' and Long.139deg.40'.

Your help will be greatly appreciated. Mick.

From: Crocker, Tony (FSA) <Tony.Crocker@transamerica.com>

Emapwin calculates totality durations of 3:30 for 1974 @ 115.03E, 34.23S (decimal degrees) and 1:56 for 1976 @ 139.67E, 37.21S.

From: Mick Wolf <mickwolf@picknowl.com.au>

Could anybody give me the duration of the eclipse in Potosi,Bolivia on the 3/11/94,lat. 19deg.35'S and long.65deg.45'W. Thanks Mick/

From: Dale Ireland <direland@drdale.com>

http://sunearth.gsfc.nasa.gov/eclipse/SEpath/SEpath1901/SE1994Nov03T.html Dale

From: Peter Tiedt <rigel@stars.co.za>

From Emapwin 2m 42.7s Peter Tiedt

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From: Julien Onderbeke To: Patrick Poitevin Date: 09.08.01 Subject: **RT eclipsen**

RT - ECLIPSEN Bij het bekijken van tabellen met zonsverduisteringen in de nabije toekomst viel mij op dat de RT-eclips van 2013 een totaliteitsduur heeft van 1m40s. Dit verraste mij toch wel. Een blik op alle RT-eclipsen in de periode -2000 tot +2500 leerde me dat er vier dergelijke eclipsen zijn met een totaliteitsduur boven de 1m40 s nl.

-1297 Sep 17 : 1m41s
+1350 Nov 13 : 1m42s
+1423 Jul 8 : 1m45s
+2013 Nov 3 : 1m40s

Het is maar een visuele controle in de Mucke-Meeus canon, misschien heb ik er nog overgeslagen. De distributie van RT-eclipsen is zeer onregelmatig per eeuw. Dat is al een paar keer opgemerkt, zoals in de tabel 10A van de Mathematical Astronomy Morsels. Ik vroeg me eigenlijk af of er ook een bovengrens bestaat voor de totaliteitsduur, net zoals Mevr. Lewis die berekend heeft voor de "gewone" totale eclips, zijnde 7m31s. Ik vermoed dat zij hiervoor een theoretisch bewijs aanhaalt en dat het om een supremum ofte kleinste bovenlimiet gaat.

Een totaliteit van meer dan anderhalve minuut (en zo zijn er redelijk wat RT-eclipsen) is toch niet weinig. Ik had altijd de neiging te denken dat RT-eclipsen een totaliteit hebben van hooguit enkele seconden maar de genoemde gevallen geven het gevoel dat ze soms bij de "serieuze" totale eclipsen horen. Het is misschien een opmerking die in dezelfde lijn ligt als puntje 8 van hfst. 10 van de Morsels (blz. 61) waarin gesteld wordt dat het zichtbaarheidsgebied van partiële eclipsen soms tot aan de evenaar (of erover) kan strekken en niet noodzakelijk een "polaire" bedoening is.

Ook zou het misschien interessant zijn bij RT-eclipsen de punten H1 en H2 aan te duiden op de centrale lijn, punten waar de totaliteitsduur precies 0 seconden is en de breedte van de totaliteitszone precies nul is. De Meeus-notaties gebruikend zouden dit dus punten langs de centrale lijn zijn waar de grootheid L2' nul wordt. Wellicht is de benaming RT-eclips niet zo gelukkig. Ze is historisch natuurlijk door Oppolzer gebruikt (bij mijn weten voor het eerst want in de Almanakken van voor Oppolzers tijd duidde men ze aan als ringvormige eclipsen.

Van den Bergh noemt ze hybride en dat lijkt me beter. Tenslotte zijn de meeste RT-eclipsen eigenlijk RTR-eclipsen, ringvormig bij het begin en het einde. De eclips van 2013 is hierop een merkwaardige uitzondering. Het is een echte RT-eclips die ringvormig begint en dan voor de rest totaal is. Vriendelijke groeten, Julien

From : Michael Gill <eclipsechaser@yahoo.com> To : "SOLARECLIPSES@AULA.COM" <SOLARECLIPSES@AULA.COM> Subject : [SE] **Eclipse videos - 2 requests (From Francis Podmore)** Date : Fri, 10 Aug 2001 07:22:17 -0700 (PDT)

For those going to Totality Day 2001 in Milton Keynes:

Find below a message forwarded from Francis Podmore, who is currently in the UK and unable to access his Zimbabwean (SEML subscribed) email account.

Please respond directly to Francis (not to me) either via email (fpodmore@yahoo.com) or in person at Totality Day. Thanks.

I have two requests about eclipse videos...

(1) If you are coming to Totality Day 2001 next Saturday and have the AWESOME eclipse video, would it be possible to make a copy for me to take back to show friends in Zimbabwe?? I know it is a commercial product, but I cannot spare the 10 UK pounds for an original I am afraid.

(2) Is anyoe coordinating the production of a video about 'our' TSE2001?? In fact since SEML has such good contacts, could we coordinates efforts to video and document each central eclipse, especially for the benefit for those who cannot get to see the real thing?? Hoping to see some of you this weekend - Francis Podmore

From : Hal Couzens <hal@dneg.com>

I'm not sure how Patrick feels about eclipse video correspondence taking place on-line BUT at least initially it would be worthwhile until any interested parties have connected with each other.

I am a film-maker and would be very interested in collaborating on such a video and future such projects. I am at present working on a documentary about my own trip (Chisamba village - very local flavour).

I will be at Totality day tomorrow (lots of hair is the best clue I can give...). Totality day would also be an ideal day to get some footage for such a video (ok so I was going to bring my camera anyway). Best, Hal Couzens

From : "Madden.G" <iluvelx@netacc.net>

I think there is a good idea embeded here.

A one hour (more or less) professionally produced video

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incorporating the best video and stills taken by members of the SEML.

We could market it and use the proceeds to fund educational programs and materials, special needs and so forth. George Madden

From : KCStarguy@aol.com

I could contribute and make a slide video show of photos that can be placed on a video. It is a real nice way to view individual images one by one. I did that for my eclipse video that I just produced . I can handle and convert video and process digital quality video (preferred not Hi8mm) with my powerbook. Put my name on the list to help eventhough I will not be at the conference. Dr. Eric Flescher

From SKY & TELESCOPE'S NEWS BULLETIN - AUGUST 10, 2001 Copyright 2001 Sky Publishing Corporation

NASA MISSION TO SAMPLE SOLAR ORIGINS

Just as the book of Genesis described the creation of the Earth, NASA's new mission by the same name will explore the beginnings of the solar system. Launched Wednesday at 12:13 p.m. EDT from Cape Canaveral, Florida, Genesis will spend 30 months monitoring and collecting tiny bits of the solar wind (the steady stream of charged particles escaping from the Sun's atmosphere) before returning home. This is the first mission to return samples of another solar-system body since the Apollo and Luna flights to the Moon.

According to principal investigator Donald S. Burnett (Caltech), the main objective is to measure the chemical composition of the solar wind. Since the Sun contains more than 99 percent of all the matter in the solar system, and since its outer layers have (in theory) not changed since their formation, scientists believe that the solar wind should contain elements in the same proportions that existed in the early solar nebula. "Matter in the corona is escaping from the Sun," explains Burnett. "So all you have to do is get a little bit beyond the [Earth's magnetosphere] and catch the solar wind."

