NASS Glossary of Sundial Terms

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[Astrolabe Components](#), [Coordinate Systems](#), [Dial Types](#), [Hour Systems](#)

Term	Definition	References
Image		

A		
Abscissa	A point's degree of horizontal distance from the vertical axis. Also known as the "X" coordinate. See Ordinate	

Acanthus	A genus of flowering plants commonly found around the Mediterranean. Acanthus leaf designs are often used as sculpted architectural flourishes, as well as ornamental engravings on stationary and portable sundials. Augsburg and other portable European dials with large amounts of flat, engravable space often feature elaborate floral patterns incorporating acanthus leaves.	

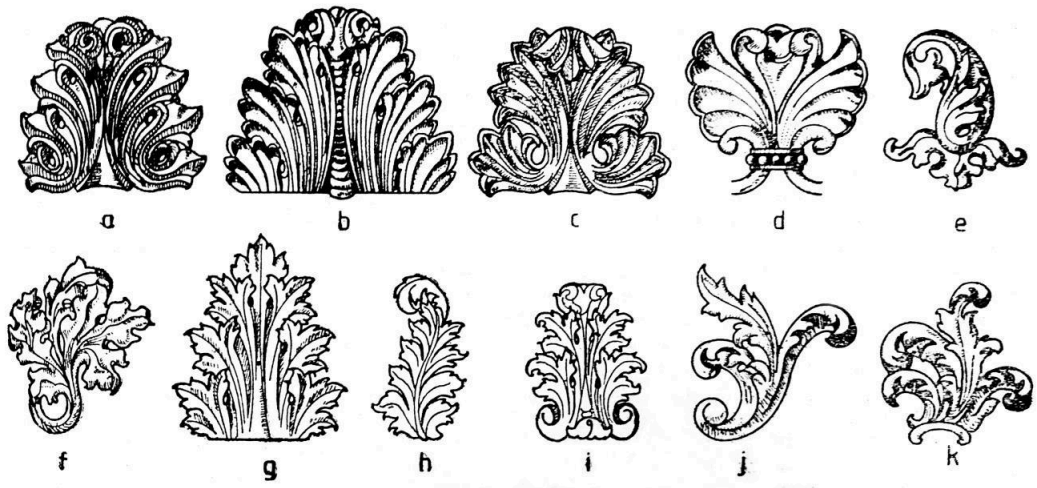


Photo: Wikimedia Commons, Arthur Diebold

Accuracy	The degree to which a set of measurements match the theoretical true value. See Precision	

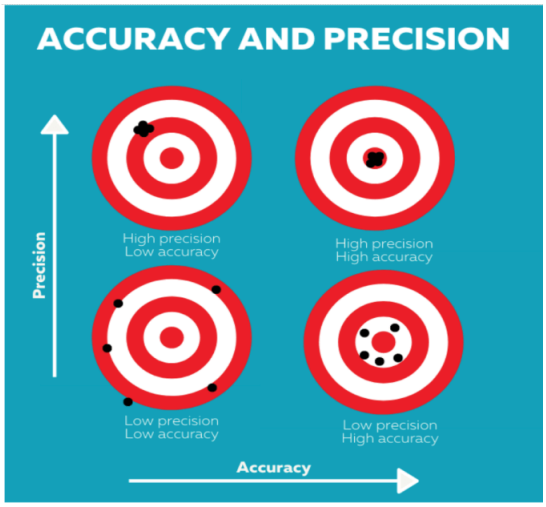


Photo: Christine Johnson, Kaiterra

Age of Moon	See Lunar Age	

Ahoratram	In ancient Indian science, a unit of time equal to 1 sidereal day.	Compendium Vol. 24 No. 2 p. 10-11

	One ahoratram is defined as 30 muhutra.	

Alidade	A sighting device equipped with two opposing vanes. When aligned with each other, these vanes achieve a precise line of sight with the sun, star, or terrestrial feature. The innermost (indicating) edge of the alidade may be either straight or counter-changed, with the latter being most common on European models. Alidades are used on many different types of instruments. When used on an astrolabe, it is found on the reverse side of the mater. See Planispheric Astrolabe Components	Compendium Vol. 2 No. 1 p. 7-8

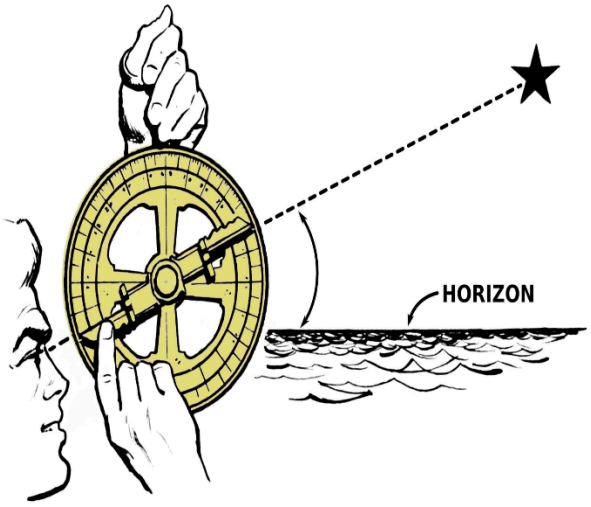


Photo: Newslea, National Park Service

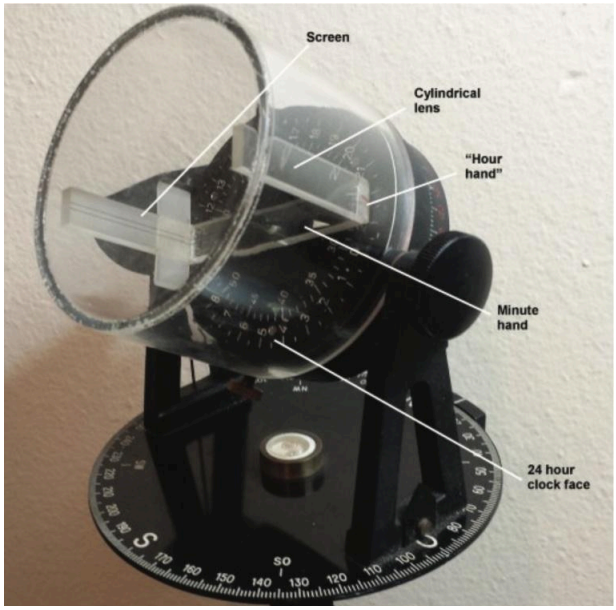


Photo: Dan LaPorte, Sun Compass

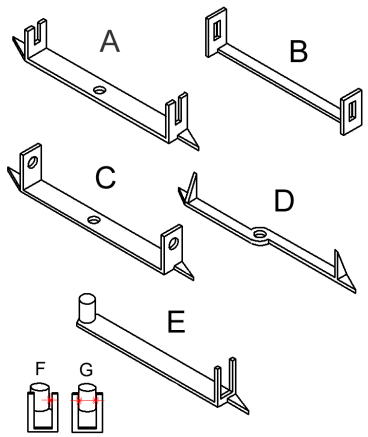


Photo: Wikimedia Commons, Michael Daly

Almucantar	A line of constant solar altitude, drawn as a circle parallel to the horizon. On a sundial, used to indicate solar altitude. On a planispheric astrolabe, used to model the altitude of the sun or stars.	Compendium Vol. 17 No. 2 p. 19-20

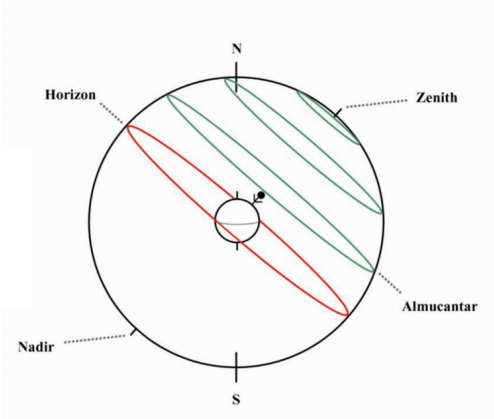


Photo: Timothy Mitchell, Astrolabe Project

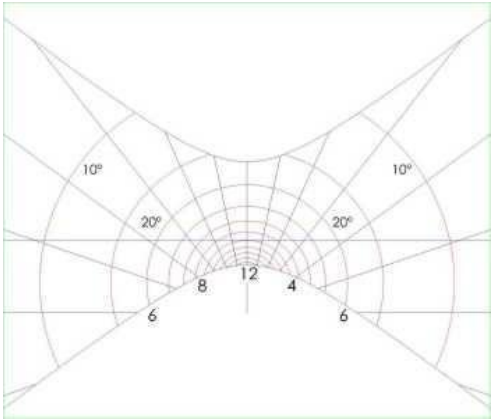


Photo: Sundial Primer, Altitude – ZW2000/CAD

Altitude	Angle measure of an object's height above or below the local horizon, -90° to +90°	Compendium Vol. 16 No. 1 p. 34-35

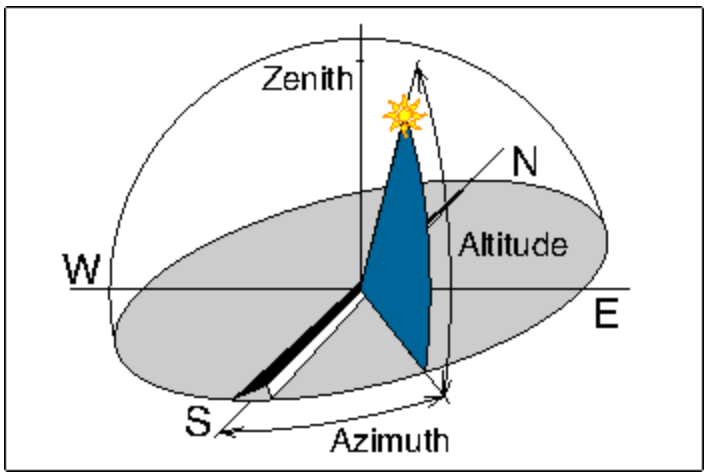


Photo: Nancey Chang, Univ of Oregon, Architecture Dept.

Altitude dial	A dial that uses the sun's altitude above the local horizon to determine the time.	Compendium Vol. 8 No. 1 p. 16-22 Compendium Vol. 14 No. 2 p. 39-41 Compendium Vol. 15 No. 2 p. 33-39 Compendium Vol. 20 No. 4 p. 27-29 Compendium Vol. 22 No. 4 p. 33-37 Compendium Vol. 25 No. 2 p. 13-24 Compendium Vol. 27 No. 1 p. 6-15 Compendium Vol. 29 No. 2 p. 42-49 Compendium Vol. 29 No. 4 p. 53-69

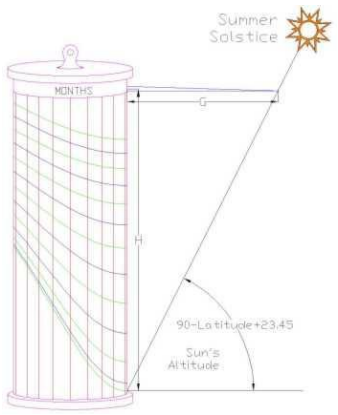


Photo: Carl Sabanski, Sundial Primer

Altitude of Sun (Alt)	The sun's angular elevation above the local horizon. The sun's altitude at noon equals the co-latitude plus declination. Sun Alt = (90 - φ) + δ Sun's altitude at time t: sin(Alt) = sin(φ) sin(δ) + cos(φ) cos(δ) cos(t)	

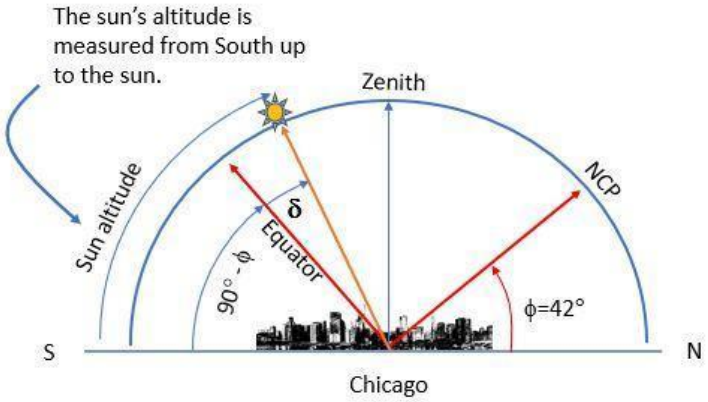


Photo: Elements of Dialing, NASS

Amphiscian	One who lives between the tropics.	Compendium Vol. 1 No. 3 p. 19

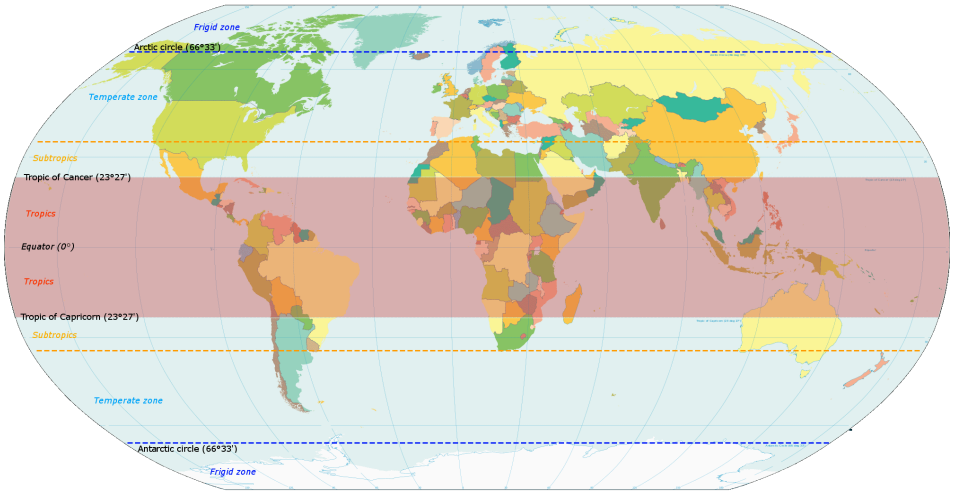
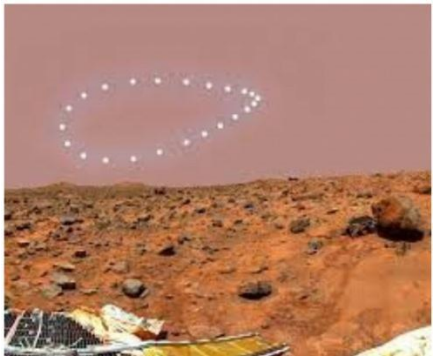
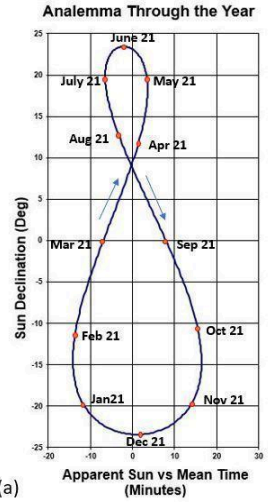


Photo: Wikimedia, KVDP

Analemma	A graphical representation of the sun's changing position in the sky over the course of the year. Also a graphical representation of the Equation of Time against the sun's declination and/or calendar date.	Compendium Vol. 3 No. 2 p. 14-16 Compendium Vol. 4 No. 1 p. 27-28 Compendium Vol. 5 No. 4 p. 1-8 Compendium Vol. 13 No. 4 p. 1-3 Compendium Vol. 20 No. 4 p. 1-4 Compendium Vol. 21 No. 3 p. 1-4 Compendium Vol. 24 No. 2 p. 31-33 Compendium Vol. 27 No. 4 p. 9-12 Compendium Vol. 29 No. 3 p. 40-51 Compendium Vol. 31 No. 2 p. 1-9 The Analemmatic Sundial Source Book The Analemmas of Vitruvius and Ptolemy, Dead Reckonings





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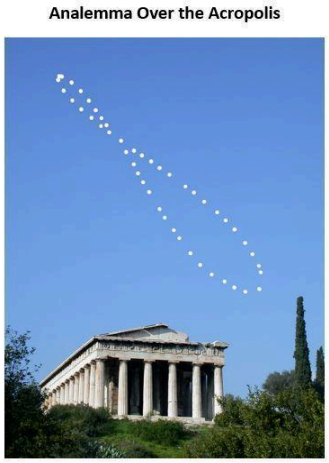


(b) Photo by A. Ayiomamitis

Photo, Elements of Dialing, NASS Photo: A. Ayiomamitis, Photo: NASA, a simulation of Mars' analemma)

Analemma of Vitruvius	A two-dimensional projective drawing of the celestial sphere used to design sundials originally documented in Vitruvius' "de Architectura." "But it is also possible to get astronomical quantities like half-length of daylight, eastern amplitude, sun's altitude and sun's azimuth by means of a compass and ruler using the ingenious concept of the analemma."	Compendium Vol. 22 No. 4 p. 21-28 Compendium Vol. 23 No. 3, p. 7-20 Compendium Vol. 24 No. 3 p. 22-25 Compendium Vol. 25 No. 2 p. 13-24 Compendium Vol. 26 No. 1 p. 17-19 Compendium Vol. 28 No. 2 p. 44-57 Compendium Vol. 28 No. 4 p. 59-85 Compendium Vol. 30 No. 1 p. 33-50 Dead Reckonings Analemma of Vitruvius, De Architectura, Book IX, Chapt VII

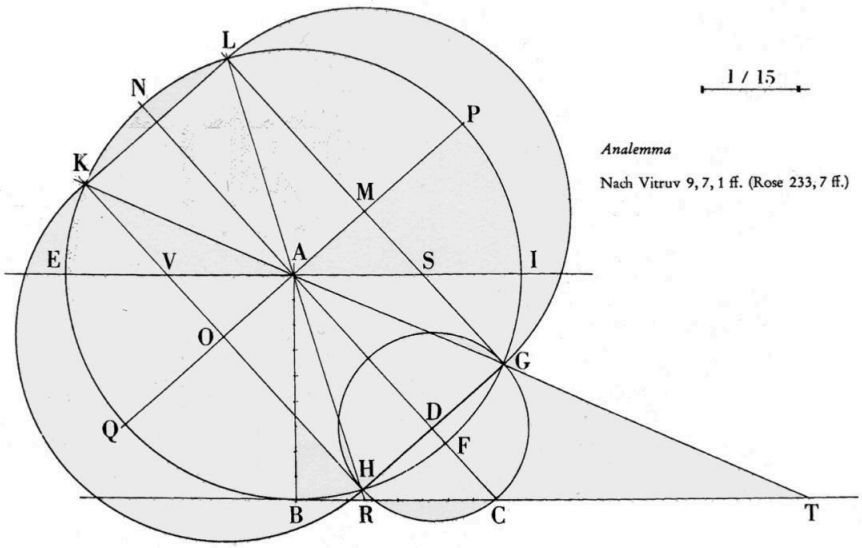
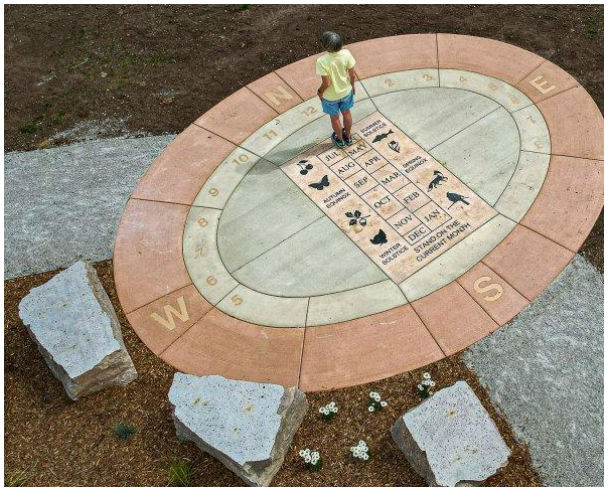


Fig. 2. The analemma of Vitruvius[2]. AB = gnomon = shadow casting rod, BC = shadow casting at the equinoxes, AC = sunray at the equinoxes, EI = horizon, menaeus = circle around D, NF = equator, LH = ecliptic.

Analemmatic Dial	An azimuthal sundial with a vertical gnomon. Depending on the sun's declination, the gnomon's position must be adjusted along a date scale. Ellipse x = R sin(t), y = R cos(t) sin(φ)	Compendium Vol. 2 No. 3 p. 24-28 Compendium Vol. 5 No. 1 p. 4-9, 10-13 Compendium Vol. 7 No. 4 p. 8-11 Compendium Vol. 10 No. 3 p. 1-7, 8-14 Compendium Vol. 10 No. 4 p. 1-6, 7-10 Compendium Vol. 11 No. 1 p. 1-6, 11-18 Compendium Vol. 13 No. 1 p. 17-19 Compendium Vol. 15 No. 2 p. 5-11 Compendium Vol. 16 No. 1 p. 9-10 Compendium Vol. 17 No. 1 p. 8-11, 22-23 Compendium Vol. 17 No. 3 p. 13-16

		Compendium Vol. 20 No. 1 p. 28-30 Compendium Vol. 21 No. 1 p. 32-34 Compendium Vol. 23 No. 4 p. 23-33 Compendium Vol. 26 No. 1 p. 7-16 Compendium Vol. 26 No. 4 p. 15-18 Compendium Vol. 27 No. 3 p. 1-6 Compendium Vol. 30 No. 4 p. 43-49 The Analemmatic Sundial Source Book
 Photo: NASS Registry, #1065		 Photo: John Carmichael, Sundial Sculptures

Analemmic Dial	A dial designed around the form of the analemma. These dials have in-built affordances for the equation of time which may be built into either the hour lines or the gnomon itself.	Compendium Vol. 13 No. 2 p. 24-26 Compendium Vol. 18 No. 2 p. 30-35 Compendium Vol. 24 No. 2 p. 34-36 Compendium Vol. 24 No. 4 p. 7-14 Compendium Vol. 31 No. 2 p. 1-9

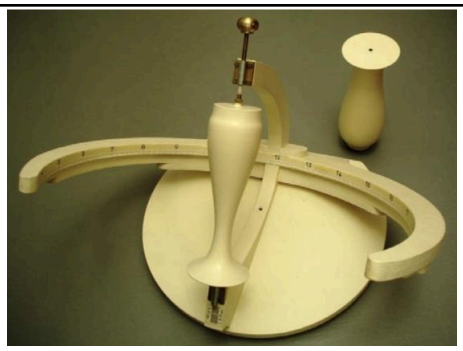
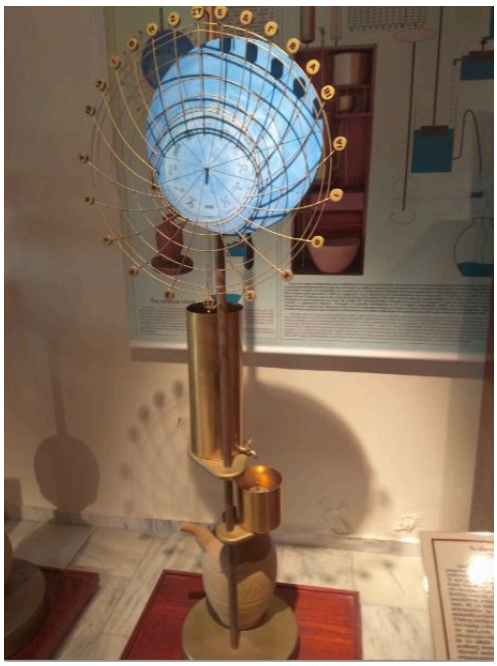


Photo: Rolf Wieland, Compendium 18:2

Anaphoric Clock	A mechanically driven display of the local sky, rotating behind a fixed grid of seasonal hour lines and declination circles. This rotating sky cam indicates the positions of stars, as well as the hour by means of a manually set marker. The anaphoric clock is considered the precursor to the planispheric astrolabe. See Clepsydra	Compendium Vol. 26 No. 1 p. 20-22 Clocks, Oxford Classical Dictionary The anaphoric clock, Kotsanas Museum



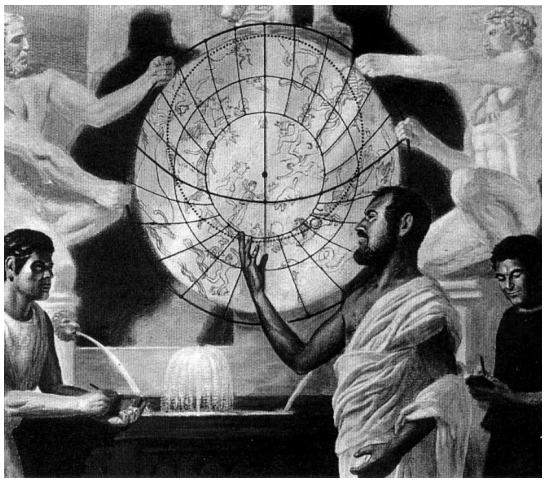


Photo: Nirc1703, Wikimedia Commons Photo: Paolo Albèri Auber, Compendium 26:1

Anomalistic Month	The time the moon takes to travel from perigee to perigee. An Anomalistic month averages 27.554550 days.	Compendium Volume 24 Number 1 p. 1-4 Compendium Volume 31 Number 1 p. 1-8

Antarctic Circle	A region encircling the South pole, located at approximately 66º 34’ S. This line delineates the northern limit of the area where the sun spends at least one full day above the horizon on the winter solstice, and one full day below the horizon on the summer solstice.	

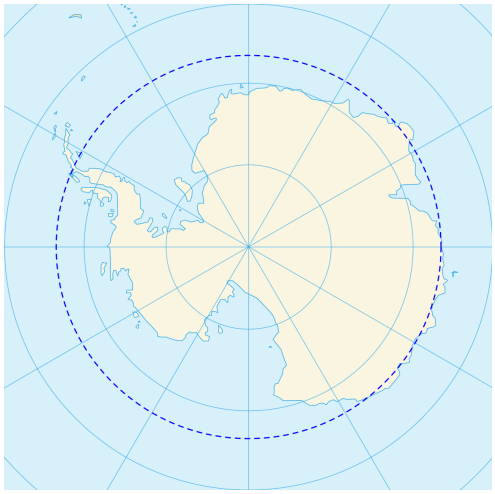


Photo: Thesevenseas, Wikimedia Commons

Ante Meridiem	The portion of the day between midnight and noon.	

Antisolar Point	An imaginary point in the celestial sphere directly opposite the Sun forms the observer's perspective.	https://en.wikipedia.org/wiki/Antisolar_point Compendium 8-1 pp 13-15

Aperture	A hole through which light passes	Compendium 7-3 pp 12-14 Compendium 12-4 pp 1-4

Aphelion	The point of earth's elliptical orbit that is farthest from the sun. Currently, the Earth's distance from the sun at aphelion is 152,094,000 km.	Compendium Vol 12 No. 4 p. 24-32 Compendium Vol 21 No. 1 p. 21-31 Compendium Vol. 25 No. 4 p. 4-15 Compendium Vol. 26 No. 2 p. 2 Compendium Vol. 27 No. 3 p. 27-33 Compendium Vol. 28 No. 3 p. 5

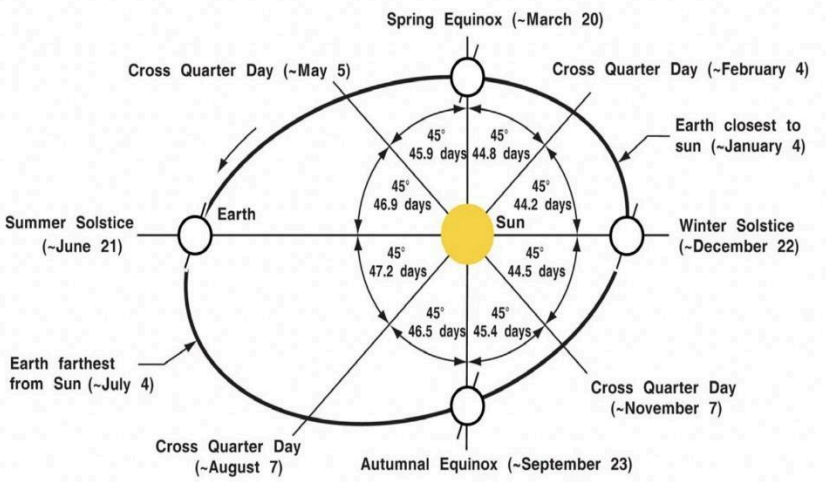


Photo: Chris Vaughan, AstroGeo

Apogee	The point at which an eccentrically orbiting body is furthest away from that which it orbits.	

Apparent Sun	The sun as seen from earth. "The bright light in the sky that causes shadows. It inherits the non-uniform motion of the true sun, and is, moreover, affected by atmospheric refraction" (De Rijcke, Compendium 31:1). The apparent sun is fundamentally local, as its measured position is dependent on the observer's latitude and longitude.	Compendium Vol. 10 No. 1 p. 24-33 National Oceanic and Atmospheric Administration

Apsidal Precession	The gradual revolution of the ellipse of Earth's orbit around the sun. The ellipse completes one full rotation around the sun every	Compendium Vol. 27 No. 3 p. 27-33 Apsidal precession - Wikipedia.

	112,000 years. This cycle affects only the orbital path of the Earth, not the direction of its tilt relative to the sun.	

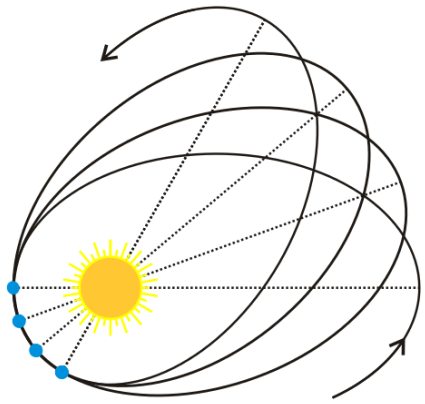


Photo: Large Norwegian Encyclopedia

Arctic Circle	A region encircling the North pole, located at approximately 66º 34’ N. This line delineates the southern limit of the area where the sun spends at least one full day above the horizon on the summer solstice, and one full day below the horizon on the winter solstice.	

Photo: Heraldry, Isochrone, Wikimedia Commons

Armillary dial	A subclassification of equatorial dial featuring rings reminiscent of an armillary sphere. These rings may be full or partial to allow for clear reading.	Compendium Vol. 2 No. 2 p. 19-20 Compendium Vol. 6 No. 3 p. 12-14

Photo NASS Registry # 303

Photo: NASS Registry #683

Armillary Sphere	A demonstrational model of the celestial sphere with rings for the meridian, equator, ecliptic, tropics, and arctic circles. From the Latin *armilla* meaning ring and *sphaera* meaning sphere.	Compendium Vol. 6 No. 3 p. 12-14

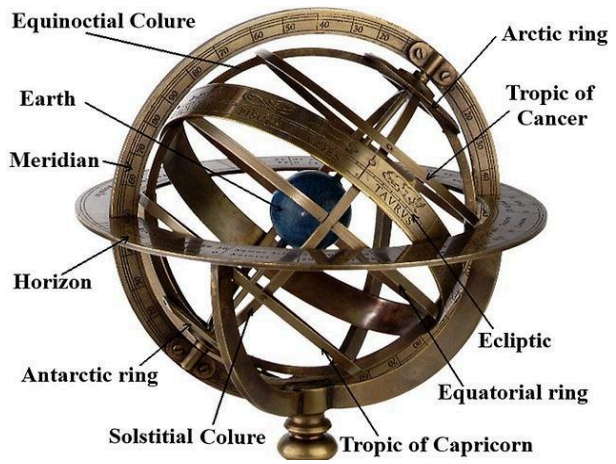


Photo: Kristjan Salev, Science of Gadgets

Ascendant	The point on the ecliptic which intersects the eastern horizon at a particular time (i.e. that of a person's birth).	Compendium 16-1 pp 15-26

Ascending Node	The point on the ecliptic where the moon crosses from South to North, enabling eclipses. See Lunar Nodes	

Asr	One of the five Islamic prayer times, beginning at mid-afternoon and ending at sunset.	Compendium Vol. 27 No. 2 p. 10-18 Compendium Vol. 28 No. 2 p. 29-43 moonsighting.com

Assostyle	See Polar Style.	

Astroarchaeology	The study of the astronomical practices of ancient cultures, such as the construction of	Compendium Vol. 29 No. 2 p. 1-14

	calendrical monoliths. See Significant Alignment	

Astrolabe	An analog astronomical computer that represents the celestial sphere with a two-dimensional projection. Depending on the astrolabe type, the positions of the sun and stars can be modeled with a rotating rete, sliding rule, or brachiolum. See Mariner's Astrolabe, Planispheric Astrolabe, Rojas Astrolabe	Compendium Vol. 17 No. 2 p. 18-26 Compendium Vol. 28 No. 3 p. 18-19 Compendium Vol. 30 No. 3 p. 61-76 The Astrolabe by James E. Morrison
 **Photo: Andrew Dunn, Whipple Museum of the History of Science**		

Astronomical Ring Dial	A suspended dial consisting of three folding rings. This dial is equipped with two opposing sights which rotate about the polar ring. The sights of the dial may be carried by a rotating band, or may take the form of an alidade. "Two rings are equal, hinged at the diameter with a joint mechanism. When they are open, they stay on two perpendicular planes, the local Meridian and the Equator,	Compendium Vol. 27 No. 1 p. 19-35 Compendium Vol. 31 No. 3 p. 61-79

	respectively." This instrument was simplified and adapted to become the universal ring dial, which replaced the rotating sights with a central, adjustable nodus.	

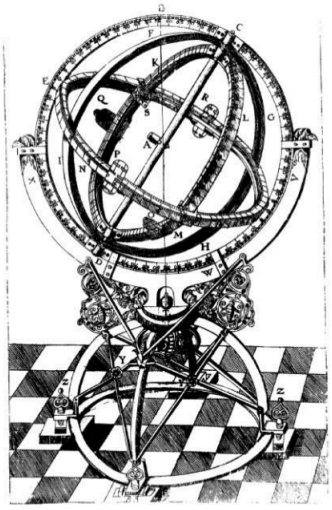


Photo: Tycho Brahe's *Mechanica*

Photo: Wikimedia Commons, Rama

Astronomical twilight	Astronomical Twilight starts/ends when the sun is 18° below the horizon. This indicates the first/last detectable sunlight.	

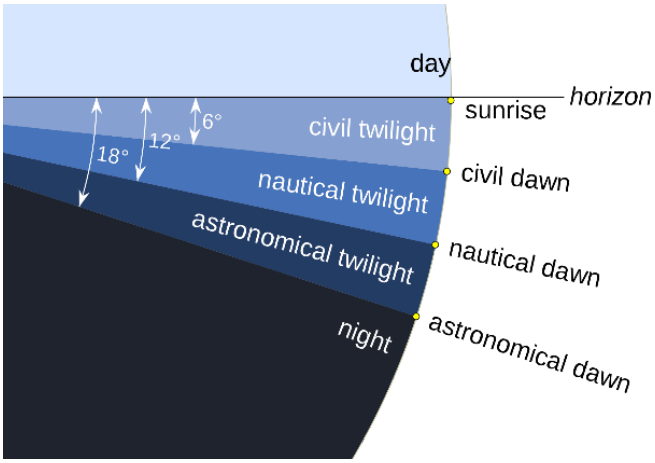


Photo: Wikimedia Commons, Pmurph5

Atmospheric Refraction	As light from the sun passes through the earth's atmosphere, "the direction of the ray is continuously modified and undergoes a progressive and continuous bending." This results in the sun appearing to exist higher than it truly is. At sunrise and sunset, when this effect is most dramatic, atmospheric refraction results in the sun appearing to sit on the horizon when in reality it is below. Note that atmospheric refraction only affects the altitude of the apparent sun, not its azimuth. See Sunrise, Sunset, Refraction, Refraction Dial	Compendium Vol. 20 No. 2 p. 9-19 Compendium Vol. 26 No. 1 p. 1-6 Compendium Vol. 26 No. 2 p. 2-3 Compendium Vol. 29 No. 1 p. 1-6 Compendium Vol. 30 No. 3 p. 1-7

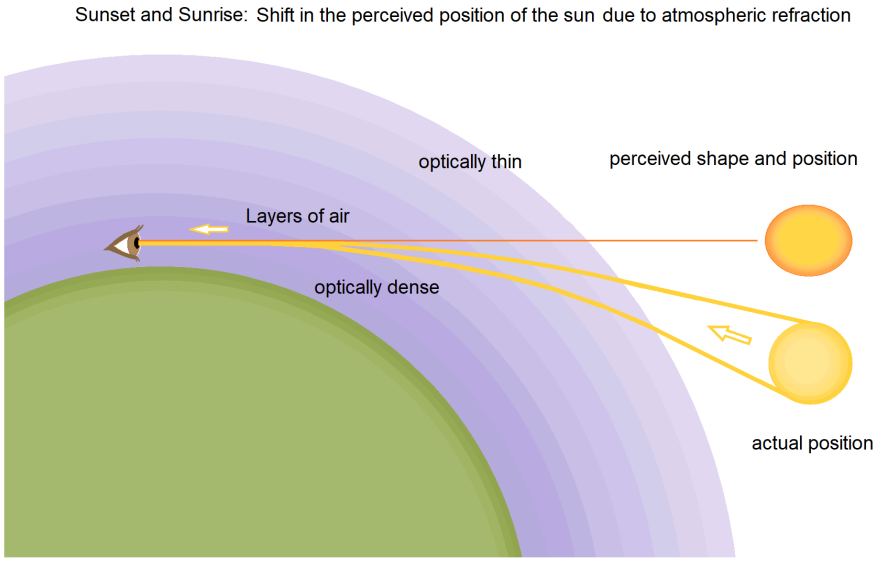


Photo: Wikimedia, Sciencia58

Augsburg Dial	A portable equatorial dial designated by its hinged hour plate and accompanying latitude scale, octagonal base, and large embedded compass.	

