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The History of the Mitchell Building Skylight

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keywords: *skylight, SEP, 25th reunion*

ABSTRACT

During recent earthquake reinforcement of the Ruth Wattis Mitchell Earth Sciences Building, funds were successfully raised to install a skylight in the 4th floor. The skylight was completed in January of 1998 and dedicated during the Stanford Exploration Project's 25th year reunion on July 17th, 1998. Here is the story.

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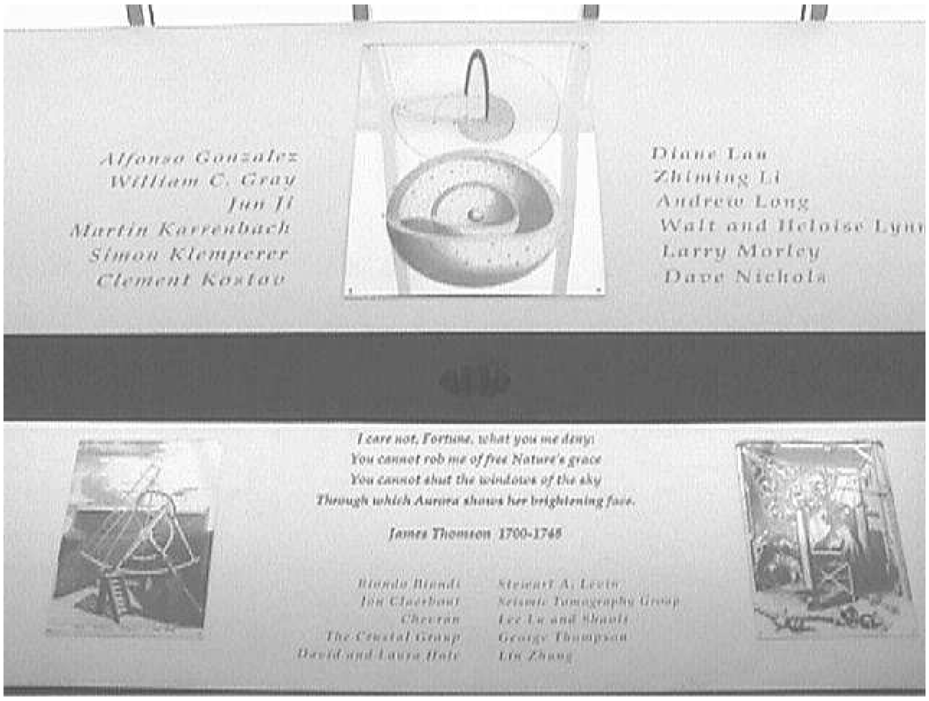
Alfonso Gonzalez
William C. Gray
Jun Ji
Martin Karrenbach
Simon Klemperer
Clement Kostov
Diane Lau
Zhiming Li
Andrew Long
Walt and Heloise Lyn
Larry Morley
Dave Nichols
I care not, Fortune, what you me deny:
You cannot rob me of free Nature's grace
You cannot shut the windows of the sky
Through which Aurora shows her brightening face.
James Thomson 1700-1748
Biondo Biondi
Jon Claerbout
Chevron
The Crustal Group
David and Laura Hale
Stewart A. Levin
Seismic Tomography Group
Lee Lu and Shaoli
George Thompson
Lin Zhang


Gregory Croft
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Christine Ecker
Raul Estevez
John Etgen
Bill Harlan
Jerry M. Harris
Darcy Karakelian
David Lumley
Reinaldo Michelena
Erminia Mallia-Zarb
Peter Mora
James Rickett
Thanks to the many donors, both named and anonymous,
whose generous contributions made this skylight possible.
Flat Lux
Genesis 1:3
Dedicated this Seventeenth day of July in the year
One Thousand Nine Hundred and Ninety Eight.