Genesis will "catch" just 10 to 20 micrograms of these charged particles, about one-hundredth the mass of a grain of table salt. It will cast its net from Earth's first Lagrangian point, 1.5 million kilometers (930,000 miles) toward the Sun, where the pull of solar and terrestrial gravity combine to keep a body "hovering" between them. Once the spacecraft is in place, the outflowing ions will strike and embed themselves in wafers of ultrapure silicon, sapphire, and other materials. The spacecraft will return to Earth with these captured particles, and in September 2004 eject its sample-return capsule into the atmosphere above Utah. As the precious payload parachutes to the ground, a helicopter will snag it in midair. Notes Genesis project manager Chester Sasaki (NASA/Jet Propulsion Laboratory), "It's after we bring our samples back that the true science of Genesis starts."

Astronomers have collected solar-wind particles during the Apollo landings, when astronauts erected aluminum foil sheets on the Moon. But these crude collectors were only left out for a few hours or days at best. "The Genesis sample is a whole new ball game," says investigator Meenakshi Wadhwa (Field Museum, Chicago).

From : KCStarguy@aol.com To : SOLARECLIPSES@aula.com Subject : [SE] **duncan steel eclipse book** Date : Sun, 12 Aug 2001 15:56:33 EDT

Here is my review of the Duncan Steel eclipse book Dr. Eric Flescher (KCStarguy@aol.com)

Eclipse by Duncan Steel. ISBN 0-7472-6284-5 It cost 79.95 s.africa rands or british pounds 7.00 or us about 15 dollars

Walking into a bookstore in Johanneburg, S.Africa while coming back from the 2001 eclipse. I had finished presented my 10 myths of eclipses during my trip and gathered much information from many sources for the presentation. When I read this book, I found many of the pieces of information I had managed to find, in one place. The author, while supplying pieces of information that I already knew, nevertheless, there was always tidbits and pieces of information that elaborated upon what I already was aware of but provided for a richer understanding.

This book is a good comprehensive review of all sorts of historical events that involved eclipses. The author also supplies information about eclipse etymology and where the word "eclipse" comes from and a variety of derivations from different culture. The solar eclipse saros and the eclipse cy"cle is explained and analyzed and there is also information about lundar eclipses as well. Warp in space" deals with how the sun shines and elaborate on Einstein's Theory of Relativity and the importance and the size of the sun. The turbulence of the sun chapter talks about the sun's makeup, talks about the corona and what is inside the sun and observing the corona without an eclipse. Connections between the length of the day and eclipses makes for good reading. The author makes more connections and provides

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more information on the importance of eclipses.

Eclipses also helped determine the size of the sun. Eclipses of a third kind- occulations (the first two being solar and lunar) are covered and includes information on occulation importance with the learning more about asteroids, comets, rings of other planets and more. The fourth eclipse type, transits, are also covered from ancient sightings to those by the spacecraft near Jupiter and the other planets. Stepping beyond the solar system covers the discovery of Pluto, stars that have eclipses (Algol and others). The last chapters covers what happens during eclipses (with instances of the 1999 eclipse in England), future solar and lunar eclipses and ends with information about how the eclipse path moves over time and the distribution of eclipses over the earth. A glossary of eclipse related terms end the book.

There are old eclipse historical photographs, illustrations and more information about various facets of each events, the people and circumstances. These supplemented the interesting readings. You will find that Mr. Steele's writings are comprehensive yet easy to understand. I recommend this book highly to all eclipse and astronomy enthusiasts who want to learn about a variety of information about history, science, astronomy, eclipses and more. You will find that this excellent book provides much " food for thought " about many facets of the eclipse phenomenon and much more.

From : <turkey@qatar.net.qa>

I have bought this book 1 year ago and very much agree with your opinion. Regards, K.alsubai

From : Hal Couzens <hal@dneg.com>

To be on the record.... I was given this book for Christmas (lovely) and its proved an invaluable source of info and was an excellent read indeed.

I would criticize it in that it lacks some practical details, at least in terms of quick reference. Of course it is not the goal of this volume to be treated as a quick reference guide but it would not be hard to have added this info (I would've thought). For example it does not say where the transits of Venus and Mercury are visible from or their scope of view or duration (I know now thanks to this list).

Also it does not have any photographs etc which is always a disappointment in an eclipse book (sly hint to all you authors out there). Still very worthwhile. Hal Couzens

From : "Janita V Hill" <janitah@senet.com.au>

Here is my review of the Duncan Steel eclipse book Dr. Eric Flescher (KCStarguy@aol.com)

Dear Eric, (and others) I sent your review to Duncan Steel and he has returned this message:

Dear Janita, Thanks for that. Glad to know that someone liked the book! BTW, people might like to know that a new 'American' edition will appear this fall/autumn, I think in November. This is fully revised and updated, but also has five new chapters, four of them about specific aspects of eclipses as viewed in North America. The publisher is the Joseph Henry Press, which is part of the National Academies Press in Washington, DC. People coming to the 2002 December 4 eclipse may well want to get one of this edition. There are also more pics than in the British edition. Kind regards, Duncan, Duncan@steel87.fsnet.co.uk

From : "Patrick Poitevin" <patrick_poitevin@hotmail.com> To : SOLARECLIPSES@AULA.COM Subject : [SE] **Hephaistio of Thebes and eclipses** Date : Wed, 15 Aug 2001 04:55:40 +0000

Dear All, Astrologer Hephaistio of Thebes (born 380 A.D.) dedicates, of what I have learnt, a chapter (24) on the meanings of eclipses and comments in his Apotelesmatica. Does anybody knows more about this? Best regards, Patrick

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

I hope it will help... That comes from Google... The most interresant reference is an online translation...

Cordialement, jean-paul.godard@noos.fr

Bibliography:

http://www.sas.ac.uk/warburg/institute/astro_biblio5.htm
Hephestion de Thèbes, Apotelesmatica libri III, éd. D. Pingree, Leipzig, 1973- 1974, 2 vols.

(Catalogus Codicum Astrologorum Graecorum I, Bruxelles 1898, pp. 131-134).

IV/V d.C. Hephaestio astrologus (Heph.Astr.) Pingree, D., Hephaestio Thebanus. Apotelesmatica, Leipzig (T) 1973-74 (cit. por lib., cap. y n. al margen). 1.330: App. = Appendix. 2: Epit. = Epitomae.

Catalogus Codicum Astrologorum (Cat.Cod.Astr.) Cumont, F. y otros, Bruselas 1898-1953, 12 vols.

GENERAL TOPICS

http://www.levante.org/Pinneri/Italian/Antique/Holden.htm
http://www.cultureandcosmos.com/books_noticed/apotelesmatics.htm

Translation avaiable on the web (20$) at http://www.projecthindsight.com/translat.htm
VOL. VI: HEPHAESTIO OF THEBES. COMPENDIUM, Bk I. 380 A.D. Treats of general principles of astrology & universal astrology, blending Ptolemy with Dorotheus and others. Highly interesting delineations of the decans. Also contains a very long excerpt from Nechepso/Petosiris on detailed eclipse delineation. Preserves an ancient Egyptian method of prediction using the Dog-Star alone.

http://www.zodiac-x-files.com/schmidta.htm

Hephaestio of Thebes, Hephaestionis Thebani Apotelesmaticorum Libri Tres, Ed. David Pingree, Leipzig, 1973.

Hephaestio of Thebes, Hephaestionis Thebani Apotelesmaticorum Epitomae Quattuor, Ed. David Pingree, Leipzig, 1974.

http://cura.free.fr/quinq/04bezza.html

From : Shivapuja@aol.com patrick, et alia, here's a source for you. (let us know if you uncover anything interesting about sirius as a predictor.)