	Many dials of this type feature gazetteers inscribed on the bottom to aid in setting latitude, as well as plumb bobs to aid in leveling. This dial was invented in Augsburg, Germany in the 1700's. Despite what its name might imply, the design tradition spread and these dials were produced elsewhere.	

Photo:The Metropolitan Museum of Art

Azimuthal dial	A sundial that uses the sun's azimuth (as opposed to its hour-angle or altitude) for indicating time.	Compendium Vol. 12 No. 2 p. 13-16 Compendium Vol. 21 No. 1 p. 15-20 Compendium Vol. 28 No. 2 p. 6-28 Compendium Vol. 30 No. 1 p. 77-79

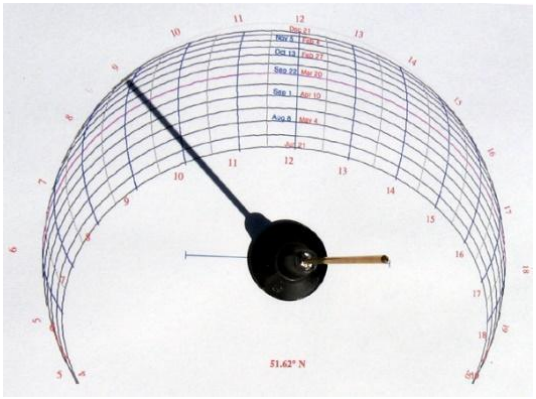


Photo: J Giesen

Azimuth (Az)	In the Northern hemisphere, a clockwise angle measured from due south to the sun. -180° - +180° Note: maps and astronomers measure azimuth from due north. tan Az = sin(t) / (sin(φ) cos(t) – cos(φ) tan(δ))	Compendium Vol. 3 No. 2 p. 16-17 Compendium Vol. 16 No. 1 p. 34-35 Compendium Vol. 25 No. 2 p. 8-12

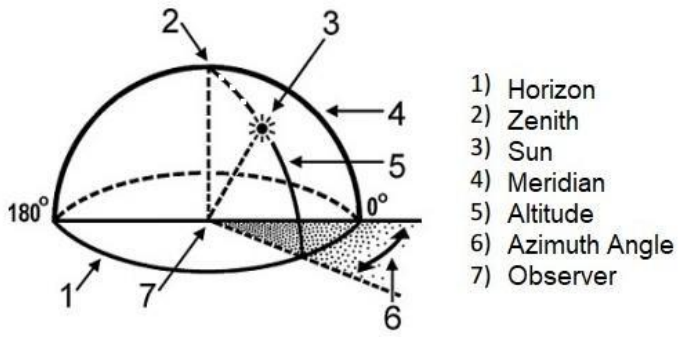
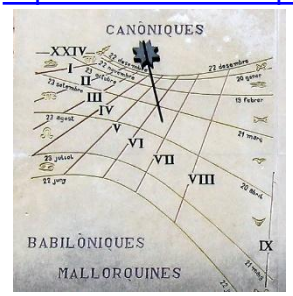
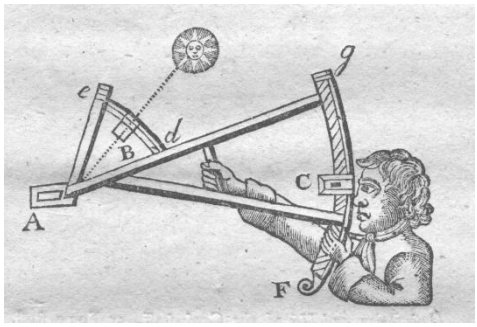
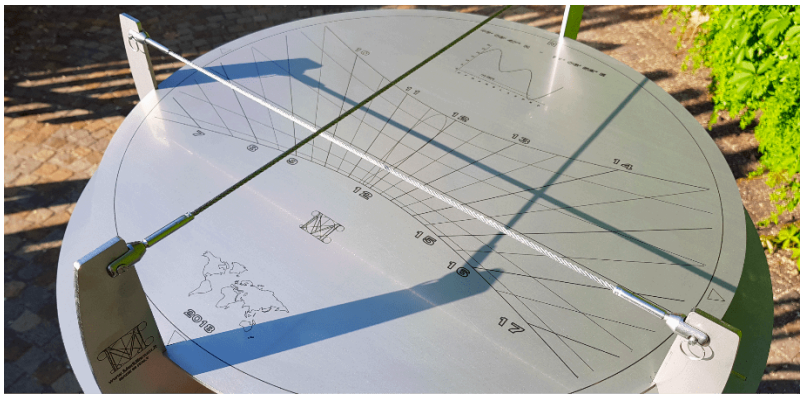


Photo: U.S. Army Map Reading and Land Navigation Handbook. Field Manual 3-25.26.

B		
Babylonian hours	An equal hour system which counts the hours starting from sunrise, 0 – 24,	Compendium Vol. 5 No. 2 p. 1-6 Compendium Vol. 5 No. 4 p. 13-19 Compendium Vol. 16 No. 3 p. 21-23, 24-32 Compendium Vol. 18 No. 2 p. 22-25 Compendium Vol. 26 No. 4 p. 22-27

		Compendium Vol. 27 No. 1 p. 16-18 BabylonianHours.com
https://www.shadowspro.com/en/user-manual.html  **Photo: J Giesen, Sanuari de Lluc, Majorca**		

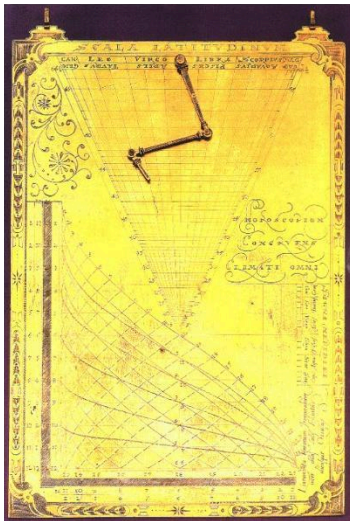
Backstaff	A 16th-18th century navigational instrument to measure the altitude of a celestial object without damaging the eyes of the observer.	https://en.wikipedia.org/wiki/Backstaff https://jerryhedrick.blogspot.com/2018/01/are-we-there-yet-reproducing-back-staff.html
 **Photo: Wikimedia Commons, Rama**  **Photo: Jerry A Hendrick**		
Bifilar Dial	A dial that uses the intersection shadows cast by two perpendicular filaments to indicate the hour.	Compendium Vol. 6 No. 4 p. 16-22 Compendium Vol. 7 No. 2 p. 7-13 Compendium Vol. 7 No. 3 p. 7-11 Compendium Vol. 7 No. 4 p. 1-5, 12-16 Compendium Vol. 8 No. 4 p. 1-3, 4-6

		Compendium Vol. 13 No. 4 p. 20-25 Compendium Vol. 14 No. 2 p. 5-11 Compendium Vol. 15 No. 3 p. 20-26 Compendium Vol. 18 No. 2 p. 36-39 Compendium Vol. 20 No. 4 p. 21-24 Compendium Vol. 24 No. 2 p. 5-9 Compendium Vol. 28 No. 1 p. 16-39 Compendium Vol. 29 No. 2 p. 68-76 Compendium Vol. 31 No. 1 p. 19-28, 61-68 Compendium Vol. 30 No. 4 p. 28-33, 33-42
 **Photo: Wikimedia Commons, Stefano Aldegheri**		

Bissextile	A year that includes an extra day, February 29. Leap year.	

Bowstring Equatorial Dial	A subcategory of equatorial dial designated by its half meridian and equatorial rings. The polar gnomon of the dial spans the diameter of the meridian circle, resembling the	

	resting string of a bow.	
 **Photo: NASS Registry #228**		

Brachiolum	An articulated arm present on certain sundials such as the Regiomontanus rectilinear dial. The arm is used to position the plumb bob for the latitude and solar declination Certain universal astrolabes also make use of such a brachiolum.	Compendium Vol. 5 No. 4 p. 13-19 Compendium Vol. 6 No. 1 p. 4-8
 **Photo: Fer K DeVries, Compendium 5:4**		

Butterfield Dial	Portable universal horizontal dial with inlaid compass. These dials feature nested hour lines to be referenced at different latitudes.	Compendium Vol. 2 No. 3 p. 10-11

	Butterfield dials are known for the small bird gnomon that acts as a latitude selection mechanism. The edge of the polar gnomon is adjusted against a latitude scale until the bird's beak points to the latitude of use.	

Photo:The Metropolitan Museum of Art

C

Campbell-Stokes Recorder	A glass sphere that focuses sunlight onto a card to record the hours of sunshine over the course of a day. Invented in 1853 by John Francis Campbell. The replaceable card has an hour scale and declination lines. See Caustic Curve	Compendium 17-2 pp 15 Compendium 23-4 pp 21

Photo: Wikimedia Commons, Bidgee

Cannon Dial	A horizontal dial designed around a miniature cannon which blasts to signal solar noon.	Compendium Vol. 1 No. 2 p. 14-15 Compendium Vol. 30 No. 4 p. 67-85

	A magnifying glass, adjusted to the sun's altitude at noon, provides the heat source to ignite the gunpowder in the cannon. Although the full horizontal dial is often included, some dials may feature only the glass lens and canon.	
 **Photo: Wikimedia Commons, Andres Rueda**		

Canonical Hours	Unequal hour system of 2 x 12 divisions used to mark times of prayer. Unlike seasonal hours, canonical hours do not mark segments of time, but rather points of prayer.	Compendium Vol. 19 No. 1 p. 5-11 Compendium Vol. 26 No. 2 p. 10-13

Capuchin Dial	An altitude dial with a plumb bob that must be adjusted for solar declination. The dial is named for its resemblance to the pointed hoods of Capuchin monks.	Compendium Vol. 6 No. 1 p. 4-8 Compendium Vol. 17 No. 2 p. 33-35

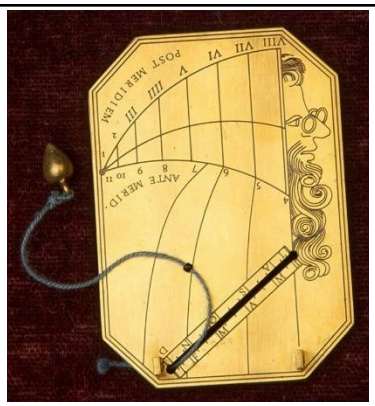


Photo: Master Terebrus

Catoptric Dial	See Reflection Dial	

Caustic Curve	The envelope of rays near the focal point. See Caustic Curve Sundial	Compendium Vol. 22 No. 3 p. 23-24 Caustic Curve, Thinking about Science

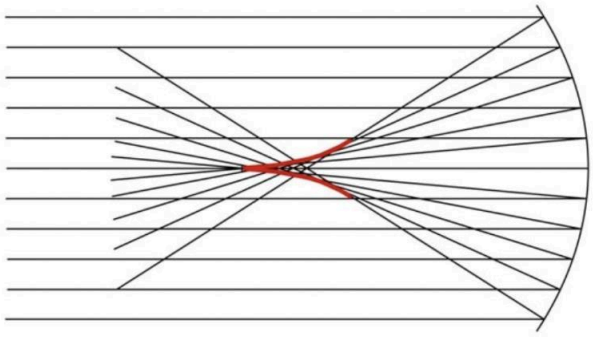


Figure 1: Caustic curve, shown in red, formed by parallel light rays focused by a spherical mirror.

Photo: Bert Willard, Compendium 22:3

Caustic Curve Sundial	A dial that uses the principles of caustic curves to focus light on its dial face, indicating the time. Often, this dial will take the form of an equatorial dial with a thick, translucent, cylindrical gnomon.	Compendium Vol. 22 No. 3 p. 23-24

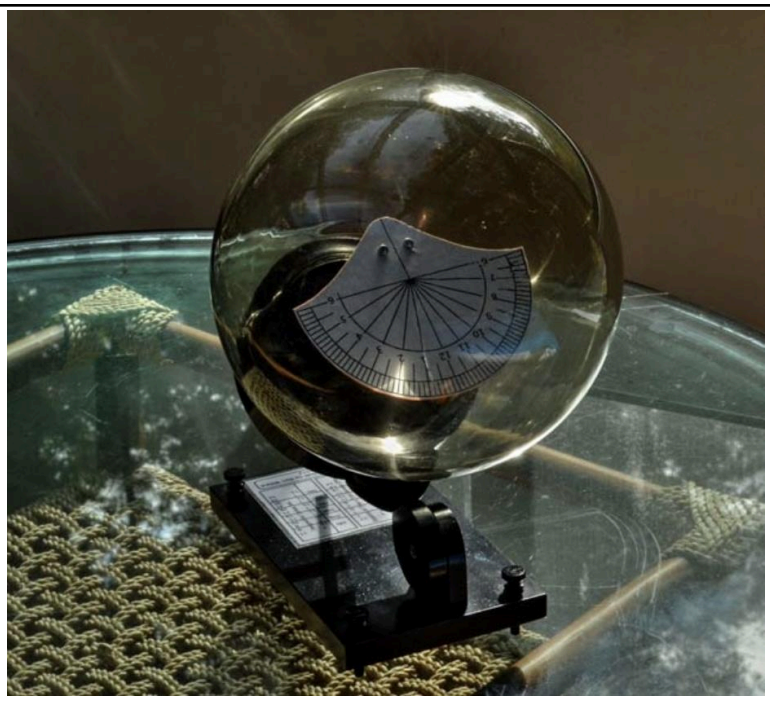


Photo: Bert Willard, Compendium 22:3

Ceiling Dial	See Reflection Dial	

Center	The point on the dial face where all hour lines intersect.	

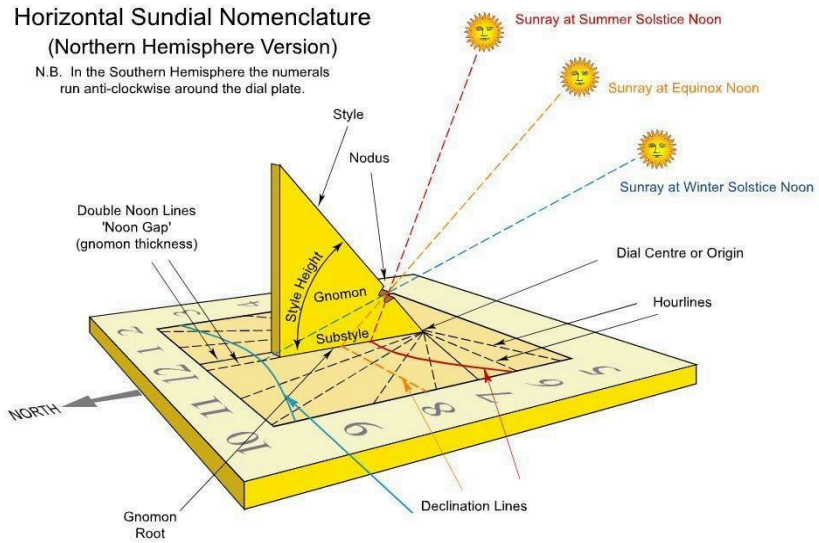
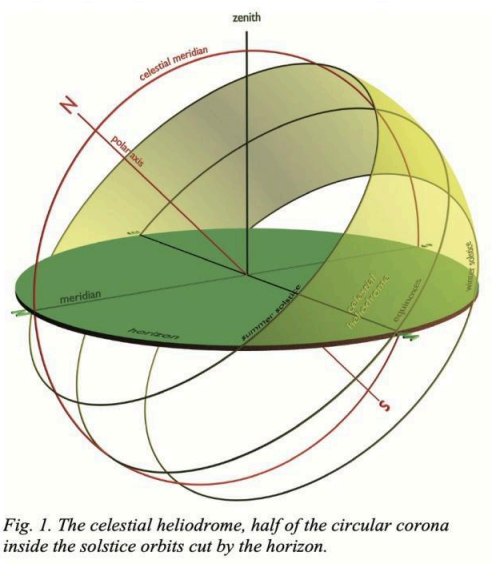


Photo: British Sundial Society

Celestial Heliodrome	A wide band on the celestial sphere defined by the two extremes (tropics) of the ecliptic. This band contains every possible position the sun can occupy in the sky for a given latitude.	Compendium Vol. 27 No. 3 p. 7-14
 *Fig. 1. The celestial heliodrome, half of the circular corona inside the solstice orbits cut by the horizon.* **Photo: Fabio Savian, Compendium 27:3**		

Celestial Latitude	See Declination	

Celestial Longitude	See Right Ascension	

Celestial Sphere	An imaginary sphere on which all celestial objects lie. The Earth's axis and equator are	Compendium Vol. 9 No. 4 p. 20-23 Compendium Vol. 25 No. 3 p. 11-22

	projected onto the celestial sphere, with the observer positioned at the center	Compendium Vol. 25 No. 4 p. 4-15 Compendium Vol. 27 No. 3 p. 27-33 Celestial Sphere, Wikipedia Solar Movement Simulator

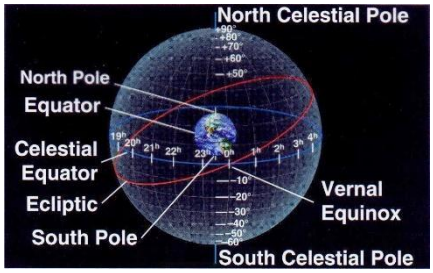


Photo: http://astro.wsu.edu/worthey/astro/html/lec-celestial-sph.html
https://www.astronomy.ohio-state.edu/pogge.1/Ast161/Au06/Unit2/motions.html

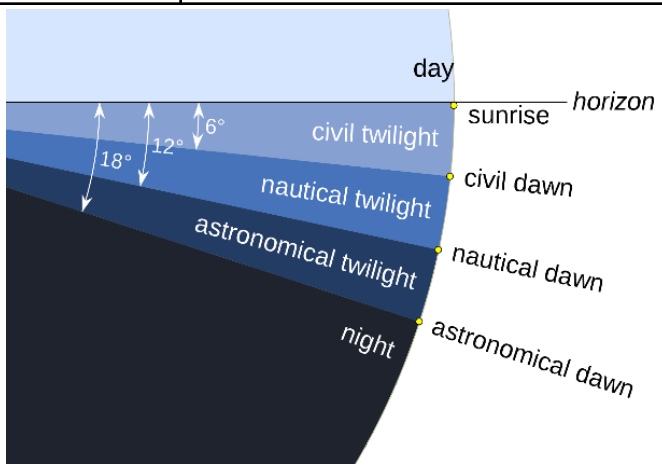
Chapter Ring	The ring on a sundial that contains the numerals marking the hours of the day.	

Chronogram	A motto or message with certain capitalized letters. When isolated and read out, these letters act as Roman numerals denoting a significant number.	Compendium Vol. 24 No. 2 p. 37-38

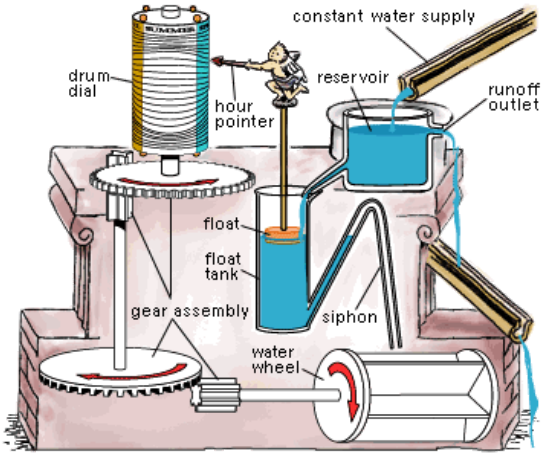
SVB HAC VMBRA DATVR SECVRA QVIES EX HOC OMNIS DECOR EXVRGET. *i.e. Under this shadow safe rest is given; from it every grace will arise.* = 1726

Civil time	Time as defined by the government of a particular country. Typically based on Zone Time but may have fixed differences. A time zone with a fixed difference from Universal Coordinated Time, or UTC. Typically using a 2 x 12 counting from midnight. May also be called	Compendium Vol. 24 No. 2 p. 21-28 Compendium Vol. 24 No. 2 p. 29-30 Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 30 No. 1 p. 1-6 Compendium Vol. 30 No. 3 p. 50-60

	common or French hours.	Hour, Wikipedia

Civil twilight	Civil Twilight starts/ends when the sun is 6° below the horizon.	
 Photo: Wikimedia Commons, Pmurph5		

Clepsydra	A timekeeping device driven by flowing water. A tank's changing water level provides the basis for the displayed time. The most precise and elaborate clepsydrae are known as "inflow clepsydrae," and are equipped with various siphons and a regulatory tank to prevent water pressure from changing in the reservoir. This ensures the consistent rising rate of the water level/indicator.	An Athenian Clepsydra When Time Flowed



Outflow Clepsydra. Photo: Wikimedia Commons, Marsyas
Inflow Clepsydra. Photo: Tony's Education Website

Clock Time	See Civil Time	

Co-latitude	Complementary angle to latitude. 90-φ	

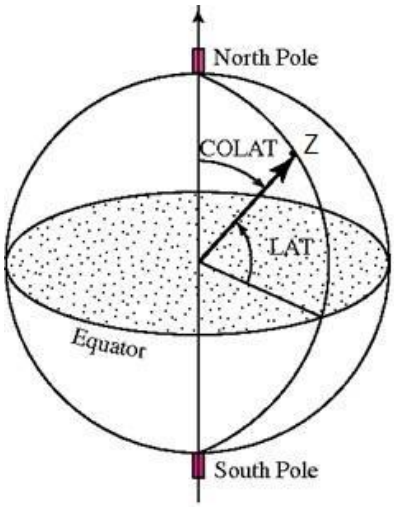


Photo:
https://www.semanticscholar.org/paper/Using-Satellite-Technology-(global-Positioning-to-'brien/c3fc9ad8f712fb7a8455d606144a4e6cda259782

Counter-Changed	An adjective describing alidades which feature balanced offsets of material on either side of the indicating edge. This	

	type of alidade is found on the vast majority of European astrolabes. Counter-changed alidades are differentiated from those found on many Islamic astrolabes, which have a single continuous indicating edge passing through the pivot.	

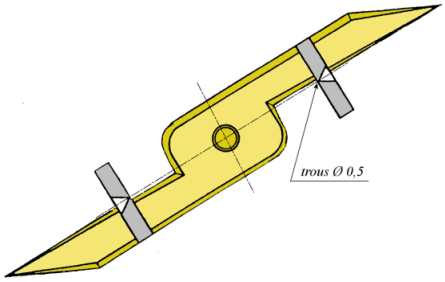


Photo: Wikimedia Commons, Aubry Gérard

Climate	See Tympan	

Common Hours	The standard 2 x 12 equal hour system starting at midnight and noon.	Compendium 19-2, pp 5-11

Compendium	A single instrument incorporating a variety of dial types and ancillary tools. “Giving a sense and substance of the topic within small compass.”	

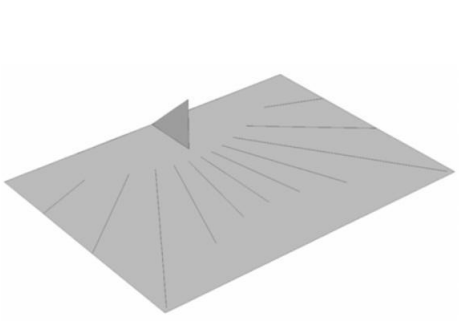
Photo: Wikimedia Commons,

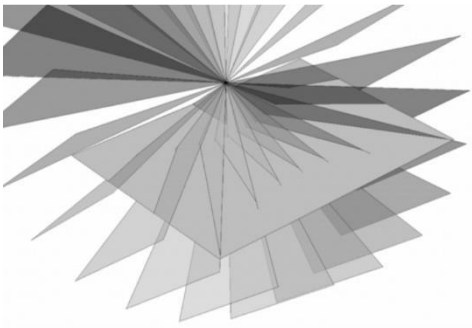
Photo: NASS Registry #733

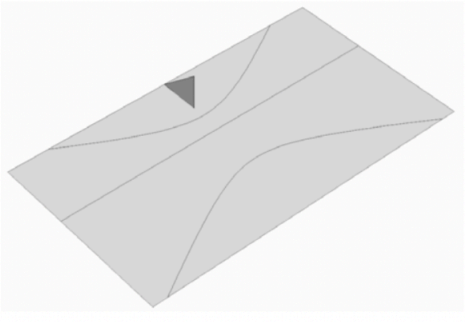
History of Science Museum #45366https://www.britishmuseum.org/collection/object/H_1855-1201-227

Compound Dial	See Multi-Dial	

Computer Aided Dialing (CAD)	The virtual mapping and 3D modeling of sundials using dedicated computer applications.	Computer Aided Dialing, The Sundial Primer Compendium Vol. 12 No. 2 p. 17-25 Compendium Vol. 24 No. 4 p. 7-14 Compendium Vol. 27 No. 2 p. 19-24 Compendium Vol. 29 No. 1 p. 52-56







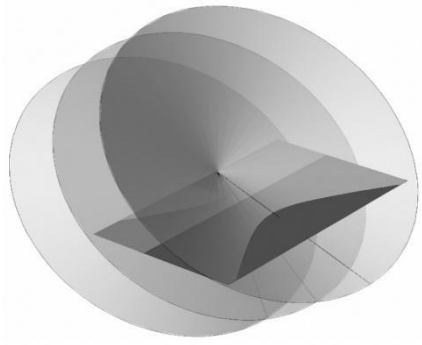
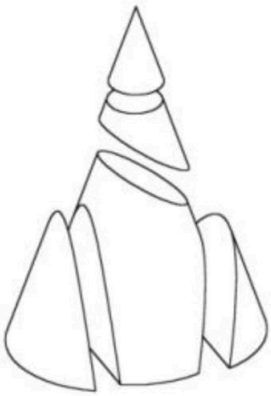


Photo: Steven Lueking, Compendium 12:2

Conic	Relating to a cone. Several curves can be seen when a plane intersects a cone at various angles. The conic sections are closely entwined with sundial design; they often define the daily paths traced by shadows on dial faces.	Compendium Vol. 8 No. 4 p. 21-24 Compendium Vol. 25 No. 1 p. 11-19
 ***Figure 2** - conic sections: top - circle, middle - ellipse, left - hyperbola, right - parabola.* **photo: Stephen Luecking, Compendium 8:4**		

Conic Dial	A dial with either a conic gnomon or hour plane.	Compendium Vol. 12 No. 2 p. 17-25 Compendium Vol. 13 No. 3 p. 13-15 Compendium Vol. 20 No. 4 p. 30-37 Compendium Vol. 21 No. 4 p. 29-37 Compendium Vol. 27 No. 4 p. 24-33

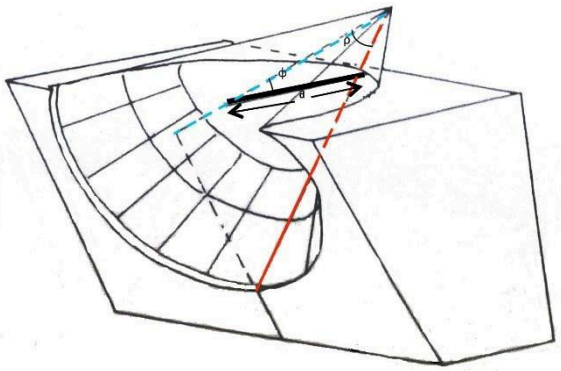


Photo: Evangelia C Panou, Archaeology.wiki

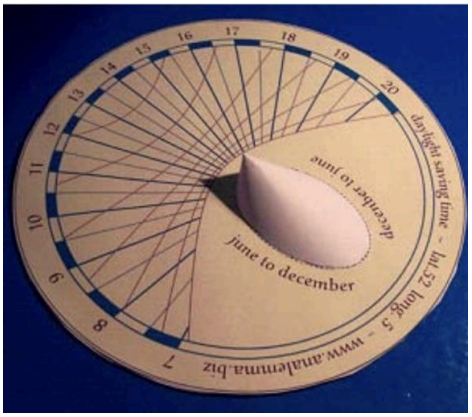
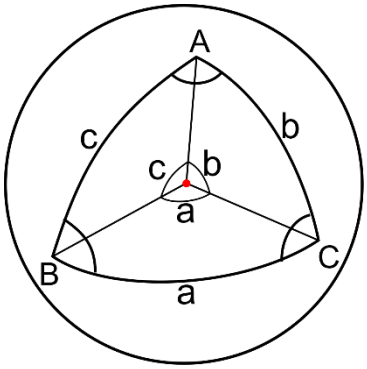


Photo: Hendrik Hollander

Cosine rule	The Spherical Law of Cosines: For a spherical triangle on a unit sphere has side lengths a, b and c, and let C denote the included angle adjacent to sides a and b. Then (using radian measure): cos(c) = cos(a) cos(b) + sin(a) sin(b) cos(C).	Compendium Vol. 3 No. 1 p. 8-13



https://en.wikipedia.org/wiki/Spherical_trigonometry

Cos(c) = Cos(a) Cos(b) + Sin(a) Sin(b) Cos(C)

Photo: Wikimedia Commons, Peter Mercator

Crossed C's Dial	See Bowstring Equatorial Dial	

Cross staff	An instrument used to measure the angle between the horizon and the sun or star to obtain the	

	latitude.	

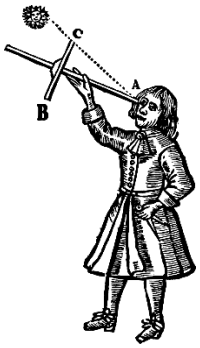


Photo: Wikimedia Commons, John Seller (1603-1697)

Cruciform Dial	A dial in the form of a cross. These dials often incorporate their hour lines into the body of the cross itself, acting as polyhedral polar dials.	Compendium Vol. 17 No. 4 p. 37

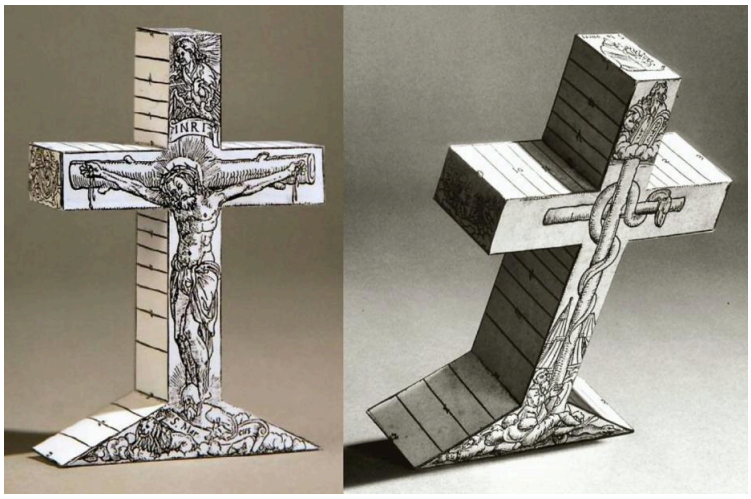
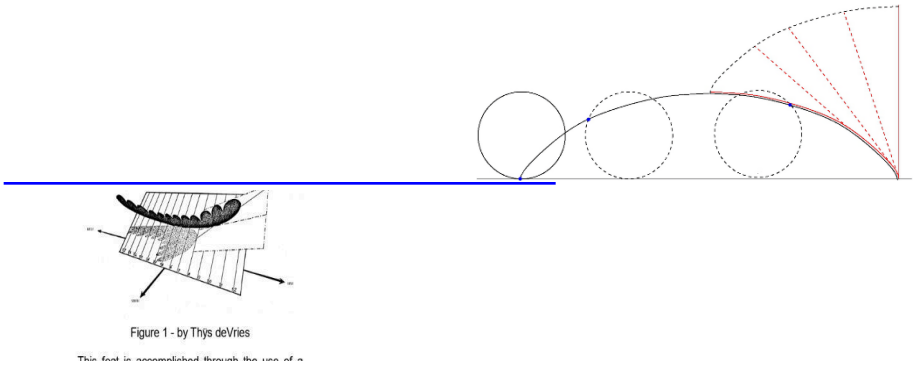


Photo: Tektonten Papercraft

Culmination of the Sun	The peak of the sun's daily arc. The altitude of this peak changes with solar declination, occurring closest to the zenith at the summer solstice and farthest at the winter solstice.	