IN THE BEGINNING

Ending Darkness

—*Marie Prucha*[2] Darkness. *Definition: Mitchell 4*th.
28 years of darkness.
Unrelenting, unrelieved.
Day or night, night or day,
Always dark. Darkness. *Students the prisoners,*
the victims.
Working endlessly,
not knowing sunlight,
white pallor the rule. Darkness. *Is there sun?*
Is there rain?
Is it summer, spring, or fall?
Could be a blizzard.
No way to tell. Darkness. *Fluorescent bulbs.*
Plastic plants.
Colorful screensavers.
Not enough.
The dark side will always be stronger. Darkness. *But then a voice:*
"This place is a dungeon in the sky."
Seek freedom!
Money incoming,
Hope outpouring. Darkness still. *Finally enough!*
Then Claerbout declared:
"Let there be light!"
And there was light.
And there was much rejoicing. Light.

After the Loma Prieta quake, Stanford began the process of reconstructing and reinforcing the buildings on campus, including reinforcement of the Mitchell Building. George Thompson astutely observed to Jon Claerbout that, while he was going to lose one of the windows in his third floor office to a reinforcing pillar, the time was opportune to request that a skylight be installed in the 4th floor as part of the construction activity. Jon Claerbout contacted his friends, colleagues, sponsors and students, both present and former, and raised the requisite funds to turn the idea into a reality. Facts:

- Over 60 donors contributed to the skylight fund.
- Fund raising was completed in 5 months.
- Better than 90% of those solicited for donations contributed—a response rate unprecedented in the history of Stanford University fundraising.

[2]Written for the skylight dedication ceremonies July 17th, 1998.

MORE THAN JUST A PLAQUE

In the course of preparations for the SEP 25th year reunion, Jon Claerbout opined that we should prepare a plaque or sign recognizing the donors who contributed to the skylight and who were going to be present, by and large, at the reunion. While a plaque itself tends to be rather boring, the inside surfaces of the skylight shaft itself provided four large $4' \times 15'$ areas in which to place text and graphics. Having been inspired by a brass rubbing I made in St. Martin of the Fields while vacationing in London, I suggested a pictorial theme of old scientific illustrations augmented by one or more quotations to complement the lengthy list of donors' names. Having come up with a concept, the idea was then refined by other SEP'ers to focus on a primarily astronomical theme appropriate to a skylight and we began a search for such illustrations. To this end we went to the Stanford University Library rare book collections to begin the search. The Assistant Head of Special Collections, John Mustain, managed to find quite a few illustrated books for us to look through and, with some additional search through the stacks, we compiled a sufficiency[3] of material. With concept and materials well in hand, we contacted a commercial sign-making firm in nearby Redwood City to turn our materials into a design and implement it in the skylight shaft. After a series of email and fax exchanges, the final design was approved. This was installed during the week leading up to the reunion and was immediately covered over with a black plastic drop cloth to protect the design from prying eyes before the official dedication and unveiling. The final design consisted of 4 panels, each divided into three areas horizontally. In each area either a graphic or a text display was place. These individual elements are discussed next.

Flamsteed's sextant

John Flamsteed, the first Astronomer Royal of the Greenwich Observatory, was fortunately wealthy and well-connected enough to equip the Observatory with a fine set of the newest telescopic instruments. One of these instruments is the 7 foot sextant shown in the illustration from Flamsteed's *Historia Coelestis* (1725) which was designed to measure inclinations to a precision of 10 seconds of arc.

Hevelius' sextant

Johannes Hevelius was an accomplished astronomer who worked approximately half a century before Flamsteed. His 6 foot sextant shown in this illustration from *Machina Coelestis* (Hevelius, 1969) was fitted with an ordinary eyepiece rather than the telescopes on later instruments such as Flamsteed's.

[3]Actually everyone wanted something from Huygens, but his line drawings were pretty feeble.