Click Here: <A HREF="http://ProjectHindsight.com/index.html">Project Hindsight - Restoration of Ancient Astrâ€¦</A>

The main focus of Project Hindsight has been the restoration of the astrology of the Hellenistic period (300 B.C.E. to about 600 C.E.). This is the astrology that developed in Egypt and the surrounding Mediterranean area after the Alexandrian conquest and through the Roman period. It is the primary source for all later Western astrology. We believe that we are the first to have restored this ancient discipline to its original form.

VOL. VI: HEPHAESTIO OF THEBES. COMPENDIUM, Bk I. 380 A.D. Treats of general principles of astrology & universal astrology, blending Ptolemy with Dorotheus and others. Highly interesting delineations of the decans. Also contains a very long excerpt from Nechepso/Petosiris on detailed eclipse delineation. Preserves an ancient Egyptian method of prediction using the Dog-Star alone.

SKY & TELESCOPE'S NEWS BULLETIN - AUGUST 3, 2001

RUSSIAN SUN-WATCHER REACHES ORBIT

July ended with a bonus for solar physicists as the Russians launched their first dedicated scientific satellite since 1996. Now circling Earth in a 490-by-530-kilometer polar orbit, KORONAS-F has a windmill shape and a mass of 2,260 kilograms. Its Sun-pointing payload includes a radio-burst detector, three ultraviolet sensors, and nine X-ray detectors including an extreme-ultraviolet telescope with Ritchey-Chr,tien optics and 1.5-arcsecond resolution. These instruments will monitor dynamic processes on the Sun such as active regions, flares, and mass ejections -- objectives similar to those of the highly successful Solar and Heliospheric Observatory (SOHO).

KORONAS is the Russian acronym for "Complex Orbital Near-Earth Observations of the Solar Activity," a long-delayed project left over from Soviet times (July's launch was originally planned for 1991). It continues a long tradition of missions developed by the Ukranian Yuzhnoe company, whose first such satellite (Kosmos 1) reached orbit in 1962. The DS series and their successors in the Automated Universal Orbiting Station program are the equivalent of NASA's Explorer project. There were 11 launches of Earth-oriented AUOS-Z satellites between 1976 and 1991, followed by the two solar-pointing satellites AUOS-SM-KI (KORONAS-I) and AUOS-SM-KF (KORONAS-F), whose names reflect the two research institutes who were the original principal investigators for the experiment payloads. The I satellite, for the IZMIRAN geophysics institute, was launched in 1994 but lost attitude control after just a few months; it reentered the atmosphere last March. The new F satellite carries that designation because the original lead organization was the Lebedev Institute (known as FIAN in Russian), though it also carries experiments from IZMIRAN and several other European research centers.

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From: Leonard Krylov <cl4lkryl@CLING.GU.SE> To: <HASTRO-L@WVNVM.WVNET.EDU> Sent: Friday, August 10, 2001 8:51 PM Subject: **medieval eclipse prediction capabilities?**

Having encountered several cases where eclipse predictions are mentioned as early as 4th century, I'm starting to get curious. How did they do it? Did they have an algorithm or did they tabulate solar&lunar positions calendarically somehow? What kind of minimum of data and knowledge is needed to predict and retrocalculate eclipses?

I would also want to know, if anybody worked on this specific issue, if there exist "hard proofs" of medieval/early-medieval methods of eclipse calculation and if there is, how precise the results would be.

So, is it true that "thee olde" long before Keplerian mechanics could, and did, predict&retrodict eclipses?

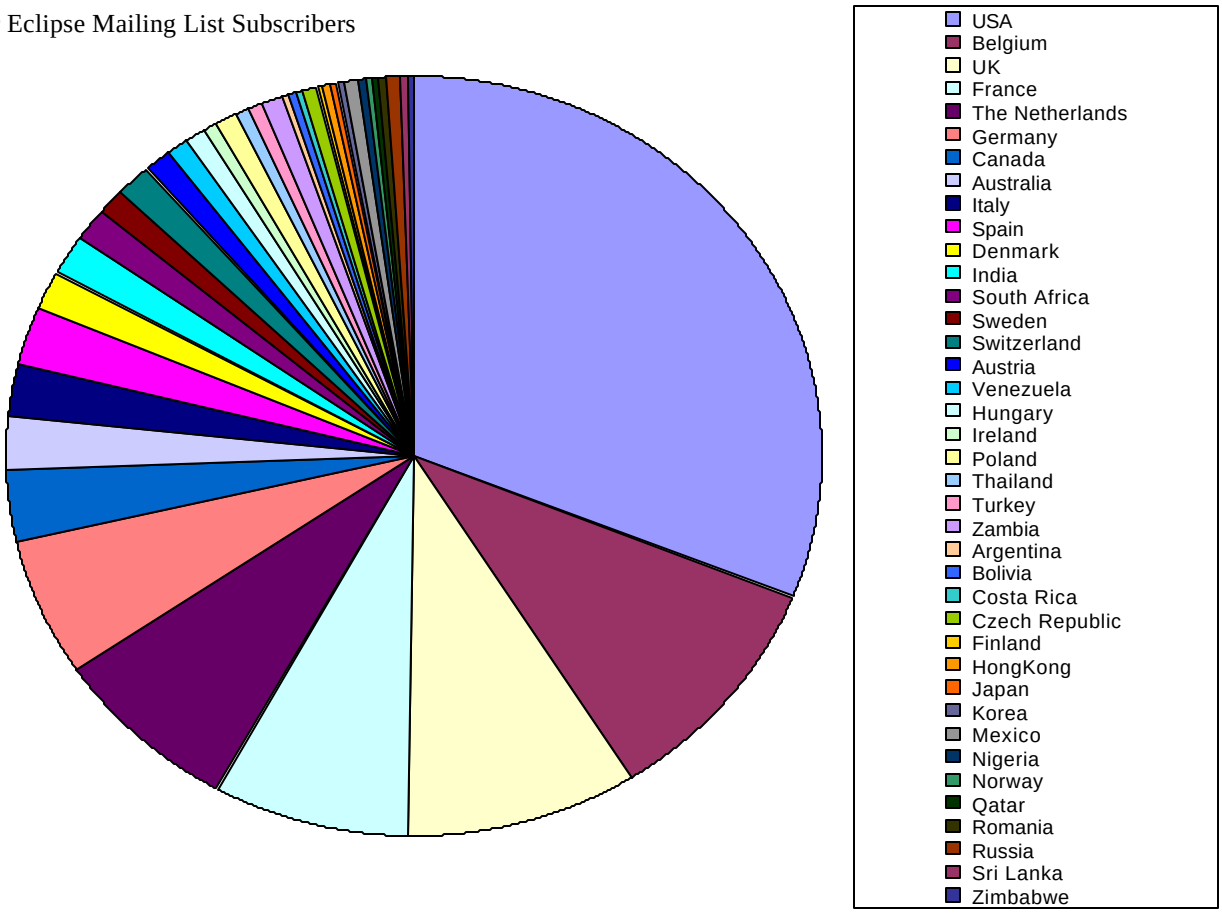
From: Keith Pickering <keithp@MINN.NET>

Book VI of the Almagest (Ptolemy, 2nd century AD) deals extensively with eclipses and their calculation, both lunar and solar. Most medieval astronomers would have had access to the work.

Rough prediction of a lunar eclipse can be done, minimally, by noting the pattern of 5-month and 6-month intervals between lunar eclipses. (This is probably how the Mayans did it.) Better results are obtained by observing the 19-year rotation of the nodes of the Moon's orbit around the ecliptic.