Cycloid Polar Sundial	A Cycloid is a curve traced by a point on the edge of a circle rolling along a line. The dial uses this shape as the style.	Compendium Vol. 5 No. 4 p. 21-24



Volkthe, Creative commons

Figure 1 - by Thijs deVries

Photo: Wikimedia Commons, Volk the **Photo: Cycloid Polar Sundial, T deVries, Compendium 5:4**

https://www.daviddarling.info/encyclopedia/C/cycloid.html

Cylindrical dial	A sundial whose face is a cylindrical surface, either concave or convex. Dial face may be polar or vertical. This term may also be used to describe the pillar dial.	Compendium Vol. 6 No. 1 p. 25-30 Compendium Vol. 14 No. 1 p. 5-7, 8-10 Compendium Vol. 14 No. 3 p. 25-28 Compendium Vol. 19 No. 4 p. 6-10 Compendium Vol. 22 No. 4 p. 29-32 Compendium Vol. 26 No. 3 p. 19-26 Compendium Vol. 29 No. 4 p. 39-52 Compendium Vol. 30 No. 3 p. 50-60

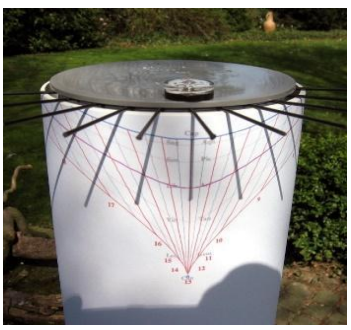


Photo: NASS Registry #538 Photo: J Giesen http://www.jgiesen.de/PingreSundial/index.html

D		
Danda	See Nadi	

Dawn	Morning twilight. See Nautical Twilight, Twilight, Sunrise	

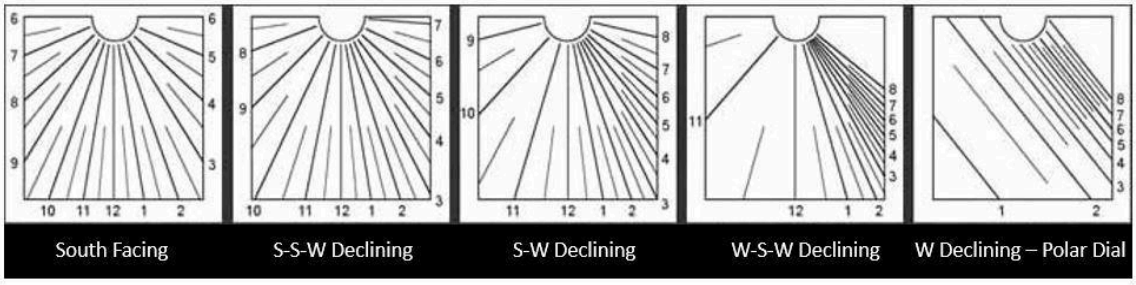
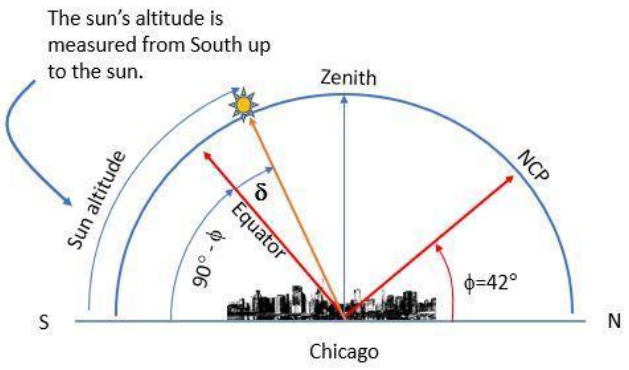
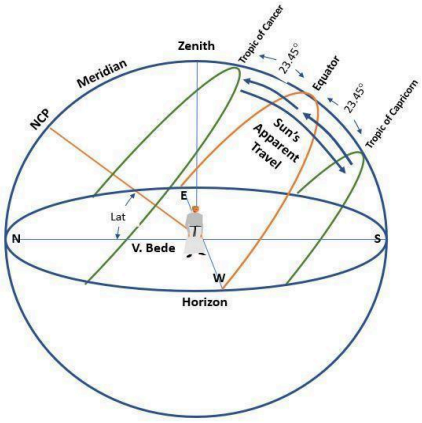
Declination of Dial (d)	The angle between a horizontal south line and a horizontal line perpendicular to the dial face. South facing dial, d = 0°, Direct East, d = -90°, Direct West d = +90°	Compendium Vol. 14 No. 4 p. 1-4 Compendium Vol. 16 No. 2 p. 29-37 Compendium Vol. 17 No. 1 p. 24-29 Compendium Vol. 26 No. 1 p. 33-40 Compendium Vol. 27 No. 2 p. 27-39
		

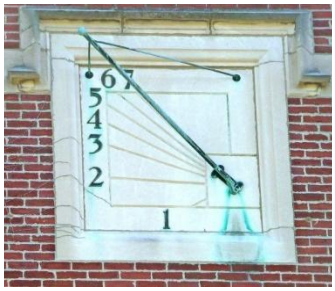
Photo: Wikimedia Commons, Willy Leenders at Dutch Wikipedia

Declination of Sun (δ)	The angular distance of the sun above/below the equator. Tropic of Cancer = +23.45º (north of equator) Tropic of Capricorn = - 23.45º (south of equator). $\sin(\delta) = \sin(Alt)\sin(\varphi) - \cos(Alt)\cos(\varphi)\cos(Az)$	Compendium Vol. 9 No. 4 p. 20-23 Compendium Vol. 10 No. 3 p. 26-31 Compendium Vol. 14 No. 4 p. 10-13, 14-19 Compendium Vol. 16 No. 4 p. 35-39

		Compendium Vol. 17 No. 2 p. 33-35 Compendium Vol. 18 No. 2 p. 9-10 Compendium Vol. 18 No. 4 p. 8-14 Compendium Vol. 24 No. 4 p. 38-39 Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 25 No. 4 p. 4-15 Solar Movement Simulator
 **Photo: NASS, Elements of Dialing**		 **Photo: NASS, Elements of Dialing**

Declining dial	If the vertical dial's face is not facing a cardinal direction (N, E, S, W) it is declining. See declination	Compendium Vol. 3 No. 3 p. 14-18 Compendium Vol. 4 No. 1 p. 24-26 Compendium Vol. 7 No. 1 p. 21-23 Compendium Vol. 7 No. 2 p. 7-13 Compendium Vol. 10 No. 3 p. 23-25 Compendium Vol. 14 No. 2 p. 28-29 Compendium Vol. 14 No. 4 p. 1-4, 20-23 Compendium Vol. 18 No. 1 p. 35-38

		Compendium Vol. 21 No. 1 p. 37-39 Compendium Vol. 21 No. 2 p. 35-39 Compendium Vol. 24 No. 1 p. 10 Compendium Vol. 25 No. 2 p. 25-34 Compendium Vol. 25 No. 4 p. 19-22 Compendium Vol. 27 No. 2 p. 27-39 Compendium Vol. 27 No. 4 p. 35-38



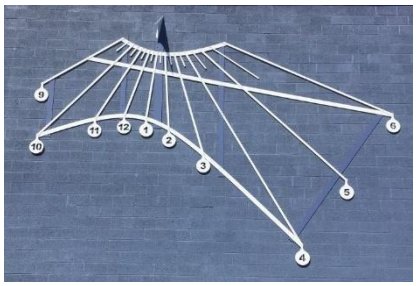
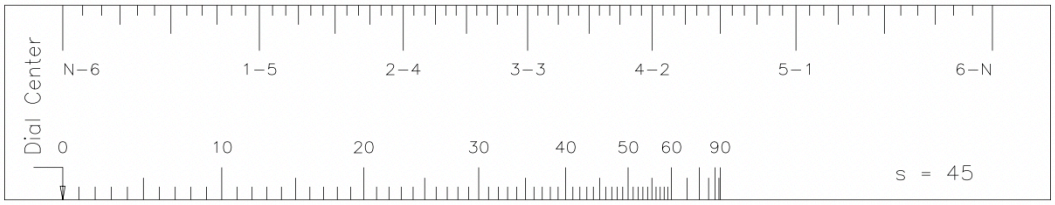


Photo: NASS Registry #53 **Photo: NASS Registry #923**https://www.shadowspro.com/en/user-manual.html

Descendant	The Point on the ecliptic that crosses the western horizon at a given moment in time.	
Descending Node	The point on the ecliptic where the moon crosses from North to South, enabling eclipses. See Lunar Nodes	

Dialing Scales	A tool, such as a ruler, designed to solve dialing equations. Dialing scales are analog computers and therefore bypass	Compendium Vol. 8 No. 3 p. 7-10, 11-13 Compendium Vol. 8 No. 4 p. 7-9, 10-13 Compendium Vol. 10 No. 1 p. 9-20, 21

	the more complex mathematical procedures traditionally used to draw sundials. Dialing scales may be used to lay out hour lines graphically, or to reverse-engineer the intended latitude of a dial by measuring its hour lines.	Compendium Vol. 11 No. 1 p. 7-8 Compendium Vol. 11 No. 3 p. 33-35 Compendium Vol. 16 No. 3 p. 36-38 Compendium Vol. 23 No. 1 p. 4-5 Compendium Vol. 23 No. 3 p. 27-28 Compendium Vol. 23 No. 4 p. 5-15 Compendium Vol. 25 No. 1 p. 7-8 Compendium Vol. 25 No. 3 p. 7-9 Compendium Vol. 27 No. 4 p. 17-22
 **Photo: Sawyer, Compendium 16:3**		

Digital Dial	Sundial that displays hourly numerals in sequence, without a gnomon or hour lines. Commonly, these dials take the form of polar plates with equatorial bands carrying the hours. These hours are projected onto a reading line at the center of the plate, indicating the time. In order to ensure that the hours fall on the reading line all year, the line must be sized according	Compendium Vol. 2 No. 3 p. 4-10 Compendium Vol. 2 No. 4 p. 20-22 Compendium Vol. 11 No. 2 p. 1-10 Compendium Vol. 11 No. 3 p. 1-10 Compendium Vol. 23 No. 1 p. 32-39

	to the following equation: Line Length = tan (23.44º) x 2r r: radius of the equatorial band	

Photo: https://www.mojoptix.com/2015/10/25/mojoptix-001-digital-sundial/ **Photo: Kellogg, Compendium 23:1**https://www.etsy.com/shop/HighlandPlastic?ref=shop-header-name&listing_id=976269465

Dioptric Dial	See Refraction Dial	

Dipleidoscope	A device that precisely indicates the moment of the sun's transit of the meridian by use of a prism. The device shows two suns. When the images converge into one, the moment of solar noon is indicated. While not a full sundial, the dipleidoscope may be able to indicate the hours surrounding noon in addition to noon itself.	Compendium Vol. 25 No. 3 p. 23-27

Photo: Illustrating Shadows

Diptych Dial	A portable sundial with both vertical and horizontal dials hinged together. These dials feature string gnomons, and may be equipped with multiple hour scales to be used at different latitudes.	Compendium Vol. 27 No. 1 p. 19-35 Compendium Vol. 31 No. 1 p. 29-40

Photo: The Metropolitan Museum of Art, Look and Learn History Picture Archivehttps://news.harvard.edu/gazette/story/2019/12/collection-of-historical-scientific-instruments-continues-to-amaze/

Dischrony (Δ λ)	Literally “different time.” Dischrony is introduced when a sundial is made to find time for a location other than the one it resides in. See Longitude Correction	

Draconic Month	The length of time the moon takes to complete one orbit, beginning and ending at its ascending node. A draconic month averages 27.212221 days.	Compendium Volume 24 Number 1 p. 1-4 Compendium Volume 31 Number 1 p. 1-8

Diurnal	Occurring daily.	

Diurnal Arc	The path of the sun during one day.	

Dusk	Evening twilight. See Nautical Twilight, Twilight, Sunset	

E		
Eccentricity, e	In conic sections, the ratio of: the distance from any point on the conic section to focus, and the perpendicular distance from that point to the directix. e = 0 is a circle. Astronomically, the degree to which an orbital path deviates from a perfect circle.	Compendium 1:1, pp 9-14 Compendium 25:4, pp 4-15

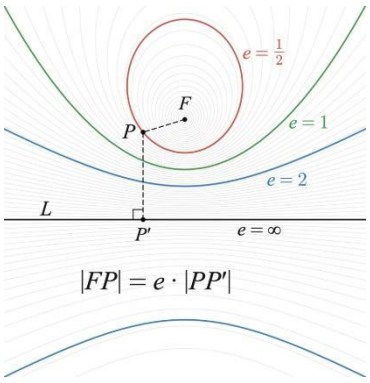


Photo: Jacobolus, Wikimedia Commons

Ecliptic	The apparent path the sun takes across the celestial sphere over the course of the year (a year being one full circuit through the ecliptic). The ecliptic is 23.44° from the Celestial Equator.	Compendium Vol. 12 No. 4 p. 24-32 Compendium Vol. 16 No. 1 p. 15-26 Compendium Vol. 25 No. 4 p. 4-15

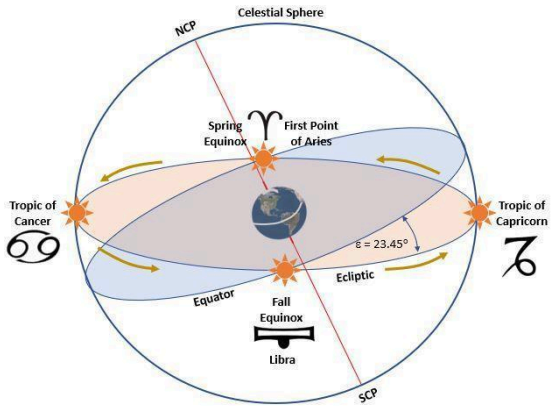
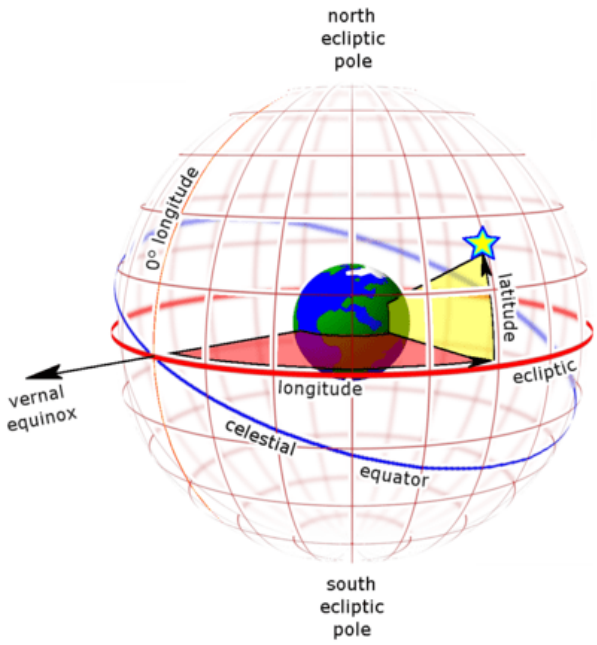


Photo: NASS, Elements of Dialing

Ecliptic Coordinates	A coordinate system wherein observations are made relative to the ecliptic plane. In this system, ecliptic longitude and ecliptic latitude are used to describe a celestial object's position. Ecliptic longitude is measured along the ecliptic from the first point of Aries (March equinox), while ecliptic latitude is a distance perpendicular to the ecliptic.	Compendium Vol. 26 No. 3 p. 27-35 Ecliptic coordinate system, Wikipedia



(Wikimedia Commons, Tfr000).

Ecliptic Latitude	A positive (northern) or negative (southern) perpendicular distance from the ecliptic. See Ecliptic Coordinates, Ecliptic Longitude	Compendium Vol. 26 No. 3 p. 27-35 Ecliptic coordinate system, Wikipedia

Ecliptic Longitude	A distance measured west to east along the ecliptic, starting from the first point of Aries (Vernal equinox). See Ecliptic Coordinates, Ecliptic Latitude	Compendium Vol. 26 No. 3 p. 27-35 Ecliptic coordinate system, Wikipedia

Empirical	Relating to a focus on physicality and manual practice rather than theory or calculation.	Compendium Volume 30 Number 4 p. 16-27

Envelope	All tangent lines of the outer	Compendium Vol. 17 No. 4 p. 23-30

	edge of a curve. “These tangent lines form a one-parameter family, where the envelope is the curve itself.” See Envelope Dial	

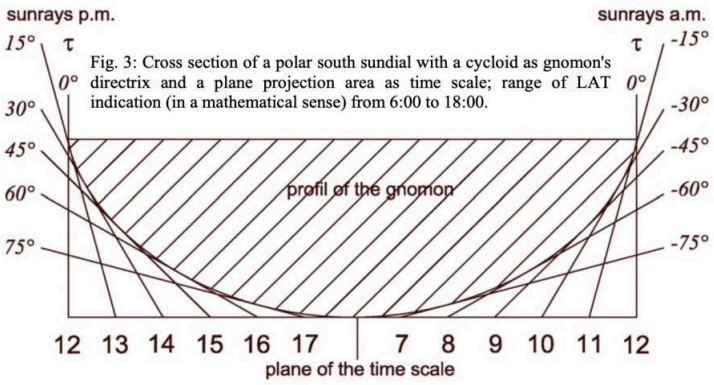
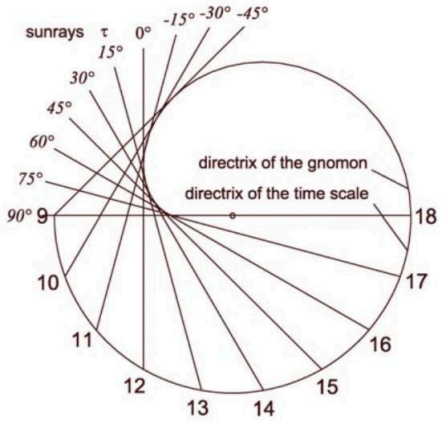


Fig. 3: Cross section of a polar south sundial with a cycloid as gnomon's directrix and a plane projection area as time scale; range of LAT indication (in a mathematical sense) from 6:00 to 18:00.



Photos: Ortwin Feustel, Compendium 17:4

Envelope Dial	A dial designed with curving elements following the envelope of the sun’s rays. “The hour is then given by the point of the shadow where the tangent is parallel to the hour lines”	Compendium Vol. 13 No. 1 p. 27-33 Compendium Vol. 14 No. 1 p. 13-16 Compendium Vol. 31 No. 2 p. 69-83

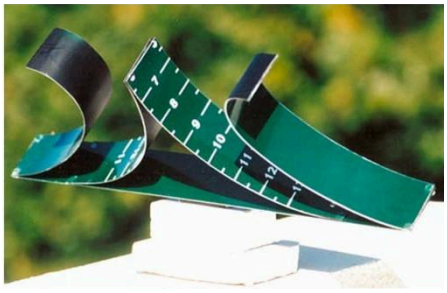


Photo: Sawyer, Compendium 14:1

Epact	The age of the moon at midnight on January 1st. Epact tables helped calculate the date	Compendium 31:1 pp 29-40

	of the full moon and other astronomical values. Epacts may be found alongside other volvelles on portable dials such as diptychs.	

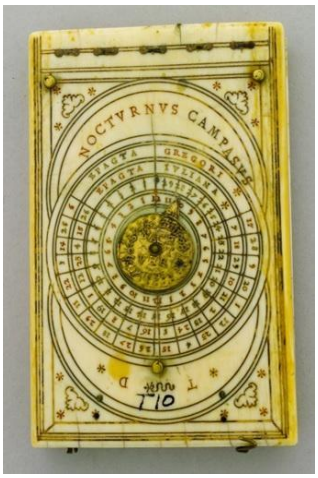


Photo: Adler Planetarium, Object T-10

Ephemeral	Describing impermanence. To be ephemeral is to be fleeting.	

Ephemeris	Tabulated predictions of celestial occurrences and patterns. These tables of information are not perpetual and must be recalculated after their initial predictive range expires.	

Equal Hours	Any hour system in which the length of each hour is the same throughout the year.	Compendium 19-1 pp 5-11

Equation of Time (EoT)	The time difference between Local Solar Time and Mean Solar Time. The value is a function of	Compendium Vol. 1 No. 1 p. 9-14 Compendium Vol. 4 No. 2 p. 32 Compendium Vol. 9 No. 2 p. 27-28

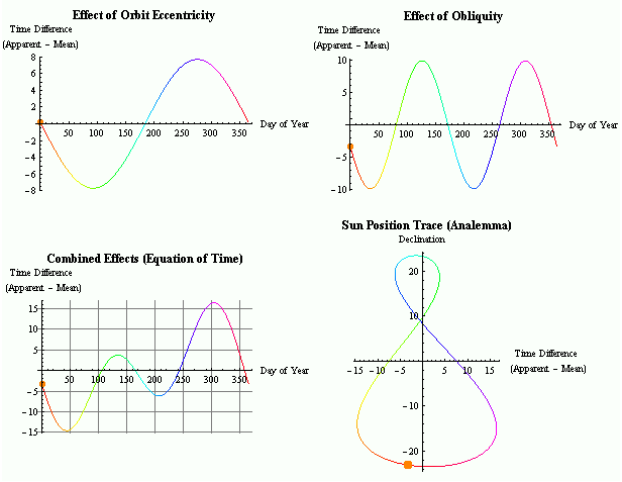
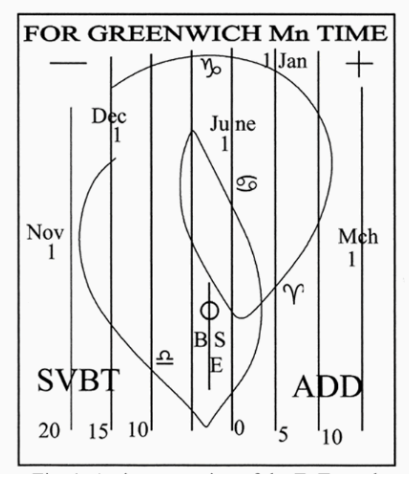
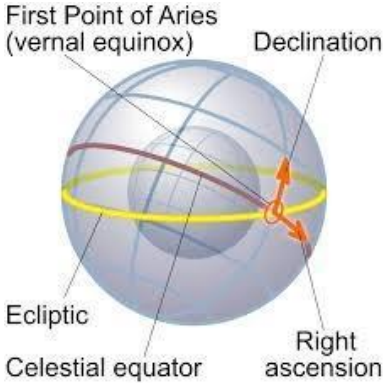
	the elliptical orbit of the earth and the tilt of the earth's axis relative to the ecliptic. When the equation of time is applied to a sundial displaying solar time, mean time is determined. To get to civil (clock) time, longitude and daylight savings corrections must also be accounted for. Note: Astronomers reverse the sign on the equation of time, starting from standard time to find solar time.	Compendium Vol. 10 No. 1 p. 24-30 Compendium Vol. 12 No. 3 p. 29-31 Compendium Vol. 14 No. 3 p. 29-33 Compendium Vol. 16 No. 4 p. 4-6, 23-29, 30-31 Compendium Vol. 18 No. 1 p. 18-20, 21 Compendium Vol. 20 No. 1 p. 32-33 Compendium Vol. 21 No. 1 p. 12-14, 21-31 Compendium Vol. 24 No. 2 p. 1-4 Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 29 No. 1 p. 5-6 Compendium Vol. 30 No. 1 p. 8-11 Compendium Vol. 31 No. 2 p. 1-9 Equation of Time, Wikipedia Current EoT Value
		

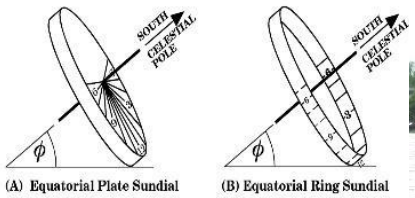
Photo: Wikimedia Commons, Rob Cook	**Photo: Bury St Edmund EoT, Fred Sawyer**

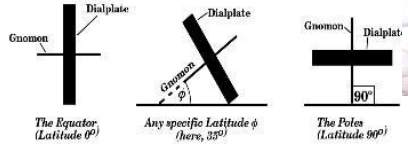
Equatorial Coordinates	A coordinate system wherein observations are made relative to the equatorial plane. In this system, right ascension and declination are used to describe a celestial object's position.	Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 26 No. 3 p. 27-35 Equatorial coordinate system, Wikipedia



(Wikimedia Commons, Cmglee).

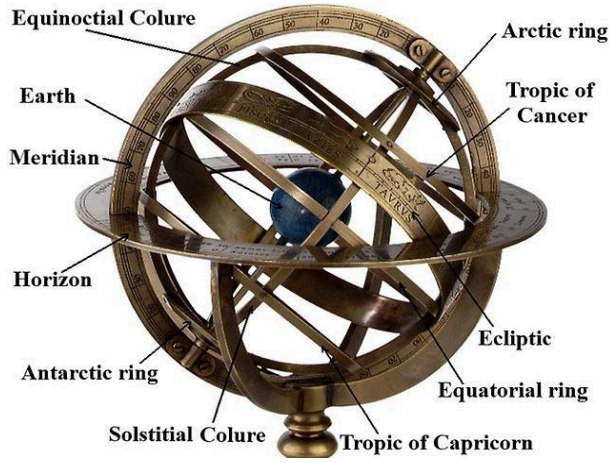
Equatorial Dial	A sundial with a polar gnomon and an hour plate that parallels the equator. Hours are spaced 15° apart.	Compendium Vol. 3 No. 3 p. 3-4 Compendium Vol. 5 No. 4 p. 1-8 Compendium Vol. 14 No. 2 p. 1-4 Compendium Vol. 19 No. 3 p. 1-4 Compendium Vol. 30 No. 3 p. 50-60



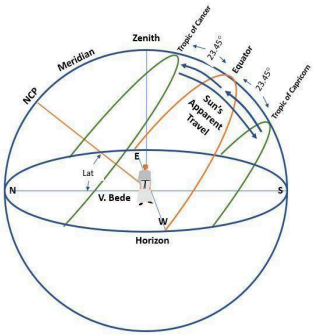


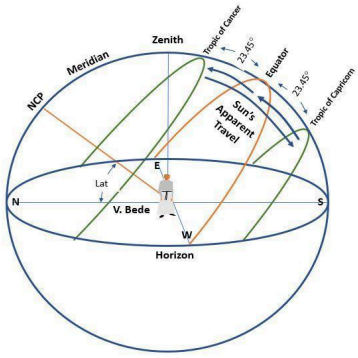
https://www.sundialsaustralia.com.au/equatorial-sundials

Photo: NASS Registry #24

Equinoctial Colure	On [armillary spheres] and some sundials, a [great circle] passing through the poles and the [ecliptic] at the first points of [Aries] and Libra–the [vernal] and [autumnal] [equinoxes].	
 **Photo: Kristjan Salev, Science of Gadgets**		

Equinox	The moment the center of the sun is on the celestial equator. The length of day and night are approximately equal, 12 hours, measured by [sunrise]/[sunset]. Sun rises at the East Cardinal Point and sets at the West Cardinal Point, approximately. “the precise point in time when the tilt of Earth's axis is neither leaning towards or away from the Sun, but rather leaning along its direction of travel along the ecliptic path” (Don Petrie, Compendium 27:3).	Compendium Vol. 15 No. 1 p. 1-4, 30-34 Compendium Vol. 21 No. 1 p. 35-36 Compendium Vol. 25 No. 2 p. 25-34 Compendium Vol. 25 No. 4 p. 4-15 Compendium Volume 27 Number 3 p. 27-33 Compendium Vol. 30 No. 3 p. 1-7 Compendium Vol. 31 No. 2 p. 1-9 [Equinox, Wikipedia]

	On the equinox, seasonal hours and common hours share the length of 60 minutes.	
 **Photo: NASS, Elements of Dialing**		

Equinox (Autumnal)	The moment the sun is on the celestial equator going southward in September. Occurs on the first point of Libra.	Compendium Vol. 15 No. 1 p. 1-4, 30-34 Compendium Vol. 21 No. 1 p. 35-36 Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 30 No. 3 p. 1-7
 **Photo: NASS, Elements of Dialing**		

Equinox (Vernal)	The moment the sun is on the celestial equator going northward in March. Equivalent to zero Right Ascension and the basis for Ecliptic Longitude. Also known as the First Point of Aries. The	Compendium Vol. 15 No. 1 p. 1-4, 30-34 Compendium Vol. 21 No. 1 p. 35-36 Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 30 No. 3 p. 1-7

	“start” of the zodiac.	

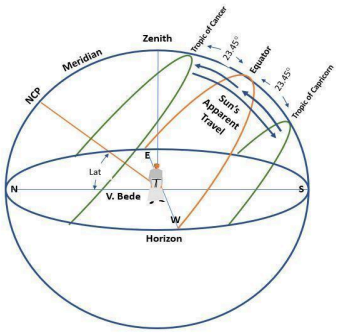


Photo: NASS, Elements of Dialing

F		
Face	The surface of the dial that receives the gnomon’s shadow.	

Fajr	One of the five Islamic prayer times, beginning at the start of astronomical twilight and ending at sunrise.	Compendium Vol. 27 No. 2 p. 10-18 Compendium Vol. 28 No. 2 p. 29-43 moonsighting.com

Farmer’s Ring	See ring dial	

Faux Dials	Sundial-like objects or sculptures that appear as if they might tell time, but do not.	Compendium Vol. 17 No. 1 p. 1-4

Photo: Compendium 17:1, Kellogg

First Point of Aries	That point on the celestial equator on the March/Vernal Equinox where the ecliptic crosses the celestial equator. 0h 0m 0s RA The First Point of Aries is no longer in the constellation of Aries due to precession.	Compendium Vol. 25 No. 3 p. 11-22

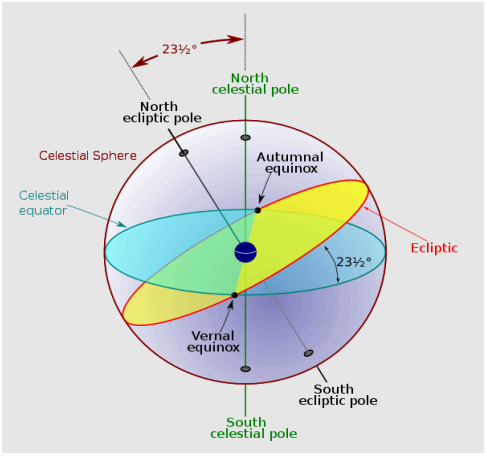
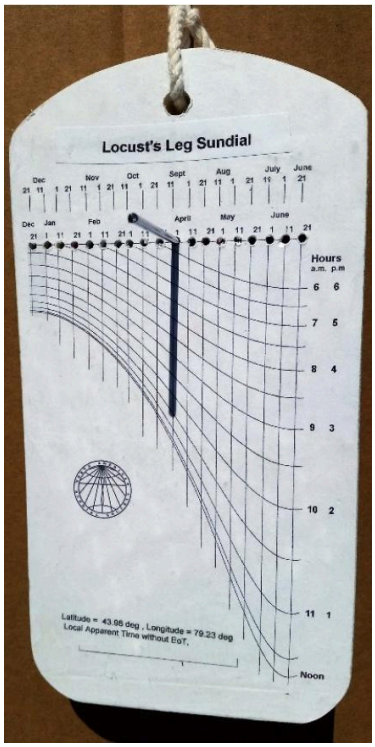


Photo: Wikimedia Commons, Sanu N

Flag Dial	The flattened/unwrapped form of the pillar dial. Often, flag dials feature a condensed face with declination lines indicating two dates each. "Hour Lines on the cylindrical	Compendium Vol. 25 No. 4 p. 30 Compendium Vol. 27 No. 1 p. 6-15 Compendium Vol. 29 No. 4 p. 38-52

	sundial plan are bilaterally symmetrical on either side of the solar noon line, so the Cylinder Dial plan can be divided vertically at the summer solstice date line into two mirror-image halves” (Don Petrie, Compendium 29:4).	
 Photo: Don Petrie, Compendium 29:4		

Floating Dial	Sundials built upon magnetized, “floating” compass cards, often enclosed within a glass dome. Due to the fixed nature of the dial, its small size, and an inability to correct it for magnetic declination, this dial offers relatively imprecise readings.	Compendium Vol. 4 No. 3 p. 1-7


Photos: Genuth, Terwillger & Heckenberg, Compendium 4:3

Flower Clock	A sundial with incorporated flowerbeds, organized in such a way that they bloom in succession with the passing hours. Alternatively, these dials may simply include furniture indicating the blooming hours of various flowers.	Compendium Vol. 23 No. 4 p. 35-36

Photo: Mark Montgomery, Compendium 23:4

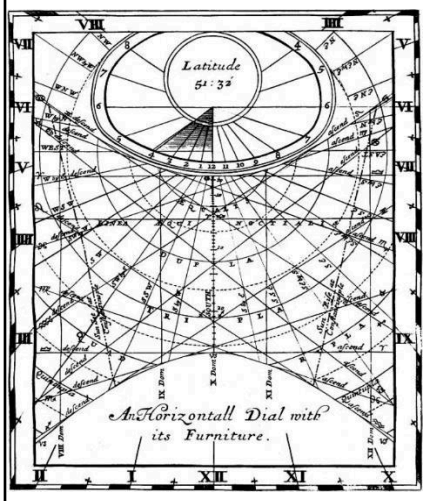
Foster-Lambert Dial	An azimuthal dial which produces a circular dial face with	Compendium Vol. 10 No. 4 p. 13-16

	equally spaced hour points.	Compendium Vol. 13 No. 4 p. 14-19 Compendium Vol. 23 No. 4 p. 23-33 Compendium Vol. 24 No. 2 p. 16-20 Compendium Vol. 30 No. 4 p. 45-49

Photo: Wikimedia Commons, S.Wetzel

French Hours	Early name for an equal hour system, 2 x 12 starting at noon and midnight. See Common Hours.	

Furniture	All features on a sundial face other than the core hour lines and associated numerals.	Compendium Vol. 7 No. 2 p. 28-29 Compendium Vol. 13 No. 1 p. 6-16 Compendium Vol. 15 No. 4 p. 11-21



G		
Gazetteer	On sundials, a tabulated list of cities and their corresponding latitudes.	
 **Photo: Adler Planetarium, T-57**https://www.researchgate.net/figure/A-colonial-administrator-Butterfield-type-sundial-made-in-Paris-by-Pierre-le-Maire-II_fig13_320026818		

Gemma's Rings	See Astronomical Ring Dial	

Geocentric	Astronomical model using the earth as the center of the solar system. Most sundial terminology assumes a geocentric view.	Compendium Vol. 25 No. 3 p. 11-22 Geocentric model, Wikipedia

Ghati	See Nadi	

Ghatika	See Nadi	

Globe Dial	A sundial that uses a sphere or globe as the dial face or the dial nodus. Note, dials that use a concave spherical face are commonly called spherical dials	Compendium 23-3, pp 7-20 Compendium 23-4, pp 16-22 Compendium 5-1, pp 21-22 Compendium Vol. 30 No. 3 p. 49

Photo: monticello.org

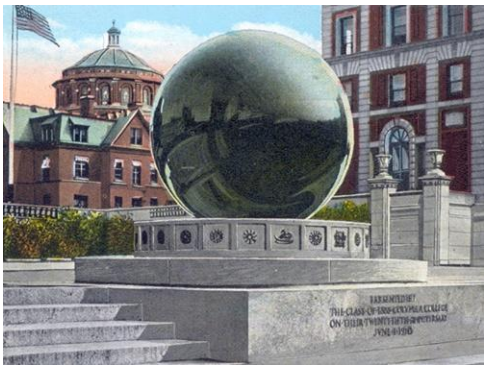


Photo: Wikimedia Commons, Columbia Univ.

Gnomon	The part of the sundial that casts a shadow. Derived from the Greek word meaning “pointer.”	Compendium Vol. 12 No. 4 p. 14-18 Compendium Vol. 14 No. 3 p. 1-4 Compendium Vol. 16 No. 4 p. 1-3 Compendium Vol. 20 No. 1 p. 1-2 Compendium Vol. 26 No. 4 p. 1-4 Compendium Vol. 28 No. 1 p. 1-6

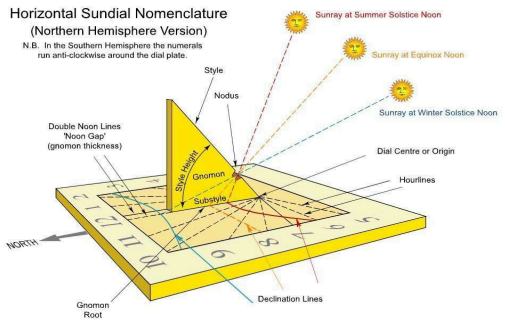


Photo: British Sundial Society

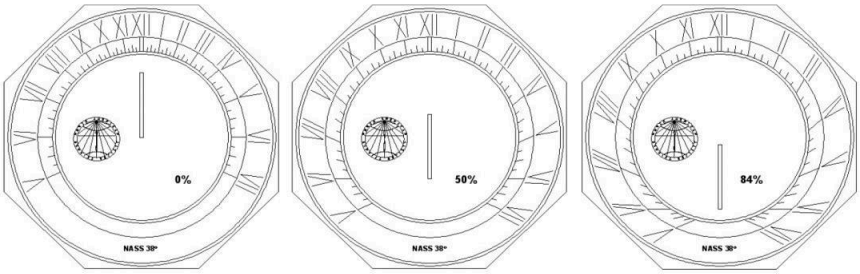


Fig. 3 Moving the gnomon’s position.

Photo: Kellogg, Compendium 20-1

Gnomon Height	Angle of the gnomon relative to the dial face. On a horizontal dial, gnomon height = local latitude.	Compendium Vol. 13 No. 1 p. 1-3

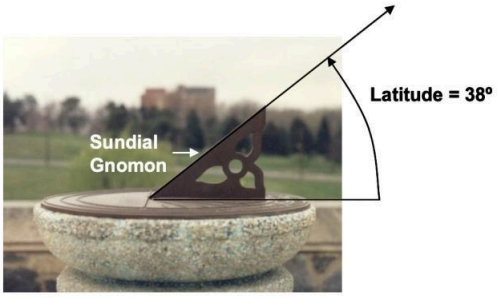


Figure 1 Latitude of Sundial Gnomon Matches Site Latitude

Photo: Kellogg, Compendium 13-1

Gnomonic Projection	A map projection that renders any great circle drawn as a straight line.	Compendium Vol. 12 No. 1 p. 1-8 Compendium Vol. 21 No. 3 p. 4-13 Compendium Vol. 29 No. 2 p. 37-41

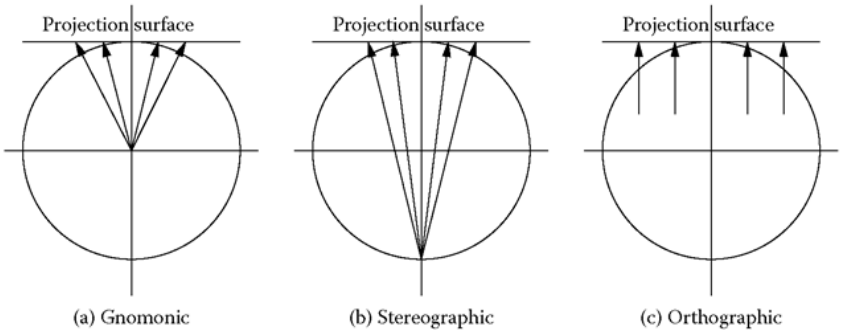


Photo: https://what-when-how.com/the-3-d-global-spatial-data-model/projection-criteria-map-projections-and-state-plane-coordinates-the-3-d-global-spatial-data-model/

Gnomonics	The study and science of sundials.	Gnomonics, Wikipedia
Goniometer	An instrument used to precisely measure angles.	Goniometer, Wikipedia Goniometer, Britannica

Great Circle	Any circle drawn on a globe	

	whose diameter is equal to the diameter of the sphere. The plane of a great circle will always intersect the sphere's center.	