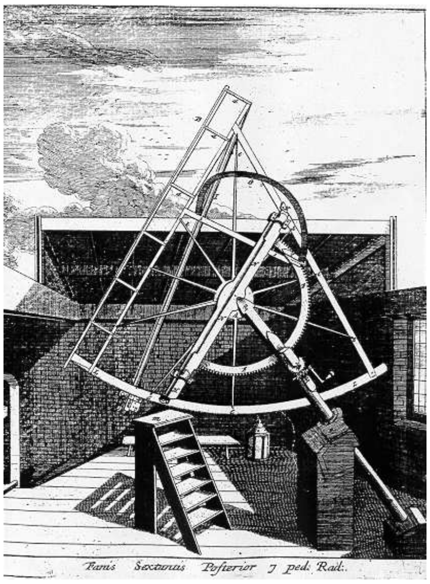


Figure 1: Flamsteed's Sextant stew1-flamsteed [NR]

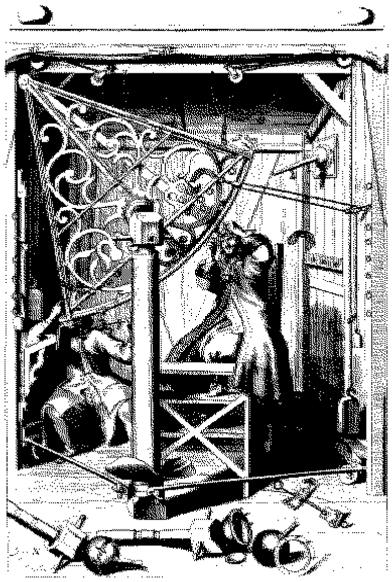


Figure 2: Hevelius' Sextant stew1-hevelius [NR]

Wright's starry spheres

Thomas Wright of Durham, a navigation instrument maker, is credited (albeit somewhat erroneously) with explaining the luminescence of the Milky Way along a band of the sky as looking through a large layer of stars end on. Shown here is Plate XXVII from *An Original Theory or New Hypothesis of the Universe* (1750) in which he actually attributes the effect to looking approximately tangential to a spherical shell of stars distributed uniformly about a central divine center of universal order. Appendix A gives the text that accompanied this and its preceding figure.

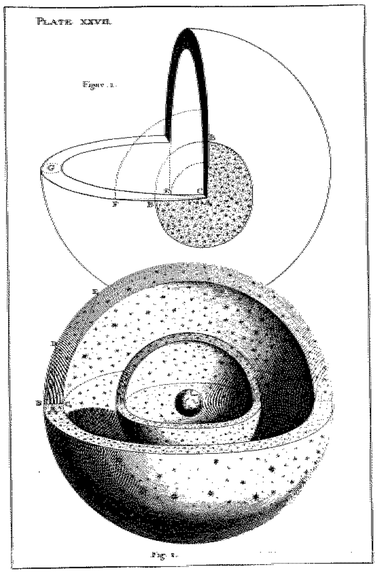


Figure 3: Wright's starry spheres
stew1-wright [NR]

The Octagon Room of the Greenwich Observatory

The Great Star Room or Octagon Room was part of John Flamsteed's House adjacent to the old Royal Observatory in Greenwich. Due to smog and light pollution, the Royal Observatory was moved to Herstmonceux Castle in Sussex in the late 1940's and early 1950's. The Royal Observatory will close permanently on October 31st, 1998.

Gauss' diary

This facsimile page from Gauss' diary (1796) dates from the year before he received his doctorate from Göttingen. The terse nature of these entries makes translation difficult, but the highlighted note [84] is most probably related to the partial classification of ternary quadratic forms that appears in his famous *Disquisitiones Arithmetica* (Gauss, 1801) where he also demonstrated the ruler-and-compass constructibility of the regular 17-gon.

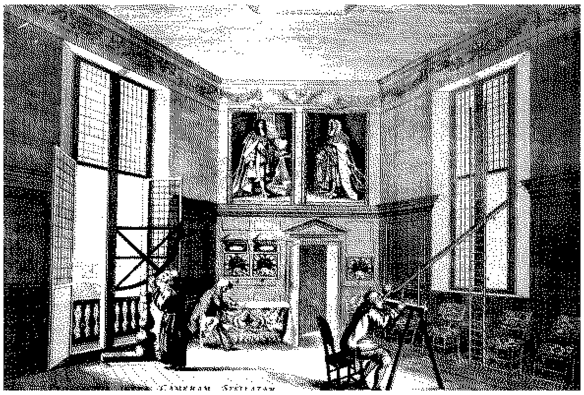


Figure 4: The Octagon Room stew1-octagon [NR]