Solar eclipses are more complicated, requiring in addition knowledge of the Moon's parallax -- i.e., a reasonably high level of sophistication. But I see no reason why a medieval astronomer could not have done it. Keith Pickering

The Solar Eclipse Mailing List Subscribers



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From : KCStarguy@aol.com To : SOLARECLIPSES@aula.com Subject : [SE] **ring of fire pics** Date : Mon, 20 Aug 2001 00:56:09 EDT

Greetings I shot a 360 degree video of the ring of fire 2 minutes before totality in Hungary 1999. For 2001 I wanted to do that but during totality. I was able to videotape all the way around during totality. Until I was able to produce the quicktime VR movie of it or animated gif , I thought I'd post to landscape photos to show you what I captured.

This weekend I was able to convert the video to frame/stills. I then started to work with a demo copy of Photoshop Elements, Adobe's new scaled down product for under $99. (It can be downloaded for 30 day trial from their website. It took me several days however to dowload the whole bundle but if you get hung up the uploaded will allow you to continue the process and do not have to start all over).

It has one neat tool that PS 6 does not have and that is called a panorma tool. With this feature, a user can stich together a panorama of photographs.

You upload your pics (choose within a window box that opens up after you click on new project panaorama). You choose the pictures you then want to add and are positioned on a top toolbar. Then you drag each picture to the work area. The trick is to allign them exactly so that they stich together and are seemless.

After several trials and tribulations, I managed to create the 360 degree field with 2 photoshop panoramas long photos. I then converted both to jpg to place on my website.

If you want to take a look , point towards the following and scroll down http://members.aol.com/kcstarguy/blacksun/2001eclipse.htm Let me know what you think. Everything seemed to show fine in IE although I have not had time to check out Netscape which has been giving me a little trouble lately.

This tool can be used for any pictures you want not just eclipse ones. You may want to try the demo and see what you can put together. It takes a little practice but I thought it was a challenge and a lot of fun. I may try it on some other photos I have that are not in the dark.

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From : "Vic & Jen Winter, ICSTARS Inc." <webmaster@icstars.com> To : SOLARECLIPSES@AULA.COM Subject : [SE] **Amateur and Professional Perfection** Date : Thu, 23 Aug 2001 01:43:23 -0500

By definition, a professional is an individual who has ever been paid for his/her work in the field in question.

Any person who has sold one copy of a photograph they were responsible for in any capacity, clicking the shutter, or running a scanner or adjusting the color for is a professional photographer. A carreer astronomy photographer would make his/her primary income in this field.

Should this photo be of an astronomical object or phenomenon, that would make the individual a "Professional Astronomy Photographer"

One should not confuse the terms "Professional" and "Accredited" as that would pertain to an individuals creditaion by means of professional degrees, publishings, citations or academic achievements.

As "professional" astronomy photographers, we are also in many ways admidetly amateurs at a wide array of aspects of the wide science of astronomy.

It is difficult for us to hear terminology such as "Perfect Images" or "Ultimate Imaging Configuration" or "Best Equipment"

Remember, also that Astronomy is a Science and Photography is an Art. The science of astronomy may, in many ways, be measured and predicted. The art of photography is a subjective, interperative and flexible medium.

Each representation made by a printed or digitized photograph is a "rendition" in color, contrast, hue, saturation and lightness of what the eye can perceive. Ultimately, each eye will also perceive this image differently and each eye will percieve the photograph differently.

Through the years, we may find more advanced technological methods of capturing and reproducing an object... but to date, it is not an exact science. Even those of us with decades of photography, astronomy, image correction experience are still children in the world of new technology and new tools, equipment and applications to help us do our job. Vic & Jen Winter - Professional Career Astro-Photographers

From Alejandra Leon Castella

I found your definitions very enlightening. Art and science are great compliments in the search for interpretations of knowledge and beauty.

Good luck in your continuing perfection of both. Alejandra Leon-Castella San José, Costa Rica

From Gerry Foley

Any person who has sold one copy of a photograph they were responsible for in any capacity, clicking the shutter, or running a scanner or adjusting the color for is a professional photographer.

I'm sure no one cares, but I disagree. My few $5 payments for covers on the Sunday magazine section of the Columbus Citizen in 1941-2 did not make me think I was a professional photographer. Gerry K8EF

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From: R.H. van Gent <r.h.vangent@PHYS.UU.NL> To: <HASTRO-L@WVNVM.WVNET.EDU> Sent: Saturday, August 04, 2001 12:22 PM Subject: Re: **Time from Jupiter satellites.**

George Huxtable wrote: Yes, it's accepted that mapmakers could obtain longitudes to high accuracy based on Jupiter satellite observations. Even if the predictions of the times of satellite events were inaccurate, a mapmaker could compare his measured times, retrospectively, with times of corresponding events measured at the observatory which he used as his longitude reference. The precision of such a procedure would not depend at all on any uncertainties in the predictions. However, if a traveller needed to use Jupiter satellite measurements to obtain on-the-spot longitudes for immediate use, prior to his return to a base observatory, then he would be completely dependent on the precision of the predictions. Maskelyne claimed that the errors in the predictions for the first > satellite (Io) were better than 1 minute of time. I wonder when that accuracy in the predictions for Io was achieved?

Hi George, I do not believe that there is any evidence that 18th-century mapmakers reduced the measured times of Jovian satellite events themselves as the original observations were only seldomly published or available.

The practice in the 18th century was (I think) as follows: travellers, who were equipped with a small telescope and astronomical tables listing the Jovian satellite events, deduced their longitudes along their way whenever an opportunity arose to observe a Jovian satellite eclipse/transit/occultation. These longitudes would be published on safe arrival at home or made available to mapmakers in some other way. No one would question the accuracy of these longitude determinations unless a later traveller would supply evidence to the contrary. In that case the latter's results would most probably be used and the earlier ones discarded.

As to which tables were available for predicting the Jovian satellite events and how accurate they were, you may want to consult the following paper:

S. Débarbat & C. Wilson, "The Galilean Satellites of Jupiter from Galileo to Cassini, Rømer and Bradley", in: M.A. Hoskin (ed.), The General History of Astronomy (Cambridge University Press, Cambridge, 1989), vol. IIA, pp. 144-157.

The earliest tables listing the Jovian satellite events in detail were the Menologiae Iovis compendium seu ephemerides Medicaeorum (1656) of Gioanbatista Hodierna (listing the events from 1650 to 1682) and the Ephemerides Bononiensis Mediceorum syderum (1668) of Giovanni Domenico Cassini.

These tables led in the early 1670's to the discovery of the correction for the light travel time between the Earth and the Sun of which the near annual effect on the Jovian satellite events was first estimated to be some 10 to 11 minutes but was later lowered to about 7 to 8 minutes (Newton, Optics, book II, part III, prop. XI).

A comparison of Cassini's tables with the best available observations by Halley in 1694 showed that they were accurate to within 3 or 4 minutes of time. Halley himself also prepared Jovian satellite event tables which were published after his death in his Tabulae Astronomicae (1749). These were based on the observations of James Bradley who from them had determined the presence of several small periodic inequalities in the motions of the satellites (now known to be due to the slight eccentricities of the satellite orbits and mutual gravitational interactions between the satellites). Some of these inequalities had already been noted previously by Cassini but it was not until the time of Lagrange and Laplace that their amplitudes and periods could be accurately deduced from the theory of gravitation.