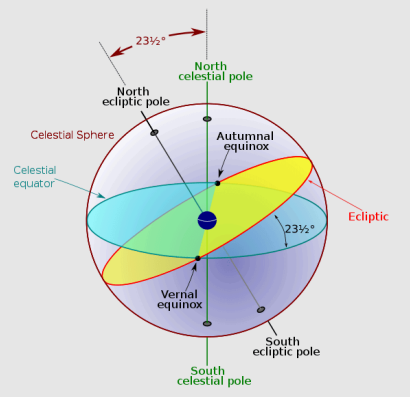


Photo: Wikimedia Commons, Sanu N

Great Year	One full precession cycle; 25,772 years. The extremes of the cycle result in either Polaris or Vega becoming pole stars.	Compendium Volume 27 Number 3 p. 27-33

H		
Hand-dial	Certain techniques devised for creating a sundial with one's own hand(s). Through specific placements of the digits, an approximation of the solar time can be measured	Compendium Vol. 7 No. 3 p. 18-23 Compendium Vol. 9 No. 1 p. 29-30 Hand Dials, Karen's Sundial Page

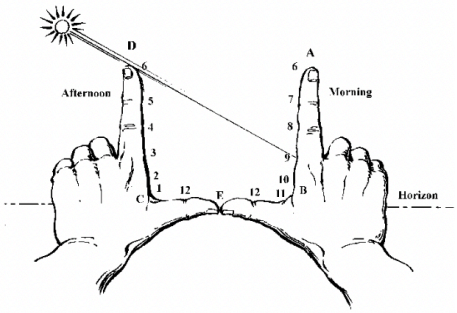


Photo: Sawyer, Compendium 7:3

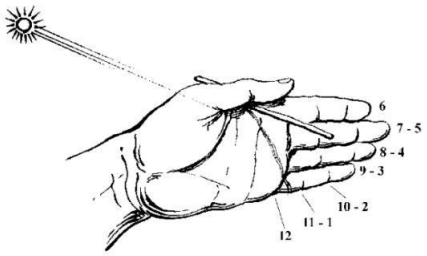


Photo: Sawyer, Compendium 7:3

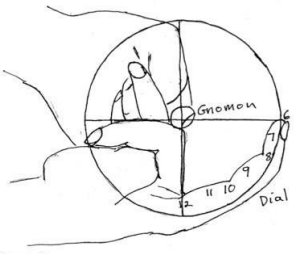


Photo: Robinson, Compendium 9:1

Heliocentric	Astronomical model using the sun as the center of the solar system.	Compendium Vol. 25 No. 3 p. 11-22 Heliocentric orbit, Wikipedia

Heliochronometer	A precision sundial which incorporates the equation of time and longitude correction to allow civil time to be read directly from the dial face.	Compendium Vol. 5 No. 4 p. 26-27 Compendium Vol. 8 No. 3 p. 14-16 Compendium Vol. 10 No. 4 p. 17 Compendium Vol. 16 No. 3 p. 13-19 Compendium Vol. 21 No. 2 p. 5-11, 12-22 Compendium Vol. 23 No. 1 p. 11-24 Compendium Vol. 23 No. 3 p. 21-26 Compendium Vol. 24 No. 2 p. 29-30 Compendium Vol. 24 No. 3 p. 29-31 Compendium Vol. 24 No. 4 p. 7-14 Compendium Vol. 25 No. 1 p. 21-23 Compendium Vol. 29 No. 1 p. 20-23

Photo: Precision Sundials

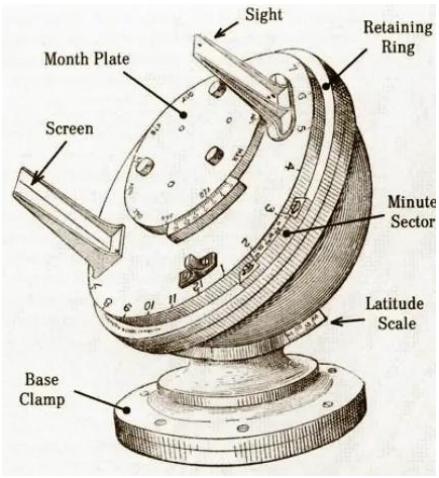
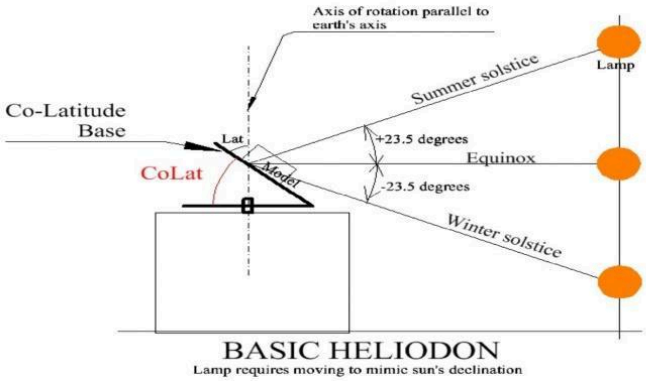


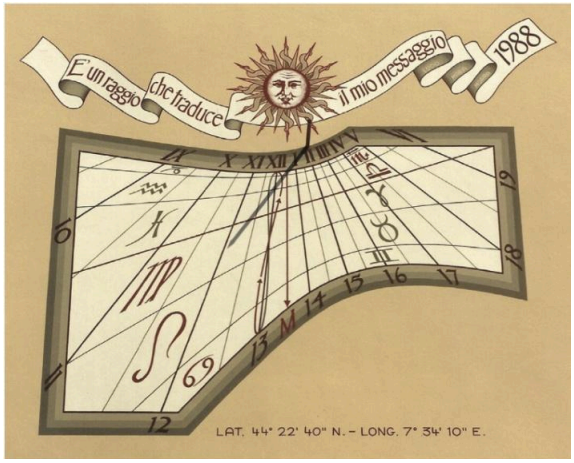
Photo: UK Patent No. 10,787

https://www.ukaa.com/pilkington--and--gibbs-helio-chronometer-sundial-6269

Heliodon	"A device that simulates sunlight at a location, date, and time of your choosing." While some heliodons materially represent the celestial sphere much like the armillary sphere, others achieve the same effect by using a single, fixed lamp and an angled, rotatable horizon.	Compendium Vol. 17 No. 4 p. 34-36 Compendium Vol. 25 No. 4 p. 1-3 Compendium Vol. 26 No. 3 p. 27-28



Photos: Albinson, Compendium 26:3

Heliodrome (Sundial)	The full, functional area of a dial that receives sunlight. Physical obstructions may diminish a dial's heliodrome, as well as the orientation and dimensional limits of the dial itself. A dial's heliodrome can be expressed as a percentage of the celestial heliodrome: "An unrestricted horizontal dial meets the whole celestial heliodrome with an efficiency of 100%." See Operating Limit	Compendium Vol. 27 No. 3 p. 7-14
 **Photo: Savian, Compendium 27:3**		

Heliograph	See Campbell-Stokes Recorder	

Helioscope	An observational device used to safely view a projected image of the sun	Museo Galileo

		University of Michigan Library Digital Collections

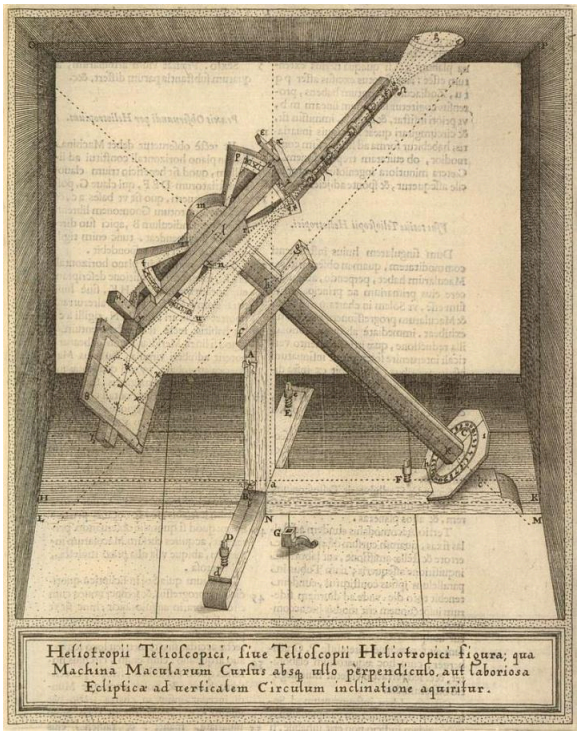
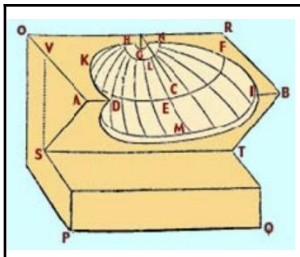


Photo: Wikimedia Commons, Christoph Scheiner

Heliotropism	The tendency for certain plants and animals to face/follow the sun.	Compendium Vol. 27 No. 4 p. 1-4

Hemicyclium	A sundial with hour lines drawn on a concave, spherical surface. This type of dial is similar to the scaphe, except that the lower portion–which never receives the nodus' indicating point–is cleaved away at a slanting angle.	Compendium Vol. 13 No. 2 p. 27-30 Compendium Vol. 18 No. 4 p. 27-33 Compendium Vol. 19 No. 1 p. 27-32 Compendium Vol. 21 No. 3 p. 23-30 Compendium Vol. 26 No. 3 p. 19-26



Photos: Goretti, Compendium 19:1

Hemispherium	See Scaphe	

Heteroscian	One who lives between the tropics and the arctic circles.	Compendium Vol. 1 No. 3 p. 19

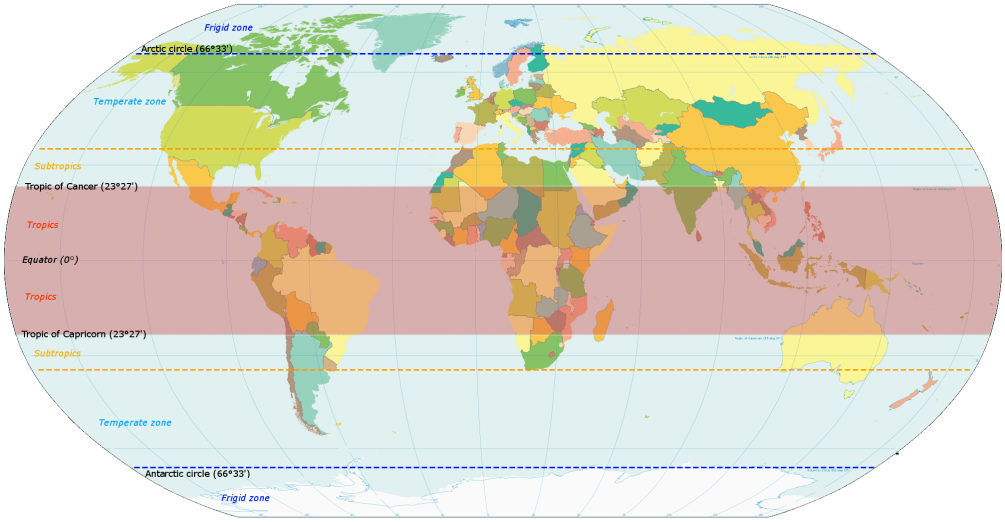


Photo: Wikimedia, KVDP

Hevelius Altitude Dial	A portable altitude dial featuring an enclosed hour scale and nodus adjustable for solar declination. The unused space of the dial may contain an epact or perpetual calendar. While most dials of this type operate within a single latitude, some can be made universal.	Compendium Vol. 29 No. 1 p. 57-76 Compendium Vol. 29 No. 2 p. 42-49 Compendium Vol. 29 No. 3 p. 51-58 Compendium Vol. 29 No. 4 p. 81-82

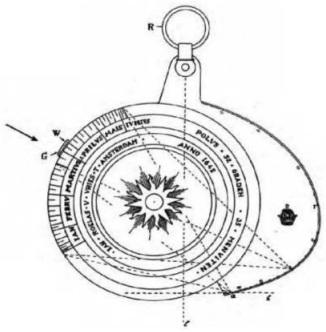


Photo: R. H. van Gent, Guicheteau, Compendium 29:1

Horae ab occasu solis	"Hours from sunset." See Italian Hours	

Horae ab ortu solis	"Hours from sunrise." See Babylonian Hours	

Horizon	The plane tangent to an observer on the earth. Because it is dependent on the location of the observer, the horizon is entirely local.	Horizon, Wikipedia

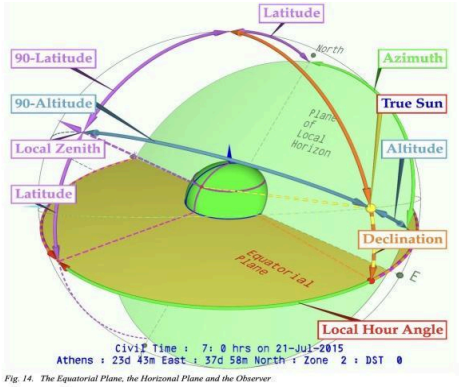
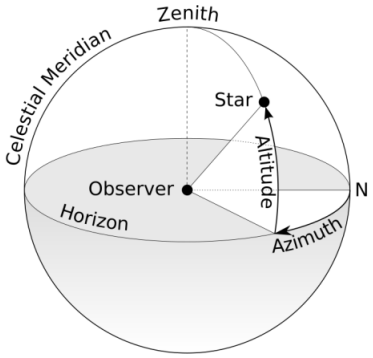


Fig. 14. The Equatorial Plane, the Horizonal Plane and the Observer

Photo: Kevin Karney, Basic Astronomy for the Gnomonist

Horizontal Coordinates	A coordinate system wherein observations are made relative to the	Compendium Vol. 26 No. 3 p. 27-35 Compendium Vol. 29 No. 2 p. 37-41

	overseer's local horizon. In this system, altitude and azimuth are used to describe a celestial object's position.	Horizontal coordinate system, Wikipedia
 (Wikimedia Commons, TWCarlson).		

Horizontal Dial	Sundial with its dial face parallel to the horizontal plane $\tan \theta = \tan t \sin \varphi$ θ: Angle of hour line measured from noon t: Hour Angle φ: Latitude	Compendium Vol. 4 No. 1 p. 1-11, 14-17 Compendium Vol. 7 No. 2 p. 18-22 Compendium Vol. 9 No. 3 p. 19-26 Compendium Vol. 12 No. 3 p. 13-27 Compendium Vol. 19 No. 1 p. 33-35 Compendium Vol. 19 No. 2 p. 4-5 Compendium Vol. 19 No. 4 p. 39 Compendium Vol. 20 No. 1 p. 31 Compendium Vol. 20 No. 2 p. 37 Compendium Vol. 20 No. 3 p. 39 Compendium Vol. 21 No. 1 p. 25-28 Compendium Vol. 21 No. 3 p. 13

		Compendium Vol. 27 No. 3 p. 15-19 Compendium Vol. 23 No. 4 p. 37 Compendium Vol. 24 No. 2 p. 36 Compendium Vol. 24 No. 4 p. 15-20 Compendium Vol. 25 No. 3 p. 3-6 Compendium Vol. 27 No. 3 p. 15-19 Compendium Vol. 30 No. 2 p. 1-6 Compendium Vol. 31 No. 1 p. 9-18

Photo: Craig, Compendium

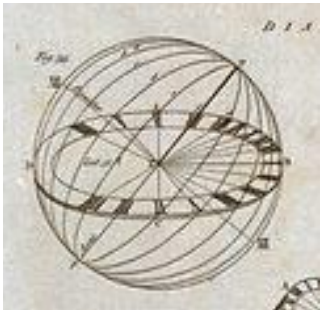


Photo: Engraving by John Taylor, Lool and Learn History Picture Archive

Horologium	A Latin term to encompass all time-telling instruments, including sundials and water clocks.	

Hour Angle (t)	The clockwise angular measure of the sun/star from the meridian. 15°/hr, -180° to + 180° $\tan(t) = \sin(Az) / (\tan(Alt)\cos(\varphi) + \sin(\varphi)\cos(Az))$ $\cos(t) = -\tan(\varphi)\tan(\delta)$ $t = (T_{24} - 12) * 15°$ Difference between the local	Compendium Vol. 10 No. 2 p. 29-34 Hour angle, Wikipedia

	longitude and the longitude where the sun is currently on the meridian. Local Solar Time = (12 + HA/15) hours. Afternoon (PM), positive HA are west of the local meridian. Morning (AM), negative HA are east of the local meridian. One hour = 15º longitude.	

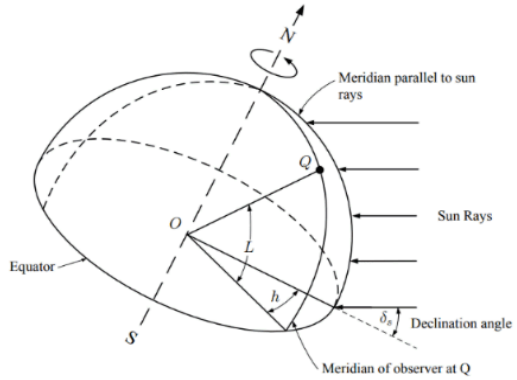


Photo: Ricardo Vasquez Padilla, Simplified Methodology for Designing Parabolic Trough Solar Power Plants, 2011

Hour Angle Dial	Sundials that measure time by the hour angle of the sun (as opposed to its altitude).	

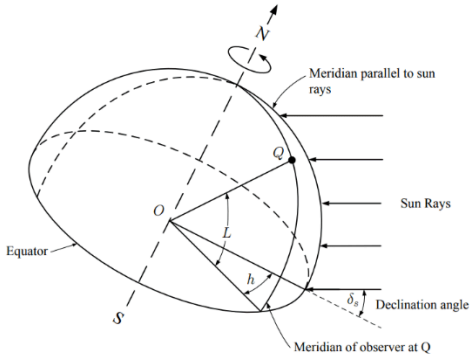
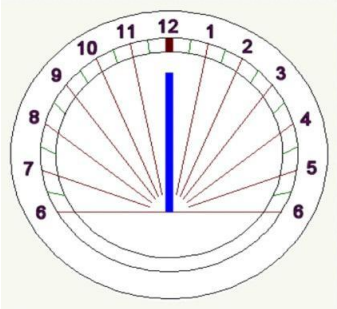
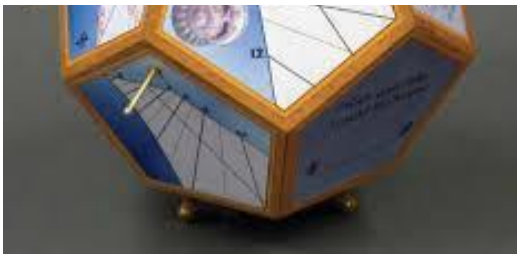


Photo: Ricardo Vasquez Padilla, Simplified Methodology for Designing Parabolic Trough Solar Power Plants, 2011

Hour Line Angle	The angle an hour line on the dial face makes with the noon	Compendium Vol. 3 No. 3 p. 5-7

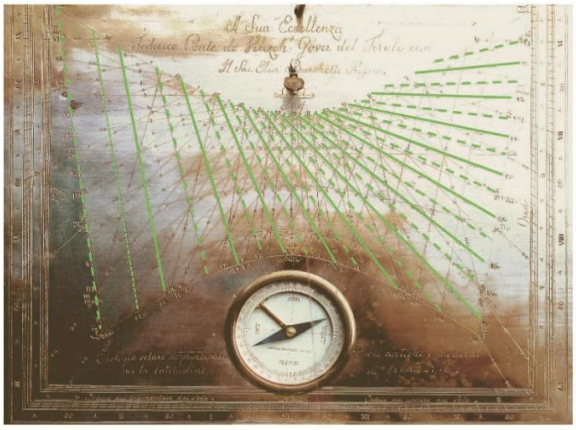
	line.	Compendium Vol. 4 No. 4 p. 14-20 Compendium Vol. 8 No. 2 p. 24-27 Compendium Vol. 9 No. 2 p. 29-31 Compendium Vol. 10 No. 2 p. 29-34
		

I		
Icelandic Spar	See Optical Calcite	

Inclining Dial	A vertical sundial whose face is tilted backward (downwards). The angle between a horizontal line and the face of the dial. Horizontal = 0^{o}; vertical downward = -90^{o} In mathematical expressions, the inclination of a dial is typically represented with ı	Compendium Vol. 19 No. 2 p. 10-19 Compendium Vol. 21 No. 1 p. 17-20, 29-34 Compendium Vol. 21 No. 2 p. 35-39 Compendium Vol. 25 No. 2 p. 25-34
 **Photo: Snyder, Compendium 19:2**		

Isha	One of the five Islamic prayer times, beginning at the end of	Compendium Vol. 28 No. 2 p. 29-43

	astronomical twilight and ending at midnight.	moonsighting.com

Italian Hours	An equal hour system which counts the number of hours from the prior sunset, 0 – 24	Compendium Vol. 5 No. 2 p. 1-6 Compendium Vol. 5 No. 3 p. 2-4 Compendium Vol. 5 No. 4 p. 13-19 Compendium Vol. 13 No. 3 p. 21-23 Compendium Vol. 16 No. 3 p. 24-32 Compendium Vol. 18 No. 2 p. 22-25 Compendium Vol. 26 No. 4 p. 22-27 Compendium Vol. 27 No. 1 p. 16-18 Compendium Vol. 28 No. 2 p. 58-68
https://www.shadowspro.com/en/user-manual.html  **Photo: Armin Denoth, Compendium 26:4**		

J		
Jacob's Ladder	See Sun Pillar	

Julian Century	"The time elapsed since January 1, 2000, 12 UT, measured in 'centuries' of 36525 days." (De Rijcke, Compendium 31:1).	Compendium Volume 31 Number 1 p. 15
$T = \frac{\text{JD} - 2451545.0}{36525}.$		

Julian Day	"The number of days passed since January 1, 4712 BCE, 12:00 UT" (De Rijcke, Compendium 31:1).	Compendium Volume 31 Number 1 p. 15

Algorithm used to calculate the current Julian Day:

Input:	Y (year), M (month), D (day) in the Gregorian calendar, UT (time in Universal Time)
Output:	JD (Julian Day)

$D = D + \frac{\text{UT}}{24}$

if $M = 1$ or 2:

$Y \to Y - 1$

$M \to M + 12$

$A = \text{INT}\left(\frac{Y}{100}\right)$

$B = 2 - A + \text{INT}\left(\frac{A}{4}\right)$

$\text{JD} = \text{INT}\big(365.25(Y + 4716)\big) + \text{INT}\big(30.6001(M + 1)\big) + D + B - 1524.5$

(De Rijcke, Compendium 31:1).

K		
Klappsonnenuhr	German for "folding sundial." This type of dial was the first to feature a built-in compass, bringing hour-angle dials into the realm of portability. See diptych dial	Compendium Vol. 27 No. 1 p. 25

Photo: Helmut Sonderegger, Compendium 27:1

L		
Latitude (φ)	Angular measure from the equator to a place on the earth. North is positive, south is negative. +90°N to -90°S. The equator is 0°. Degrees of latitude are separated by 110.9 km, or 68.9 miles. Local latitude can be measured by sighting the angle between the horizon and Polaris.	Compendium Vol. 13 No. 3 p. 1-3 Compendium Vol. 29 No. 2 p. 37-41 Latitude, Wikipedia

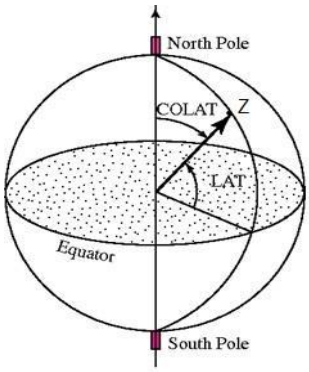


Photo: https://www.semanticscholar.org/paper/Using-Satellite-Technology-(global-Positioning-to-'brien/c3fc9ad8f712fb7a8455d606144a4e6cda259782

Latitude-Independent Sundial	"Latitude-independent sundials are not simply universal in design. They are dials that can be properly oriented to indicate the correct time without the dialist having precise knowledge of the latitude, either in designing or using the dial"	Compendium Vol. 29 No. 4 p. 70-77 Compendium Vol. 30 No. 1 p. 16-30

Limb	The raised ridge permanently attached to the mater responsible for keeping the tympans nested within.	

Local Apparent Time	See Local Solar Time	Compendium Vol. 25 No. 3 p. 11-22

Local Solar Time	Solar time measured by the real sun. Time = (12 + Hour Angle/15) hours. When the sun is on local meridian, LST = 12:00.	Compendium Vol. 25 No. 3 p. 11-22

Locust's Leg	See Solar Decliners	

Longitude (λ)	Angular measure from the Greenwich, England, meridian to a place on the earth. East is positive, west is negative. -180º to + 180º. See Prime Meridian	Compendium Vol. 13 No. 2 p. 1-2 Longitude, Wikipedia

Longitude Correction	The longitude correction is one of 3 adjustments needed to translate local solar time into clock time. Each standard time zone has a central meridian, which is	Compendium Vol. 7 No. 1 p. 4-9 Compendium Vol. 25 No. 3 p. 20

	measured in 15° increments from 0° longitude. To find the longitude correction, multiply each degree you are away from the time zone meridian by 4. If you are west from the center, add this number to the current solar time. If east, subtract it. To calculate civil time, add the EoT to this, plus daylight saving time if applicable.	

Lunar Age	The number of days since the last new moon.	Compendium 1-2 pp 6-11

Lunar Month	See Synodic Month	

Lunar Nodes	The two points where the moon's orbit intersects the ecliptic plane. The Moon's orbit is inclined to the ecliptic 5.14º. When the nodes lie on the ecliptic plane, solar and lunar eclipses occur. The nodes appear to move along the ecliptic from east to west. See Ascending Node, Descending Node	Compendium Volume 24 Number 1 p. 1-4 Compendium Volume 31 Number 1 p. 1-8 Lunar Node, Wikipedia

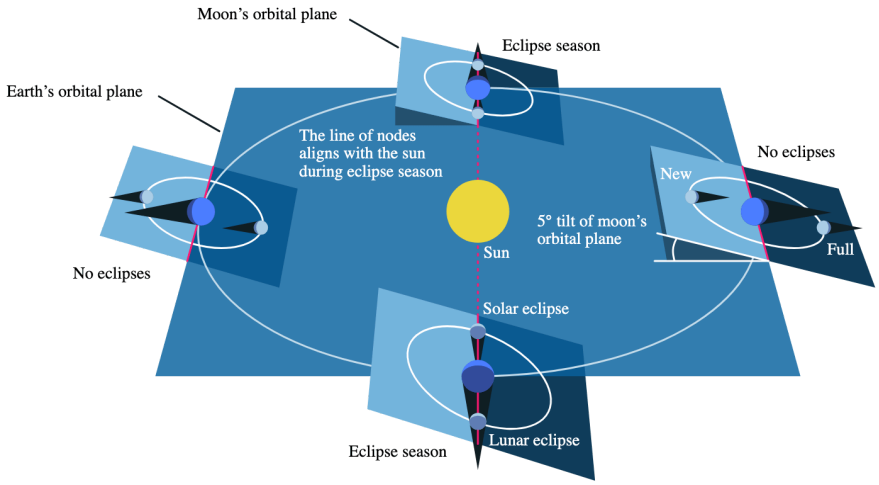


Photo: Wikimedia Commons, Nela (nyabla.net)

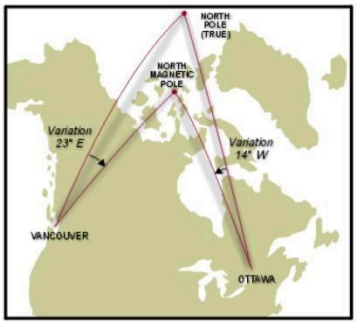
Lunar Volvelle	A series of layered discs decorated with graduated scales and cutouts used to make calculations pertaining to the positions of the sun and moon. Perhaps the most common use of the lunar volvelle is to determine solar time from the moon's hour-angle. To do this, the age of the moon must be known.	Compendium Volume 30 Number 4 p. 50-66 Compendium Volume 31 Number 1 p. 29-40 Binding the Heavens, Astrolabe Project Lunar Volvelle Simulator, Astrolabe Project

Photo: Richard Wymarc, Astrolabe Project

Lunation	The time between successive New Moons. Typically given as 29 days, 12 hours, 44 minutes and 3 seconds.	Compendium 21-4, pp 1-4 Compendium 24-1, pp 1-4

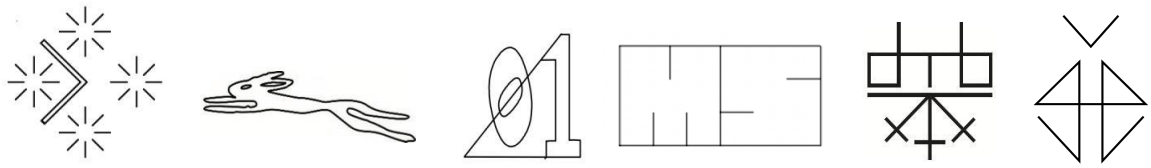
M		
Magnetic Declination	Angular distance between the North Cardinal Point (True North) and magnetic north. Value changes with location and time.	Compendium Vol. 26 No. 4 p. 19-21 Compendium Vol. 31 No. 3 p. 26-43 Magnetic declination calculator, MOAA

Maghrib	One of the five Islamic prayer times, beginning at sunset and ending at the end of astronomical twilight.	Compendium Vol. 27 No. 2 p. 10-18 Compendium Vol. 28 No. 2 p. 29-43 moonsighting.com

Magnetic north	The direction indicated by a magnetic compass. Direction will change with location and time. The magnetic pole moves approximately 28 miles/yr.	Compendium Vol. 31 No. 3 p. 26-43 North magnetic pole, Wikipedia
 **Photo: Robin Kedward, www.sdkc.org**		

Magnetic Variation	With respect to the reading of a magnetic compass, the interference introduced by local objects containing large amounts of iron or other metals.	Compendium Vol. 31 No. 3 p. 26-43

	Magnetic variation can be considered analogous to magnetic declination, though on a hyper-local scale.	

Maker's Mark	A unique signature used to designate the work of a particular craftsman.	
		

Mariner's astrolabe	A navigational instrument used to determine a star's altitude, to calculate a ship's latitude. Not a proper astrolabe, but a graduated circle with an alidade to measure vertical angles. This device lacks the computational ability of its namesake. Designed to be used at sea, the mariner's astrolabe is rather skeletal and made of very thick metal thus ensuring the instrument remains level and unmoved by winds as it is suspended from an outstretched arm.	
 **Photo: Wikimedia Commons, Neochichiri11**		

Mass dial	Medieval, vertical south facing dial used to mark the time of	Compendium Vol. 9 No. 3 p. 6-11

	church mass. Often marked with seasonal or canonical hours.	Compendium Vol. 18 No. 3 p. 35-36 Compendium Vol. 19 No. 1 p. 5-11 Compendium Vol. 26 No. 2 p. 10-

Frans W Maes, Compendium 19:1

Mater	The “base” component of the astrolabe. The mater cradles the tympans within the womb. The Throne and Limb are permanently attached to the Mater. The reverse side of the mater carries the alidade and several scales suited for sighting angles and referencing dates.	
https://archive.org/details/ilmetauqeet_gmail_659/page/n25/mode/1up?view=theater		

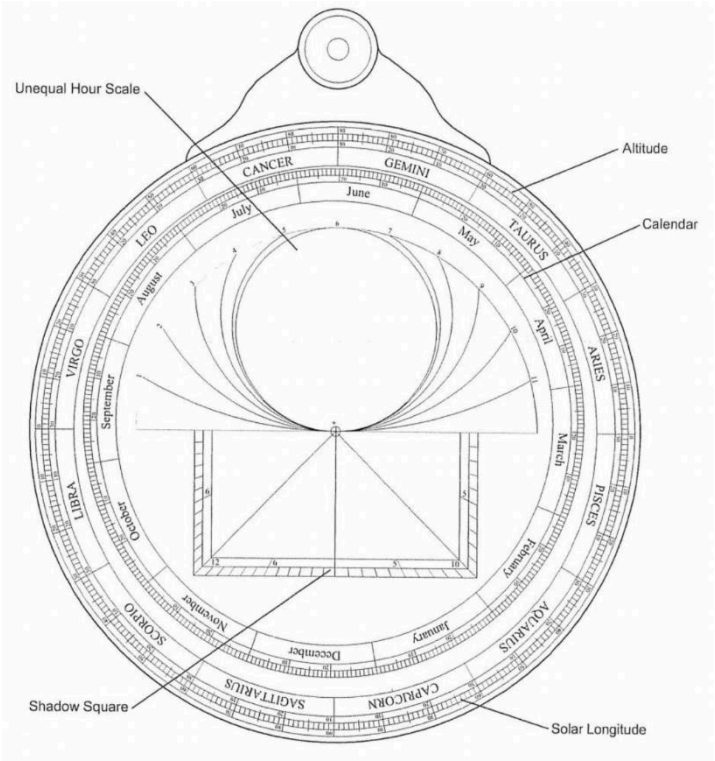


Photo: Richard Wymarc, Astrolabe Project

Mean	Average: the total sum of a set divided by the number of items. See Mean Solar Day, Mean Solar Time	

Mean solar day	Time between successive local meridian transits of the mean sun.	Compendium Vol. 14 No. 4 p. 14-19 Compendium Vol. 15 No. 1 p. 35-38

Mean Solar Time	Local Solar time with the EoT applied. Mean time at the center meridian of a time zone dictates civil time. See Mean Sun	Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 30 No. 1 p. 1-6

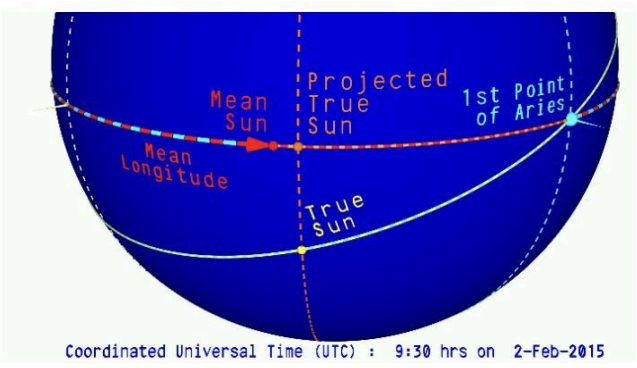


Fig. 5 The Mean Sun & Mean Longitude

Photo: Kevin Karney, Compendium 25:3

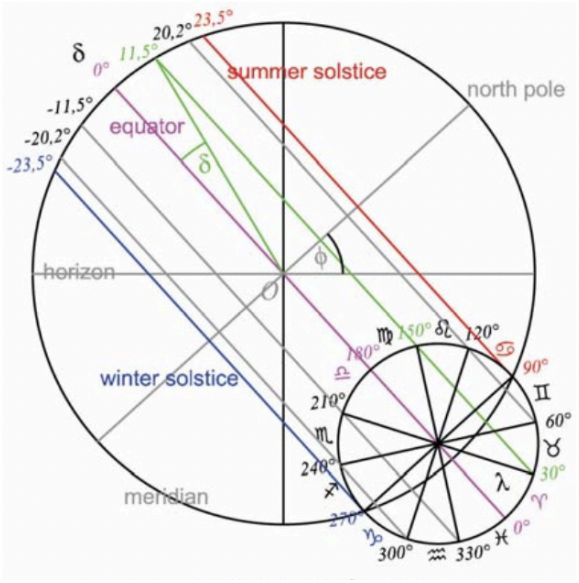
Mean Sun	A fictional sun that travels around the celestial equator at a speed is equal to the average (mean) rate of the Earth's rotation for a year. Unlike the apparent sun, the mean sun does not travel along the ecliptic or have an irregular rate of motion. The equation of time effectively transforms the apparent sun into the mean sun, averaging the variations introduced by the earth's tilt and eccentric orbit. The mean sun provides the basis for the mean solar day.	Compendium Vol. 14 No. 4 p. 14-19 Compendium Vol. 15 No. 1 p. 35-38 Compendium Vol. 25 No. 3 p. 11-22

Mean Time Dial	A sundial with adjustments made for the Equation of Time but not the longitude correction. These dials read local mean solar time.	Compendium Vol. 13 No. 3 p. 13-17

Mechanical Equatorial Dial	Mechanical equatorial dials are stationary, yet do not passively display the hour. First, the user must manually rotate an alidade or other sighting element to face the sun. While the central arm indicates the hour, its manual rotation engages gearing that displays the minute, often on a smaller sub-dial. On some dials, there is no hour arm and a single clock dial displays both the hour and minute.	Compendium Vol. 31 No. 3 p. 26-43 Compendium Vol. 24 No. 3 p. 29-31
 Photo: Daderot, Wikimedia Commons		

Menaeus	A component used in the graphical construction of various types of dials. The menaeus can be used to construct the declination scales of the regiomontanus, equatorial ring, and analemmatic dials, among others. Particularly relevant to the use of the Analemma of Vitruvius, the menaeus is a circle that, when divided into 12 equal parts, can project parallel	Compendium Vol. 24 No. 3 p. 10-25

	declination lines.	