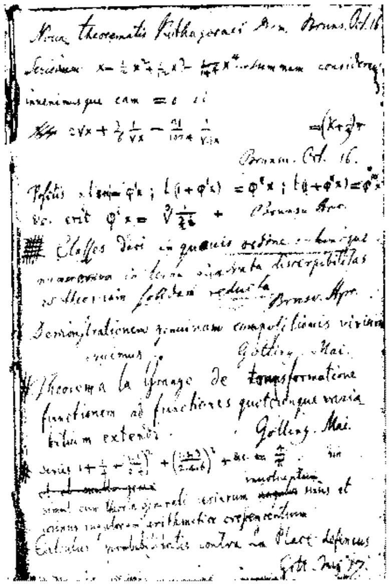
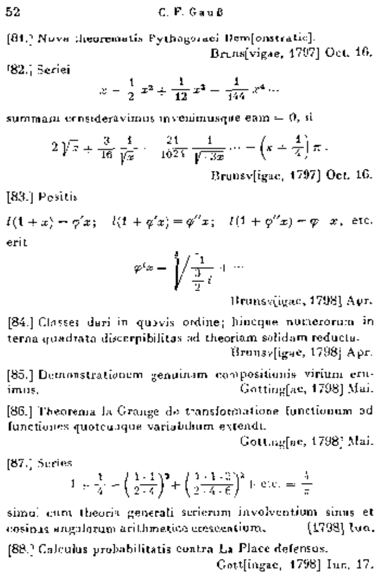


Figure 5: Facsimile page from Gauss' Diary ... stew1-gauss-1 [NR]



52 C. F. Gauß

[81.] Nova theorematis Pythagoraei Dem[onstratio].
Bruns[vigae, 1797] Oct. 16.

[82.] Seriei

$$x - \frac{1}{2}x^2 + \frac{1}{12}x^3 - \frac{1}{144}x^4 \cdots$$

summam consideravimus invenimusque eam = 0, si

$$2\sqrt{x} + \frac{3}{16}\frac{1}{\sqrt{x}} - \frac{21}{1024}\frac{1}{\sqrt{x^3}} \cdots = \left(x + \frac{1}{4}\right)\pi.$$

Brunsv[igae, 1797] Oct. 16.

[83.] Positis

$l(1+x) = \varphi' x$; $l(1+\varphi' x) = \varphi'' x$; $l(1+\varphi'' x) = \varphi''' x$, etc.

erit

$$\varphi^i x = \sqrt{\frac{1}{\frac{3}{2}i}} + \cdots$$

Brunsv[igae, 1798] Apr.

[84.] Classes duri in quovis ordine; hincque numerorum in terna quadrata discerpibilitas ad theoriam solidam reducta.
Brunsv[igae, 1798] Apr.

[85.] Demonstrationem genuinam compositionis virium eruimus. Gotting[ae, 1798] Mai.

[86.] Theorema la Grange de transformatione functionum ad functiones quotcunque variabilium extendi.
Gotting[ae, 1798] Mai.

[87.] Series

$$1 + \frac{1}{4} + \left(\frac{1\cdot 1}{2\cdot 4}\right)^2 + \left(\frac{1\cdot 1\cdot 3}{2\cdot 4\cdot 6}\right)^2 + \text{etc.} = \frac{4}{\pi}$$

simul cum theoria generali serierum involventium sinus et cosinus angulorum arithmetice crescentium. [1798] Iun.

[88.] Calculus probabilitatis contra La Place defensus.
Gott[ingae, 1798] Iun. 17.

Figure 6: ...and its typewritten transcription stew1-gauss-2 [NR]

Copernicus' manuscript

These two handwritten Latin pages from Copernicus' famous *De Revolutionibus* (1543) are from Book IV in which he analyzes lunar eclipses in terms of the relative precession of the moon due to the Earth's orbit around the sun. Appendix B give a translation of the text.

