
The NASS Website

Robert Terwilliger, Webmaster

The NASS home pages continue to expand. New links are continually being added to the links page, where they appear at the top of each category.

The Message Board needs your support. This is where our knowledgeable membership can "meet the public". We are currently getting more questions than answers. Please visit the Message Board and see if there is a request for which you can supply a reply.

We have recently added a secure server through which prospective members can join NASS using Visa or MasterCard. We hope this will make NASS membership more accessible, especially to prospective overseas members who may have currency exchange problems. Renewals can also be accepted through the server.

The URL of the NASS Website is <http://sundials.org>

The Kukulcan Equinox Phenomenon

From: Roger Bailey, rtbailey@expertcanmore.net

A highlight of my recent trip to Mexico was the Mayan ruins at Chichen Itza, in particular, El Castillo, the Temple of Kukulcan. This great pyramid is designed to mark the yearly cycle of the sun. Each of the four faces represents a season. Each of the four stairs has 91 steps, the number of days in each of the four seasons. The temple at the top represents the 365th day. The winter solstice sun just grazes the north face as the 45° angle equals the noon azimuth. ($90^\circ - \text{lat } 20.666^\circ - \text{dec } 23.44^\circ - \text{semidiameter } .25^\circ = 45.6^\circ$)

The corners of the nine platforms cast a series of triangles on the stairway. As the sun sinks, the triangles of light move up creating the illusion of a serpent ascending from the ground to the temple. Tens of thousands come to this site at the spring and fall equinoxes to witness this remarkable

phenomenon of the serpent descending to the ground as the sun rises and then ascending in the afternoon as the sun sets. The show takes over 3 hours and peaks near sunset when all nine triangles of light show the whole serpent.

I could not find a good technical analysis of the phenomenon. The description in a booklet I bought has serious flaws. Most descriptions have more mysticism than facts. I asked myself if sundial design math could elucidate the phenomenon. Declination lines are the solution!

The concept of declination lines is familiar to most of you. These lines are the path of the tip of the gnomon shadow for various dates and solar declinations. When the declination and latitude have the same sign, these lines are hyperbolic curves towards the gnomon. When the latitude and declination signs are contrary the lines curve away. On the equinox, the declination lines are straight lines. This is a universal phenomenon. The path of all shadows cast on any plane surface at any latitude on the equinoxes are straight lines. On the horizontal plane, the equinox declination line is due east west. On a south facing vertical plane the line is horizontal. On a vertical declining plane, the declination line is sloped at an angle equal to the Substyle Distance (SD) of a vertical dial on that plane. The usual vertical declining design equation applies: $\text{Tan SD} = \text{Sin Dec} / \text{Tan Lat}$ where Dec is the declination of the vertical plane from south.

This special case of the straight declination line on the equinox is the basis of the Kukulcan ascending serpent effect. At Chichen Itza, the latitude is 20.666° and the orientation of the pyramid is 18° off the north south axis. In this case, the formula reduces to $\text{SD} = 39^\circ$. This is exactly the angle the staircase of the tower makes with the horizontal plane. This explains the movement of the shadows along the face of the staircase creating the illusion of the serpent ascending as the sun sets. Each triangle of light and shadow is in effect a separate gnomon casting a shadow moving in a straight line at a 39° slope. A remarkable phenomenon, simply explained with the mathematics of sundials.

The light and shadow phenomenon of the Kukulcan equinox is world famous. See www.piramideinn.com/equinox.htm as well as web.kyoto-inet.or.jp/org/orion/eng/hst/maya/chichen1.html.

This investigation required a lot of direct experimentation. I had to build several sand castle models on the beaches of Cancun and Isla Mujeres to test the solar orientations. I may now have to build one at home, adjusting for the latitude difference by tilting the model by 30°. This should demonstrate the effect just as well as the original but snow may not be the appropriate construction material.

Have any of you witnessed the event? Do you know of other examples of light and shadow shows built into solar oriented structures? Do you know of any good references to more complete technical analyses of the phenomenon at Chichen Itza?

A New Korean Coin

From: D.H. Kim, unisoncom@netsgo.com

A hemispherical scaphe sundial was adopted in the design of a Y2K memorial coin in Korea, issued by The Bank of Korea on Jan. 4th, 2000.

Material composition : Copper 75% , Nickel 25 %

Diam.: 28mm (1.1 inch) Wt.:10.7g (0.37 oz)

Coin Head : Text inscription of *A new millennium for all* in English

Coin Tail : Text inscription of *Year 2000, Korean Won 2,000, The Bank of Korea* in Korean and with the combined image of the dial plate of the Korean National Treasure sundial and astronomical instrument. The dial plate shows the 0600 to 1800 hour lines and 13 seasonal change lines. The astronomical instrument measured and traced the stars, the sun and the moon. These two were invented during the 15th century in Korea.