Halley's tables assume a light travel time correction of 6 minutes 56.5 seconds (modern value 8 minutes 19 seconds). This implies that there is at least a near annual periodic error of about 1 minute and a little more than 20 seconds on the times of the Jovian satellite events as predicted by Halley's tables.

The tables given in the Nautical Almanac from 1767 to 1804 were not based on those of Halley but on those first published by P.W. Wargentin in 1746 ("Tabulae procalculandis eclipsibus satellitum Jovis", Acta Soc. reg. sci. Upsaliensis ad annum 1741), which were revised in 1759 and again in 1771. I do not know which values Wargentin adopted for the light travel time correction or which periodic inequalities he took into account.

How well Wargentin's tables performed would depend on how well he estimated the periods and the amplitudes of these inequalities. Perhaps the simplest way to assess the accuracy of the Jovian satellite event tables in the Nautical Almanac or the Connaissance des Temps (initially based on the Cassini tables, revised in 1693, and later also based on the Wargentin tables) would be to compare them with the times predicted from modern algorithms, such as in J. Meeus, Astronomical Algorithms, 2nd ed. (Richmnond, 1998), pp. 301-315.

From: George Huxtable <george@HUXTABLE.U-NET.COM>

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I am grateful to Robert van Gent for a full and comprehensive answer to my questions about obtaining time from Jupiter satellite events. I admire the width and depth of his knowledge on such matters.

Now I have another question to ask about timing from the Jupiter satellites.

Before dawn this morning (4 August) a colleague observed the immersion of Io, using a cheapish 4 1/2-inch Newtonian. Conditions were by no means perfect, Jupiter being only 9 degrees up, the Sun 15 degrees down. Full Moon was up, but on the other side of the sky. However, Io could be seen clearly much of the time, though occasional strands of cloud were a nuisance, and its disappearance was timed at 02-31-24 UTC.

The predicted immersion of Io (in the supplement to ~Connaissanse des Temps") was given as 02-33-37, in Terrestrial Time (effectively, Ephemeris Time). Allowing for a delta-t of 63 seconds (is that a good current value for delta-T?) the UTC time of the observation would translate to 02-32-27 TT, 70 seconds earlier than the predicted value. It's possible that the early disapperance may have been related to one of those wisps of cloud.

My colleague was somewhat disappointed by this divergence between the observed and predicted times, but perhaps it may not be too unreasonable. Presumably the prediction is for the geometrical moment when the last sliver of the satellite has disappeared into the deep umbra of the planet. Presumably no practical telescope is able to observe the waning light right up to that final moment of extinction. An observer with a smaller telescope will report a correspondingly earlier time for the moment at which he can see no more light. Smaller telescopes will be biased toward reporting earlier times for immersions, and correspondingly later times for emersions.

I would be interested to know if observers of such events apply a known bias factor to their timings, depending on the telescope aperture and perhaps on other factors also. Does anyone know of any reports on this matter in the lierature?

Maskelyne, when he made the Jupiter-event predictions, would not have had the precise geometrical data that is available to compilers of the modern ephemeris. My guess is that his own predictions were based on his judgment of the mo ment at which the satellite was no longer visible to him, through his telescope at Greenwich (whatever he used for that job). In that respect, his predictions may have been more "useful" to an observer than the modern ones which predict the geometrical moment of total disappearance. Does anyone have thoughts to offer on these matters? George Huxtable.

From: R.H. van Gent <r.h.vangent@PHYS.UU.NL>

Hi George, What a fascinating idea to have a friend making such observations with modern equipment.

> The predicted immersion of Io (in the supplement to ~Connaissanse des ...

Your Delta T value of +63 seconds is a trifle too small, something like +64.2 seconds would be more correct. The best current and future estimates for Delta T can be obtained from:

ftp://maia.usno.navy.mil/ser7/deltat.preds

> My colleague was somewhat disappointed by this divergence between the ...

I note that the observations were made with a Newtonian reflector. You may get better results with a refractor which will allow you to use larger magnifications. Whatever telescope you use, it is good observing practice to note the magnification and/or the focal lengths of the eye piece and the object glass or primary mirror involved.

Your bias factor is exactly what Chauvenet warned about (see my posting of 17 July). Try to obtain a pair of immersion and emersion observations of Io with the same telescope and the same magnification factor. Both observations should have the same bias factor but with opposite arithmetical sign. For emersion observations you will have to know in advance roughly where the moon will reappear but you should be able to find this information in your tables.

> I would be interested to know if observers of such events apply a known ...

There may be something published on this matter in the earlier issues of the Journal of the British Astronomical Association where they have a planet watching section. Peter Hingley may be able to help you there.

> Maskelyne, when he made the Jupiter-event predictions, would not have had ...

This was your first trial, I expect that the results will get better after a few more successful observations. You could perhaps also interest members of an astronomy club in

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your neighbourhood to make similar observations with their telescopes, you would then be able to assess the influence of telescope type and magnification factor in more detail under nearly similar weather conditions. Regards,

From: Peter Broughton <pbroughton@3WEB.NET>

Using the ephemeris generator http://ssd.jpl.nasa.gov/cgi-bin/eph, which produces an ephemeris with a spacing no finer than one minute, I see that Io was in partial eclipse from 2:29 to 2:32 UTC and in total umbral eclipse from 2:33 onwards. This web site provides a great deal of other information including Delta T. I also see in the RASC Observer's Handbook 2001 that the predicted time of eclipse was 2:31. I think these times in the Handbook are provided by David Dunham of IOTA. As George pointed out in an earlier posting, the finite size of Io makes it impossible to determine the "instant" of disappearance during an eclipse. Peter Broughton

From: Herbert Prinz <hprinz@ATTGLOBAL.NET>

A while ago, I worried George Huxtable with a rather pessimistic comment about the accuracy of Jupiter satellite ephemeris at the time of Captain Cook's first voyage. I doubted that the ephemeris was sufficiently accurate to be useful for direct comparison with observations for the purpose of determining longitude and claimed that the established practice of surveyors was to compare simultaneous observations at different places. I was asked to back this up with literature. Excellent sailing weather has been preventing me for a while from accessing my books at home as well as from visiting libraries. I apologize to George for the delay in my reply. I followed the discussion on the list and realize that some of the material I present has been covered in the mean time.

Now that I got a chance to look again in more detail over the sparse material that is available to me, I confirmed my position with regard to map making. Cassini introduced systematic Jupiter satellite eclipse observations into cartography. The DSB [12], in the Article about Gian Domenico Cassini, says that his Ephemerides Bononsiensis mediceorum siderum " [...] were utilized for the determination of longitude in numerous world wide expeditions undertaken by French astronomers (in Denmark, the coast of France, Cayenne, Egypt, the Cape Verde Islands, the Antilles, a.o.". Then it describes how it was done: "As initiator of the method, Cassini made the observations at Paris to serve as controls and co-ordinated the results on a large planisphere". I will show below that Wales also used control observations (at Greenwich) 100 years later when evaluating Cook's journals.

The theory.

Where the use of the satellite ephemeris for navigation is concerned, I have revised my position slightly. The good news is: The tables were probably sufficiently accurate for the purpose of navigation. The bad news is: Cook did not navigate by them nor did he use them for charting.

Individual statements about accuracy are often contradictory. In a letter to Newton dated Dec. 27, 1684, Flamsteed claims: "I can answer all the eclipses of the first [satellite] that have been carefully observed within lesse then 2 minutes of time." ([3], p.256). This statement is remarkable, given that he was assuming uniform mean motion and allowing for no other inequality than "Roemer's equation of light". But then, fitting a theory to a limited number of past observations within a certain tolerance is one thing, and making predictions with the same accuracy is quite an other. Two years later in another letter he speaks of 3 minutes [1], p.98-99 and n64. This resembles much better the result I get myself when trying to emulate his methods on my computer.