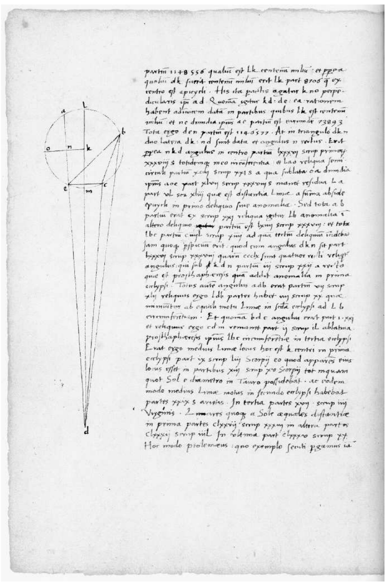


Figure 7: Copernicus' Manuscript
stew1-copernicus-1 [NR]

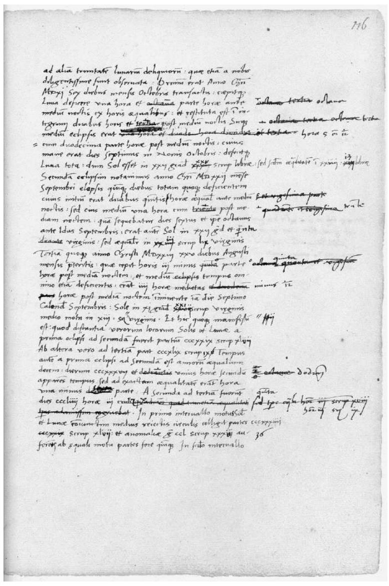


Figure 8: Copernicus' Manuscript
stew1-copernicus-2 [NR]

Thomson's poem

The quotation, found during an Internet search, originates from Thomson's *The Castle of Indolence* (1748) published less than half a year before his death. Some of the spelling and punctuation have been changed for the skylight. Appendix C gives the original text of that verse.

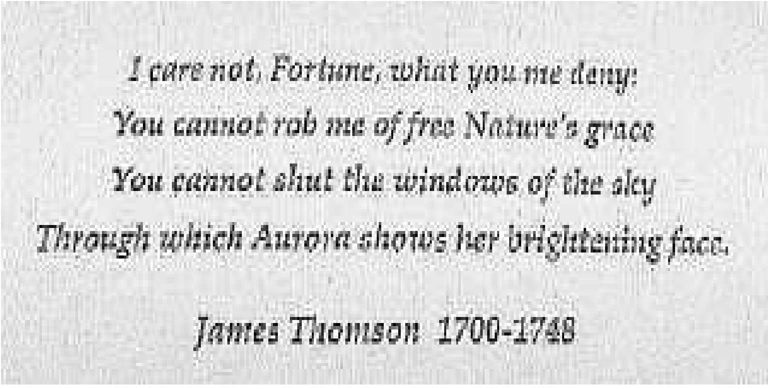


Figure 9: Thomson's Poem stew1-thomson [NR]

Fiat Lux

In addition to its biblical translation "Let there be light," *Fiat Lux* has a classical meaning of the dawning of new knowledge or enlightenment, which is how U.C. Berkeley (*Boo! Hiss!*) uses it in their motto. This short, classical quotation nicely balances the longer verbiage of the rest of the dedication.

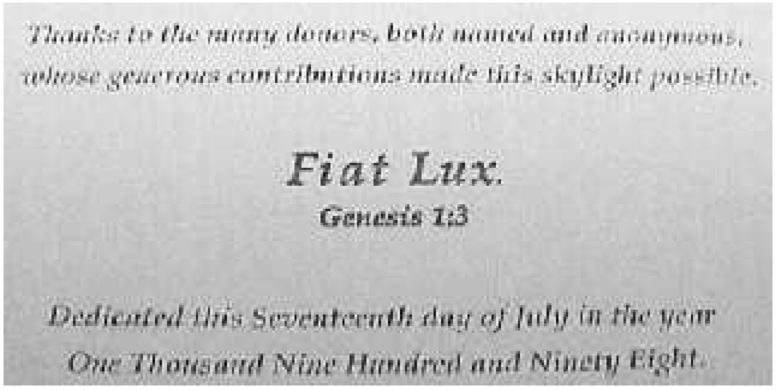


Figure 10: Fiat Lux. stew1-fiat-lux [NR]

Donor name lists

The list of 62 names of donors was divided up into three alphabetized[4] groups according to space requirements, with the biggest monetary donors in the largest, most visible panel and so forth. All anonymous donors are acknowledged on the dedication panel.