Gnomonica On CD

The first 5 issues of Gnomonica, the Italian gnomonic journal, are now available on 1 CD-R in WORD 97 / WIN 95 format. The CD-R costs 20,000 Lira to European addresses or 30,000 Lira (approx. \$15) to addresses outside Europe. You can request the CD-R by enclosing payment (in Italian currency) in a letter (priority mail) to:

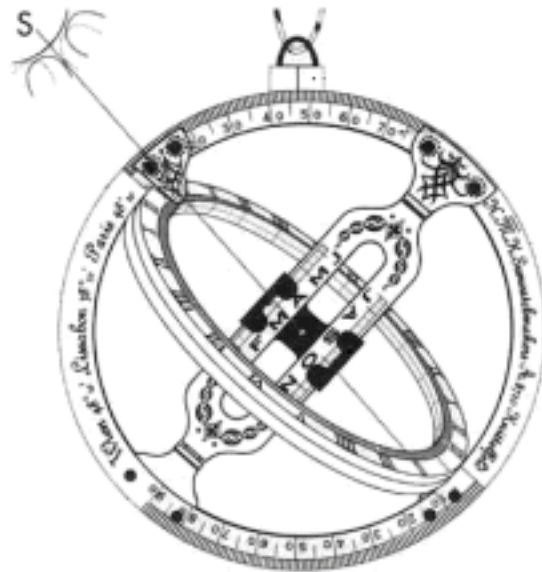
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A New Universal Ring Dial

From: Fred Sawyer

I purchased two universal ring dials for my daughters at Christmas. The dials are imported from Austria by NASS member Bruno Pichler who has recently begun to distribute them in the U.S. The pocket-size dials are very nicely constructed and all parts which should move do in fact move. The dial produces a fine small spot of sunlight which falls in exactly the right location on the etched line on the interior edge of the equatorial ring. I enjoyed the dials so much that my daughters finally had to gently but firmly tell me to go buy my own! It's truly a nice item that I expect any NASS member would enjoy using.

Bruno has agreed to offer the dials at a special price (\$40 + s/h) to NASS members. His paid advertisement and order form are included with this issue.



Eclipse Moondialing

From: John Carmichael, pappas@azstarnet.com

Here are the results of my observations during the January 20 total lunar eclipse. We had excellent viewing conditions with low ambient light pollution.

Readability: The gnomon's shadow disappeared when about 3/4 of the moon was darkened.

Time accuracy: The sundial kept perfect time in the moments just before the gnomon's shadow disappeared and just after it reappeared. (I corrected for EOT and longitude).

Declination/date readings: As some of us suspected, the date showed July 20th throughout the course of the evening.

Color: the moon during totality was a yellowish ocher, and had a very three-dimensional look. Just before the last sliver of white lunar surface disappeared, the moon looked very much like a picture of Mars with it's white polar cap!

Kremsmünster CD

From: Gianni Ferrari, frank.f@pianeta.it

In September 1999 during a journey in Austria, we arrived, by chance, in the small city of Kremsmünster, near Linz, where a beautiful Benedictine Abbey, built in 1700, is found.

Connected to the Abbey there is an astronomic tower that was originally used as an observatory for astronomical research and that is today a museum of astronomy. Here one can see an impressive number of astronomical observation instruments, including a sextant made of iron that was probably used by Johannes Kepler in Prague, a collection of pocket sundials, terrestrial and celestial globes, etc.

P. Amand Kraml, the administrator of the museum, has collected in a CD the images of all the sundials that are in the museum and P. Ansgar Rabenalt has written (in German) a booklet containing a short description of each of them (70 pages).

The CD is very simple and does not contain any index. In its parts we find :

- a short presentation of the astronomic tower of the Abbey.
- 3 photographs of a very famous diptych (in color)
- 154 photographs of about 100 sundials described in the booklet.

All the images are in JPG format (about 1450 x 1450 pixels) and are very detailed. To view them, it is necessary to use a program such as Photoshop, ACDSee, etc. They are all in b/w (excluding # 74). The sundials are of many different types (almost all portable) and were built in the period 1700-1900.

- 25 photographs of the pages of the manuscript "Gnomonica" written by P. Laurenz Doberschitz in 1764.

The CD is for sale and costs 360 AS (Austrian Schillings) - about 25 US\$. The booklet costs 100 AS (about 7.5 US\$) plus postage. If someone has interested he or she can write to P. Amand Kraml asking other information on the CD-ROM Sonnenuhren, and the book Nr. 33 - P. Ansgar Rabenalt - Die Sonnenuhrensammlung der Sternwarte Kremsmünster

There is also on sale a CD containing the photos of the terrestrial and celestial globes that are in the museum (360 AS) : CD-ROM Globen.

For more information, point your browser to <http://members.telecom.at/~stewar/>

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Ancient Dialing

Fr: Fred Sawyer

For an interesting text on ancient dialing techniques, members may want to investigate James Evans' *The History And Practice Of Ancient Astronomy*, (Oxford University Press, 1998). The book is both a history and a how-to manual covering many aspects of astronomical practice from Babylonian to early modern times. There is a section specifically dedicated to sundials, discussing the history of Greek and Roman dials, the work of Vitruvius, and a detailed description of Bilfinger's method for constructing an analemma (*i.e.* a two-dimensional projective drawing of the celestial sphere) and using it in the layout of a sundial. The text also covers the construction of various forms of astrolabes.