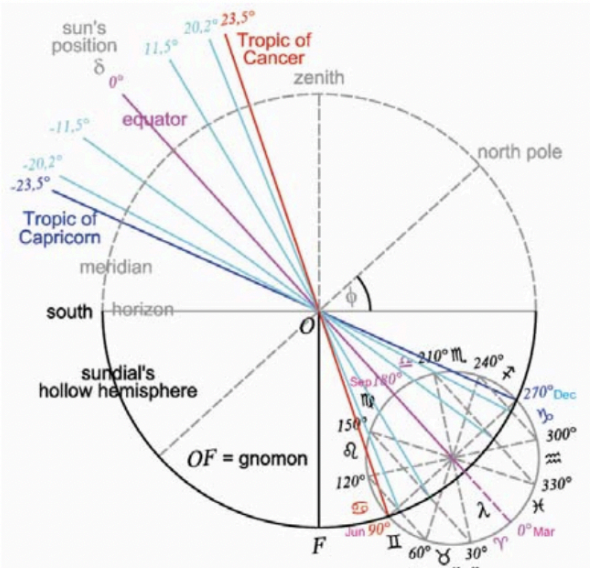


Photo: Ortwin Feustel, Compendium 24:3

Menza Sphera	A latitude-dependent Roman hemispherical guide used to draw hour lines on planar and spherical dials. The spacing of hours of the hemisphere can theoretically be manufactured to reflect any hour system. When the central hole of the hemisphere is placed over the nodus of a dial, rods can be inserted through each hour-hole, modeling the position of the sun and thus the various shadows cast.	Compendium Vol. 26 No. 1 p. 17-19

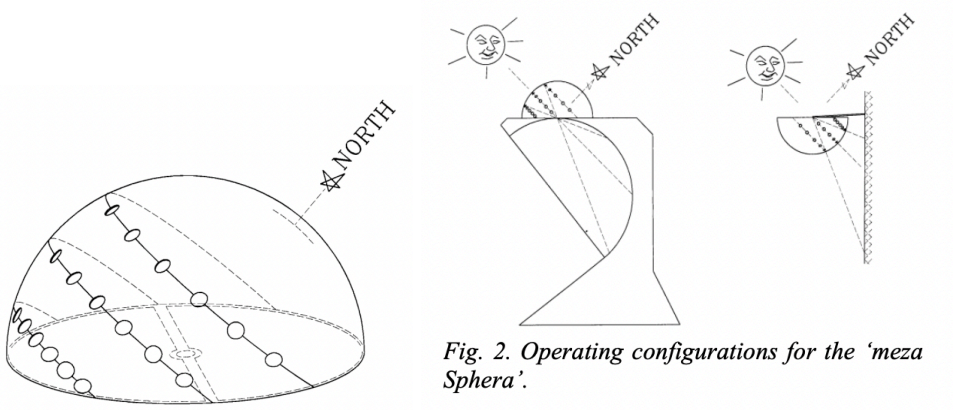


Fig. 2. Operating configurations for the 'meza Sphera'.

Photos: Alessandro Gunella, Compendium 26:1

Meridian	A celestial arc passing from due south (South Cardinal Point), through the zenith, and due north (North Cardinal Point).	Compendium Vol. 9 No. 2 p. 7-16 Compendium Vol. 4 No. 3 p. 23-27 Compendium Vol. 10 No. 3 p. 15-17 Compendium Vol. 12 No. 2 p. 1-4 Compendium Vol. 14 No. 3 p. 5-7 Compendium Vol. 19 No. 3 p. 5-11 Compendium Vol. 19 No. 4 p. 11-17 Compendium Vol. 24 No. 3 p. 32-37 Compendium Vol. 27 No. 1 p. 38-41 Compendium Vol. 28 No. 4 p. 36-43

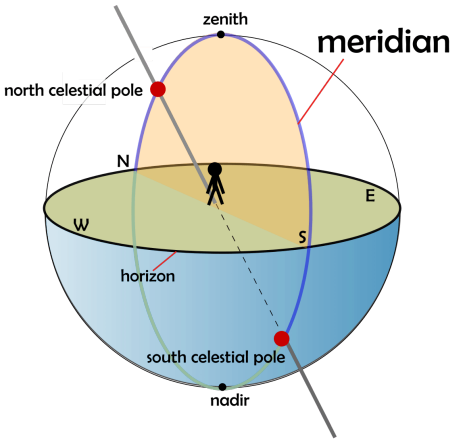


Photo: Wikimedia Commons, Amitchell125

Meridian Dial	See Noon Mark	

Metonic Cycle	A cycle of 19 years or 235 lunar months over which the sun and moon return to the same relative positions in the celestial sphere.	Compendium 25-3, pp 11-22 Compendium 26-2, pp 10-13

Moondial	A sundial together with a mechanism to correct for the difference between solar and lunar hour angles. The moon dial uses the moon's shadow to directly read local solar time using only the information on the dial furniture. The correction value may be supplied by a table, an incorporated lunar volvelle, lunar hour lines or a movable gnomon.	Compendium Vol. 1 No. 2 p. 6-11 Compendium Vol. 6 No. 2 p. 11-13 Compendium Volume 31 Number 1 p. 29-40

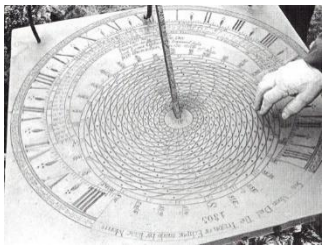


Photo: Christopher Daniels (1995), Compendium 31:3

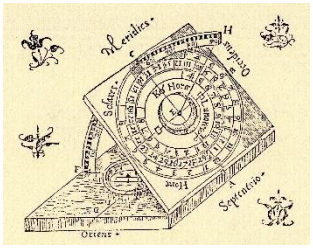


Photo: Oronce Fine (1560) , Compendium 31:3https://www.britishmuseum.org/collection/object/H_1871-1115-10

Muhutra	In ancient Indian science, a unit of time equal to 28 minutes. One Muhutra is defined as 2 Nadis.	Compendium Vol. 24 No. 2 p. 10-11

Multi-Dial	Multiple sundials present in a single form. In some cases, each dial will operate under a different mathematical basis, such as in the case of the self-orienting analemmatic dial. In cases such as this, the dial becomes self-orienting. Also see Polyhedral Dial	Compendium Vol. 29 No. 3 p. 29-38

Photo: NASS Registry #733

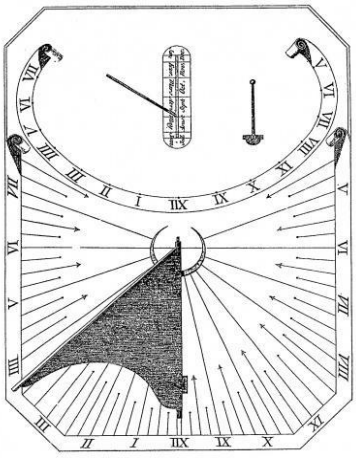
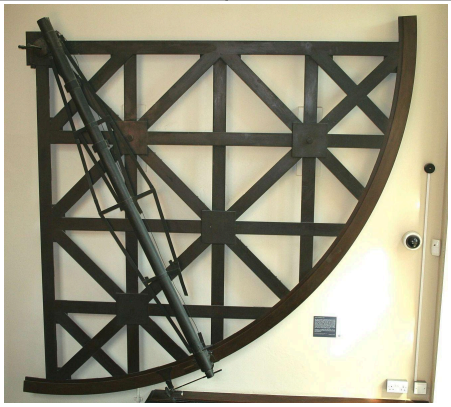


Photo: Dom Francois Bedos de Celles, Analemmatic Sourcebook

Mural Quadrant	A large quadrant used to measure the altitude of celestial bodies. Often, these quadrants are fixed in the plane of the meridian.	Mural Quadrant, Wikipedia
 Photo: Wikimedia Commons, Arcy		

Multifilar	Sundials with multiple shadow-casting filaments. See Bifilar	Compendium Vol. 28 No. 2 p. 69-78

N		
Nadi	In ancient Indian science, a unit of time equal to 24 minutes. One Nadi is defined as 60 Vinadis.	Compendium Vol. 24 No. 2 p. 10-11

Nadika	See Nadi	

Nadir	Point on the celestial sphere directly opposite the zenith. Altitude = zenith -180^{o} The nadir is directly under the	

	observer.	

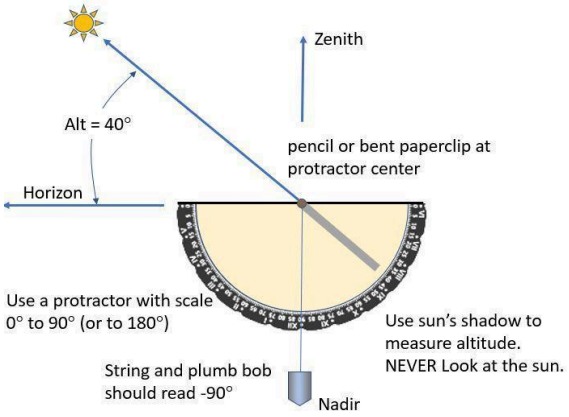


Photo: NASS, Elements of Dialing

Nautical Twilight	Nautical Twilight starts/ends when the sun is 12° below the horizon.	Compendium Vol. 30 No. 3 p. 1-7

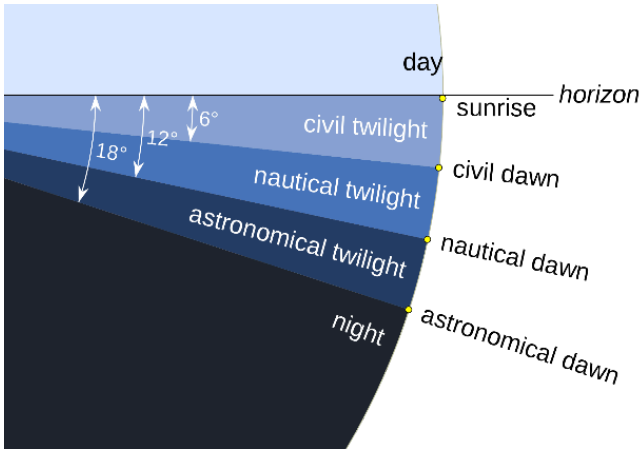


Photo: Wikimedia Commons, Pmurph5

Navicula	An universal altitude dial in the shape of a ship. Often features a vetus quadrat on its reverse.	Navicula Sundial, Kristen Lippincott

Photo: Wikimedia Commons, Rama

Nocturnal	An instrument that finds time at night by referencing the stars. Most common is a volvelle with an alidade to measure circumpolar stars relative to Polaris. A second type of nocturnal takes the form of a vertical window dial. Here, a nodus on the window is used in conjunction with a movable string to find time using hour lines drawn around the glass. The reference star's right ascension is used to determine that of the sun and thereby the time.	Compendium Vol. 2 No. 1 p. 19-22 Compendium Vol. 28 No. 3 p. 54-73 Compendium Vol. 29 No. 4 p. 9-27

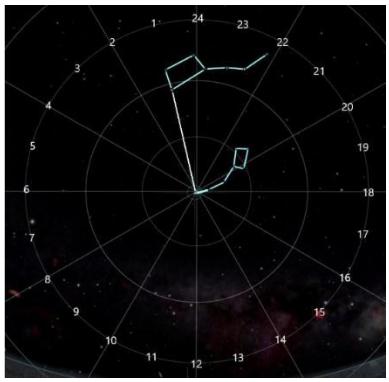


Photo: Montgomery

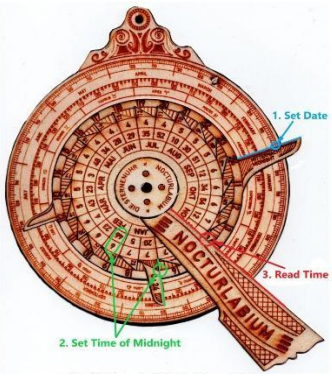
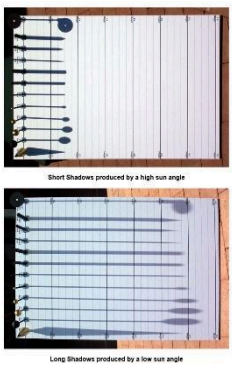


Photo: Redshift, redshiftsky.com

Photo: Leyborne (1700), Compendium 29:4

Nodus	A projected point of light or shadow. The nodus differs from the style in the sense that it indicates a single point rather than a line. This allows it to mark solar declination.	Compendium Vol. 4 No. 4 p. 1-4 Compendium Vol. 6 No. 2 p. 3-7 Compendium Vol. 15 No. 1 p. 9-14 Compendium Vol. 15 No. 2 p. 1-4



https://www.shadowspro.com/en/sundials.html

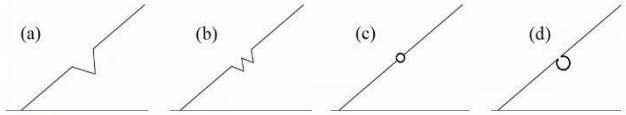


Fig. 4. Diagram of various nodus types for a horizontal dial. (a) V-cut, (b) 'W' form, (c) cross-cylinder, (d) through-hole.

Photo: McCluney, Compendium 4:4

Photo: John Carmichael, Compendium 13:4 Digital Bonus

Nomogram	An analog calculator used to graphically manipulate and solve for variables. Some examples of nomograms include dialing scales, slide rules, and volvelles.	Compendium Vol. 5 No. 4 p. 13-19 Compendium Vol. 8 No. 1 p. 13-15 Compendium Vol. 8 No. 3 p. 11-13 Compendium Vol. 15 No. 2 p. 22-31

Noon Gap	A gap that splits the hour scale of a dial at the noon mark. This gap is the same thickness as the gnomon.	Compendium Vol. 8 No. 4 p. 27-28 Compendium Vol. 28 No. 1 p. 1-6 Wide Gnomon, The Sundial Primer

	When a dial's gnomon is of considerable thickness, the hour lines must be drawn to account for its width. A wide gnomon typically has two styles, which cast the shadow. The distance between the styles is the thickness of the gnomon.	Wide Gnomon Equatorial Dial, The Sundial Primer

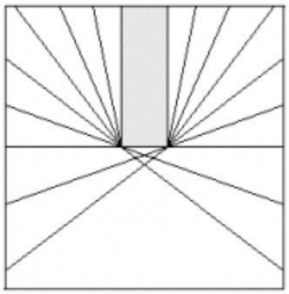


Photo: Fer de Vries, Compendium 8:4

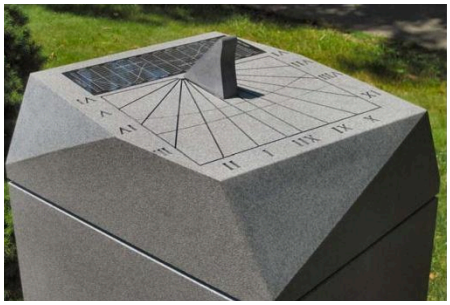
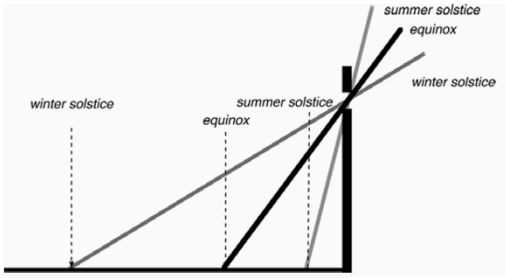


Photo: Robert Adzema, Compendium 19:4

Noon Gun	See Cannon Dial	

Noon Mark (Dial)	A dial that marks only solar noon and occasionally the hours surrounding it. This dial may feature a nodus to indicate the date in addition to the time.	Compendium Vol. 12 No. 4 p. 1-4 Compendium Vol. 17 No. 2 p. 1-4 Compendium Vol. 19 No. 3 p. 5-11 Compendium Vol. 19 No. 4 p. 11-17 Compendium Vol. 21 No. 4 p. 1-4 Compendium Vol. 24 No. 3 p. 32-37 Compendium Vol. 27 No. 1 p. 38-41



Photos: Bohannan & Norris, Compendium 19:4

North Celestial Pole	The point in the sky where the Earth's rotational axis, when extended, intersects the celestial sphere.	

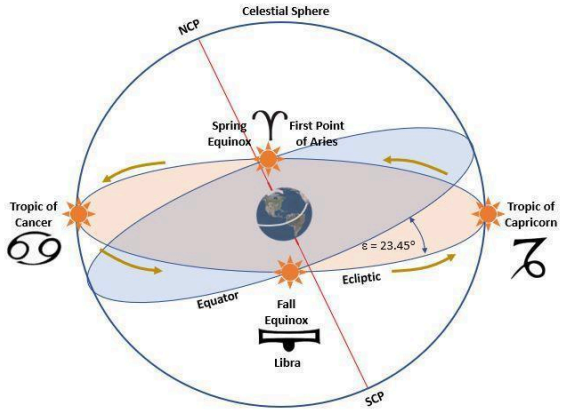


Photo: NASS, Elements of Dialing

North Star	Whatever star sits (approximately) above the northern end of the celestial axis. Due to procession, the star in this position will change over time. Currently, Polaris is the North Star.	

	See Polaris	
Nutation	The gradual, cyclical change of the earth's average tilt. The extremes of this cycle are obliquities of 22.1º and 24.5º This cycle is about twice as long as precession, with one cycle taking about 41,000 years.	Compendium Volume 27 Number 3 p. 27-33 Compendium Volume 31 Number 2 p. 1-9

O		
Obliquity of Ecliptic	Angular distance of the Earth's equator from the ecliptic plane to the celestial equator. Currently 23.45°.	Compendium Volume 27 Number 3 p. 27-33 Compendium Volume 31 Number 2 p. 1-9 Axial tilt, Wikipedia

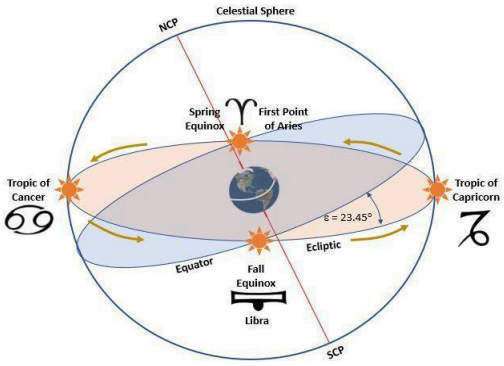


Photo: NASS, Elements of Dialing

Operating Limit	The limits of a sundial's useful surface. For example, solstice arcs may act as the edges of a dial, seeing as the nodus' shadow will never cross either of them.	Compendium Vol. 3 No. 1 p. 2-7 Compendium Vol. 27 No. 3 p. 7-14

	See Heliodrome (Sundial)	

Optical Calcite	A mineral with double-refractive properties. Its ability to split light into two polarized rays lends it the potential to indicate the azimuth of the sun, even when the sun itself is not directly visible. It has been speculated that this mineral was used by Vikings as a navigational aid.	Compendium Vol. 25 No. 4 p. 31-36

Photo: © Raimond Spekking / CC BY-SA 4.0

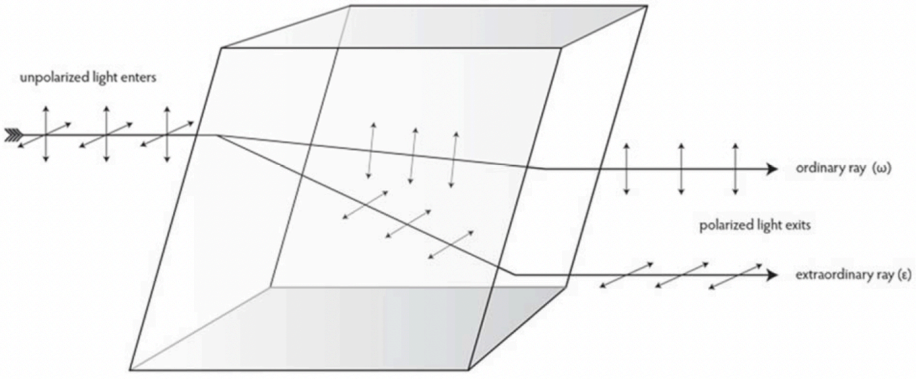


Photo:Guy Ropars, Proceedings of the Royal Society A, 2012, 468

Ordinate	A point's degree of vertical distance from the horizontal axis. Also known as the "Y" coordinate. See Abscissa	

Orthogonal Gnomon	See Orthostyle	

Orthostyle	A nodus that is fixed perpendicularly to the dial face (distinctly non-polar). Note that a nodus' supporting rod is not necessarily required to be perpendicular to the dial, so long as its end is positioned in the correct location. Thus, nodus rods set at angles may give the illusion of polar styles.	Compendium Vol. 27 No. 3 p. 7-14

P		
Parhelion	A phenomenon wherein atmospheric ice crystals refract sunlight, creating 1-2 bright spots around 22º above or beside the sun. This occurrence is most noticeable when the sun is near the horizon. "The term 'sun dog' (or mock sun) originates from Greek mythology. It was believed the god Zeus walked his dogs across the sky and that the bright 'false suns' in the sky on either side of the sun's disk were the dogs." (Tom Skilling)	Compendium Vol. 28 No. 3 p. 1-5 Sun dog, Wikipedia

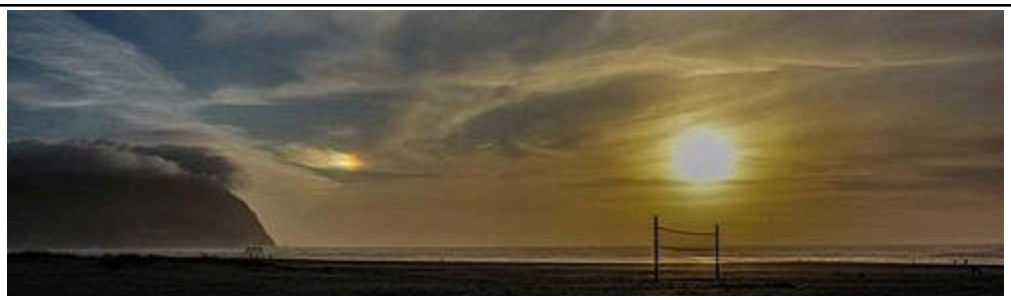
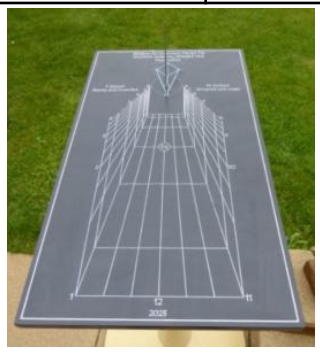
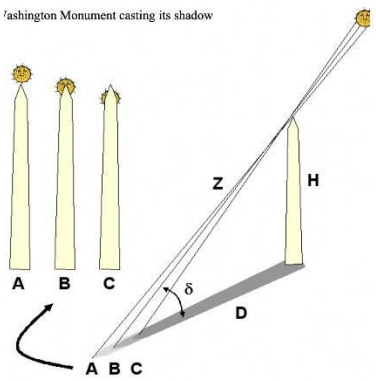


Photo: Robert Kellogg, Compendium 28:3

Peaucellier Dial	A sundial which uses either only straight lines or only circles for its hour and declination scales.	Compendium Volume 13 Number 2 p. 16-23 Compendium Volume 28 Number 2 p. 6-28 Compendium Volume 28 Number 3 p. 76-77 Compendium Volume 31 Number 1 p. 41-47



Penumbra	Partial shadow, or shadow that only partially obscures the surface. Compared to an umbra shadow that totally obscures the surface.	Compendium Vol. 9 No. 2 p. 19-21 Compendium Vol. 9 No. 4 p. 1-5, 6-11 Compendium Vol. 10 No. 1 p. 3-8 Compendium Vol. 18 No. 2 p. 1-6 Compendium Vol. 23 No. 2 Compendium Vol. 23 No. 3 p. 2-35



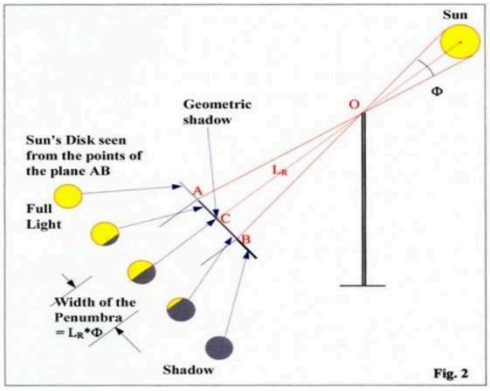


Photo: Gianni Ferrari, Compendium 23:2 **Photo: Robert Kellogg, Compendium 18:2**

Perigee	The point at which an eccentrically orbiting body is closest to that which it orbits.	

Perihelion	The point of earth's elliptical orbit that is closest to the sun. Currently, the Earth's distance from the sun at perihelion is 147,098,000 km.	Compendium Vol. 25 No. 4 p. 4-15 Compendium Vol. 26 No. 2 p. 2 Compendium Vol. 27 No. 3 p. 27-33 Compendium Vol. 28 No. 3 p. 5

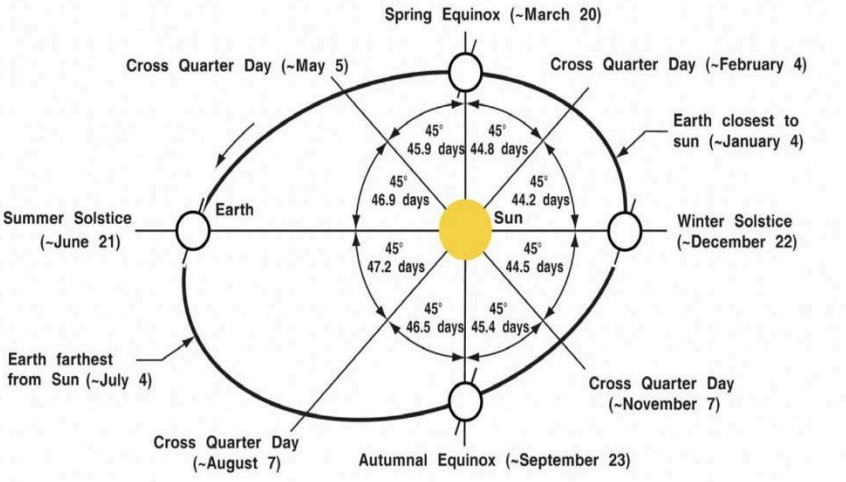


Photo: Chris Vaughan, AstroGeo

Periscian	One who lives between an arctic	Compendium Vol. 1 No. 3 p. 19

	circle and pole.	

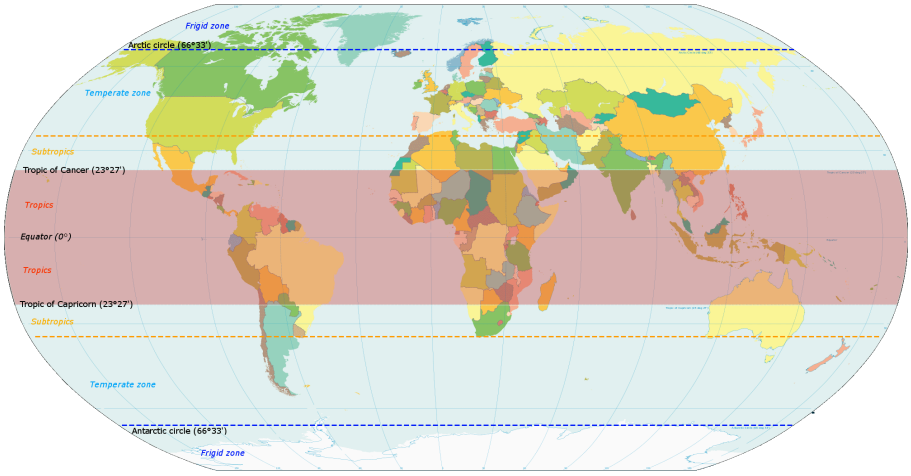


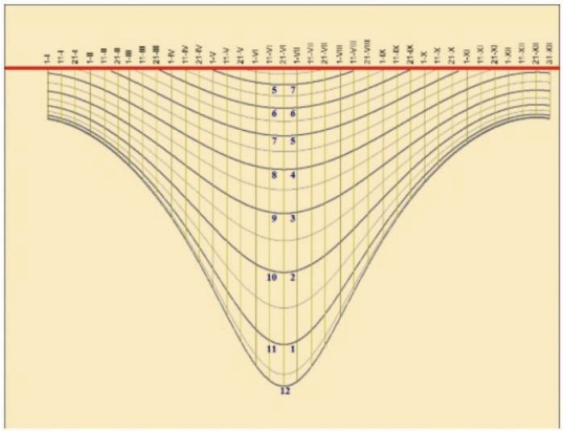
Photo: Wikimedia, KVDP

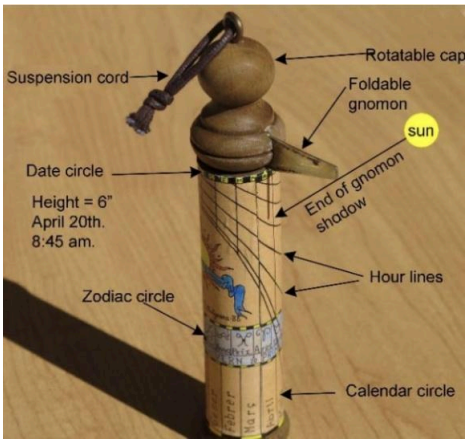
Philippi Dial	An ancient Greek altitude dial consisting of several folding rings, designed for four latitudes. The dial is visually reminiscent of the later equatorial ring dial, though operates under a distinct mathematical basis unrelated to hour-angle.	Compendium Vol. 31 No. 3 p. 61-79 The Horologion of Philippi: A portable Sundial (250-350 C.E)

Photo: Wikimedia Commons, Gts-tg

Pillar Dial	An altitude dial with a vertical/cylindrical face inscribed with hour and date lines. A	Compendium Vol. 16 No. 4 p. 7-14 Compendium Vol. 25 No. 4 p. 26-30

	horizontal point nodus is aligned with the date and oriented toward the sun's azimuth. L = H tan(Lat - 23.44) L: Gnomon length in mm H: Vertical distance between the base of the gnomon and summer solstice declination line. See Cylindrical Dial, Flag Dial	Compendium Vol. 29 No. 4 p. 28-38, 39-52, 53-69 Compendium Vol. 30 No. 1 p. 32-50





Photos: Donald Petrie, Compendium 25:4

Planetary Hour	The time it takes for half a Zodiac sign on the ecliptic to rise (15° on the ecliptic plane instead of the diurnal arc). "The length of the hour changes within one day because the time needed for a sign to rise is different. Sometimes a *[Zodiac]* sign rises fast; another time a sign rises slowly. So the length of an ecliptical planetary hour also changes in one day while an antique hour is constant in one day."	Compendium Vol. 16 No. 1 p. 15-26 Compendium Volume 31 Number 2 p. 14-15

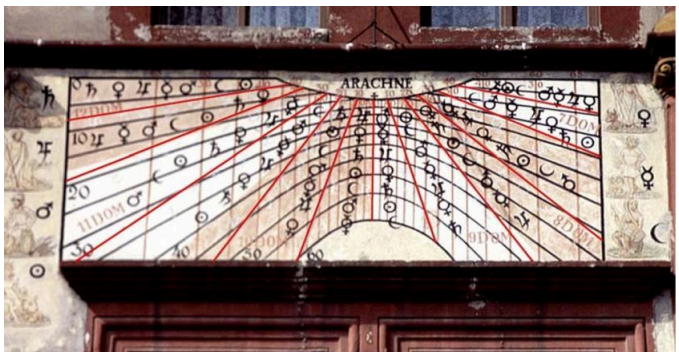
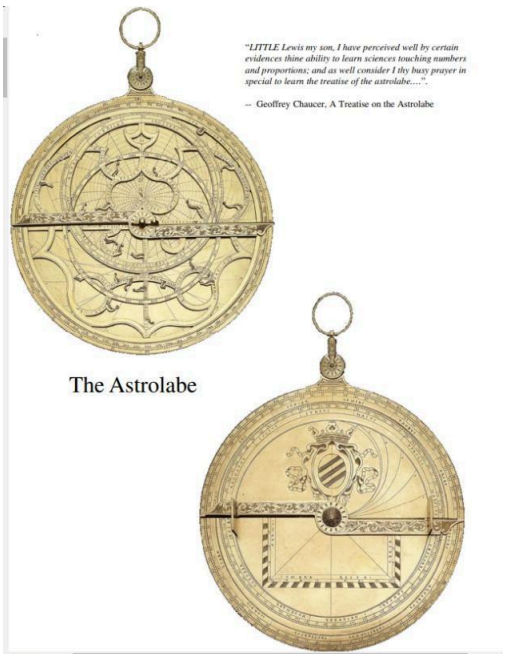


Photo: Fer de Vries, Compendium 16:1

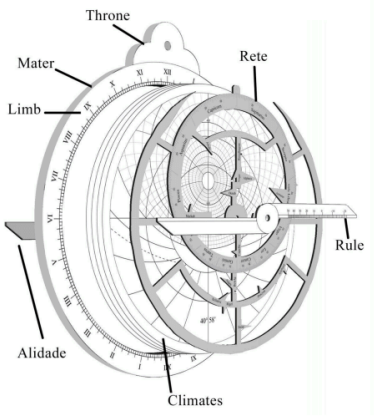
Planispheric Astrolabe	The most common and earliest type of astrolabe. Planispheric astrolabes utilize stereographic projection to display a latitude-specific portion of the sky. By rotating the rete over this celestial coordinate grid, the motion of the sun and stars can be modeled. With this instrument, one can calculate the time of day or night, height of objects, direction of true north, the position of the sun and stars at any given instant, and various astrological functions. Because stereographic projection is latitude-specific, a separate latitude plate must be inserted for each location where the astrolabe is to be used. Some planispheric astrolabes can accommodate many of these interchangeable plates, while others are built with only one. See Shadow Square	Compendium Vol. 17 No. 2 p. 18-26 Compendium Vol. 28 No. 3 p. 18-19 Compendium Vol. 30 No. 3 p. 61-76 The Astrolabe by James E. Morrison Interactive Astrolabe, Astrolabe Project



Photos: Richard Wymarc, Astrolabe Projecthttps://www.whipplemuseum.cam.ac.uk/explore-whipple-collections/astronomy/medieval-astrolabe/parts-astrolabe

Planispheric Astrolabe Components	A series of stacked elements secured together via a central screw which together allow for a variety of astronomical observations and calculations.	

Major Components of the Astrolabe



Notes:

-The Alidade Rete and Rule are all designed to rotate freely.

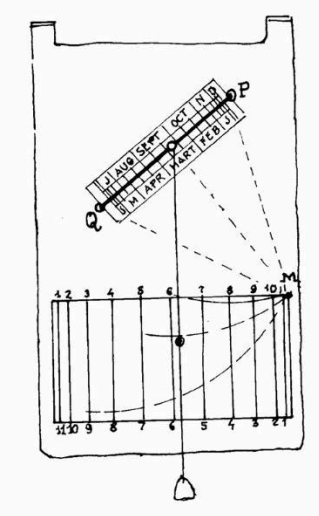
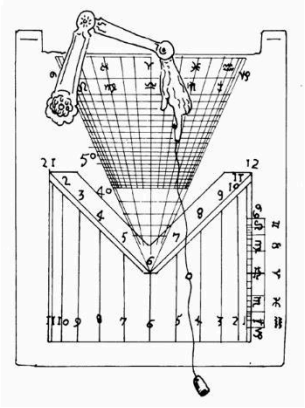
-The Plates (also known as climates) of an astrolabe are specific to a given latitude. Therefore most astrolabes contained a set of climates, that could be swapped out as the user moved to different locations.

-The Astrolabe rule could be either single or double ended.

Photo: Richard Wymarc, Astrolabe Project

Plate	See Tympan	

Plinth	Pedestal or base part of pedestal.	