A good glimpse on the state of affairs at the beginning of the 18th century is afforded by a remark by Bradley about an error of 5 minutes and 10 seconds found between the times observed and those predicted for immersion and emersion at the occasion of a simultaneous observation of the first satellite in Lisbon and New York in 1726. (Quoted after van Helden in [1], p.99, apparently from a paper on "Longitudes by Eclipses of a Jupiter Satellite", Philosophical Transactions of the Royal Society 34, No 394 (1726), 85, also reprinted in "Miscellaneous Works and Correspondence of the Rev. James Bradley, S.P. Rigaud, ed., Oxford 1832.)

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On the other end of the scale, even as late as in 1880, Souillart could still add a few perturbation terms that would, for the first satellite, amount to a maximum amplitude of 91 arc sec of true longitude (i.e. ca. 10 sec of time), and even more for the other ones ([5], p.264).

The Nautical Almanac falls in-between these two limits. According to what the preface says in the 1st ed., 1767, its calculations are based on tables that de Lalande published for the first three satellites in 1759, and for the forth in 1766. Lalande's tables, in turn are based on efforts by Pehr Wilhelm Wargentin. Lacking direct information about Lalande/Wargentin's tables, I thought I could estimate their accuracy by looking into the subsequent evolution of the theory and by estimating the magnitude of terms that were added later. But the results are inconclusive, because the general consensus in the literature is that the tables by Lalande/Wargentin were better than their underlying theory (or rather lack thereof) would lead one to expect.

P.W. Wargentin took a long series of careful timings of the eclipses of the satellites, comparing them with older observations and established the synodic periods of the satellites. In 1740, he found an inequality in the motion of the third satellite equal to that of the first two. Trying to determine the amplitudes of this common sinusoidal anomaly he found 3.5 minutes for the first one, but failed to establish that of second one. For a short technical explanation of these inequalities, see [4], p.114 and [5], p.264.

In 1741, Wargentin published "De satellitibus Jovis", and five years later, "Tabulae pro calculandis eclipsibus satellitum Jovis" in Acta Regiae societalis scientiarum Upsaliensis pro 1741" (1746). It is interesting that Wargentin did not add or improve any analytic theory, but apparently obtained good results on a purely statistical basis. The DSB [12], in the Article on Wargentin, says "Among his contemporaries W. was considered the outstanding expert in his field, and his tables of Jupiter's moons remained authoritative until the improvement of mathematical analysis made possible exact theoretical solutions of the problems. And his empiricism, even when compared with modern theory must be considered surprisingly reliable."

1766 Lagrange derived the observed perturbational equalities from dynamical theory. He accounted for the first time for the effects of distance from the sun, latitude, or spheroidal shape of Jupiter. Finally, Laplace started to work on the Jupiter satellites in the mid 1780s using observational data from Delambre. He published an analytical theory in 1805 in the 4th volume of his celestial mechanics [6]. Only in 1817 Delambre published a table based on Laplace's theory.

The DSB, in the Article on Laplace states that "Wargentin's tables needed only a small correction". This statement is compatible with the four values (20s, 18s, 30s and 33s) of Almanac error that I extracted from Wales (see below).

The Practice.

The "Connoissance des temps for 1728" tabulates eclipses only for the first satellite and only to a minute of an hour. It states ([7], p.152) that the longitude obtained from eclipses of Jupiter satellites is "much more accurate" than that obtained through lunar eclipses. This is a rather modest claim, as the latter would give 15 minutes of an hour at the best.

In 1773, the French were already more confident in their ephemerides. I only have a Connoissance for 1790 handy [8], but I believe that the text is identical to the that in 1773: "Quand on a observe l'immersion ou l' emersion d'un Satellite, & que l'on veut en conclure la longitude du lieu, on compare le temps vrai de l'observation avec celui de la meme immersion ou emersion, calculee pour Paris ou observee le meme jour. [...] Mais on ne doit attendre une precision suffisante de la part de calcul, que par rapport au premier Satellite de Jupiter, les Eclipses des trois autres Satellites ne pouvant pas encore se predire avec precision d'une minute." I agree with George Huxtable that this constitutes an implicit claim for accuracy better than a minute for the first planet. But I also notice the subtle hint to use the control observation rather than the calculation.

Next, I would like to call attention to a message by Peter Broughton, with a quote from a passage from the The Nautical Almanac for 1800, instructing the observer to "be settled at his Telescope Three Minutes before the expected Time of an

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Immersion of the first Satellite; Six or Eight Minutes before that of the second or third Satellites; and a Quarter of an Hour or more before that of the fourth Satellite; chiefly on account of the Uncertainty of their Theories".

The 'uncertainty of the theories' must have diminished slowly over the years: The corresponding figures in 1819 improved to 3 minutes for the first three satellites and 10 minutes for the forth. (But this was long after Cook.) Nevertheless, the user of the Almanac is still advised that "It is to be observed that a correspondent observation of an eclipse of a satellite of Jupiter, made under a well known meridian, is to be preferred to the calculations of the Ephemeris for comparing with an observation made in a meridian whose longitude is required; but if no corresponding observation can be obtained, as is frequently the case, it will be best to find what correction the calculations of the Ephemeris require by the nearest observations to the given time that can be obtained; which correction applied to the calculation of the given eclipse in the Ephemeris, renders it almost equivalent to an actual observation." [9], p. 164

In the same context, Maskelyne explains that "The eclipses of Jupiter's satellites are observed by astronomers at land, as well in order to provide materials for improving the theories and tables of their motions, as for the sake of comparison with the corresponding observations which may be made by persons in different parts of the globe, whereby the longitude of such places will be accurately ascertained." [9], p.167

To sum up, Maskelyne prefers simultaneous observations to observations separated by a short time interval, and the latter to a comparison of an observation to the ephemeris. Even as late as 1819 this passage was not considered obsolete and not removed from the explanatory part of the almanac.

Cook's use of Jupiter's satellites.

After studying Cook's log of the first voyage in the first volume of Beaglehole's edition, I come to the conclusion that Jupiter's satellites played no role whatsoever in his navigation and very little for the production of his charts.

Amongst the several entries in Cook's log pertaining to Jupiter, many merely state the impossibility of a planned observation due to bad weather. Only two entries during the entire journey, dated 29 June and 17 June 1770, record a successful observation by Green and Cook of emersions of the first satellite, both at Endeavour River. We may safely assume that Cook trusted Green to carry out the astronomical routine work and to record it adequately. But then, why did Cook record so many lunar distance observations himself? The only answer can be that the latter were of interest to him because of their practical use for his daily navigation, whereas the Jupiter satellites were not.

Checking Wales' "Astronomical Journals" [11], I found only one (!) other set of observations, also taken by Green and Cook, at Point Venus on May 10/12/27, June 4/13/18/20/21, July 4/6. The co-ordinates of this place were of utmost importance for the astronomical mission of the voyage and it is no surprise that every attempt has been made to corroborate them.

The Venus transit on June 4 was duly recorded by Cook in his log, as was a lunar eclipse that happened to take place on June 18. But all the Jupiter observations are conspicuously absent. Ironically, there is one entry on April 17 remarking that clouds hindered the observation of the first satellite. What am I missing here? It almost looks as if Cook had an aversion against Jupiter satellite observations. Could it have to do with the fact that he was not particularly good at them? On average, he saw an emersion 20s later than Green. In one instance he was 100s late! (But, if memory serves me right, according to Green he had a similar problem with the ingress of Mercury, Nov 8).