[4]At least Claerbout really belongs before Chevron in SEP's opinion!

DEDICATION

On the evening of July 17$^{\mathrm{th}}$, 1998, SEP reunion participants were herded from the Hartley Conference Center up to the 4$^{\mathrm{th}}$ floor of the Mitchell Building to witness the dedication. At the signal from Dimitri Bevc that the last of the stragglers had arrived, Jon stood somewhat precariously on a chair to say a few words (Appendix D) of welcome and explanation about the history of the skylight and the planned dedication events that evening. Marie Prucha took over and recited the poem she wrote for the occasion after which people were carefully herded onto the carpeted area under the still-masked skylight. The end of the poem signalled SEP's reenactment of "*. . . facta est lux*" resulting in the rapid removal of the black plastic cover and an unexpected, but delightful, shower of balloons on the spectators. After a minute or two of oohs and aahs, Dean Lynn Orr made a short impromptu(?) speech of recognition to Jon and his team's accomplishment in bringing light into the basement aerie to complement the intellectual lights that had graced the 4$^{\mathrm{th}}$ floor over the past 25 years. This was followed by a toast composed and read for the occasion by Biondo Biondi.

AN INVITATION

In conclusion, I invite everyone to come up and wander around the 4$^{\mathrm{th}}$ floor of the Mitchell Building and compare its flourescent-lit recessed corridors to the open, skylit expanse in front of the elevator to really appreciate the improvement that the skylight has made.

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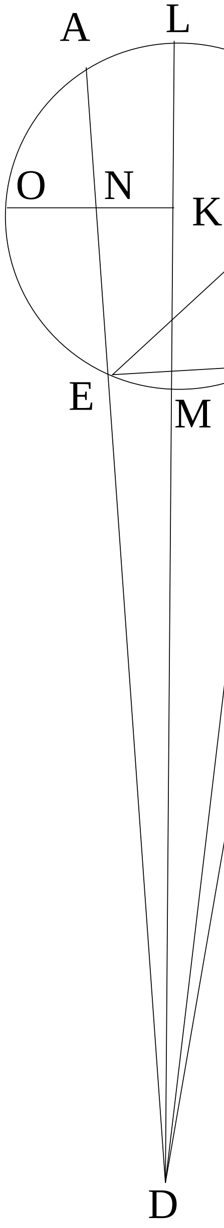
APPENDIX A

From page 64 of Thomas Wright's text: PLATE XXVI. Represents a Creation of a double Construction, where a superior Order of Bodies C, may be imagined to be circumscribed by the former one A, as posessing a more eminent Seat, and nearer the supream Presence, and consequently of a more perfect Nature. Lastly, PLATE XXVII. Represents such a Section, and Segments of the same, as I hope will give you a perfect Idea of what I mean by such a Theory. *Fig.* I. is a corresponding Section of the Part at A, in *Fig.* 2. whose versed Sine[5] is equal to half the Thickness of the starry Vortice AC, or BA. Now I say, by supposing the Thickness of this Shell, I. you may imagine the middle Semi-Chord[6] AD, or AE, to be nearly 6 ; and consequently thus in a like regular Distribution of the Stars, there must of course be at least three Times as many to be seen in this Direction of the Sine, or Semi-chord AE, itself, than in that of the semi-versed Sine[7] AC, or where near the Direction of the Radius of the Space G. *Q.E.D.*

[5]minus the cosine of the angle
[6]half a chord
[7]half the versed sine

APPENDIX B



Translation from Wallis (1995): But since segment EA is less than a semicircle, the centre of the epicycle will not be in it but in the remainder ABCE. Therefore let K be the centre, and let DMKL be drawn through both apsides[8], and let L be the highest apsis and M the lowest. Now, by Euclid, III, 36, it is clear that

rect. AD, DE = rect. LD, DM.