Plumb Bob	Provides a vertical reference line or plumb-line. When a plumb-line is attached to a right angle, the horizontal, or level, reference line can be determined. Plumb bobs may be affixed to portable dials to aid in leveling, used as tools for drawing dials or meridian lines, or used with sighting devices (such as quadrants and certain altitude dials) to identify the altitude of celestial bodies. When used to level a dial, a downward spike on the plumb bob is often opposed by an upward spike on a lower stationary plate. When the two points meet, the dial is leveled to the local horizon.	Compendium 3:1 p 8-13 https://en.wikipedia.org/wiki/Plumb_bob
  **Photos: Alessandro Gunella, Compendium 15:2**		

Pobble	The movable bead on the plumb-line of altitude dials.	

Point Source	A light source with negligible dimensions, yielding perfectly sharp shadows. The sun is not a point source as it has an apparent diameter of 0.5º.	Compendium Vol. 1 No. 3 p. 11-15

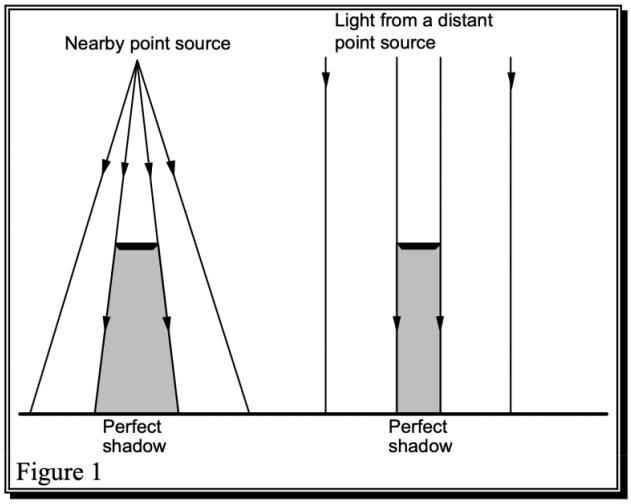


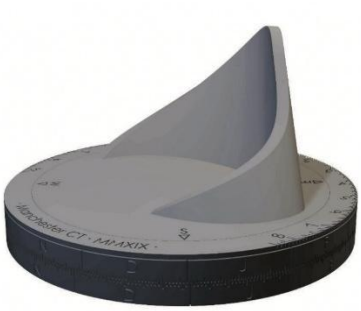
Figure 1

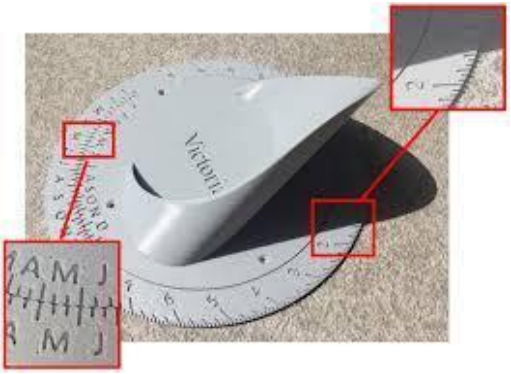
Photo: Ross McCluney, Compendium 1:3

Polar Dial	Sundial with a face (and often gnomon) parallel to the Earth's rotational axis. X = GH tan t X = distance of hour lines from substyle GH: chosen height of gnomon t: Hour Angle	Compendium Vol. 1 No. 4 p. 17-19 Compendium Vol. 5 No. 4 p. 21-24 Compendium Vol. 6 No. 2 p. 3-7 Compendium Vol. 7 No. 2 p. 6 Compendium Vol. 8 No. 4 p. 1-3

NASS Registry #1056https://www.shadowspro.com/en/classic-sundial.html

Polar Envelope Dial	Horizontal dial with extra wide polar gnomon, hour lines are equally spaced around a circular face. See Envelope Dial	Compendium Vol. 26 No. 1 p. 5-14 Compendium Vol. 26 No. 4 p. 5-14 Compendium Vol. 27 No. 2 p. 19-24





https://sundials.org/index.php/features/3d-printed-polar-envelope-sundial
Photo: Fred Sawyer, Compendium 26:4

Polaris	The current north star, sitting roughly above the north end of the celestial axis. The altitude of Polaris is approximately the latitude of the observer's location.	

Photo: NASA/Preston Dyches

Polar Style	A shadow-casting edge that runs parallel to the earth's axis (and is therefore inclined to the degree of its latitude). Because polar styles indicate time with their entire length, they cannot indicate changes in solar declination unless a point along the style is differentiated as a nodus. In mathematical expressions, the angle the polar style makes with the face of a dial is typically represented with ε	

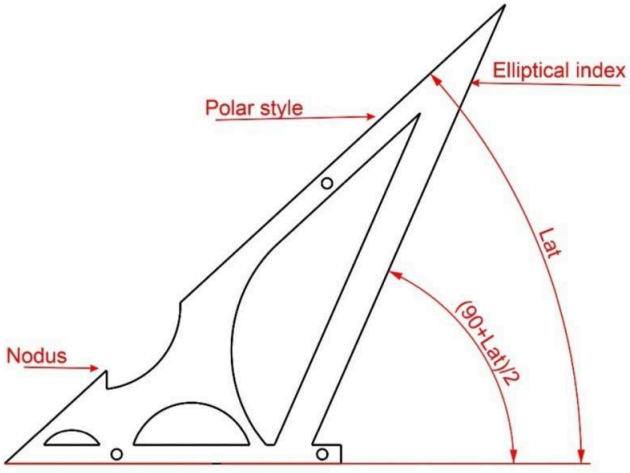


Photo: Busto, Compendium 30:2

Polyhedral Sundial	A multi-faced sundial, often with different type of dial on each face. All polyhedral dials are multi-dials.	Compendium Vol. 6 No. 1 p. 1-3 Compendium Vol. 12 No. 3 p. 8-9 Compendium Vol. 17 No. 1 p. 12-21 Compendium Vol. 19 No. 2 p. 10-19 Compendium Vol. 27 No. 4 p. 5-8

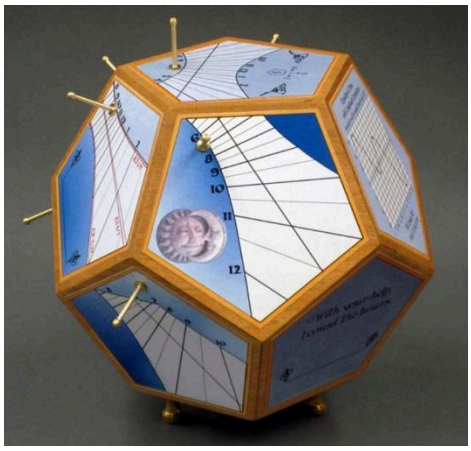


Photo: NASS Registry #27

Photo: Donald Snyder, Compendium 19:2

Portable Sundial	Small dials intended to be carried or used in multiple locations. Many portable dials feature latitude-selection mechanisms, widening their range of operation. Prior to the invention of the magnetic compass in roughly 1300, all portable dials were altitude dials. Some well-known portable dials include the universal equatorial ring, diptych, Regiomontanus, pillar, Philippi, Augsburg, Butterfield, and ring dials.	Compendium Vol. 24 No. 3 p. 29-31 Compendium Vol. 26 No. 2 p. 19-32 Compendium Vol. 27 No. 1 p. 19-35 Compendium Vol. 28 No. 4 p. 59-77 Compendium Vol. 31 No. 3 p. 61-79

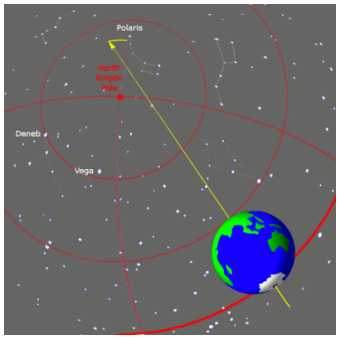
Photos: Metropolitan Museum of Art

Portici Ham	A small, portable, Roman altitude dial found to be in the shape of a raw ham. The dial features declination and hour lines similar to those on a flag dial, though features a fixed nodus rather than a movable one. To use the dial, it is suspended and rotated until the nodus' shadow falls on the current date line, at which point the seasonal hour is indicated. See Solar Decliners	Compendium Vol. 4 No. 2 p. 23-25 Compendium Vol. 26 No. 2 p. 19-32 Compendium Vol. 31 No. 3 p. 61-79

Photo: A model of the "pork clock" sundial shows the time as 9 a.m. PHOTOGRAPH BY CHRISTOPHER PARSLOW, 3-D PRINT BY CHRISTOPHER CHENIER, WESLEYAN DIGITAL STUDIO LAB

Post Meridiem	The portion of the day between noon and midnight.	12 hour clock, Wikipedia

Prana	In ancient Indian science, a unit of time equal to 4 seconds. One Prana is defined as the time taken to perform one respiration.	Compendium Vol. 24 No. 2 p. 10-11

Precession	Slow westward progression of the equinoxes on the ecliptic, caused by drift of the earth's axis. This drift occurs at a rate of 50.4 arcseconds per year or 1.38 degrees per century. "The tilt last reached its maximum in 8,700 BCE. It is now in the decreasing phase of its cycle, and will reach its minimum around the year 11,800 CE" (Don Petrie, Compendium 27:3).	Compendium Vol. 27 No. 3 p. 27-33 Precession, Wikipedia
 **Photo: Wikimedia Commons, Tfr000**		

Precision	The level of consistency of a set of measurements. Precise measurements do not necessarily equate to accurate measurements.	Compendium Vol. 17 No. 4 p. 1-4 Compendium Vol. 21 No. 2 p. 30

	See Accuracy	

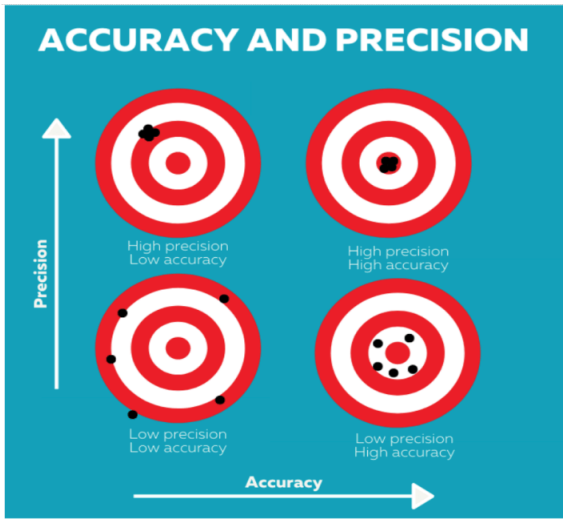


Photo: Christine Johnson, Kaiterra

Prime Meridian	0º of longitude and the basis for Universal Coordinated Time. The Prime Meridian is half of a great circle that runs through the Royal Observatory in Greenwich, England.	Compendium Vol. 30 No. 1 p. 1-6

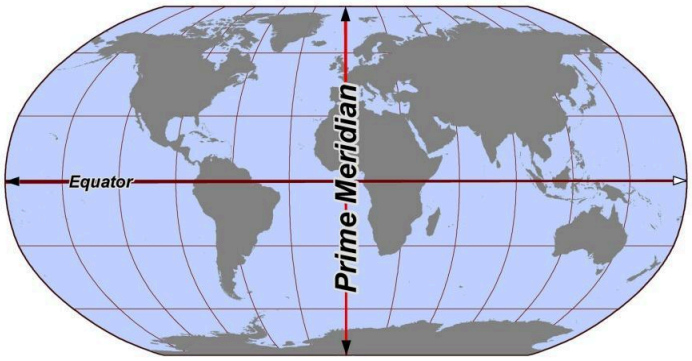


Photo: Wikimedia Commons, Kmf164

Prime vertical	A celestial arc passing from due east (East Cardinal Point), through the zenith, and due west (West Cardinal Point).	Compendium Vol. 12 No. 3 p. 10-12 Compendium Vol. 28 No. 4 p. 22-35

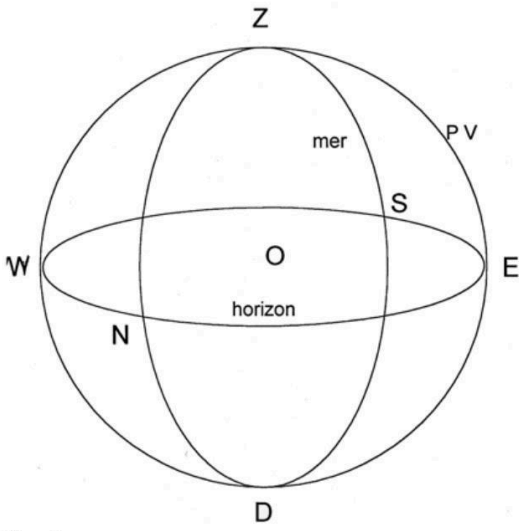


Photo: John F Schilke, Compendium 12:3

Ptolemaic Coordinates	A system of locating points on the celestial sphere used by Ptolemy. Coordinates are extrapolated from the planes of the horizontal, meridian, and prime vertical. "These circles form 6 angles μ1, λ1, μ2 , λ2, μ3, λ3 that are the 'Ptolemaic coordinates.'"	Compendium Vol. 5 No. 3 p. 17-24 Compendium Vol. 6 No. 1 p. 9-19 Compendium Vol. 9 No. 1 p. 14-15

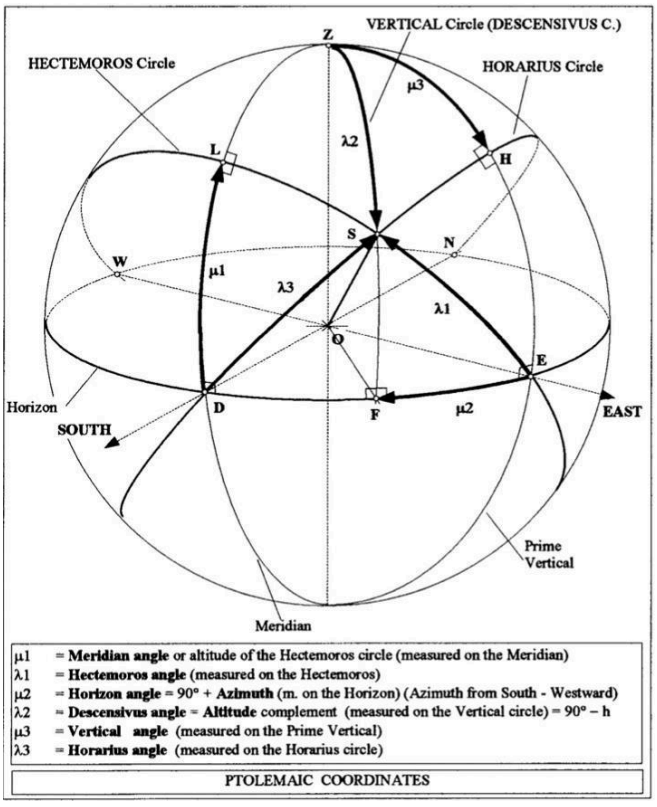
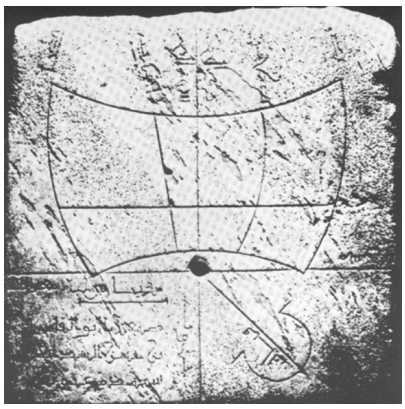


Photo: Gianni Ferrari, Compendium 6:1

Q		
Qibla	The direction of Mecca, the focal point of Muslim prayer, from a given location. Several instruments designed to indicate the Qibla have been devised, falling under the broad category of “Qibla indicators.” These include certain quadrants, compasses, and directional markings on stationary dials.	Compendium Vol. 17 No 3 p. 35



(Qibla indicator at lower right corner)
Photo: Alain Brieux

Quadrans Novus	One of several forms of astrolabe quadrant. The quadrans novus can be considered a planispheric astrolabe folded in half twice, with the workable area projected onto a single quadrant of the once full circle. Because of this folding, the device can be used at only one Latitude, though there also exists a universal horizon version.	The Astrolabe by James E. Morrison

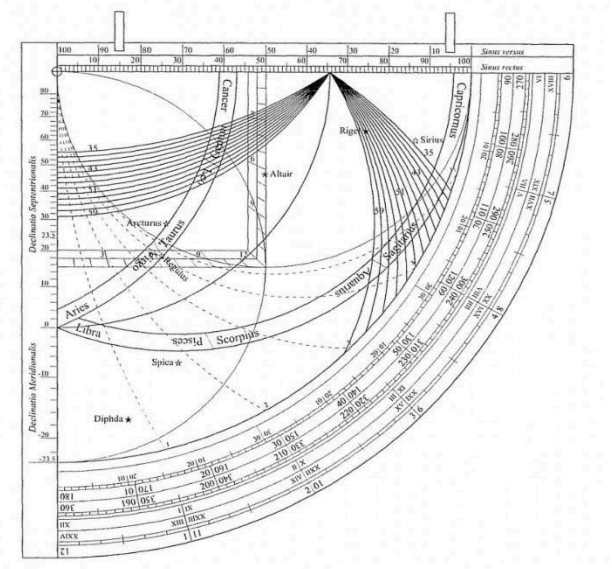
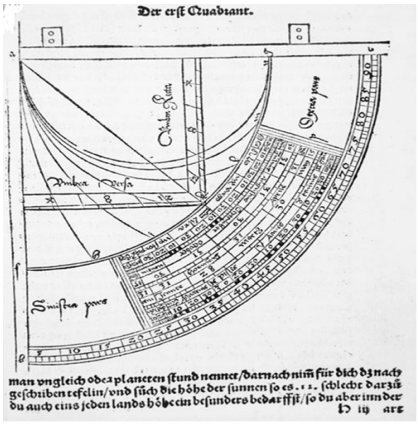


Photo: The Astrolabe by James E. Morrison

Quadrans Vetus	A quadrant using the seasonal hour system. On certain models, a movable plate is included which aides the setting of solar declination. The unequal hour is read by referencing the position of a bead along the string of a plumb bob.	
Photo: From Sacrobosco's Tractatus de quadrante		

Quadrant	A wide category of sighting instruments which take the form of a ¼ circle. Some quadrants simply measure the altitude of celestial bodies or objects, while others are equipped with scales used for further calculation or time-finding. Common types of horary quadrants include the quadrans vetus, and quadrans novus	Quadrant, Smithsonian

Photo: Daily Mail, 11/3/2011, Rob Waugh

R		
Radian	An angle at the center of a circle whose arc equals the length of the radius. 1 radian = $180^{o}/\pi$	Radian, Wikipedia

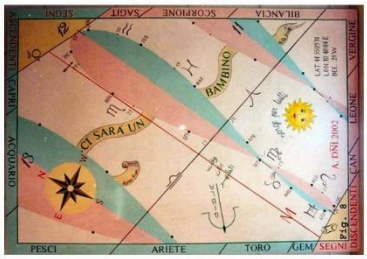
Reclining Dial	A vertical sundial whose face is tilted forward (upward). The angle between a horizontal line and the face of the dial. Horizontal = $0^{o;}$ vertically = $+90^{o}$	Compendium Vol. 19 No. 2 p. 10-19

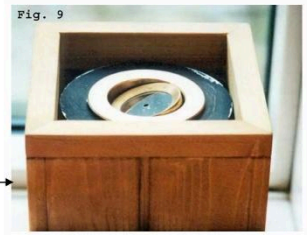
Photo: NASS Registry #1001

Reflection dial	A dial that uses reflected light–most often a small mirror near a window–to mark the passage of time on a dial face. In this case,	Compendium Vol. 2 No. 4 p. 17-19 Compendium Vol. 3 No. 1 p. 18-21 Compendium Vol. 11 No. 1 p. 23-29

	the mirror takes the place of a nodus. Dials of this type are most often drawn on ceilings. The dial is traced across by a small point of light (rather than a shadow) reflected by a windowsill mirror.	Compendium Vol. 11 No. 2 p. 23-32 Compendium Vol. 14 No. 2 p. 32-36 Compendium Vol. 16 No. 3 p. 13-19 Compendium Vol. 17 No. 3 p. 23-30 Compendium Vol. 19 No. 1 p. 23-26 Compendium Vol. 19 No. 3 p. 12-22 Compendium Vol. 20 No. 1 p. 11-15 Compendium Vol. 22 No. 3 p. 25-31, 32-35 Compendium Vol. 24 No. 4 p. 21-29 Compendium Vol. 25 No. 3 p. 31-37 Compendium Vol. 26 No. 2 p. 14-18 Compendium Vol. 29 No. 1 p. 8-16 Compendium Volume 31 Number 2 p. 10-34, 35-48

In figures 7, 8, 9: the room, the sundial, the adjustable mirror (next to the door, on the right).





Photos: Gianni Ferrari, Compendium 11:1

Refraction	Describes the phenomenon that occurs when light passes between mediums of differing density. As light travels, its path is diverted by an amount that corresponds to the density of the medium encountered. This concept is notably relevant during sunrise and sunset, as atmospheric refraction results in the sun appearing to sit on the horizon when in reality it is below. See Sunrise, Sunset	Compendium Vol. 2 No. 4 p. 26-27 Compendium Vol. 17 No. 4 p. 1-4 Compendium Vol. 20 No. 2 p. 9-19 Compendium Vol. 26 No. 2 p. 1-3 Compendium Vol. 28 No. 3 p. 1-5

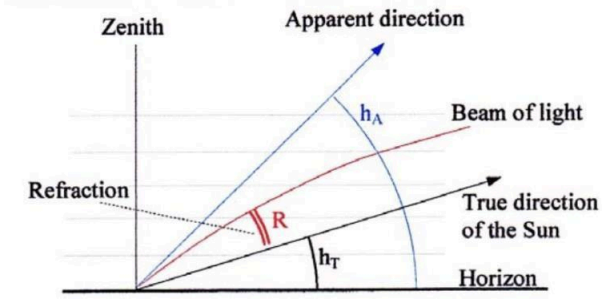


Photo: Gianni Ferrari, Compendium

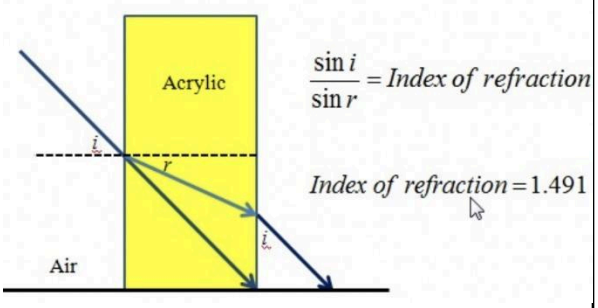


Photo: Fred Sawyer, Compendium 19:3

Refraction Dial	A dial built around the principles of refraction. These dials account for the refractive indices of various fluids, allowing time to be read. Some dials of this type place their focus on accounting for atmospheric refraction, while others feature hour lines for use in liquids. One such dial is known as the chalice dial, and features hour lines along its inner sides. Some dials of this type feature two sets of hour lines; one used when the cup is empty, and one when it is filled with a liquid.	Compendium Vol. 2 No. 4 p. 26-27 Compendium Vol. 14 No. 4 p. 25-31 Compendium Vol. 15 No. 1 p. 15-24 Compendium Vol. 19 No. 3 p. 27-31 Compendium Vol. 20 No. 2 p. 9-19

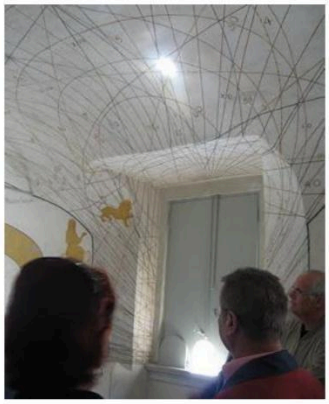
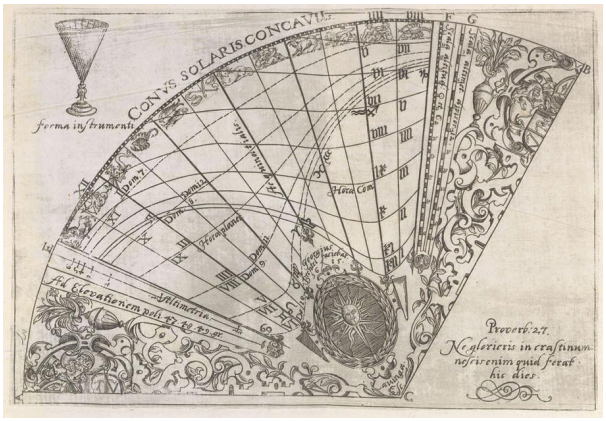
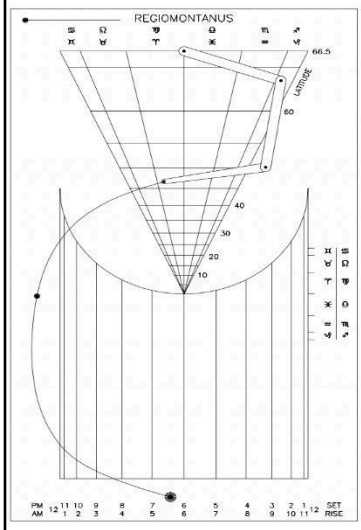


Photo: Sian Bonnell,



Compendium 26:2 Photo: https://crouchrarebooks.com/product/instrument/rare-treatise-on-the-chalice-sundial/ https://www.britishmuseum.org/collection/object/H_1896-1214-1

Regiomontanus Rectilinear Dial	A portable, altitude dial that adjusts the cord's starting location with a brachiolum based on the observer's latitude and date.	Compendium Vol. 5 No. 4 p. 13-19 Compendium Vol. 15 No. 2 p. 33-39



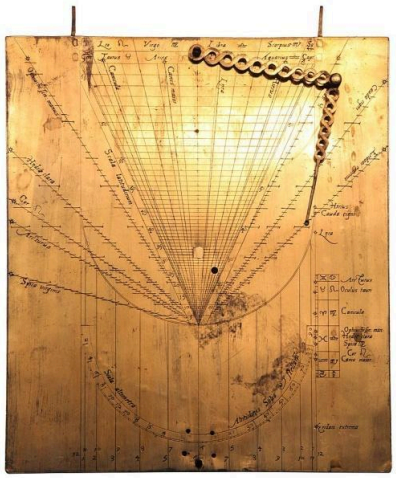


Photo: Wikimedia Commons, Rama

Rete	A skeletal and often artfully wrought disc that carries the ecliptic ring and star pointers.	

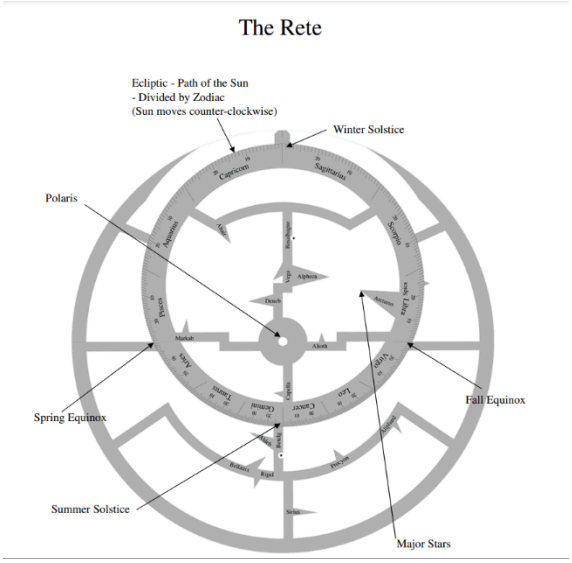


Photo: Richard Wymarc, Astrolabe Project

Reverse Italian hours	An equal hour time system that numbers the hours to next sunset, 24 – 0	Compendium Vol. 4 No. 1 p. 28-29 Compendium Vol. 16 No. 3 p. 21-23 Compendium Vol. 24 No. 2 p. 16-20 Compendium Vol. 24 No. 4 p. 39 Compendium Vol. 26 No. 2 p. 14-18 Compendium Vol. 28 No. 3 p. 6-17 Compendium Vol. 30 No. 1 p 77-79 Compendium Vol. 30 No. 2 p. 73-75 Compendium Vol. 30 No. 3 p. 49

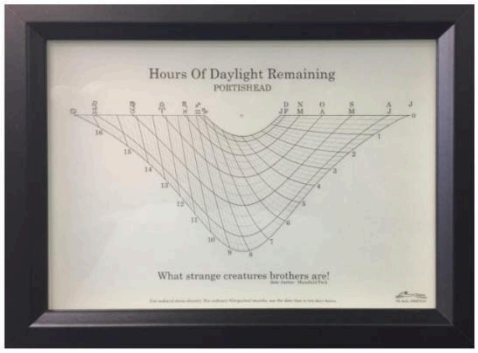


Photo: Steve Lelievre, Compendium 26:2

Ring Dial	A portable, altitude dial in the shape of a ring. These dials feature either a fixed or movable nodus. Dials with movable nodi can be set for solar declination.	Compendium Vol. 12 No. 3 p. 32-39

Right Ascension	Equivalent of longitude in the celestial sphere. Measured in Hours, Minutes, and Seconds. Origin, 0h 0m 0s is the March equinox meridian at the equator. Also called the First Point of Aries. While hour angle is measured from east to west, right ascension is measured from west to east.	Compendium Vol. 9 No. 2 p. 7-16 Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 25 No. 4 p. 4-15 Right ascension, Wikipedia

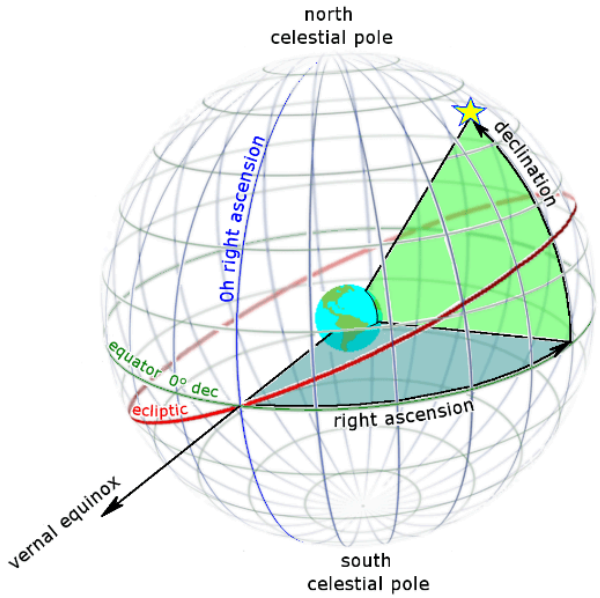


Photo: Wikimedia Commons, Tfr000
https://en.wikipedia.org/wiki/Right_ascension

Rojas Astrolabe	A type of universal astrolabe that utilizes a sliding rule or trigon assembly. These astrolabes utilize universal projection and as such bypass the need for individual tympans or a rete.	Compendium Vol. 9 No. 4 p. 30-33

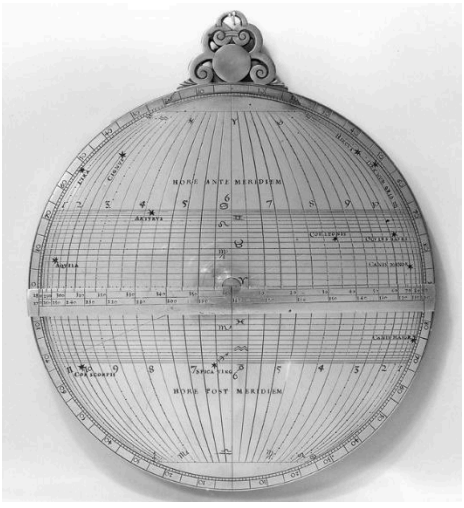
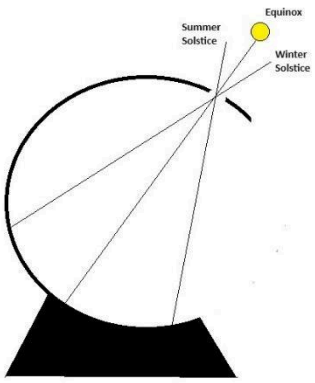


Photo: Wellcome Collection. Attribution 4.0 International (CC BY 4.0). Source: Wellcome Collection.

Roof Dial	A spherical dial that has a nodus aperture near the top.	Greek and Roman Sundials, Sharon L Gibbs, Yale University Press, 1976 pp 23-27.
 **Photo: Mark Montgomery**		

Rule	In dial drawing and geometric construction, rule can simply be synonymous with "ruler." On Astrolabe, an index for lining up points on the ecliptic and outer scales on the mater in order to read the astrolabe. On certain analog computers, the rule is a movable indicator.	

S	
Saros Cycle	The circuit of the lunar nodes around the ecliptic; capable of predicting solar and lunar eclipses. This cycle has a period of 223 synodic months. "One Saros [cycle] is equal to 223 synodic months. However, 239 anomalistic months and 242

Compendium Volume 24 Number 1 p. 1-4 Compendium Volume 31 Number 2 p. 1-9 Compendium Volume 31 Number 1 p. 1-8 Astroleague Eclipses and the Saros

	draconic months are also equal to this same period" (Kellogg, Compendium 31:1).	