I shall confine myself to what I did find, rather than speculate about what I didn't find. In the introduction to his "Astronomical Journals", Wales explains the purpose of this book as " [...] to deduce the situations of such lands as were seen in these voyages [...] in the best manner that the observations and other data would admit of". The allusion to 'other data' indicates the intention to review and cross check the observations on the journeys with other observations and other sources of information. This applies to all observations, not just to those of Jupiter satellites. The lunar tables, for instance, were found to have a 2 minute time error amounting to 30' shift westerly in longitude. See [10], Vol. I, p.418, p. CCLXXV n.. And it goes without saying that lunar eclipses, planet transits before the Sun and star occultations by the Moon needed elaborate evaluation and mutual comparison of observation data world wide.

As far as as the Jupiter satellite eclipses are concerned, the reduction procedure was this: For Point Venus, Wales compiles

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a table of the whole set taken (see p.35). He discards the ones that he does not trust and calculates the mean of the other ones. Next, he allows an adjustment of 20s (which had been established experimentally by Maskelyne) for the fact that a 2 feet reflector with magnifying power 95 had been used on the expedition, as opposed to the six feet reflector available at Greenwich. Then he establishes the bias of the Almanac: Two control observations were taken at Greenwich on June 8 and July 1, one with a 6' reflector, the other one with a telescope comparable to the one Cook had. The time of the former he corrected by 20'. Then he compares both times with the Almanac and finds the former observation 10s early and the latter 13s, thus arriving at a final correction of 11.5s to be applied to the mean of Green's/Cook's observations.

The way Wales performs the reduction puts a veil over the reality of things: In fact, the Almanac was late 30s and 33s respectively. This becomes immediately transparent when we establish the bias between the Almanac and the control observation in Greenwich first (correcting the second one for telescope error, rather than the first), and independently correct Green's observation by 20's for telescope error.

The longitude calculation of Endeavour River is similar, except that Wales also averages with lunar distances taken at that place. The details can be found on p.138. The required Almanac correction for this observation was 18s and 20s, their mean nearly cancelling the telescope error of 20s.

We can learn 4 lessons from this: 1) Control observations were indeed used. 2) The Almanac error was in the order of half a minute. 3) Adjacent table entries could be expected to have approximately the same bias (within a few seconds). 4) Whatever instant it was that was measured in Greenwich, the method must have been pretty well standardized (even though different telescopes were used), as each pair of control observations is not nearly so wildly divergent as the observation pairs of Green and Cook.

The latter of the two observations are the ones that Cook recorded in his log. I have difficulty matching the numbers that Cook gives with those that Wales gives. At any rate, Wales obtains as result an "error of the chart" at Endeavour River of 2' 30". Much has been made of this result. Beaglehole claims it to be off only 2 1/2 nm from the modern value. I have not checked this. Even if true, I see no justification to generalize this rather isolated event. Obviously, Cook must not have integrated the result of this observation into his navigation. Had he done so, he would have noticed sooner or later a discrepancy between his lunar distances and his Jupiter satellite eclipses. On his return to New Zealand on his second voyage, he realized that the calculations from lunar distances were off by 25' on average. In his own words, "[...] it should seem that the whole of New Zealand is laid down too far to East", [10], Vol. 2. p?? (Sorry, I can't decipher my scribble). The error was up to 40' in individual cases. Why did Cook not become aware of the discrepancy on his first voyage, or if so, tried to resolve it, if he thought the result from the Jupiter observation to be definitive? Beaglehole passes over this in silence.

I checked the chart that Cook produced of the mouth of Enedeavour River, [10] Vol.5, Chart XXII b. The latitude of 15 deg 26' is prominently marked. Not so the longitude. This would be another indication that Cook must not have thought the longitude to be final.

A technicality concerning comparing longitude of far distant places.

To be sure, the restriction imposed is on distance, not on difference in longitude. If Jupiter is to be reasonably high above the horizon in both places, the two places of a simultaneous observation cannot be separated by more than say, 10000 nm, and that would be stretching it. Clearly, this prevents simultaneous observation from Greenwich and New Zealand. The long term solution to this problem was to create a world wide network of reference stations with well established longitudes at major observatories equipped with the best instruments. The more immediate solution was to compare an eclipse in a place of unknown longitude with a subsequent or previous one at the reference station of the ephemeris. Once the tables had been adjusted for errors in secular and/or long period terms, they were very accurate over short periods. The reason being that Jupiter moves slowly, the inclination of Jupiter's equator w.r.t. to the the ecliptic is only 3 deg, and Io's orbit is nearly circular and coplanar with Jupiter's equator. Hence, neighbouring eclipses basically occur with the synodic period of the satellite, corrected for light travel time. Even with Flamsteed's simple approach one can make fairly accurate short term predictions from one eclipse to the next. This, by the way, also gives justification to tabulate the phenomena to the nearest second, even though the long term accuracy might only be half a minute.

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I hope I have not raised more questions with this than I have answered. Best regards, Herbert Prinz (from 1368950/-4603950/4182550 ECEF)

References:

[1] "Longitude and the satellites of Jupiter" by Albert van Helden, in "The Quest for Longitude" symposium, ed. W.H. Andrewes, 1996.

[2] "The Galilean satelites of Jupiter from Galileo to Cassini, Roemer and Bradley", by S. Debarbat and C. Wilson, in "Planetary astronomy from the Renaissance to the rise of astrophysics", Part A, ed. Taton and Wilson, Cambridge U.P.,1989

[3] "The Newtonian achievement in astronomy", by Curtis Wilson, in "Planetary astronomy from the Renaissance to the rise of astrophysics", Part A, ed. Taton and Wilson, Cambridge U.P.,1989

[4] "The work of Lagrange in celestial mechanics", by Curtis Wilson, in "Planetary astronomy from the Renaissance to the rise of astrophysics", Part B, ed. Taton and Wilson, Cambridge U.P.,1989

[5] "Satellite ephemerides to 1900", by Yoshihide Kozai, in "Planetary astronomy from the Renaissance to the rise of astrophysics", Part B, ed. Taton and Wilson, Cambridge U.P.,1995.

[6] Mecanique celeste, Vol. 4, 1805.

[7] "Connoissance de temps for the year 1728"

[8] "Connoissance de temps for the year 1790", 1788

[9] "Nautical Almanac", ed. Blunt, 1819

[10] The journals of Captain James Cook on his voyages of discovery / edited by J.C. Beaglehole. Rochester, N.Y. : Boydell Press, 1999.

[11] Wales, William, "The Astronomical Journals [...]" London, 1788

[12] Dictionary of Scientific Biography, Gillispie, Charles, ed., New York, 1970-1980.

From: George Huxtable <george@HUXTABLE.U-NET.COM>

I owe a serious debt to those who have provided such valuable responses to my questions about obtaining time from the Jupiter satellites. I have to thank Peter Broughton (who provided a quotation from Maskelyne that I copied without acknowledgment), Robert van Gent, and now for a particularly well-researched contribution from Herbert Prinz.

I think it's fair to say that Herbert and I have both shifted ground toward each other during the course of this correspondence, and that nothing now separates us. A happy state of affairs.