Now since LM, the diameter of the circle—to which DM is added in a straight line—is bisected at K, then

rect. LD,DM+sq. KM=sq. DK.

Therefore

DK

[*begin manuscript page*]

=1,148,556
where KL=100,000;

and on that account,

LK=8,706
where DKL=100,000

and LK is the radius of the epicycle. Having done that, draw KNO perpendicular to AD. Since KD, DE, and EA have their ratios to one another given in the parts whereof LK=100,000, and since

NE= $\frac{1}{2}$ AE=73,893:

therefore, by addition,

DEN=1,146,577.

But in triangle DKN

side DK is given,
side ND is given,

and

angle N=90°;

on that account, at the centre,

angle NKD=$86^\circ\, 38\frac{1}{2}'$

and

arc MEO=$86^\circ\, 38\frac{1}{2}'$.

Hence,

arc LAO=180°− arc NEO=$93^\circ\, 21\frac{1}{2}'$.

Now

arc OA= $\frac{1}{2}$ arc AOE=$47^\circ\, 38\frac{1}{2}'$;

and

arc LA=arc LAO-arc OA=$45^\circ\, 43'$,

which is the distance—or position of anomaly—of the moon from the highest apsis of the epicycle at the first eclipse. But

[8]apsis (pl. apsides)— point of closest or furthest approach of an orbit around a body.

$$\text{arc AB}=110^\circ\,21'.$$

Accordingly, by subtraction,

$$\text{arc LB}=64^\circ\,38',$$

which is the anomaly at the second eclipse. And by addition

$$\text{arc LBC}=146^\circ\,14',$$

where the third eclipse falls. Now it will also be clear that since

$$\text{angle DKN}=86^\circ\,38\tfrac{1}{2}',$$

$$\text{where 4 rt. angles}=360^\circ,$$

$$\text{angle KDN}=90^\circ-\text{ angle DKN}=3^\circ\,21\tfrac{1}{2}';$$

and that is the additosubtraction which the anomaly adds at the first eclipse. Now

$$\text{angle ADB} = 7^\circ\,42';$$

therefore, by subtraction,

$$\text{angle LDB}=4^\circ\,20\tfrac{1}{2}',$$

which arc LB subtracts from the regular movement of the moon at the second eclipse. And since

$$\text{angle BDC}=1^\circ\,21',$$

and therefore, by subtraction,

$$\text{angle CDM}=2^\circ\,49',$$

the subtractive additosubtraction caused by arc LBC at the third eclipse; therefore the mean position of the moon, i.e., of the centre K, at the first eclipse was $9^\circ\,53'$ of Scorpio, because its apparent position was at $13^\circ\,15'$ of Scorpio; and that was the number of degrees of the sun diametrically opposite in Taurus. And thus the mean movement of the moon at the second eclipse was at $29\tfrac{1}{2}^\circ$ of Aries; and in the third eclipse, at $17^\circ\,4'$ of Virgo. Moreover, the regular distances of the moon from the sun were $177^\circ\,33'$ for the first eclipse, $182^\circ\,47'$ for the second, $185^\circ\,20'$ for the last. So Ptolemy. Following his example, let us now proceed to a third trinity of eclipses of the moon, which were painstakingly observed by us. The first was in the year of Our Lord 1511, after October 6th had passed. The moon began to be eclipsed 1 $\tfrac{1}{8}$ equal hours before midnight, and was completely restored 2 $\tfrac{1}{3}$ hours after midnight, and in this way the middle of the eclipse was at $\tfrac{7}{12}$ hours after midnight—the morning following being the Nones[9] of October, the 7th. There was a total eclipse, while the sun was in $22^\circ\,25'$ of Libra but by regular movement at $24^\circ\,13'$ of Libra. We observed the second eclipse in the year of Our Lord 1522, in the month of September, after the lapse of five days. The eclipse was total, and began $\tfrac{2}{5}$ equal hours before midnight, but its midpoint occurred 1 $\tfrac{1}{3}$ hours after midnight, which the 6th day followed—the 8th day before the Ides of September. The sun was in the $22\tfrac{1}{5}^\circ$ of Virgo but, according to its regular movement, in $23^\circ\,59'$ of Virgo. We observed the third in the year of Our Lord 1523, at the close of August 25.th It began 2 $\tfrac{4}{5}$ hours after midnight, was a total eclipse, and the midtime was 4 $\tfrac{5}{12}$ hours after the midnight prior to the 7th day before the Kalends of September. The sun was in $11^\circ\,21'$ of Virgo but according to its mean movement at $13^\circ\,2'$ of Virgo. And here it is also manifest that the distance between the true positions of the sun and the moon from the first