Sciathericon	An archaic term for sundial. Literally, "shadow catcher."	Compendium Vol. 1 No. 3 p. 19

Scaphe	A sundial with hour lines drawn on a concave hemisphere. The hour is indicated by a nodus positioned at the center of the sphere, at the end of a horizontal or vertical style. This type of dial is prevalent in Greco-Roman as well as Eastern gnomonic tradition. "The nodus at the sphere's center casts a shadow that follows the sun. The standard equations are: Azimuth: $tanA = sinH/(sin\phi\ cosH - cos\phi\ tan\delta)$ Altitude: $sinh = sin\delta\ sin\phi + cos\phi\ cos\delta\ cosH$ A: azimuth, h: altitude, δ: declination, φ: latitude H: hour angle" (Mark Montgomery, Compendium 29:2).	Compendium Vol. 18 No. 4 p. 27-33 Compendium Vol. 21 No. 3 p. 23-30 Compendium Vol. 24 No. 3 p. 10-25 Compendium Vol. 29 No. 2 p. 50-66

Photo: Daderot, United States Public Domain

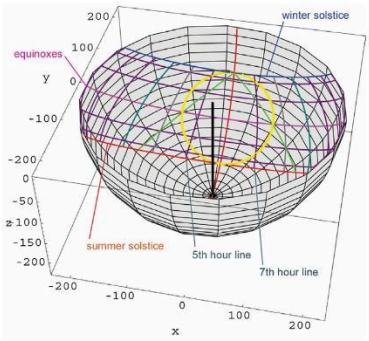


Photo: Ortwin Feustel, Compendium 24:3

Scratch Dial	See mass dial	

Seasonal hours	The division of day and night from sunrise to sunset into 12 hours. Throughout the year, the length of an hour changes because the length of the time between sunrise and sunset varies with the seasons. Sunrise marks the beginning of the first hour, noon occurs at the end of the sixth, and sunset at the end of the 12th. 2 x 12 counting from sunrise and sunset. Also knows as: Antique hours, Biblical hours, Temporary hours, Jewish hours, Unequal hours, or Roman hours (horae temporales).	Compendium Vol. 5 No. 4 p. 13-19 Compendium Vol. 8 No. 2 p. 15-21 Compendium Vol. 9 No. 3 p. 6-11 Compendium Vol. 15 No. 4 p. 6 Compendium Vol. 16 No. 3 p. 24-32 Compendium Vol. 18 No. 2 p. 22-25 Compendium Vol. 24 No. 3 p. 10-25 Compendium Vol. 26 No. 1 p. 17-19 Compendium Vol. 26 No. 2 p. 19-32 Compendium Vol. 26 No. 4 p. 22-27 Compendium Vol. 28 No. 1 p. 41-64 Compendium Vol. 29 No. 1 p. 27-51 Compendium Vol. 29 No. 3 p. 9-28

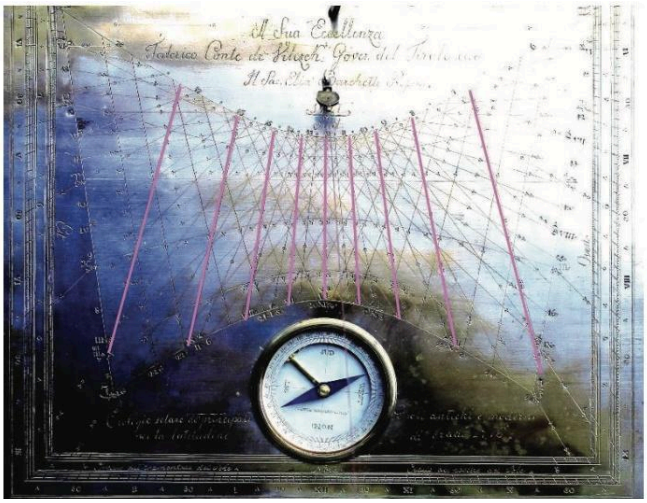


Photo: Armin Denoth and Kurk Descovich, Compendium 26:4

Self-Orienting Dial	Two combined dials operating under different principles. When both dials display the same time, the dial is oriented north and the correct time can be read.	Compendium Vol. 29 No. 3 p. 29-38 Compendium Vol. 30 No. 2 p. 29-43

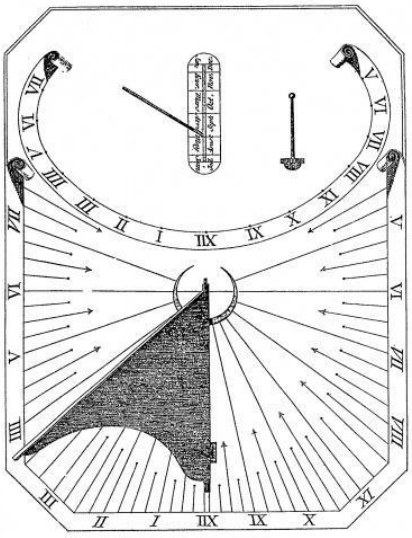


Photo: NASS, Analemmatic Source Book

Shadow Plane	The plane cast by the shadow of a rod gnomon.	Compendium Vol. 6 No. 3 p. 2-5 Compendium Vol. 17 No. 3 p. 1-6 Compendium Vol. 17 No. 4 p. 16-17

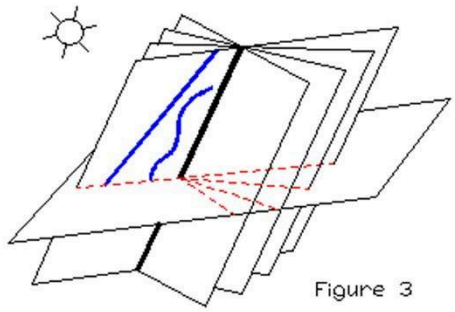
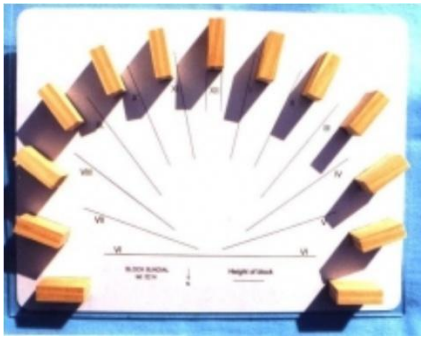
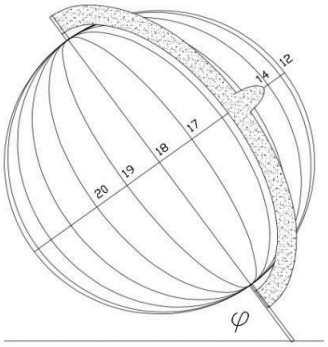


Photo: William Maddux, Mac Oglesby & Fer De Vries, Compendium 6:4

Shadow Plane Dial	Sundials that make use of shadow planes to indicate time. Some dials may require an adjustable gnomon, while others feature many shadow-casting elements that when considered together reveal the time.	Compendium Vol. 6 No. 3 p. 2-5 Compendium Vol. 6 No. 4 p. 1-5 Compendium Vol. 7 No. 1 p. 18-19 Compendium Vol. 15 No. 4 p. 24-27 Compendium Vol. 25 No. 2 p. 35-38 Compendium Vol. 29 No. 3 p. 1-8 Compendium Vol. 30 No. 2 p. 73-75





Photos: William Maddux, Mac Oglesby & Fer De Vries, Compendium 6:3 and 6:4

Shadow Sharpener	A device to help in determining the separation line between an umbra shadow and associated penumbra. The device may be as simple as a pinhole in a card.	Compendium 9-4, pp 6-11 Compendium 23-2, pp 36-40

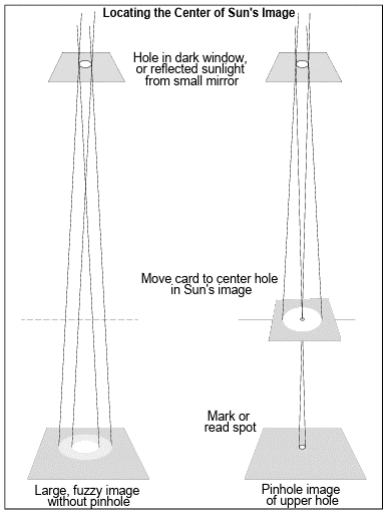
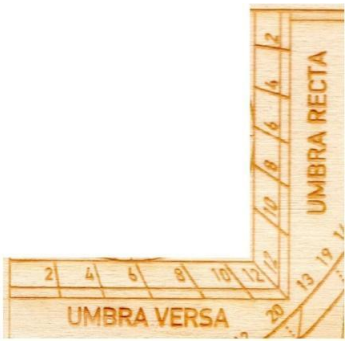
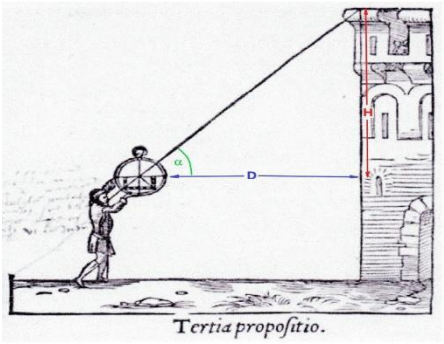


Photo: William Walton, Compendium 9:4

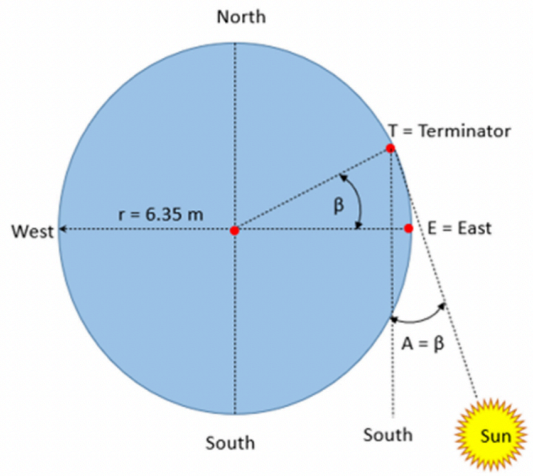
Shadow Square	A scale used in conjunction with an alidade or plumb bob to measure the height of or distance from an object. The square contains two aspects, Umbra Versa (tangent function) and Umbra Recta (cotangent function). When taking an elevation reading, the plumb bob or alidade will indicate the tangent value on the shadow square. The tangent is the value on the Umbra Versa divided by the largest number on the shadow square–usually 12. The tangent is expressed as a fraction of 12, and this ratio is used to estimate the height of the sighted object. Shadow squares are often found on the reverse side of astrolabes, but may also be drawn on vetus quadrants, other altitude dials, or exist on their own.	Compendium Vol. 28 No. 3 p. 64-73





Photos: Montgomery, Compendium 28:3

Shadow Terminator Dial	A class of sundial that indicates time using the boundary between the illuminated and shaded sides of an object. In the case of a cylindrical terminator dial, this boundary occurs on the dial's face at a line tangent to the sun's rays. See Terminator Shadow	Compendium 23-3, pp 7-20 Compendium Vol. 23 No. 4 p. 16-22 Compendium Vol. 24 No. 1 p. 12-25 Compendium Vol. 31 No. 3 p. 48-60



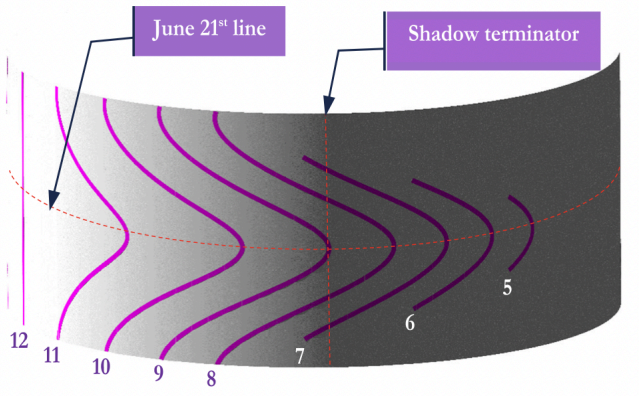


Fig. 4. Shadow simulation at 9 am local time on June 21st.

Photos: Gian Casalegno, Giuseppe De Donà, Aurelio Pantanali, Compendium 31:3

Shepherd's Dial	See Pillar Dial	

Sidereal Hours	The "star time" as measured clockwise by the angular	Compendium Vol. 5 No. 3 p. 25-29, 29-31

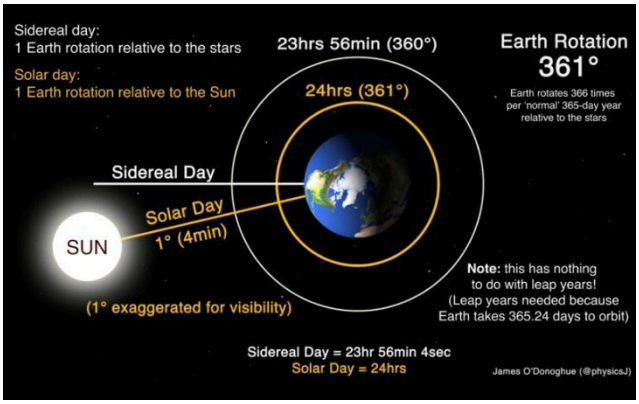
	distance from the First Point of Aries to the local meridian. One Sidereal hour is 59 minutes and 50 seconds. "Adding the sun's right ascension to the true solar time given by an ordinary sundial gives the sidereal time" (Sawyer, Compendium 30:3). A sidereal day is 3 minutes 56 seconds shorter than a mean solar day or 23:56:04.	Compendium Vol. 10 No. 4 p. 18-22 Compendium Vol. 16 No. 1 p. 3-4 Compendium Vol. 25 No. 1 p. 15-16 Compendium Vol. 25 No. 4 p. 4-15 Compendium Vol. 30 No. 3 p. 36-45 Compendium Vol. 30 No. 3 p. 46-48 Compendium Volume 31 Number 1 p. 9-18 Sidereal time, Wikipedia
		

Photo: Wikimedia Commons, James O'Donoghue

Sidereal Dial	A sundial that marks time in sidereal hours.	Compendium Vol. 25 No. 4 p. 4-15 Compendium Vol. 30 No. 3 p. 36-45 Compendium Vol. 30 No. 3 p. 46-48 Compendium Volume 31 Number 1 p. 9-18

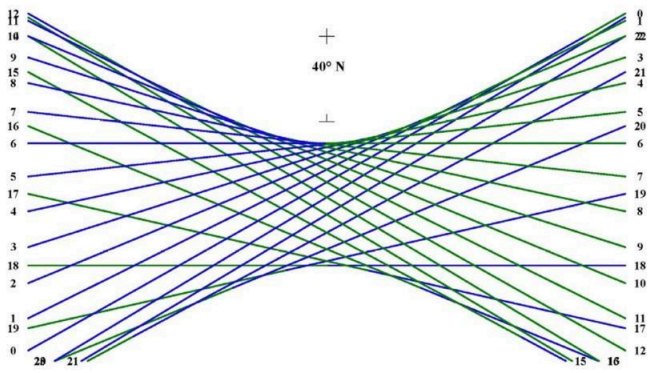


Photo: Fred Sawyer, Compendium 30:3

Sidereal Time	See Sidereal Hours.	Compendium Vol. 26 No. 3 p. 7 Compendium Vol. 30 No. 3 p. 36-45 Compendium Vol. 25 No. 1 p. 15-16 Compendium Vol. 25 No. 3 p. 11-22 Sun Path, Wikipedia

Sidereal Year	The time taken for the sun to complete a full circuit around the ecliptic, with reference to the stationary background of stars. Due to the precession of earth's axis and apsidal precession, a sidereal year is approximately 20 minutes longer than a solar year.	

Signal Gun	See Cannon Dial	

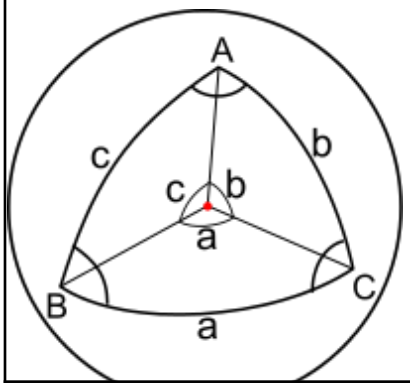
Significant Alignment	A contrived moment when an object casts a particular shadow or a celestial body assumes a particular position relative to a	Compendium Vol. 15 No. 1 p. 30-34 Compendium Vol. 16 No. 3 p. 1-4

	landmark. "Solar alignments occur daily, though from any given location they are observable only twice a year unless it occurs at one of the solstices."	Compendium Vol. 17 No. 2 p. 5-14 Compendium Vol. 21 No. 1 p. 35-36 Compendium Vol. 21 No. 3 p. 1-3 Compendium Vol. 24 No. 3 p. 1-4 Compendium Vol. 27 No. 2 p. 1-4 Compendium Vol. 29 No. 2 p. 1-14

Photo: March 12, 2009 Yomiuri Online, Compendium 17:2

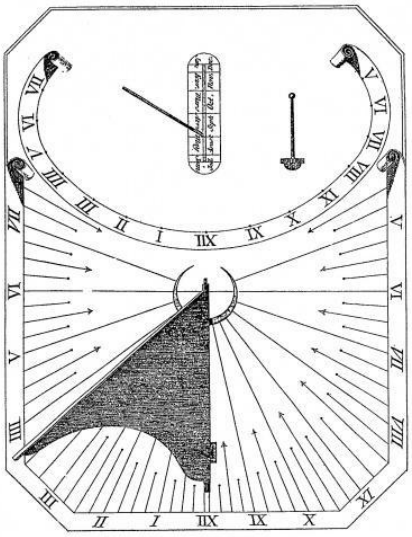
Photo: T. Kumazawa. From the Chofukeizai Shinbun, Compendium 17:2 Online http://chofu.keizai.biz/headline/photo/99/.

Sine rule	The Spherical Law of Sines: For a spherical triangle on a unit sphere has side lengths a, b, and c with angles A, B and C opposite the sides. Then, sin(A) / sin(a) = sin(B) / sin(b) = sin(C) / sin(c)	



Sin(A)/Sin(a) = Sin(b)/Sin(b) = Sin(C)/Sin(c)

Photo: Wikimedia Commons, Peter Mercator

Solar Compass	A self-orienting dial or set of dials that can indicate true north without the aid of a magnetic compass.	Compendium Vol. 7 No. 4 p. 19-26 Compendium Vol. 10 No. 2 p. 25-28 Compendium Vol. 10 No. 3 p. 18-19 Compendium Vol. 22 No. 1 p. 9-16 Compendium Vol. 30 No. 3 p. 77-82 Compendium Vol. 31 No. 3 p. 26-43 Bagnold's Sun Compass Burt's Solar Compass, Wikipedia
 **Photo: NASS, Analemmatic Sourcebook**		

Solar Decliners	A class of portable altitude dials that feature a fixed nodus. When suspended, the dial is rotated until the shadow of its nodus falls on the declination line corresponding to the current date, at which point the hour is indicated.	Compendium Vol. 27 No. 1 p. 6-15

	The Portici Ham is one such dial.	

Solargraphy	An ultra-long exposure picture of the sun's path taken by a pinhole camera over an extended period of time. Typically, the exposure period if from solstice to solstice.	Compendium Vol. 24 No. 1 p. 26-31

Photo: Montgomery, Compendium 24:1

Solar time	Time system using relative motion of earth and sun. The mean solar day is 24 hours long. Also see Local solar time	Sun Path, Wikipedia

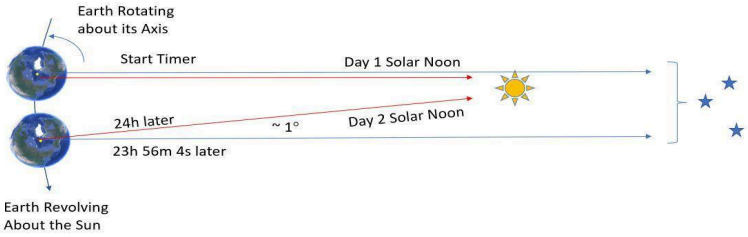


Photo: NASS, Elements of Dialing

Solstice	The moment the center of the sun is at the extreme declination values occurring in June and December. Also, known as the longest and shortest day of the year.	Compendium Vol. 15 No. 1 p. 1-4, 30-34 Compendium Vol. 15 No. 4 p. 28-32 Compendium Vol. 21 No. 1 p. 35-36 Compendium Vol. 22 No. 4 p. 1-4

	Solstice lines may be marked on sundials, indicated by a nodus or other point.	Compendium Vol. 27 No. 3 p. 34-40 Compendium Vol. 30 No. 3 p. 1-7 Compendium Volume 31 Number 2 p. 1-9 Solstice, Wikipedia

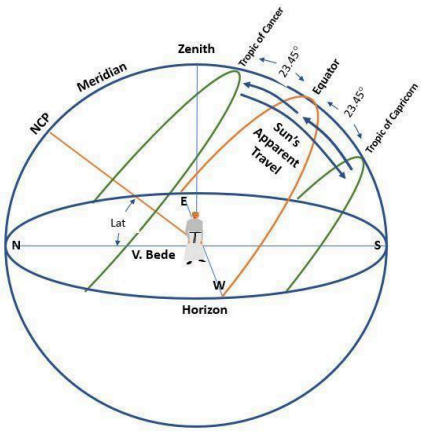


Photo: NASS, Elements of Dialing

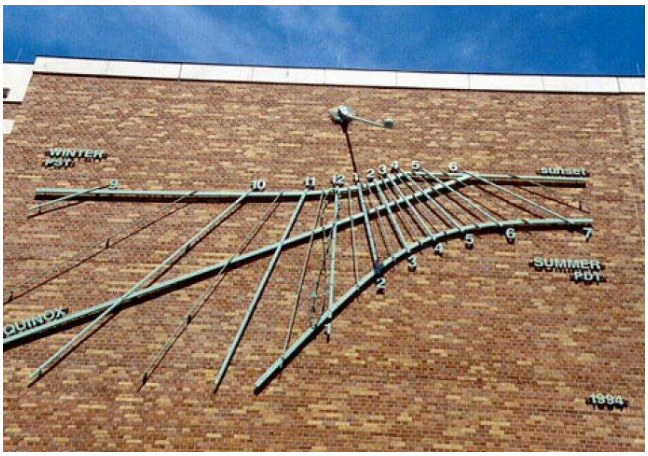


Photo: NASS Registry #117

Solstitial Colure	On armillary spheres and some sundials, a great circle passing through the poles and the ecliptic at the first points of Cancer and Capricorn–the summer and winter solstices.	

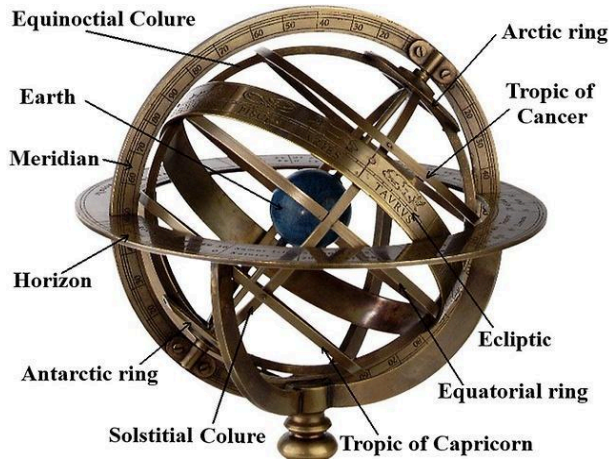
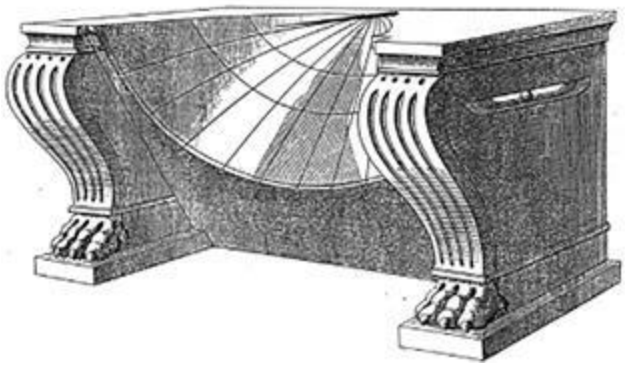


Photo: Kristjan Salev, Science of Gadgets

Spherical dial	A sundial whose face is a spherical surface, typically a concave spherical surface. A dial face with a convex spherical surface is typically called a globe dial. See Scaphe, Hemicyclium	Compendium Vol. 5 No. 1 p. 21-22 Compendium Vol. 9 No. 2 p. 23 Compendium Vol. 19 No. 2 p. 22-29 Compendium Vol. 19 No. 3 p. 32-35 Compendium Vol. 20 No. 3 p. 4-16 Compendium Vol. 23 No. 3 p. 7-20 Compendium Vol. 23 No. 4 p. 16-22 Compendium Vol. 24 No. 1 p. 12-25 Compendium Vol. 30 No. 1 p. 69-76
 **Photo: Wikimedia Commons, Ernest Renan**		

Spherical Trigonometry	The measured relationship among sides and angles of a triangle on the surface of a three-dimensional sphere.	Compendium Vol. 1 No. 3 p. 8-10 Compendium Vol. 1 No. 4 p. 19-23 Compendium Vol. 3 No. 4 p. 10-17 Compendium Vol. 16 No. 4 p. 19-22 Compendium Vol. 21 No. 3 p. 17-21 Compendium Vol. 27 No. 3 p. 20-26

		Spherical trigonometry, Wikipedia

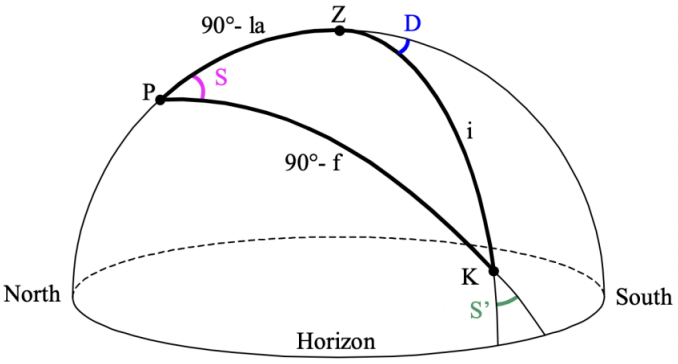


Photo: Yvon Masse, Compendium 21:3

Standard Time Zone	A geographical area observing uniform standard (civil) time as set by a country's government. Time zones are typically 15° wide, but may conform to commercial and social requirements.	Compendium Vol. 7 No. 1 p. 4-9 Compendium Vol. 24 No. 2 p. 21-28 Compendium Vol. 24 No. 2 p. 29-30 Compendium Vol. 30 No. 1 p. 1-6 Compendium Vol. 30 No. 3 p. 50-60

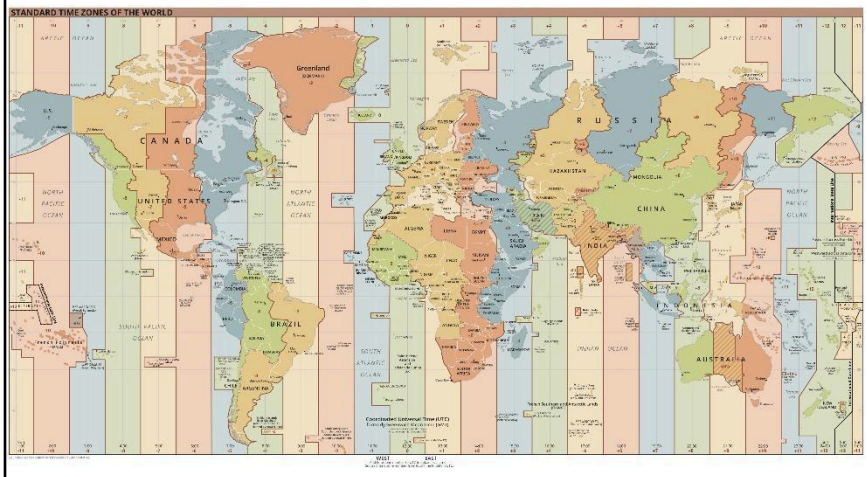


Photo: Wikimedia Commons, UnaitxuGV, Heitordp

Stereographic Projection	A projection method that casts points sighted from the south pole onto a plane tangent to the observer. With this technique, angles between	Compendium 13:2 pp 33-37 Compendium 15:2 pp 22-31 Compendium Vol. 29 No. 2 p. 37-41

	celestial objects are preserved on the projection surface. This method of projection can be seen on planispheric astrolabes and some types of sundials.	Compendium Vol. 30 No. 2 p. 51-71

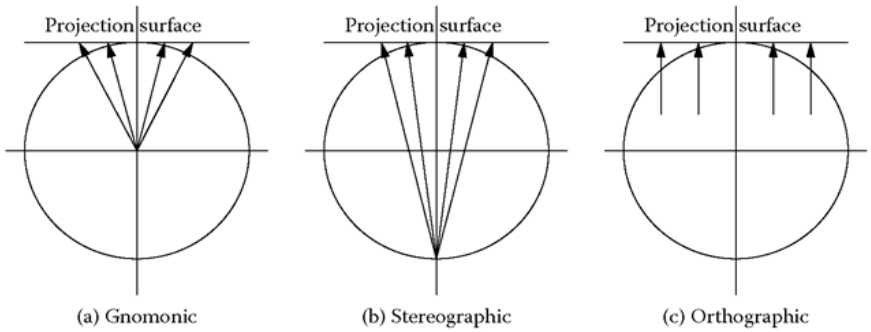


Photo:

https://what-when-how.com/the-3-d-global-spatial-data-model/projection-criteria-map-projections-and-state-plane-coordinates-the-3-d-global-spatial-data-model/

https://what-when-how.com/the-3-d-global-spatial-data-model/projection-criteria-map-projections-and-state-plane-coordinates-the-3-d-global-spatial-data-model/

Stereographic Sundial	A sundial designed using the principles of stereographic projection. See Stereographic Projection	Compendium Vol. 16 No. 4 p. 15-18

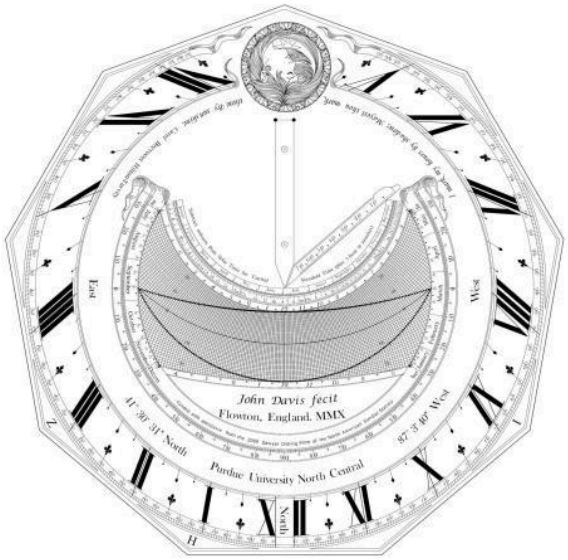


Photo: NASS Registry #1008

Style	The edge of a gnomon that casts its shadow to indicate the time.	Compendium Vol. 9 No. 4 p. 15-19 Compendium Vol. 25 No. 2 p. 35-38

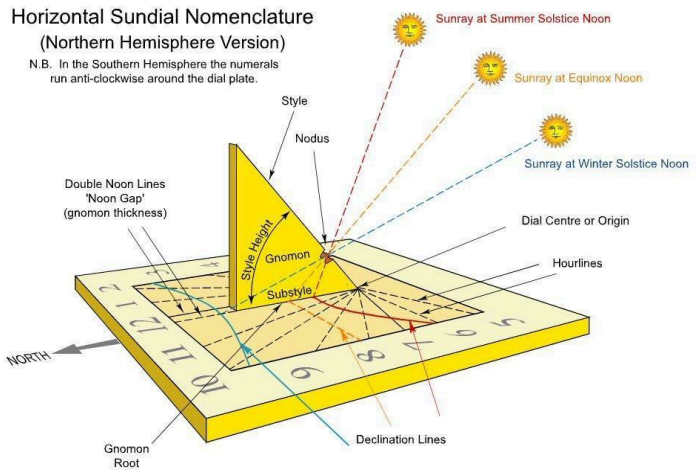


Photo: British Sundial Society

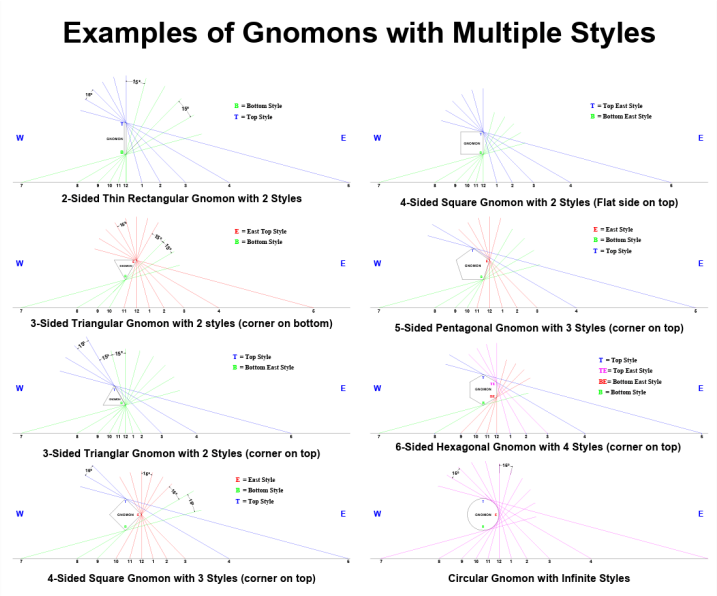
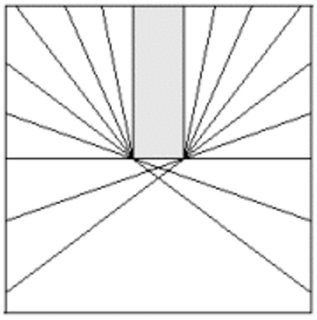


Photo: John Carmichael, Compendium 9:4

Style Height	See Gnomon height	

Style Shift	On wide gnomons or sundials with multiple styles, the switch in the shadow-casting edge over the course of a day.	Compendium Vol. 8 No. 4 p. 27-28 Compendium Vol. 9 No. 4 p. 15-19

	See Noon Gap, Style	Wide Gnomon, The Sundial Primer
 **Photo: Fer de Vries, Compendium 8:4**https://www.mysundial.ca/tsp/wide_gnomon.html		

Subsolar Point	The point on earth directly beneath the true sun at any given time. For observers at this point, the sun is seen at 90º of altitude, at the zenith. All potential subsolar points exist within the boundary of the tropics. See Zenith Day	Compendium Vol. 25 No. 1 p. 36 Compendium Vol. 30 No. 1 p 69-76

Substyle Angle (σ)	The angle the substyle makes with the noon line. See Substyle Line	

Substyle Line	A conceptual line on a dial face defined by a plane perpendicular to the hour plane which passes	Compendium Vol. 10 No. 4 p. 25 Compendium Vol. 15 No. 1 p 1-4

	through the style. While the substyle line coincides with the noon line in some cases, there are many in which it does not, such as on vertical declining dials (the substyle line on a vertical declining dial is perpendicular to the equinox line).	

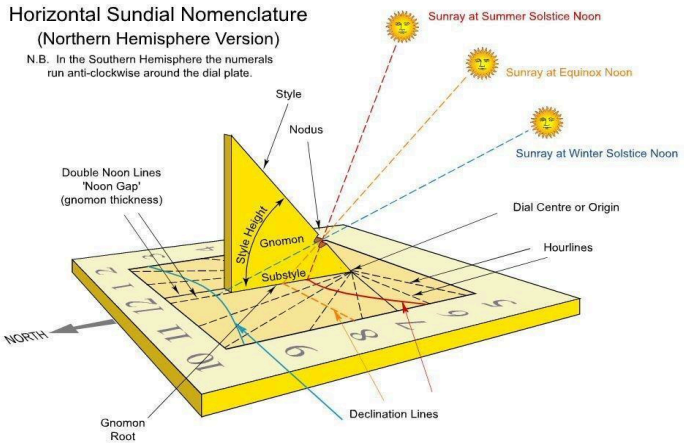


Photo: British Sundial Society

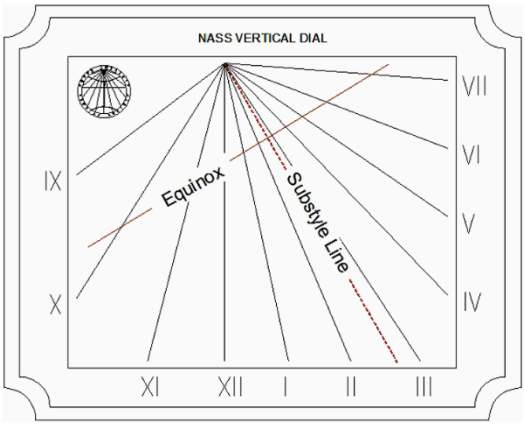


Figure 3. Vertical Dial with Equinox Line 90° to Substyle Line

Photo: Robert L Kellogg, Compendium 15:1

Sun Dogs	See Parhelion	

Sun Dollar	Circular spots of light projected by naturally occurring pinhole cameras. Most commonly, this phenomenon is caused by light filtering through leafy canopies.	Compendium Vol. 28 No. 4 p. 53-58

Sun Pillar	A phenomenon wherein atmospheric ice crystals refract sunlight, creating a “pillar” of light extending upward from the sun.	Compendium Vol. 28 No. 3 p. 4-5

Photo: Robert Kellogg, Compendium 28:3

Sunrise	Marked by the top of the apparent sun crossing above the local horizon at 0° of altitude. Due to atmospheric refraction, the true sun may still be below the horizon at the moment the top of its disc appears to crest the horizon. The solar time of sunrise is dependent on longitude, and its azimuth varies with solar declination. The rising sun marks the beginning of the first seasonal hour.	Compendium Vol. 15 No. 4 p. 1-5 Compendium Vol. 17 No. 1 p. 30-35 Compendium Vol. 26 No. 1 p. 1-6 Compendium Vol. 26 No. 2 p. 1-3 Compendium Vol. 29 No. 1 p. 1-6 Compendium Vol. 30 No. 3 p. 1-7

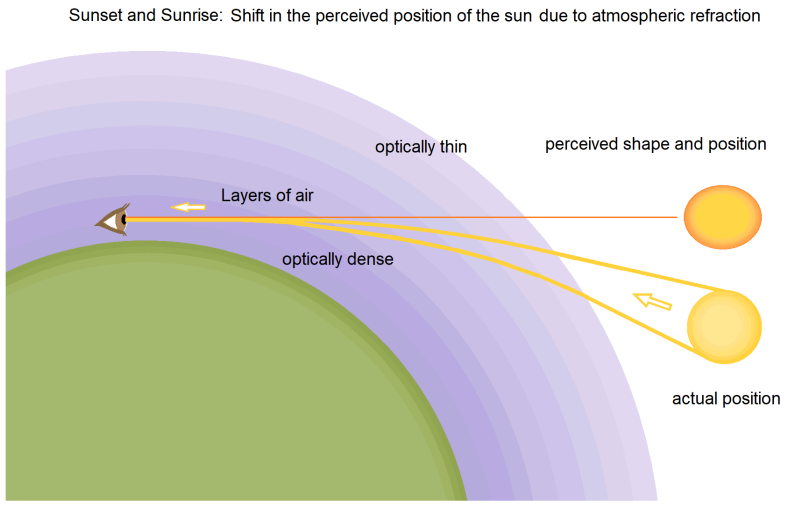


Photo: Wikimedia Commons, Sciencia58

Sunset	Marked by the top of the apparent sun crossing below the local horizon at 0° of altitude. Due to atmospheric refraction, the true sun may already be below the horizon at the moment the top of its disc appears to fall below the horizon. The solar time of sunset is dependent on longitude, and its azimuth varies with solar declination. Hour angle of sunset: $$\cos H = \frac{\sin\ h_{SS} - \sin\varphi \sin\delta}{\cos\varphi \cos\delta}$$ δ: Declination φ: Latitude H: Hour angle hss: True altitude of the sun at apparent sunset (-0° 50’ of altitude) (Steve Lelievre, Compendium 24:2)	Compendium Vol. 17 No. 1 p. 30-35 Compendium Vol. 26 No. 1 p. 1-6 Compendium Vol. 26 No. 2 p. 1-3 Compendium Vol. 29 No. 1 p. 1-6 Compendium Vol. 30 No. 3 p. 1-7

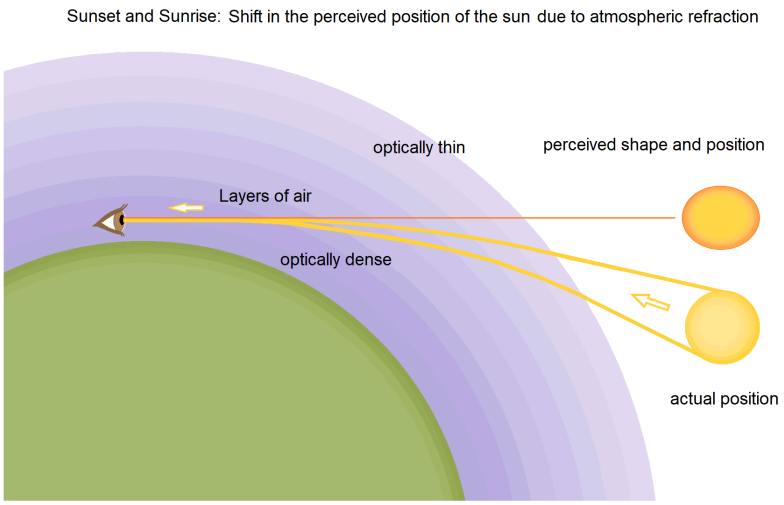


Photo: Wikimedia Commons, Sciencia58 https://en.wikipedia.org/wiki/File:Atmospheric_refraction_-_sunset_and_sunrise.png

Sundial	An instrument that, based on the sun's position in the sky, indicates the time of day in a given time system.	Compendium Vol. 8 No. 1 p. 1-9 Compendium Vol. 10 No. 2 p. 29-34 Compendium Vol. 14 No. 3 p. 1-4 Compendium Vol. 21 No. 3 p. 31-37 Compendium Vol. 22 No. 2 Compendium Vol. 23 No. 4 p. 23-33 Compendium Vol. 26 No. 1 p. 17-19 Sundial, Wikipedia
Synodic Month	The time from one new moon to the next. A synodic month averages 29.530589 days.	Compendium Volume 24 Number 1 p. 1-4 Compendium Volume 31 Number 1 p. 1-8

T	

Temporary hours	See Seasonal hours	

Terminator Shadow	The line by which an object's light and shadow sides are separated i.e. the edge of a partially illuminated moon. See Sunrise, Sunset, Shadow Terminator Dial	Compendium 18-4, pp 27-33 Compendium 20-3 pp 4-16 Compendium 23-3, pp 7-20 Compendium Vol. 23 No. 4 p. 16-22 Compendium Vol. 24 No. 1 p. 12-25 Compendium 31-3 pp 48-60
 Photo: Gian Casalegno, Giuseppe De Donà, Aurelio Pantanali, Compendium 31:3		

Terrella	A terrella is a sun dial make of a terrestrial globe in which the polar elevation matches the local latitude, and the observer's location is rotated to the top of the model. When oriented this way, the terminator shadow indicates the time.	Compendium Vol. 30 No. 1 p. 69-76 Compendium Vol. 30 No. 3 p. 49 Compendium Vol. 5 No. 1 p 21-22 Compendium Vol. 23 No. 4 p 16-22 Compendium Vol. 30 No. 1 p 69-76

Photo: NASS Elements of Dialing

Throne	A throne is permanently attached to the top of an astrolabe's mater. It provides a place to suspend an astrolabe to hang freely while measuring angles.	