Herbert has provided a valuable set of references which I will enjoy following up. One question niggles- Herbert mentions William Wales, 1788, "Astronomical Journals". I don't have a reference to the Wales work in front of me, but I think its immensely-long title started with the words "Astronomical Observations". This would not be related to journals written by Wales because he was not even on board the Cook first voyage, that repaired in Endeavour River. Wales' book analysed, long after the event, the journals and logs of Cook and Green for their astronomical content.

In a mailing to Robert van Gent, which he kindly copied to me, and which I hope you don't mind my including in a group mailing, you said-

> Modern predictions are often made for the moment at which the ...

I wonder which year of the "Phenomenes des satellites galiléens de Jupiter" you are referring to here. Because in the supplementary volume showing the 2001 predictions, timings are clearly shown as relating, NOT to the centre of the

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satellite, but to each limb separately. Perhaps they have changed the basis of their predictions.

What's more, and most unFrenchly, they have privided a full English translation of all the text. Very useful.

Finally, I am still looking for information on how the exact timing of a Jupiter satellite event would be affected by the size of the observer's telescope, and how this would relate to precise modern predictions. George Huxtable

From: Peter Broughton <pbroughton@3WEB.NET <mailto:pbroughton@3WEB.NET>>

Are there two different books here? Or two editions of one work? I am aware of the one entitled "The original astronomical observations made in the course of a voyage towards the south pole and round the world in his majesty's ships the Resolution and Adventure in the years MDCCLXXII, MDCCLXXIII, MDCCLXXIV, and MDCCLXXV" by Wales and Bayly, published by the Board of Longitude in 1777. In case you, or anyone else, might not know, there is a huge collection of microfilms of all[?] books published in English in the eighteenth Century. I imagine most major libraries have this collection which can probably be found under ESTC - The English Short Title Catalogue, and the book I have referred to is among them. I am not at the library now so I cannot check to see if there is a work by Wales published in 1788. Peter Broughton

From: George Huxtable <george@HUXTABLE.U-NET.COM <mailto:george@HUXTABLE.U-NET.COM>>

The 1788 Wales work relates to the second circumnavigation of the Dolphin, under Wallis, which preceded Cook's departure and established the coordinates of Tahiti for him. And then the first voyage of Cook in Endeavour, for which Wales was not aboard. Wales joined Cook for his second voyage in Resolution and Adventure, hence the Wales and Bayley account of 1777.

Because the astronomer Green had died during the course of Cook's Endeavour voyage, the astronomical observations of Cook's first voyage were not analysed until Wales' belated publication in 1788.

The Dolphin's voyage was remarkable for its purser, a mathematician named John Harrison (a namesake of the famous clockmaker) who, as well as his role as purser, appears to have acted as a highly competent astronomer. He took many lunar distances to establish longitude during the voyage, which had set off before the first Nautical almanac was published. So no pre-computed lunar distances were available to him. If reference is made to Maskelyne's British Mariner's Guide, it is staggering to note the complexity of the calculations that then had to be made at sea, to predict the position of the Moon.

In Wallis' journal, about establishing the position of Tahiti, he refers to John Harrison "thro whose means we took the Longitude by taking the Distance of the Sun from the Moon and Working it according to Dr Masculine's Method which we did not understand". This is in a footnote to Beaglehole's "the Journals of Captain James Cook, Vol 1, p 119. Otherwise, history seems to have forgotten that John Harrison altogether. George Huxtable.

From: R.H. van Gent <r.h.vangent@PHYS.UU.NL <mailto:r.h.vangent@PHYS.UU.NL>>

I too would like to congratulate Herbert Prinz on his fine analysis the role of Jupiter satellite eclipse observations on the determination of longitude and map making in the 18th century. I think it greatly adds to the little information that was known before and I hope that Herbert will be able to publish this in print in the near future.

It may be of interest to know that there exists a massive collection of Jupiter satellite eclipse observations that was compiled in the 1980's by J.H. Lieske for the purpose of checking and fine-tuning the long-term behaviour of his satellite ephemerides that now form the basis of the satellite eclipse predictions in the current almanacs.

His collection (containing 16802 observations, of which more than 7000 are before 1800, culled from 418 different sources and measured from 432 different sites) is described in:

J.H. Lieske, "A Collection of Galilean Satellite Eclipse Observations, 1652-1983: Part I", Astronomy and Astrophysics, vol. 154 (1986), pp. 61-76,

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and published in:

J.H. Lieske, "A Collection of Galilean Satellite Eclipse Observations, 1652-1983: Part II", Astronomy and Astrophysics Supplement Series, vol. 63 (1986), pp. 143-202.

Details are given on the observer's location and the original times are all given, reduced to the mid-eclipse UT.

Graphs of how well the observed times (reduced to mid-eclipse) compare with Lieske's ephemerides are also given and it is interesting to note that most of the pre-1800 observations of Io fall within a 180-second error band (that is errors ranging between -90 and +90 seconds).

Those of Europa fall within a slightly smaller error band (about 150 seconds) and there is a very noticeable increase in observations of this satellite during the last quarter of the 18th century. Lieske gives no explanation for this but it may have been caused by the fact that eclipses of Europa take place at a greater distance from Jupiter's disk than those of Io. The influence of Jupiter's glare is then somewhat reduced, which may perhaps explain the slight decrease in error.

The error bands of the two outer Galilean satellites (of which there are far less observations) are substantially larger.

Regarding James Cook's use of Jupiter satellite determined longitudes, it has not yet been mentioned that during his stop-over at Batavia (the capital of the Dutch East Indies on the island of Java) during his first voyage, he obtained its accurately determined position from the Dutch-German clergyman Johan Maurits Mohr (1716-1775). These were based on the latter's observations of an occultation of the star Antares by the Moon and eclipses of the two innermost satellites of Jupiter that had been carried out shortly before.

Cook noted down Mohr's results ("6° 10' South Latitude and 106° 50' East Longitude from the Meridian of Greenwich") but must later have regretted his stop-over in Batavia as this disease-infested place caused many of his crew to fall sick (including Cook himself) and several died during the last leg of the voyage, including the astronomer Green.

From John Westfall

Having just joined the HASTRO group, I'd like to make a (belated) contribution to the discussion about timing the eclipses of Jupiter's Galilean satellites.

I am the coordinator of a program of the Association of Lunar and Planetary Observers that consists of the visual timing of these events. Our program goes back to the 1975/76 Apparition of Jupiter and to date I've analyzed 8644 of these visual timings, comparing them with the JPL E-2 Ephemeris. Reports on our observations appear roughly annually in our Journal,_The Strolling Astronomer_. We also pass these timings on to Jay Lieske for his "fine tuning" of the JPL ephemeris.

Our observers time the "last speck" of light for eclipse disappearances and the "first speck" for reappearances. Both times differ from the center-of-disk predictions in ephemerides, not only because of the finite diameter of the satellite, but also because of the finite size of the penumbra of Jupiter's shadow.

There definitely is an "aperture effect." The mean difference between, say, 6-cm and 20-cm aperture in reported times is 31 seconds for Io and 45 seconds for Europa. The difference varies somewhat for Ganymede, due to the changing jovicentric latitude of the sun, but averages about 96 seconds. On the other hand, my opinion, without a formal statistical analysis, is that magnification doesn't matter much, as long as it is adequate (a minimum of 100-150X for the apertures most of our observers use).

The aperture effect has been statistically significant (at least 5-percent level, and usually the 1-percent level) for 14 of 18 apparitions for Io's eclipse disappearances and for 18 of 19 apparitions for its reappearances. (The occasional lack of significance usually denotes too few observers in a particular apparition.)

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