[9]Nones, Ides, Kalends—Roman calendar designations (*Beware the Ides of March!*).

eclipse to the second was $329° 47'$, but from the second to the third it was $349° 9'$. Now the time from the first eclipse to the second was 10 equal years 337 days $3/4$ hours according to apparent time, but by corrected equal time $4/5$ hours. From the second to the third there were 354 days 3 hours 5 minutes; but according to equal time 3 hours 9 minutes.

During the first interval the mean movement of the sun and the moon measured as one—not counting the complete circles—amounted to $334° 47'$, and the movement of anomaly to $250° 36'$, subtracting approximately $5°$ from the regular movement; in the second interval

[*end manuscript page*]

the mean movement of the sun and moon was $346° 10'$; and the movement of anomaly was $306° 43'$, adding $2° 59'$ to the mean movement.

APPENDIX C

The original text in Canto II, Verse III of James Thomson's *The Castle of Indolence* reads:

> I care not, Fortune, what you me deny :
> You cannot rob me of free Nature's Grace ;
> You cannot shut the Windows of the Sky,
> Through which *Aurora* shews her brightening Face ;
> You cannot bar my constant Feet to trace
> The Woods and Lawns, by living Stream, at Eve :
> Let Health my Nerves and finer Fibres brace,
> And I their Toys to the *great Children* leave ;
> Of Fancy, Reason, Virtue, nought can me bereave.

APPENDIX D

Jon Claerbout's dedication remarks: Most of you know me as the most aggressive proponent of this skylight. If you were slow to make your pledge, you REALLY know me as an aggressive advocate. I'd like to introduce you to a few other people who also conspired to get us this skylight.

George Thompson — spotted the architects
Dudley Kenworthy — knew how to make good things happen
Julie Hardin — CAN-DO attitude, transmit ideas to architects.

I asked each of the SEP PhD graduates to contribute. 90The Stanford development office was amazed. Our rate of return is unprecedented. Not only SEP PhD graduates contributed, but faculty, Biondo Biondi, Jerry Harris, Simon Klemperer, and Lynn Orr and about half of the students living up here contributed. Even our administrative secretaries contributed. And all your contributions were generous contributions. 17 of you contributed \$1000 or more. 35 of you contributed \$500 or more. 52 of you contributed \$200 or more. Many current students gave a week's pay. Of course you know the reason why. This place was a dungeon in the sky, and you all knew it. Most of you recall walking down the stairwells, not knowing whether you would emerge into sun or rain, light or dark. Years ago we ALWAYS went outdoors for lunch, even when it rained. With El Nino this year, we had many January lunches right here where we stand. It was delightful, as you will soon see. In years gone by, I felt the need to apologize to our new students and visitors for the quality of our quarters. I felt cheated when the Geologists and Petroleum Engineers aced us out of the new Cecil Green building. But no more. Soon you will see that we now have an excellent home. So I thank you again, for your generous contributions and, on behalf of many future generations, I express to you our heartfelt thanks. Marie Prucha will recite a poem she has prepared for this occasion. Then we will proceed with the unveiling.

Thanks to the many donors, both named and anonymous, whose generous contributions made this skylight possible.

Fiat Lux
— *Genesis 1:3*

Dedicated this Seventeenth day of July in the year One Thousand Nine Hundred and Ninety Eight.