The Tower of the Winds	An octagonal building constructed in about 100 BC in Athens, Greece. The structure features eight vertical dials and a clepsydra within.	Compendium Vol. 13 No. 4 p. 4-8 Compendium Vol. 26 No. 1 p. 20-32 Compendium Vol. 26 No. 2 p. 33-44

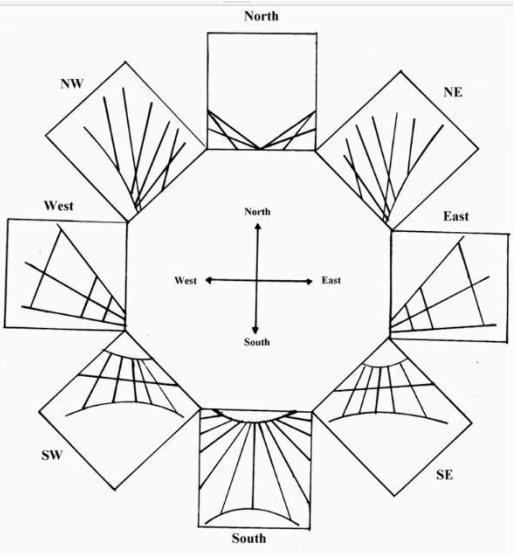


Photo: Efstratios Theodossiou, Vassilios N Manimanis, Petros Mantarakis, Compendium 13:4

Torquetum	"An astronomical instrument which can make measurements in the three sets of astronomical coordinates: horizontal (altitude-azimuthal), equatorial, and ecliptic. It also provides a mechanical means to convert horizontal coordinates to equatorial or ecliptic coordinates" See Horizontal, Equatorial, and Ecliptic Coordinates.	Compendium Vol. 26 No. 3 p. 29-35

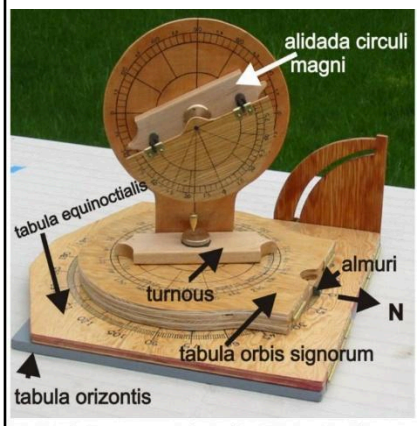


Fig. 6. The Torquetum configured for Horizon Coordinates.

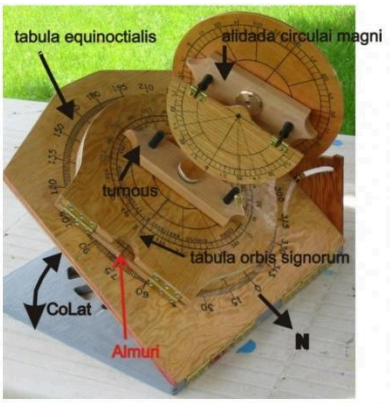


Fig. 7. Torquetum configured for Equatorial Coordinates.

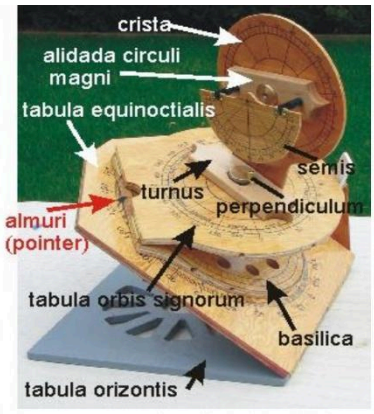


Fig. 8. Torquetum configured for Ecliptic Coordinates.

Photos: Brian Albinson & Lennart Berggren, Compendium 26:3

Trigon	In dialing, a tool used to lay out hour lines empirically. Typically a device affixed to a mounted polar gnomon. These devices may be useful for laying out dials on irregular surfaces whose hour lines and solstice arcs would otherwise require complex mathematic plotting. May occasionally refer to altitude dials or astrolabes that use a trigon rule and plumb-bob assembly.	Compendium Vol. 3 No. 2 p. 22-26 Compendium Vol. 8 No. 2 p. 25-27 Compendium Vol. 10 No. 3 p. 20 Compendium Vol. 22 No. 2 p. 17-22

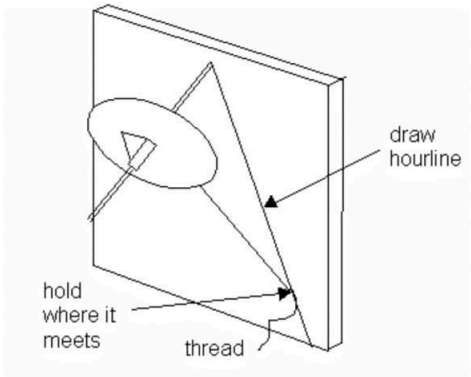


Figure 4. Marking a vertical dial in place.

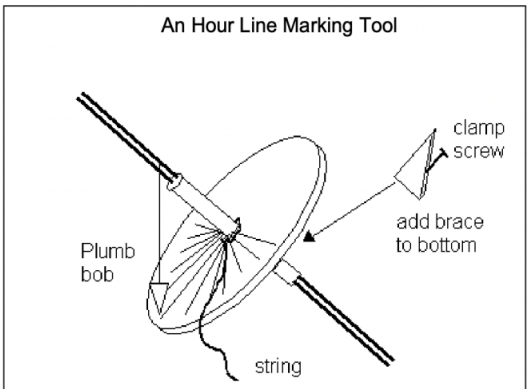


Figure 3. An Equatorial Tool

Photo: Claude Hartman, Compendium 8:2

Trigonometric Functions	Mathematical relationships between the side lengths and angles of triangles in Euclidean geometry.	Trigonometry, Wikipedia

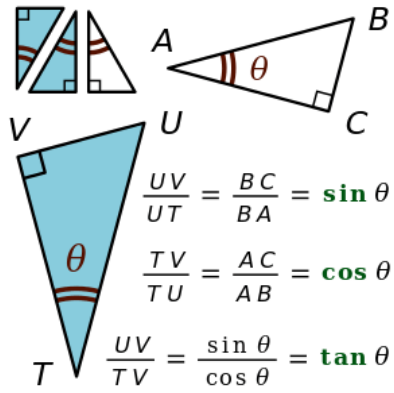


Photo: Wikipedia Commons, Baelde

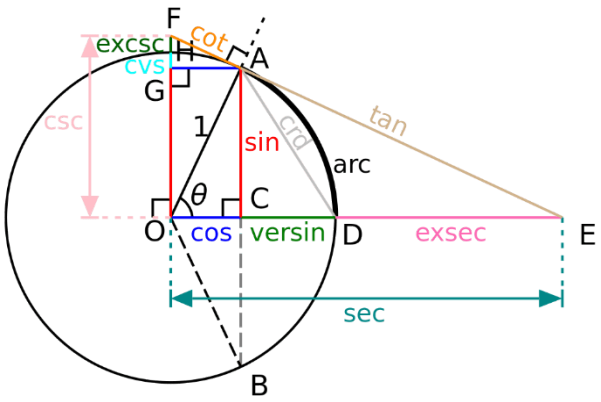


Photo: Wikipedia Commons, Steven G Johnsos

Arcosin	Arccosine is an inverse cosine function. Given an angle's cos value, arcos provides the angle in radians or degrees.	
Asin	Arcsine is an inverse sine function. Given an angle's sine value, arcsin provides the angle in radians or degrees.	
Atan	Arctangent is an inverse tangent function. Given an angle's tangent value, arcsin provides	Compendium Volume 31 Number 1 p. 77

	the angle in radians or degrees.	
Cos	On a right triangle, cos = adjacent side/hypotenuse	Compendium Vol. 9 No. 2 p. 24-27
Sin	On a right triangle, sin = opposite side/hypotenuse	Compendium Vol. 9 No. 2 p. 24-27 Compendium Vol. 22 No. 3 p. 13-19 Compendium Vol. 29 No. 2 p. 35-36
Tan	On a right triangle, tan = opposite / adjacent	Compendium Vol. 9 No. 2 p. 24-27 Compendium Vol. 22 No. 3 p. 13-19
True Sun	The sun as it truly exists, variably higher than the apparent sun due to atmospheric refraction. This effect is strongest at sunrise and sunset. "[The true sun] moves around the Earth in the ecliptic plane at a variable rate because of Earth's non-circular orbit. Its mean angular speed is $n \approx 3548''$/day." (De Rijcke, Compendium 31:1). The motion of the true sun is irregular; the eccentric orbit of the earth as well as the tilt of its axis result in days of slightly unequal length. The mean solar day, as defined by the mean sun, averages out these irregularities. See True Solar Time	Compendium Vol. 20 No. 2 p. 9-19 Compendium Vol. 10 No. 1 p. 24-33 Compendium Vol. 25 No. 3 p. 11-22 National Oceanic and Atmospheric Administration

Tropic of Cancer	The northernmost limit of the sun's declination range. Latitude	

	of +23.5° See Tropic of Capricorn	

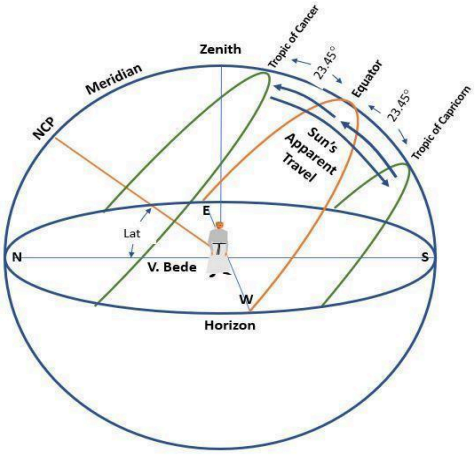


Photo: NASS Elements of Dialing

Tropic of Capricorn	The southernmost limit of the sun's declination range. Latitude of -23.5° See Tropic of Cancer	

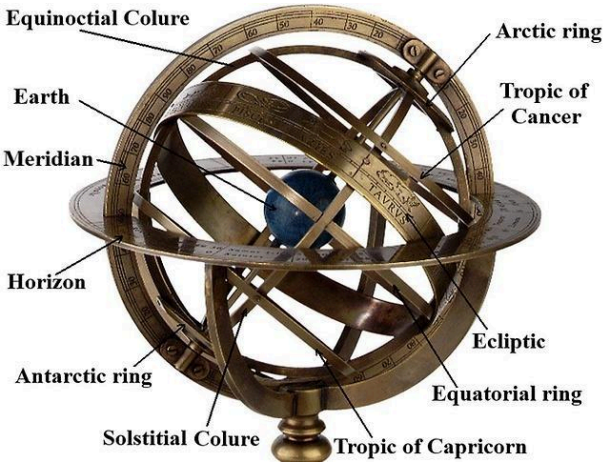
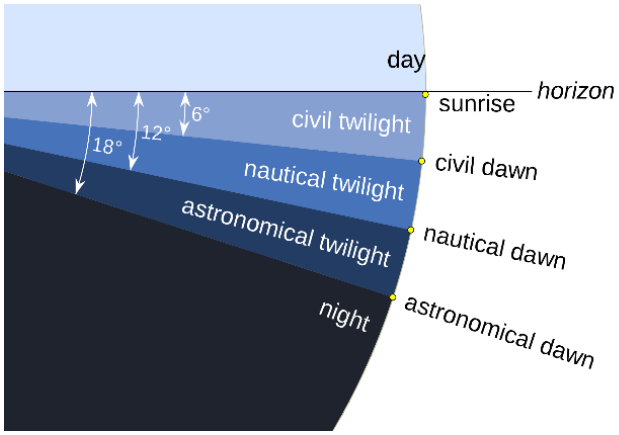


Photo: Science of Gadgets,

https://www.scienceofgadgets.com/post/how-armillary-sphere-works

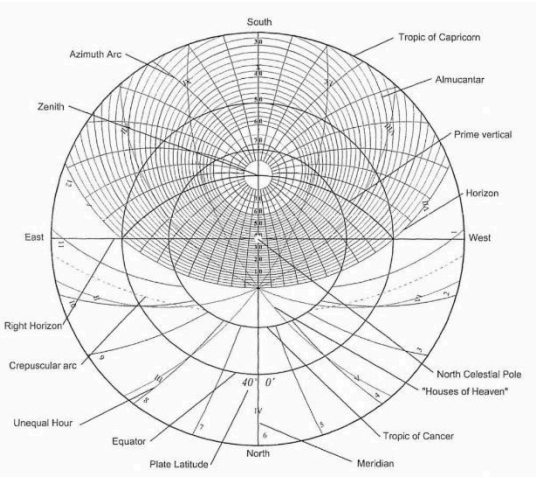
True north	The cardinal north, aligned with the local meridian. See magnetic declination.	Compendium Vol. 13 No. 3 p. 28-29 Compendium Vol. 15 No. 2 p. 12-20

		Compendium Vol. 19 No. 1 p. 14-17 Compendium Vol. 29 No. 2 p. 37-41

Twilight	Sunlight continues to brighten the sky before/after the official sunrise/sunset because (1) sunrise/set occurs when the upper edge of the sun is above the horizon and (2) atmospheric refraction bends the light around the horizon.	Compendium Vol. 25 No. 4 p. 4-15 Compendium Vol. 30 No. 3 p. 1-7 Compendium Vol. 31 No. 3 p. 26-43 Twilight Types, Weather.gov
 **Photo: Wikimedia Commons, Pmurph5**		

Tympan	A latitude-specific stereographic projection of the sky, inscribed onto a disc above which rotates the sun and stars. This projection includes a series of celestial grid lines used to model the positions of various celestial bodies: the almucantars (concentric circles of uniform altitude parallel to the horizon), and the azimuth lines (lines of uniform azimuth). Three circles of increasing size can be seen off-center to Polaris: the Tropic of Cancer, the equator, and the Tropic of Capricorn (defined by the outer edge of the tympan). Other features of tympans include the unequal hour lines and lines of zodiac.	

	On some astrolabes, the tympan is fixed, while on others it can be removed from the mater and exchanged for others. Some specialty tympans exist, such as the universal horizon plate–a plate with only the 0° almucantars, though for various latitudes.	



https://archive.org/details/ilmetauqeet_gmail_659/page/n79/mode/1up?view=theater

Photo: Richard Wymarc, Astrolabe Project

U		
Underslung gnomon	A polar gnomon that indicates time with its lower edge. With respect to wide underslung gnomons, the morning and afternoon styles are switched.	Compendium Vol. 24 No. 1 p. 8

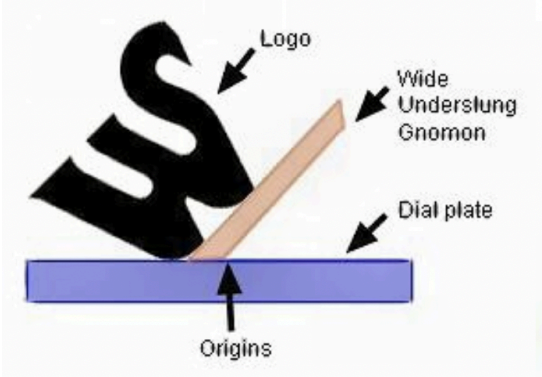


Photo: Donald J.R. Petrie, Compendium 24:1

Unequal hour system	"Unequal" can be used to describe any system of hours in which an individual hour does not have a fixed length (i.e. it varies over the course of the year). Seasonal hours are one such example.	

Universal Coordinated Time (UTC)	The standard time from which all time zones differ, based at the Prime Meridian. Note that UTC itself is not a time zone. See Civil Time	Compendium Vol. 25 No. 3 p. 11-22 Compendium Vol. 30 No. 1 p. 1-6 timeanddate.com

Universal dial	A sundial with the capacity to be accurately used at multiple locations. Often, dials of this type are portable and feature a latitude-selection element. Despite being termed universal, these dials may only have a range of a few degrees. An example of a truly universal dial (able to be used at any latitude in either hemisphere) is the universal equatorial ring dial.	Compendium Vol. 2 No. 3 p. 11-18 Compendium Vol. 3 No. 4 p. 18-25 Compendium Vol. 7 No. 2 p. 18-22 Compendium Vol. 8 No. 2 p. 15-21, 22-24 Compendium Vol. 10 No. 4 p. 7-10 Compendium Vol. 20 No. 2 p. 26-34 Compendium Vol. 22 No. 4 p. 33-37 Compendium Vol. 29 No. 4 p. 53-69

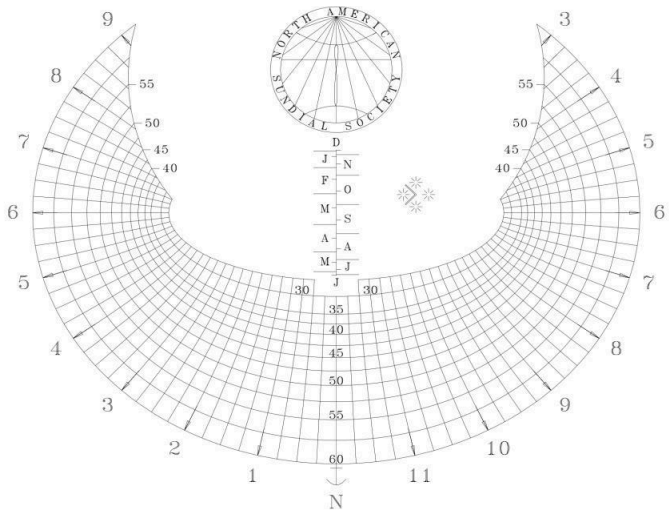


Photo: Fred Sawyer, Compendium 6:4

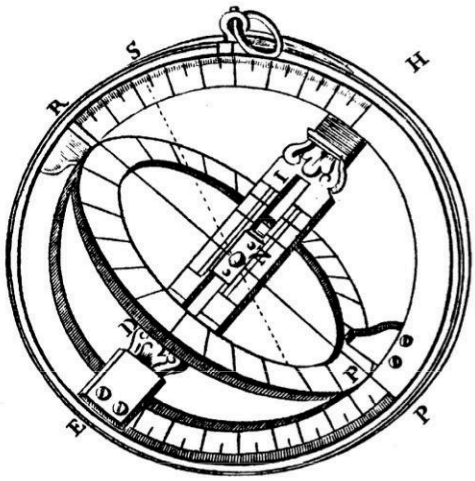


Photo: Alessandro Gunella, Compendium 17:2

Universal Equatorial Ring Dial	A portable dial with an adjustable latitude scale that unfolds to model the celestial sphere. These dials feature three main elements of the celestial sphere: a meridian circle, equator, and a gnomon assembly acting as the axis. When the central declination scale is set and the dial is rotated until the nodus can be seen on the inner equatorial band, the solar time can be read. The dial also acts as a solar compass at this moment. This dial is an evolution of the astronomical ring. See Ring Dial	Compendium Vol. 17 No. 2 p. 36-39 Compendium Vol. 27 No. 1 p. 19-35 Compendium Vol. 29 No. 1 p. 24-26 Compendium Vol. 31 No. 3 p. 61-79

Photo: Wikimedia Commons, jailbird

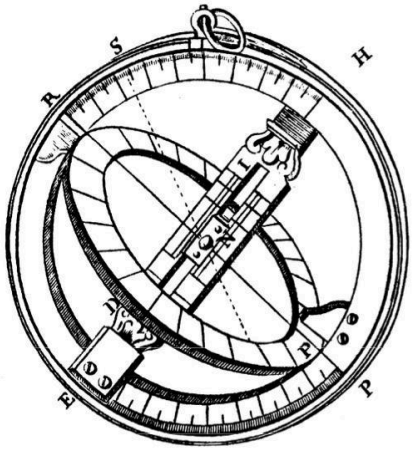


Photo: Alessandro Gunella, Compendium 17:2

Umbra	Total shadow, or shadow that totally obscures the sun. Compared to penumbra shadow that only partially obscures the sun	Compendium Vol. 9 No. 4 p. 1-5 Compendium Vol. 9 No. 4 p. 1-5, 6-11 Compendium Vol. 10 No. 1 p. 3-8 Compendium Vol. 23 No. 2 Compendium Vol. 23 No. 3 p. 2-35

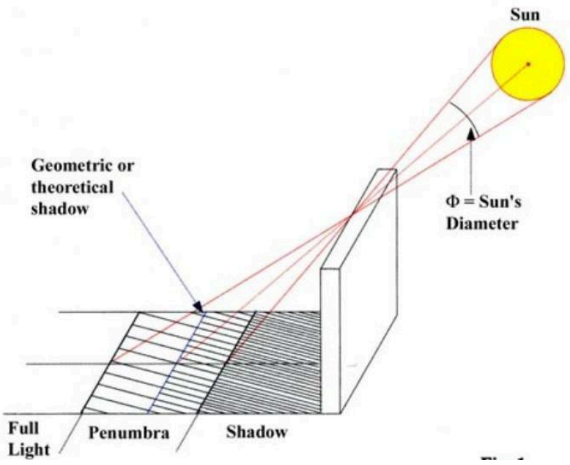


Photo: Gianni Ferrari, Compendium 10:1

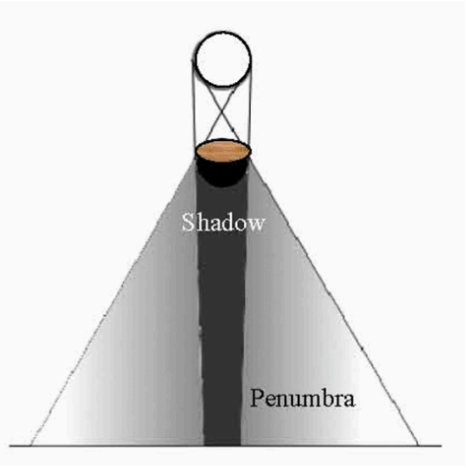


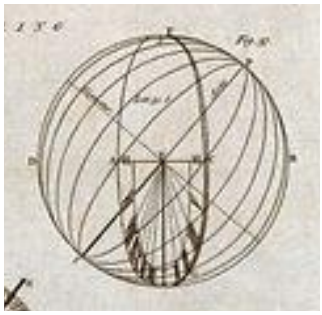
Photo: Gianni Ferrari, Compendium 23:2

V		
Vertical dial	Sundial with its face perpendicular	Compendium Vol. 3 No. 4 p. 28-29

	to the horizon. Unlike horizontal dials, the angle of the gnomon is equal to the co-latitude of the location. While they may face any compass direction, most common are direct north, east and west dials, though direct south is most common. For a direct south/north dial: $\theta = \arctan(\cos \varphi \tan t)$ For a direct east/west dial: $X = GH \tan t$ θ: Angle of hour line measured from noon X = distance of hour lines from substyle GH: chosen height of gnomon t: Hour Angle φ: Latitude	Compendium Vol. 11 No. 1 p. 20-22 Compendium Vol. 12 No. 3 p. 1-7 Compendium Vol. 15 No. 3 p. 8-12, 31-33 Compendium Vol. 26 No. 4 p. 19-21 Compendium Vol. 28 No. 2 p. 44-57

Photo: NASS Registry #1033

Photo: Engraving by John Taylor, Look and Learn History Picture Archive



Vetus Quadrant	See Quadrans Vetus	

Viking Sunstone	See Optical Calcite	

Vinadi	In ancient Indian science, a unit of time equal to 24 seconds. One Vinadi is defined as the time taken to perform six respirations.	Compendium Vol. 24 No. 2 p. 10-11

Volvelle	An assembly of stacked, rotating elements encoded with graduated scales and slits used for analog calculation. Volvelles can take many forms, though are most often either made of paper and bound into books, or included on sundials to enable their use in moonlight. See Lunar Volvelle	Astronomicum Caesareum Volvelle, Google Compendium Vol. 30 No. 4 p 50-66 Compendium Vol. 31 No. 1 p 29-40

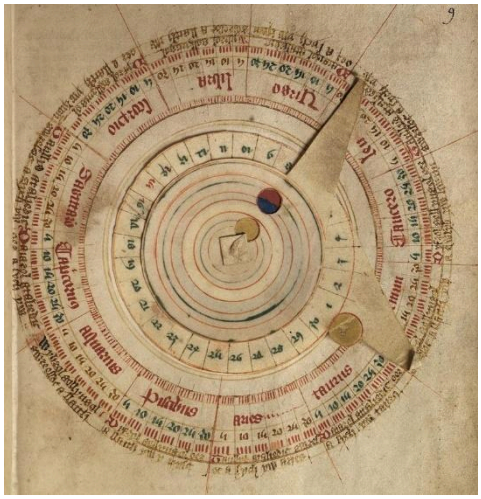


Photo: Wikimedia Commons, National Library of Wales

W	

Water Clock	See Clepsydra	

Wedge	An incline placed under a horizontal dial which allows the dial to function at a new latitude. The angle of the wedge supplements the latitude of the dial's original design, resulting in the gnomon inclining parallel to the celestial axis at the new location.	Compendium Vol. 7 No. 1 p. 10-14 Compendium Vol. 9 No. 3 p. 16-18 Compendium Vol. 18 No. 4 p. 2-7 Compendium Vol. 30 No. 1 p. 50-68 Compendium Vol. 30 No. 2 p. 7 gnomoni.ca wedge calculator

Window dial	A sundial built onto or in conjunction with a building's window. Hour lines or a nodus may project from marks on the window onto another surface, from another surface onto the window, or the window itself may carry the full dial. The dial may be reversed so as to be read from inside the windowed room. See Reflection Dial	Compendium Vol. 7 No. 2 p. 24-27

Figure 5. Reutte Shelter Model

Photo: Claude Hartman, Compendium 7:2

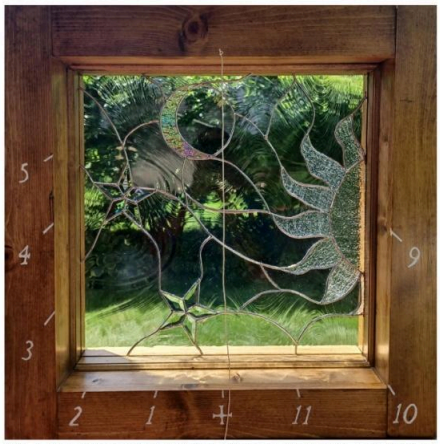


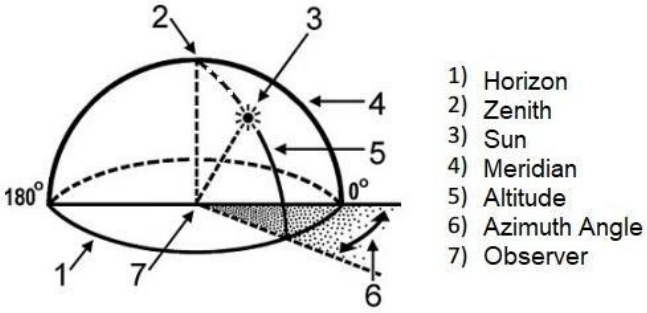
Photo: Mark Montgomery, Compendium 29:4

Womb	The inner cavity of the mater used to store Tympans. Depending on the astrolabe in question, the womb may be deep enough to store many tympans simultaneously, or only one.	

X		

Y		

Z		
Zenith	Altitude of 90° above horizon, directly overhead the observer. Opposite the celestial sphere of the nadir.	Zenith, Wikipedia



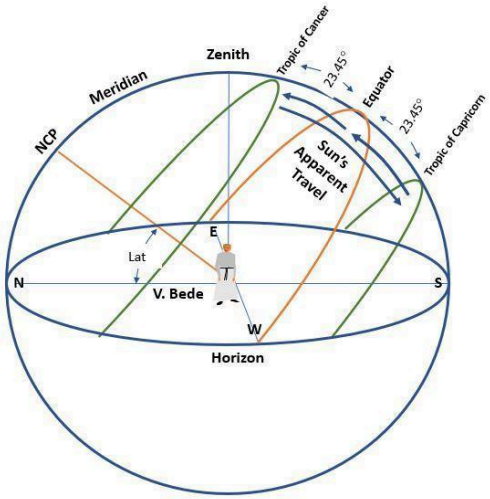


Photo: U.S. Army Map Reading and Land Navigation Handbook. Field Manual 3-25.26. **Photo: NASS Elements of Dialing**

Zenith Angle	The angular distance from the zenith to the sun which is the complement of the sun's altitude. $\zeta = (90^{o} - Alt)$	Solar Zenith Angle, Wikipedia

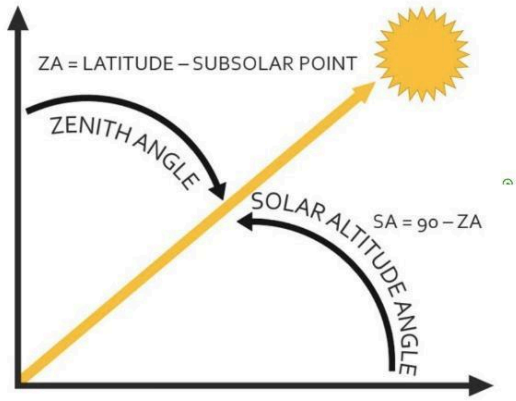


Photo:
https://www.chegg.com/homework-help/questions-and-answers/zenith-angle-decreases-increase-sun-gets-higher-sky-total-energy-received-surface-decrease-q94323201
https://www.chegg.com/homework-help/questions-and-answers/zenith-angle-decreases-increase-sun-gets-higher-sky-total-energy-received-surface-decrease-q94323201

Zenith Day	Day when the sun's altitude is +90°, or at the zenith. Between the tropics, there are	Compendium Vol. 25 No. 1 p. 36 Compendium Vol. 25 No. 3 p. 1-2

	two annual days when this occurs. These dates mark the smallest possible shadows. See Subsolar Point	Compendium Volume 31 Number 2 p. 1-9

Photo: NASS Elements of Dialing

Zenith Distance	90° - altitude. Some mariner's astrolabes are marked to measure zenith distance rather than altitude. For a given location, the sun's zenith distance at solar noon equals the latitude. See Zenith Angle, Co-latitude	

Zodiac	Constellations in the sky that surround the path of the sun or ecliptic. During its circuit of the ecliptic, the sun, moon, and planets travel through the signs of the zodiac. Due to precession, however, these segments no longer coincide with their titular constellations and have since become more *conceptual* increments. See Ecliptic	Compendium Vol. 9 No. 4 p. 19-23

Sign	Latin name	Symbol	Start date (approx.)
Ram	Aries	♈	20 March
Bull	Taurus	♉	20 April
Twins	Gemini	♊	21 May
Crab	Cancer	♋	21 June
Lion	Leo	♌	23 July
Virgin	Virgo	♍	23 August
Scales	Libra	♎	22 September
Scorpion	Scorpio	♏	23 October
Archer	Sagittarius	♐	22 November
Goat	Capricornus	♑	21 December
Water Carrier	Aquarius	♒	20 January
Fish	Pisces	♓	19 February

Zuhr	One of the five Islamic prayer times, beginning at solar noon and ending at mid-afternoon.	Compendium Vol. 27 No. 2 p. 10-18 Compendium Vol. 28 No. 2 p. 29-43 moonsighting.com

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Hour Systems

Babylonian
Canonical
Civil
Common
Equal
French
Italian
Local Solar
Planetary
Reverse Italian
Seasonal
Sidereal
Standard
Temporary
Unequal

++

Astrolabe Types and Components

Alidade

Counter-changed
Brachiolum
Climate
Limb
Mater
Plate
Rete
Rule
Throne
Tympan
Womb
Mariner's
Planispheric
Quadrans Novus
Rojas

++

Types of Coordinate Systems

Ecliptic
Equatorial
Horizontal

++

Dialing Equations & Symbols

Digital Dial
Horizontal Dial
Hour Angle
Pillar Dial
Scaphe
Vertical Dial

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Types of Dials

Altitude
Analemmatic
Analemmic
Armillary
Astronomical Ring
Augsburg
Azimuthal
Bifilar
Bowstring
Butterfield
Campbell-Stokes
Cannon
Capuchin
Catoptric
Caustic Curve
Ceiling
Conic
Crossed C's
Cruciform
Cycloid Polar
Cylindrical
Declining
Digital
Dioptric
Dipleidoscope
Diptych
Envelope
Equatorial
Floating
Flag
Foster-Lambert
Gemma's Rings
Globe
Hand

Heliochronometer
Heliodrome
Heliograph
Hemicyclium
Hemispherium
Hevelius Altitude
Horizontal
Inclining
Latitude-Independent
Locust's Leg
Mass
Mean Time
Mechanical Equatorial
Meridian
Moon
Multi
Multifilar
Navicula
Nocturnal
Noon Mark
Peaucellier
Philippi
Pillar
Polar
Polar Envelope
Polyhedral
Portici Ham
Quadrant
Reclining
Reflection
Refraction
Regiomontanus Rectilinear
Ring
Roof
Scaphe
Scratch
Self-Orienting
Shadow Plane
Shadow Terminator
Shepherd's
Sidereal
Solar Compass
Solar Decliners
Spherical
Stereographic
Terrella
Universal
Vertical